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# X-Series Signal Analyzers

## Noise Figure Mode

N9000B N9010B N9020B N9030B N9038B N9040B N9041B  
M9410A M9410E M9411A M9411E M9415A M9415E M9416A M9416E M9421A  
N8973B N8974B N8975B N8976B



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# 1 Product Support & Documentation Roadmap

This section describes the Keysight products covered by this document, and provides links to available support resources and related documentation.

- ["Products Covered by this Document" on page 46](#)
- ["Where to Find the Latest Information" on page 47](#)
- ["Product and Solution Cybersecurity" on page 48](#)
- ["Additional Documentation" on page 49](#)

## 1.1 Products Covered by this Document

For the full list of instrument models covered by this documentation, see the title page: ["Noise Figure Mode User's & Programmer's Reference" on page 1](#).

## Where to Find the Latest Information

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

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

Documentation is updated periodically. For the latest information about these products, including instrument software upgrades, application information, and product information, navigate to the URL above, then in the Support by Product Model Number box, enter the Product Number of your instrument (for example, N9040B) and click **Find**:

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

<http://www.keysight.com/find/emailupdates>

Information on preventing instrument damage can be found at:

<http://www.keysight.com/find/PreventingInstrumentRepair>

## Is your product software up-to-date?

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

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

## 1.2 Product and Solution Cybersecurity

Keysight complies with multinational regulations for the cybersecurity of its own products and is committed to providing information to assist you in protecting your products and solutions from external cyberthreats. For more information, see:

<https://www.keysight.com/us/en/about/quality-and-security/security/product-and-solution-cyber-security.html>

Keysight also recommends that you secure your IT environments using appropriate third-party tools. For instruments that run the Microsoft Windows operating system, Keysight concurs with Microsoft's recommendations for ensuring that the instrument is protected:

- Get the latest critical Windows updates
- For network-connected instruments, use an internet firewall (in Keysight instruments, Windows Firewall is enabled by default)
- For network-connected instruments, use up-to-date antivirus and anti-spyware software

### 1.2.1 Responsible Disclosure Program

Keysight recommends that security researchers share the details of any suspected vulnerabilities across any asset owned, controlled, or operated by Keysight (or that would reasonably impact the security of Keysight and our users) using this form:

<https://www.keysight.com/us/en/contact/responsible-disclosure-program.html>

### 1.2.2 Report a Product Cybersecurity Issue

If you discover a cybersecurity issue that you suspect may involve Keysight's proprietary software, or third-party software supplied by Keysight as part of a product, or that may affect the operation of Keysight products, we encourage you to report it to us using this form:

<https://www.keysight.com/us/en/about/quality-and-security/security/product-and-solution-cyber-security/report-a-product-cybersecurity-issue.html>

## 1.3 Additional Documentation

If your instrument or computer has an internet connection, then you can access the latest editions of all relevant X-Series documentation via the links below.

*This document is available in 3 formats:*

- **Embedded Help**, in the instrument
- **Online Help**, at Keysight's web site

For information on this Mode, browse to:

<http://rfmw.em.keysight.com/wireless/helpfiles/NFIGUREMode/FlexUI.htm>

- **Users & Programmers Reference**, in downloadable PDF format

For information on this Mode, download from:

<http://literature.cdn.keysight.com/litweb/pdf/N9069-90002.pdf>

The following documents are available online at keysight.com:

[X-Series Messages Guide](#)

The following documents are in downloadable PDF format:

### **Getting Started Guides, Programming & Security**

- [N90x0B Getting Started & Troubleshooting Guide](#)
- [N9041B Getting Started & Troubleshooting Guide](#)
- [N9042B Getting Started & Troubleshooting Guide](#)
- [X-Series Status Register System Diagram](#)
- [Security Features & Statement of Volatility](#)
- [Initialization Instructions: Option SF2](#)
- [Initialization Instructions: Option SF3](#)

### **Specifications Guides & Data Sheets**

- [N9000B CXA Specifications Guide](#)
- [N9010B EXA Specifications Guide](#)

## 1 Product Support & Documentation Roadmap

### 1.3 Additional Documentation

- [N9020B MXA Specifications Guide](#)
- [N9030B PXA Specifications Guide](#)
- [N9040B UXA Specifications Guide](#)
- [N9041B UXA Specifications Guide](#)
- [N9030B Data Sheet](#)

#### **Measurement Guides**

- [Analog Demod Measurement Application Measurement Guide](#)
- [EMI Measurement Application Measurement Guide](#)
- [Noise Figure Measurement Guide](#)
- [Phase Noise Measurement Application Measurement Guide](#)
- [Real-Time Spectrum Analyzer Measurement Guide](#)
- [Spectrum Analyzer Mode Measurement Guide](#)
- [M9484C VXG Signal Generator and X-Series Signal Analyzers Measurement Guide](#)

#### **Service Guides**

- [N9010B EXA Service Guide](#)
- [N9020B MXA Service Guide](#)
- [N9030B PXA Service Guide](#)
- [N9040B UXA Service Guide](#)

#### **Application Notes**

- [Faster Spectrum Measurements for X-Series Signal Analyzers](#)
- [Full Bypass Path, Option FBP](#)
- [How to Get the Most Out of Your X-Series Signal Analyzer](#)
- [Optimizing Fast-Power ACLR Measurements with N9042B-N9032B X-Series Signal Analyzers](#)

- Time Gated Spectral Analysis with X-Series Signal Analyzers
- Using Noise Floor Extension in an X-Series Signal Analyzer

### **Installation Notes**

- N9042B Power Supply Upgrade Option HW1
- N9042B X-Series Signal Analyzer 4-GHz Analysis Bandwidth Option B14 B16 and B17
- Option PC8 and PC9 Processor Assembly Upgrade Windows 10
- Option PCA and PCB Processor Assembly Upgrade Windows 10
- Option PCS Processor Assembly Upgrade Windows 10
- Option SF1
- Option SF2
- Option SF3
- Option SS1
- Option SS3
- Option SS4
- Option SS5
- Option SSD Windows 7
- PC6 and PC7 CPU Replacement Procedure

### **Technical Overviews**

- N6141C EMI Receiver X-Series Measurement Application
- N9068EM0E Phase Noise X-Series Measurement Application
- N9069C Noise Figure X-Series Measurement Application
- N9077C WLAN 802.11a/b/g/j/p/n/ac/af/ah/ax X-Series Measurement Application

1 Product Support & Documentation Roadmap  
1.3 Additional Documentation

- N9080B and N9082B LTE and LTE-Advanced FDD/TDD X-Series Measurement Application
- N9081C Bluetooth X-Series Measurement Application
- N9084EM0E Short Range Communication and IoT X-Series Measurement Application
- N9092EM0E Avionics X-Series Measurement Application



## 2 User Interface

Here are the basic elements of the Multitouch User Interface. For more information, tap a topic.

Included in this section are also topics for several front panel keys not described in other topics. Tap one of these topics for more information.



"Cancel key" on  
page 99



"Onscreen Keyboard key" on  
page 100



"Touch On/Off Key" on  
page 101



"Tab key" on  
page 102

## 2.1 Screen Tabs

In the X-Series Multitouch User Interface (or Multitouch UI), you can run many different Measurement Applications, or “Modes”. Examples are Spectrum Analyzer Mode, LTE-A FDD Mode, IQ Analyzer Mode, and Real Time Spectrum Analyzer Mode. Each Mode has its own set of controls, windows and SCPI commands.

Each Mode runs within a “Screen”. The Multitouch UI supports multiple “Screens” (see ["Multiscreen" on page 143](#) for more information). Each screen displays one Measurement in one Mode. The set of configured screens is shown across the top of the display as a set of Screen Tabs, with a + tab at the right for adding new Screens:



You can see up to six tabs at a time on the UXA, and 4 at a time on the CXA, EXA, MXA and PXA. If there are more Screens configured than this, arrows appear to the left and right of the Screen Tabs; pressing the arrows scrolls the Screen Tabs to the left or right. A scroll bar also appears at the bottom of the Screen Tabs, indicating that you can scroll the tabs by dragging them with your finger; you can also scroll them by dragging the scroll bar.

Pressing a Screen Tab selects that screen for operation. Pressing the blue (selected) Screen Tab is the same as pressing the Mode/Meas front panel key.



Both actions open the ["Mode/Meas/View Dialog" on page 55](#). In addition, if you have a PC keyboard plugged in, the sequence CTL-SHIFT-M will open up this dialog.

The + tab at the right of the Screen Tabs bar adds a new Screen by cloning the current screen. The new Screen has the identical setup and settings as the current Screen. You can then change the Mode, Measurement and/or settings of the new Screen.

You can define up to 16 screens at once.

### Example Multiscreen View

The example below shows a four-screen display in Multiscreen view.

The Screen called “Real-Time SA 2” is selected, as indicated by its blue tab. Touching any other screen or tab selects the screen for that tab and brings it to the foreground.



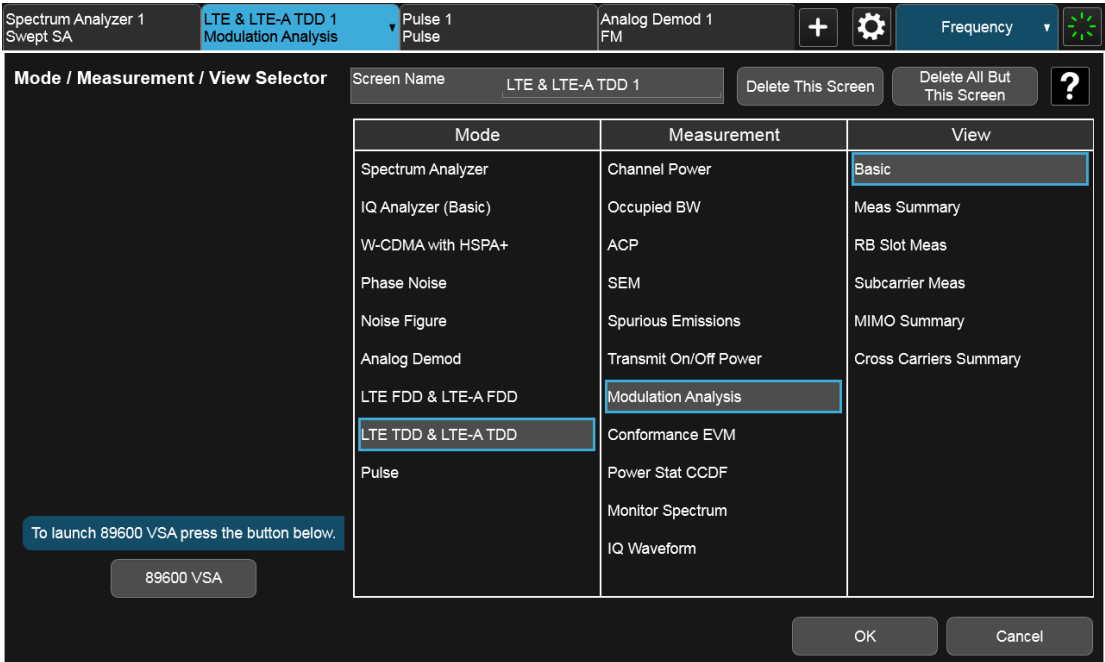
The following topics provide more information:

- "Mode/Meas/View Dialog" on page 55
- "Add Screen" on page 72
- "Multiscreen" on page 143

### 2.1.1 Mode/Meas/View Dialog

The Mode/Meas/View dialog opens when you press the selected (blue) Screen tab (see "Screen Tabs" on page 54) or the **Mode/Meas** front panel key.

This dialog displays lists of available Modes, Measurements and Views, as well as the "Sequencer" on page 66 control for configuring Screens.



2.1.1.1 Mode

The first column in the Mode/Meas/View dialog allows you to select the desired Mode from those currently licensed in your instrument.

Modes, also known as “measurement applications”, are collections of measurement capabilities packaged together to provide you with an instrument personality specific to your measurement needs. Each Mode is ordered separately by Model Number and must be licensed in order for it to be available in the instrument.

You select the Mode you want to run using the Mode/Meas/View dialog. Once a Mode is selected, only the commands that are valid for that mode can be executed

For more information on Modes, preloading Modes, and memory requirements for Modes, see ["More Information" on page 59](#)

The `:INSTRument[:SElect]` command is used to remotely select a Mode by sending the instrument a parameter which represents the name of the desired Mode. The Mode Names may be found in the table under ["Index to Modes" on page 58](#).

The `:INSTRument:NSElect` command is used to remotely select a Mode by sending the Mode Number of the desired Mode. See ["Instrument Number Select" on page 57](#). The Mode Numbers may be found in the table under ["Index to Modes" on page 58](#).

The `:INSTRument:CONFigure` command causes a Mode and Measurement switch at the same time. This generally results in faster overall switching than sending the

**:INSTrument:SElect** and **CONFiGure** commands separately. See "Mode and Measurement Select" on page 57.

|                |                                                                                                                                                                 |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <b>:INSTrument[:SElect] &lt;mode_id&gt;</b><br>where <mode_id> is one of the values listed in "Index to Modes" on page 58 below<br><b>:INSTrument[:SElect]?</b> |
| Example        | <b>:INST SA</b>                                                                                                                                                 |
| Notes          | A list of the valid mode choices is returned by the <b>:INST:CAT?</b> query                                                                                     |
| Preset         | The default Mode is set to <b>SA</b> on <b>Restore System Defaults-&gt;All</b> , unless noted below:<br>For N8973B, N8974B, N8975B, or N8976B: <b>NFIG</b>      |
| State Saved    | Saved in instrument state                                                                                                                                       |
| Annunciation   | Application Title is in the Screen Tab                                                                                                                          |

## Instrument Number Select

|                |                                                                                                                                                                                                                                                                            |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <b>:INSTrument:NSElect &lt;integer&gt;</b><br><b>:INSTrument:NSElect?</b>                                                                                                                                                                                                  |
| Example        | <b>:INST:NSEL 1</b>                                                                                                                                                                                                                                                        |
| Notes          | The Mode Numbers may be found in the table under "Index to Modes" on page 58<br>SA mode is number 1<br>The command is sequential: that is, continued parsing of commands cannot proceed until the instrument select is complete and the resultant SCPI trees are available |
| Preset         | The default Mode is set to <b>1</b> by <b>Restore System Defaults-&gt;All</b> , unless noted in the table above                                                                                                                                                            |
| State Saved    | Saved in instrument state                                                                                                                                                                                                                                                  |

## Mode and Measurement Select

|                |                                                                                                                                                                                                                                                                                                                                                                                                                               |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <b>:INSTrument:CONFiGure:&lt;mode_id&gt;:&lt;meas&gt;</b><br>where <mode_id> is a valid parameter for the <b>:INST:SEL</b> command and <meas> is a valid parameter for the <b>:CONF</b> command in the Mode specified by <mode>                                                                                                                                                                                               |
| Example        | <b>:INST:CONF:SA:SAN</b><br>selects the Spectrum Analyzer mode and the Swept SA measurement<br><b>:INST:CONF:WCDMA:RHO</b><br>selects the WCDMA mode and the Mod Accuracy measurement                                                                                                                                                                                                                                         |
| Notes          | The available parameters for <mode_id> are dependent upon installed and licensed applications resident in the instrument. The available parameters for <meas> are dependent on the <mode_id> parameter and the valid measurements available for that mode, which can depend on model numbers and installed options<br>In general this command will execute more quickly than sending the equivalent separate <b>:INST:SEL</b> |

---

and **:CONF** commands

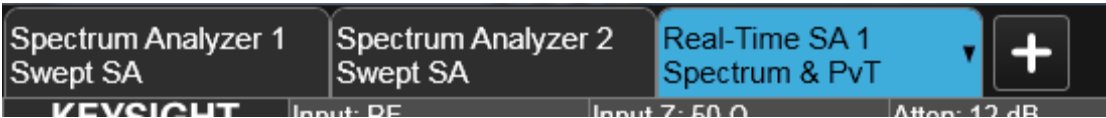
## Index to Modes

The Mode Number in the table below is the parameter for use with the **:INSTRument:NSElect** command. The Mode Parameter is the parameter for use with the **:INSTRument[:SElect]** command. Your actual choices will depend upon which applications are installed in your instrument.

| Mode                          | Mode Number | Mode Parameter<br><mode_id> |
|-------------------------------|-------------|-----------------------------|
| 5G NR                         | 109         | NR5G                        |
| 89601 VSA                     | 101         | VSA89601                    |
| Analog Demod                  | 234         | ADEMOD                      |
| Avionics                      | 232         | AVIONIC                     |
| Bluetooth                     | 228         | BTtooth                     |
| Channel Quality / Group Delay | 161         | CQM                         |
| EMI Receiver                  | 141         | EMI                         |
| GSM/EDGE/EDGE Evo             | 13          | EDGE GSM                    |
| I/Q Analyzer (Basic)          | 8           | BASIC                       |
| LTE FDD & LTE-A FDD           | 107         | LTEAFDD                     |
| LTE TDD & LTE-A TDD           | 108         | LTEATDD                     |
| Measuring Receiver            | 233         | MRECEIVE                    |
| MSR                           | 106         | MSR                         |
| Noise Figure                  | 219         | NFIGure                     |
| Phase Noise                   | 14          | PNOISE                      |
| Power Amplifier               | 81          | PA                          |
| Pulse                         | 151         | PULSEX                      |
| Radio Test                    | 300         | RTS                         |
| Real Time Spectrum Analyzer   | 2           | RTSA                        |
| Remote Language Compatibility | 266         | RLC                         |
| SCPI Language Compatibility   | 270         | SCPILC                      |
| Sequence Analyzer             | 123         | SEQAN                       |
| Short Range Comms             | 218         | SRCOMMS                     |
| Spectrum Analyzer             | 1           | SA                          |
| Vector Modulation Analyzer    | 200         | VMA                         |
| WCDMA with HSPA+              | 9           | WCDMA                       |
| WLAN                          | 217         | WLAN                        |

More Information

The Mode name appears on the Screen Tab, followed by a number identifying which instance of the Mode appears on that screen. Each Screen contains one Mode. For example, in the image below, there is one Real-Time Spectrum Analyzer screen, and two Spectrum Analyzer screens. The current Screen contains **Real-Time SA 1**.



It is possible to specify the order in which the Modes appear in the Mode menu, using the **Configure Applications** utility on the Desktop. Using the same utility, it is also possible to specify a subset of the available applications to load into memory at startup time, which can decrease the startup time of the instrument and the amount of memory consumed.

Each application (Mode) that runs in an X-Series instrument consumes virtual memory. The various applications consume varying amounts of virtual memory, and as more applications run, the memory consumption increases. Keysight characterizes each Mode and assigns a memory usage quantity based on a conservative estimate. The **Configure Applications** utility shows an estimate for how much memory each Mode will consume.

You can still run a Mode even if it is not preloaded into memory – during runtime, the first time an application that is not loaded into memory is selected (either by pressing that application's **Mode** key or by sending that application's **:INST:SEL** command), the Application will be loaded, but this takes a few seconds. The instrument will pause while loading the application while displaying a message box that says “Loading application, please wait...” Preloading the application eliminates this wait time *but* consumes additional memory.

2.1.1.2 Application Mode Remote Commands

This section contains a number of remote commands that are provided for programming convenience and remote compatibility.

Application Mode Catalog Query (Remote Command Only)

Returns a string containing a comma-separated list of names of all the installed and licensed measurement modes (applications). These names can only be used with **:INSTrument[:SElect]**.

---

|                |                             |
|----------------|-----------------------------|
| Remote Command | <b>:INSTrument:CATalog?</b> |
|----------------|-----------------------------|

|                               |                                                                                                                                                                                                                                                                                                                                                                               |
|-------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Example                       | <code>:INST:CAT?</code>                                                                                                                                                                                                                                                                                                                                                       |
| Notes                         | Query returns a quoted string of the installed and licensed modes separated with a comma. Example:<br><code>"SA,PNOISE,WCDMA"</code>                                                                                                                                                                                                                                          |
| Backwards Compatibility Notes | VSA (E4406A): <code>:INSTrument:CATalog?</code> returned a list of installed <code>INSTrument:SELECT</code> items as a comma separated list of string values, for example:<br><code>"BASIC", "GSM", "EDGE GSM", "CDMA", "SERVICE"</code><br><br>X-Series uses the ESA/PSA compatible query of a string contain comma separated values:<br><code>"SA,PNOISE,NFIG,BASIC"</code> |

### Current Application Model (Remote Command Only)

Returns a string that is the Model Number of the currently selected application (mode). This information is also displayed in the **Show System** screen.

|                |                                                                                                                                                                                        |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SYSTem:APPLication[:CURRent][:NAME]?</code>                                                                                                                                     |
| Example        | <code>:SYST:APPL?</code>                                                                                                                                                               |
| Notes          | Query returns a quoted string that is the Model Number of the currently selected application (Mode). Example:<br><code>"N9060A"</code><br><br>String length between 6 to 9 characters. |
| Preset         | Not affected by Preset                                                                                                                                                                 |
| State Saved    | Not saved in state, the value will be the selected application when a Save is done.                                                                                                    |

### Current Application Revision (Remote Command Only)

Returns a string that is the Revision of the currently selected application (mode). This information is also displayed in the Show System screen

|                |                                                                                                                                                                                                                                                                                                                                                                                                    |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SYSTem:APPLication[:CURRent]:REVisIon?</code>                                                                                                                                                                                                                                                                                                                                               |
| Example        | <code>:SYST:APPL:REV?</code>                                                                                                                                                                                                                                                                                                                                                                       |
| Notes          | Query returns a quoted string that is the Revision of the currently selected application (Mode). Example:<br><code>"1.0.0.0"</code><br><br>String length is a maximum of 23 characters. (each numeral can be an integer + 3 decimal points)<br>The format is Major.Minor.Build.Compile, where Major must correspond to the Integer portion of the Version in the license file for the application. |
| Preset         | Not affected by a Preset                                                                                                                                                                                                                                                                                                                                                                           |
| State Saved    | Not saved in state, the value will be the selected application when a Save is done.                                                                                                                                                                                                                                                                                                                |



## Current Application Options (Remote Command Only)

Returns a string that is the Options list of the currently selected application (Mode). This information is also displayed in the Show System screen

|                |                                                                                                                                                                                                                                                                                            |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SYSTem:APPLication[:CURRent]:OPTion?</code>                                                                                                                                                                                                                                         |
| Example        | <code>:SYST:APPL:OPT?</code>                                                                                                                                                                                                                                                               |
| Notes          | Query returns a quoted string that is the Option list of the currently selected application (Mode). The format is the name as the *OPT? or SYSTem:OPTion command: a comma separated list of option identifiers. Example:<br>"1FP,2FP"<br><br>String length is a maximum of 255 characters. |
| Preset         | Not affected by a Preset                                                                                                                                                                                                                                                                   |
| State Saved    | Not saved in state per se, the value will be the selected application when a Save is invoked.                                                                                                                                                                                              |

## Application Catalog Number of Entries (Remote Command Only)

Returns the number of installed and licensed applications (Modes).

|                |                                                        |
|----------------|--------------------------------------------------------|
| Remote Command | <code>:SYSTem:APPLication:CATalog[:NAME]:COUNT?</code> |
| Example        | <code>:SYST:APPL:CAT:COUN?</code>                      |
| Preset         | Not affected by Preset                                 |
| State Saved    | Not saved in instrument state.                         |

## Application Catalog Model Numbers (Remote Command Only)

Returns a list of Model Numbers for the installed and licensed applications (Modes).

|                |                                                                                                                                                                                                                                                                                                                                                                                                             |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SYSTem:APPLication:CATalog[:NAME]?</code>                                                                                                                                                                                                                                                                                                                                                            |
| Example        | <code>:SYST:APPL:CAT?</code>                                                                                                                                                                                                                                                                                                                                                                                |
| Notes          | Returned value is a quoted string of a comma separated list of Model Numbers. Example, if SAMS and Phase Noise are installed and licensed:<br>"N9060A,N9068A"<br><br>String length varies based on licenses. Licenses are between 6 and 9 characters. So the string length will be between COUNT * 7 - 1 and COUNT * 10 - 1. (7 & 10 = Model Number length + 1 for comma. -1 = no comma for the 1st entry.) |
| Preset         | Not affected by a Preset                                                                                                                                                                                                                                                                                                                                                                                    |
| State Saved    | Not saved in instrument state.                                                                                                                                                                                                                                                                                                                                                                              |

## Application Catalog Revision (Remote Command Only)

Returns the Revision of the provided Model Number.

|                |                                                                                                                                                                                                                                                                                                                                                                        |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SYSTem:APPLication:CATalog:REVision? &lt;model&gt;</code>                                                                                                                                                                                                                                                                                                       |
| Example        | <code>:SYST:APPL:CAT:REV? 'N9060A'</code>                                                                                                                                                                                                                                                                                                                              |
| Notes          | <p>Returned value is a quoted string of revision for the provided Model Number. The revision will be a null-string ("" ) if the provided Model Number is not installed, licensed, and loaded. Example, if SAMS is installed and licensed:</p> <p>"1.0.0.0"</p> <p>String length is a maximum of 23 characters. (each numeral can be an integer + 3 decimal points)</p> |
| Preset         | Not affected by a Preset.                                                                                                                                                                                                                                                                                                                                              |
| State Saved    | Not saved in instrument state.                                                                                                                                                                                                                                                                                                                                         |

## Application Catalog Options (Remote Command Only)

Returns a list of Options for the provided Model Number

|                |                                                                                                                                                                                                                                                                                                                                               |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SYSTem:APPLication:CATalog:OPTion? &lt;model&gt;</code>                                                                                                                                                                                                                                                                                |
| Example        | <code>:SYST:APPL:CAT:OPT? 'N9060A'</code>                                                                                                                                                                                                                                                                                                     |
| Notes          | <p>Returned value is a quoted string of a comma separated list of Options, in the same format as *OPT? or :SYSTem:OPTion?. If the provided Model Number is not installed and licensed a null-string ("" ) will be returned. Example, if SAMS is installed and licensed:</p> <p>"2FP"</p> <p>String length is a maximum of 255 characters.</p> |
| Preset         | Not affected by a Preset                                                                                                                                                                                                                                                                                                                      |
| State Saved    | Not saved in instrument state.                                                                                                                                                                                                                                                                                                                |

## ESA SA compatibility command (Remote Command only)

Provided for backwards compatibility with ESA. When this command is received, the analyzer aliases it to the appropriate Mode.

|                |                                                                                                          |
|----------------|----------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:INSTrument[:SElect] 'SA'   'PNOISE'   'EDGE'   'GSM'   'BASIC'</code>                             |
| Example        | <code>:INST 'SA'</code>                                                                                  |
| Notes          | The query is not a quoted string. It is an enumeration as indicated in the Instrument Select table above |

### GSM Mode compatibility command (Remote Command only)

Provided for backwards compatibility. When this command is received, the analyzer aliases it to the following:

```
:INST:SEL EDGE GSM
```

---

|                |                          |
|----------------|--------------------------|
| Remote Command | :INSTrument[:SElect] GSM |
|----------------|--------------------------|

---

|         |           |
|---------|-----------|
| Example | :INST GSM |
|---------|-----------|

### SA compatibility command for EMC (Remote Command only)

Provided for ESU compatibility. When this command is received, the analyzer aliases it to the following:

```
:INST:SEL SCPI LC
```

This results in the analyzer being placed in SCPI Language Compatibility Mode, in order to emulate the ESU Spectrum Analyzer Mode.

---

|                |                                |
|----------------|--------------------------------|
| Remote Command | :INSTrument[:SElect] SANalyzer |
|----------------|--------------------------------|

---

|         |           |
|---------|-----------|
| Example | :INST SAN |
|---------|-----------|

### Receiver compatibility command for EMC (Remote Command only)

Provided for ESU compatibility. When this command is received, the instrument aliases it to the following:

```
:INST:SEL EMI
```

```
:CONF FSC
```

This results in the instrument being placed in the EMI Receiver Mode, running the Frequency Scan measurement, in order to emulate the ESU Receiver Mode.

---

|                |                               |
|----------------|-------------------------------|
| Remote Command | :INSTrument[:SElect] REceiver |
|----------------|-------------------------------|

---

|         |           |
|---------|-----------|
| Example | :INST REC |
|---------|-----------|

### APD compatibility command for EMC(Remote Command only)

Provided for ESU compatibility. When this command is received, the analyzer aliases it to the following:

```
:INST:SEL EMI
```

```
:CONF APD
```

This results in the analyzer being placed in the EMI Receiver Mode, running the APD measurement, in order to emulate the ESU APD Mode.

|                |                                     |
|----------------|-------------------------------------|
| Remote Command | :INSTrument[:SElect] APDistribution |
| Example        | :INST APD                           |

**IF Mode compatibility command for EMC (Remote Command only)**

Provided for ESU compatibility. When this command is received, the analyzer aliases it to the following:

```
:INST:SEL EMI  
:CONF MON
```

This results in the analyzer being placed in the EMI Receiver Mode, running the Monitor Spectrum measurement, in order to emulate the ESU IF Mode.

|                |                                 |
|----------------|---------------------------------|
| Remote Command | :INSTrument[:SElect] IFANalyzer |
| Example        | :INST IFAN                      |

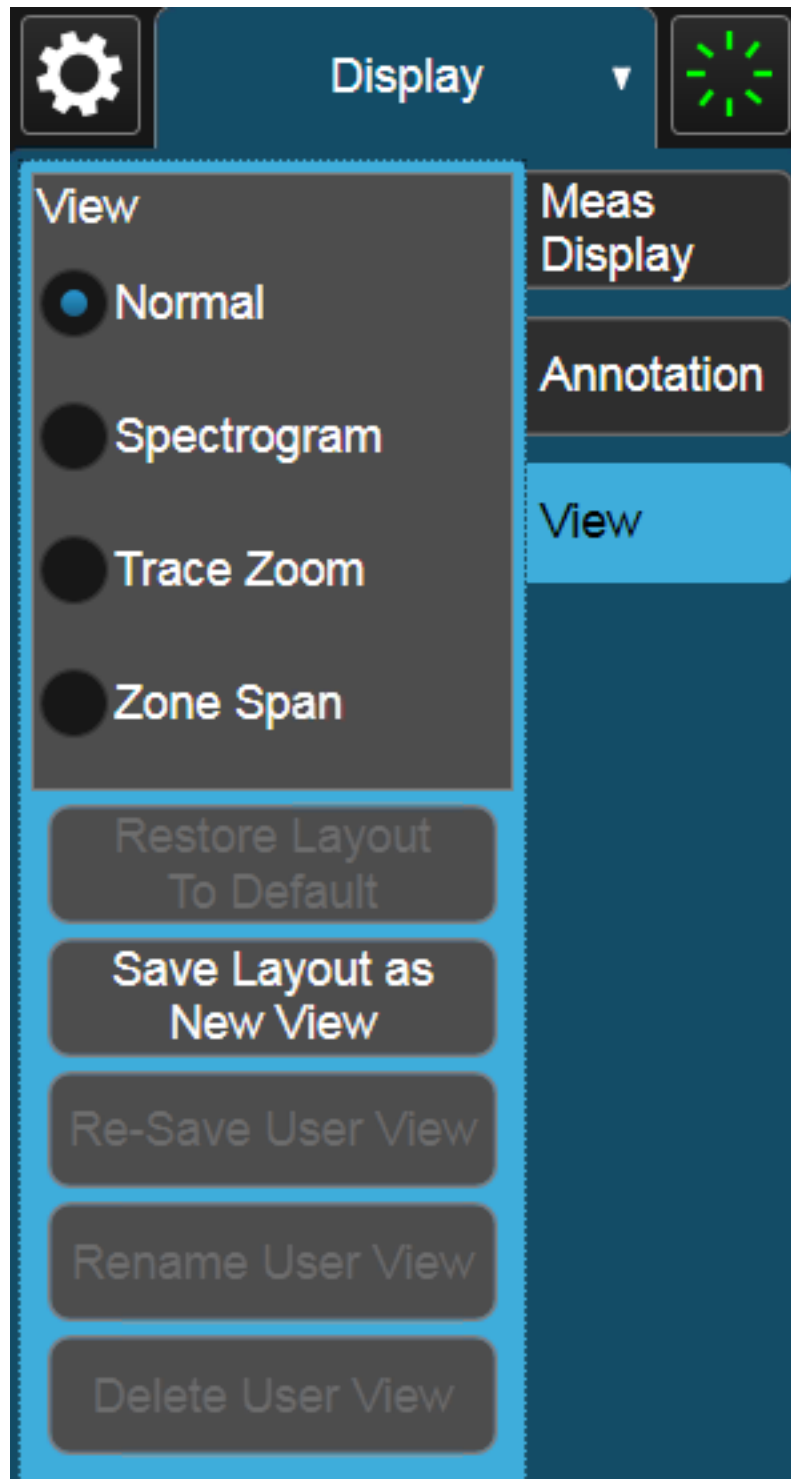
**2.1.1.3 Measurement**

The Measurement column of the Mode/Meas/View dialog shows all the Measurements available for the Mode which is selected in the first column. Select a Measurement in the second column and the View column will show all the Views available for that measurement. Once you have the Mode, Measurement and View selected, press OK to change the current Screen to that Mode, Measurement and View.

**2.1.1.4 View**

A View is a collection of Result Windows. The View column of the "Mode/Meas/View Dialog" on page 55 shows all the Views available for the Measurement which is selected in the second column. Once you have the Mode, Measurement and View selected, press OK to change the current Screen to that Mode, Measurement and View.

The View may also be set by using the View tab on the Display menu. The View tab is the last tab on the Display menu for every measurement. The Views are the same as those listed in the "Mode/Meas/View Dialog" on page 55.



2.1.1.5 Sequencer

Allows multiple Screens to update sequentially while in "Multiscreen" on page 143 display mode. Each Screen updates in sequence, and when all have updated, the sequence will start again.

To start the Sequencer, you must have more than one Screen defined, and you must have Multiscreen selected (see "Screen Tabs" on page 54).

If you want each Screen to use a different input, you must turn off All Screens Use Same Input under Input/Output, Input.

CAUTION

Differences in hardware settings between the Screens may cause switches and/or attenuators to cycle as you go from one Screen to another. This could potentially reduce the life of these components. To avoid this, make sure **Attenuation**, **µW Path Control** and other switch settings are the same in each Screen.

NOTE

When the Sequencer is running, the destination of remote commands is unpredictable, so you should stop the Sequencer before sending any measurement-related commands. Once the Sequencer has stopped, select a specific Screen using `:INSTrument:SCReen:SElect`, before sending any further commands. See "Select Screen" on page 145

NOTE

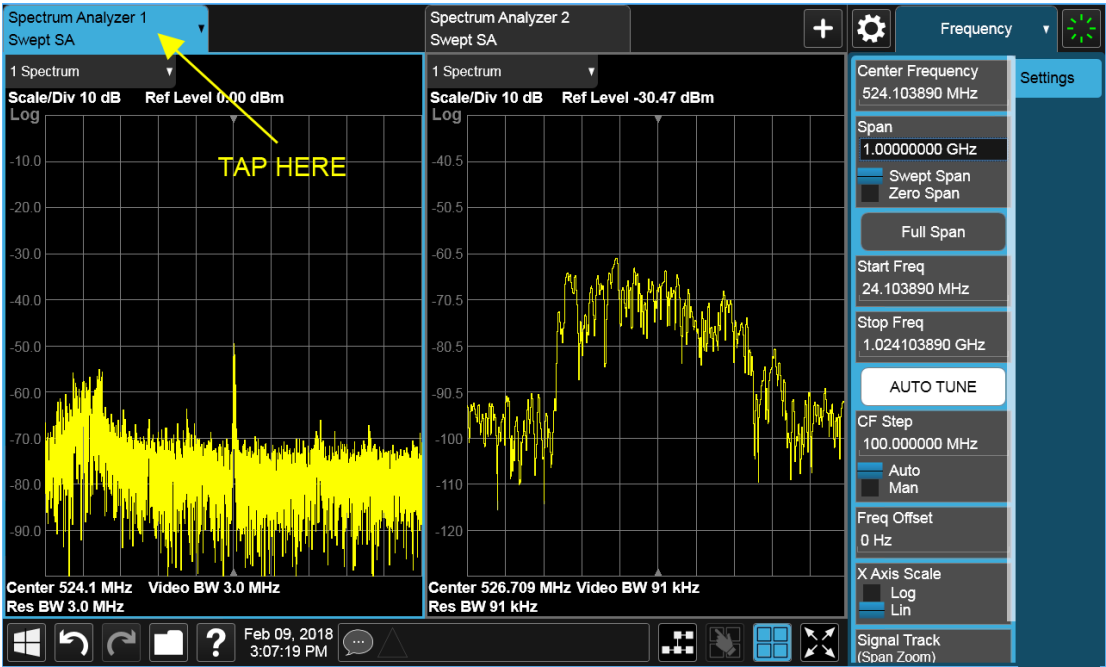
When the Sequencer is running, Auto alignment is temporarily disabled. A pending auto alignment might be executed when the sequencer is stopped.

See "More Information" on page 66

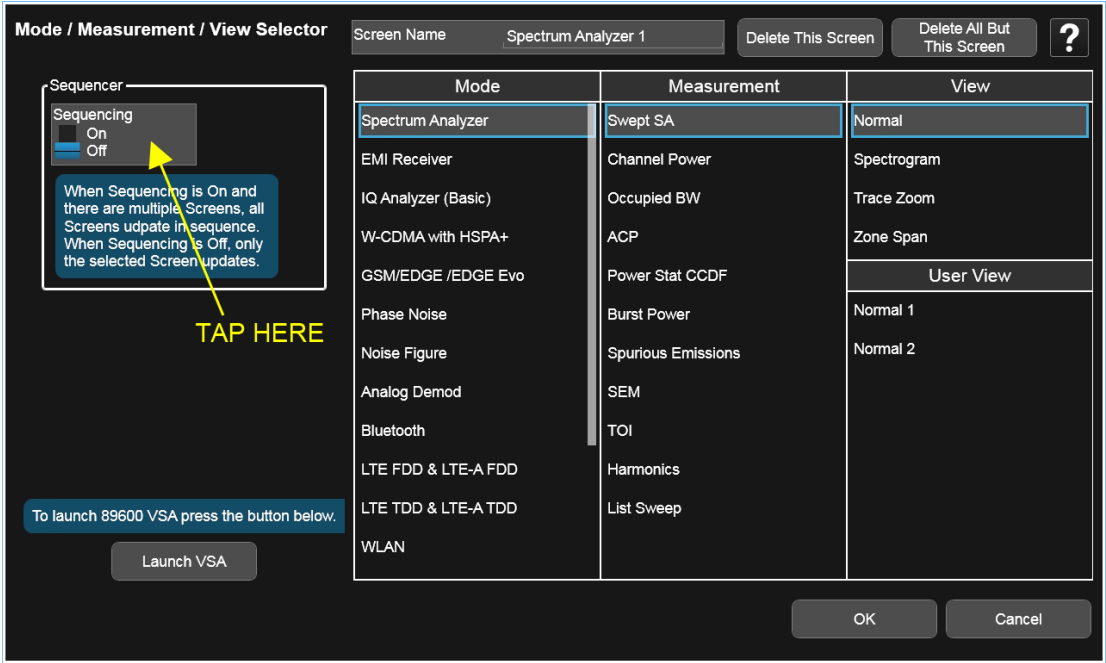
|                |                                                                                                                                                                                  |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SYSTem:SEQuencer ON   OFF   1   0</code><br><code>:SYSTem:SEQuencer?</code>                                                                                               |
| Example        | <code>:SYST:SEQ ON</code>                                                                                                                                                        |
| Notes          | If the display is disabled (via <code>:DISP:ENAB OFF</code> ) then the error message “-221, Settings conflict; Screen SCPI cannot be used when Display is disabled” is generated |
| Dependencies   | To start the Sequencer, you must have more than one Screen defined and you must have Multiscreen selected                                                                        |
| Preset         | <code>OFF</code>                                                                                                                                                                 |

More Information

To start the Sequencer, tap the current (blue) Screen tab to go into the Mode/Meas/View Dialog:



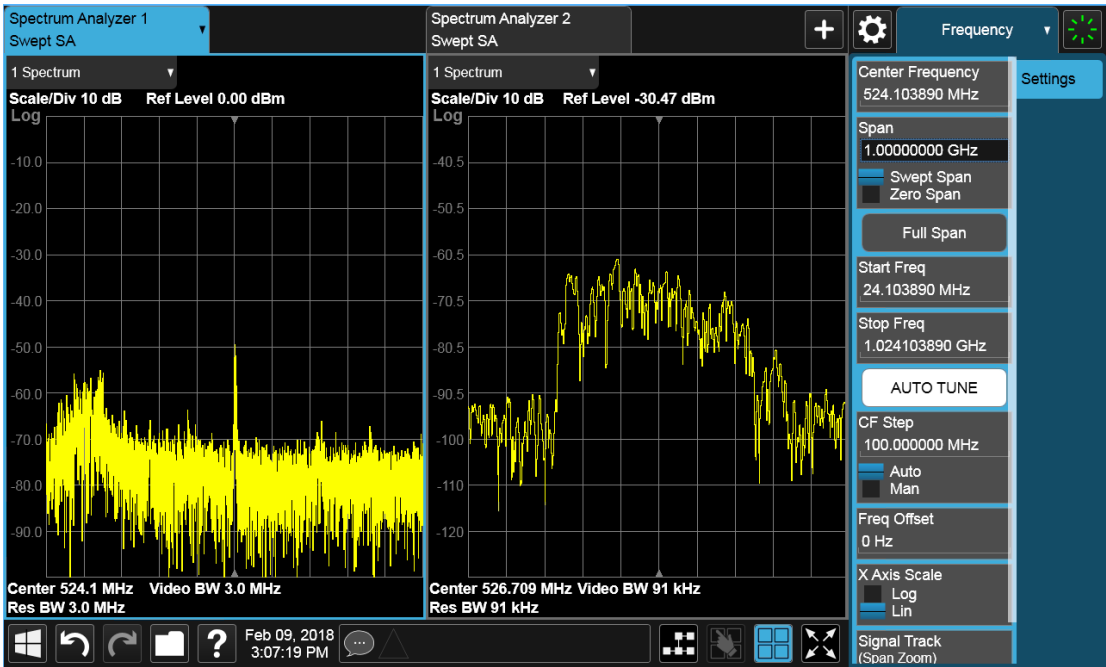
In the Sequencer block in the upper left hand corner, tap the Sequencing switch to turn it On:



2 User Interface  
2.1 Screen Tabs

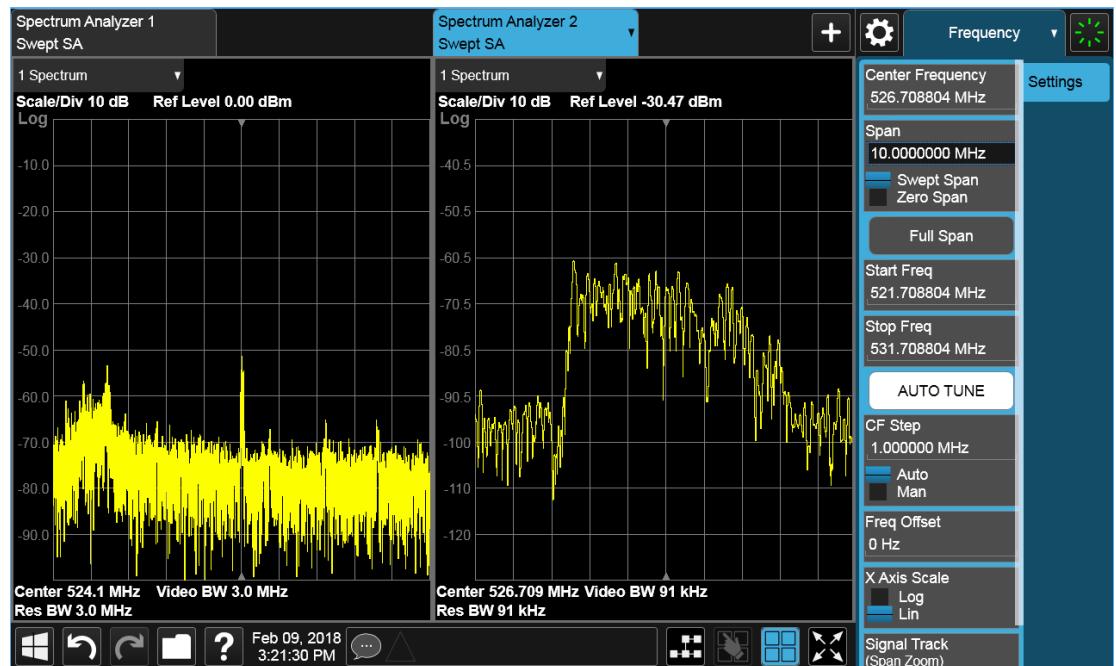
The instrument will immediately exit the Mode/Meas/View Dialog and begin making measurements in each of the screens, one after the other. When a measurement is being made in a particular Screen, that Screen's tab will be blue.

Measurement being made in Screen 1:



Measurement being made in Screen 2:





Touching any key or control on the display will cause the Sequencer to stop, so that you can make desired changes. When this happens, the message “Sequencer stopped” is displayed.

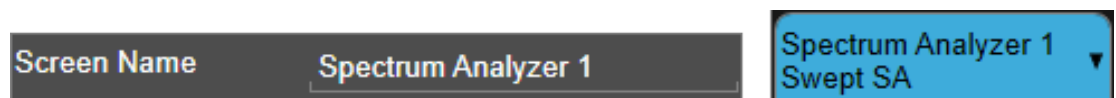
When the Sequencer is running, the screens update in the order in which they were created.

Each Screen takes one measurement then passes control to the next Screen. Each Screen updates as though it were in Single Sweep or Single Measurement mode. Thus, if Averaging is on, a Screen may take multiple sweeps before moving on to the next Screen.

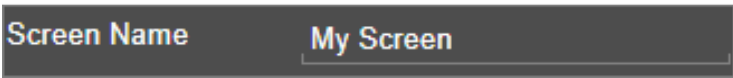
### 2.1.1.6 Screen Name

By default, the screen name is the Mode (Application) name followed by a number indicating the instance of the application.

You may change the name displayed on the Screen Tab of any screen. The control to do this appears in the ["Mode/Meas/View Dialog" on page 55](#):



When you touch this control an onscreen keyboard appears, allowing you to change the name. Whatever you change it to appears on the Tab, even if you subsequently change the screen to a different Mode.



To reset the name, delete the screen name entirely.

Each Screen Name must be unique; you cannot give the same name to more than one screen.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:INSTrument:SCReen:REName &lt;alphanumeric&gt;</code>                                                                                                                                                                                                                                                                                                                                                                                              |
| Example        | <code>:INST:SCR:REN "Baseband"</code>                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Notes          | <p>The currently active screen is renamed.</p> <p>If the <code>&lt;alphanumeric&gt;</code> specifying the new name is already present in the list of screen names, the error message “-224, Illegal parameter value; New name &lt;name&gt; already exists” appears</p> <p>If the display is disabled (via <code>:DISP:ENAB OFF</code>) then the error message “-221, Settings conflict; Screen SCPI cannot be used when Display is disabled” appears</p> |

2.1.1.7 Delete This Screen

Pressing this button deletes the current Screen (the one with the blue tab). Deleting a screen removes it from view and selects the next lower screen in the list of screens. If only one screen is configured, it cannot be deleted.

If you press the **Delete This Screen** button, a prompt appears:

“This function will delete the current screen and its settings. This action cannot be undone. Do you want to proceed?”

Pressing **OK** or Enter deletes the screen, pressing **Cancel** or **ESC** does not.

|                |                                                                                                                                                                                                                                                                                                                                                                                                               |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:INSTrument:SCReen:DELeTe</code>                                                                                                                                                                                                                                                                                                                                                                        |
| Example        | <code>:INST:SCR:DEL</code>                                                                                                                                                                                                                                                                                                                                                                                    |
| Notes          | <p>The currently active screen is deleted</p> <p>If the screen you are attempting to delete is the only configured screen, the error message “-221, Settings conflict; Last screen cannot be deleted” is displayed</p> <p>If the display is disabled (via <code>:DISP:ENAB OFF</code>) then the error message “-221, Settings conflict; Screen SCPI cannot be used when Display is disabled” is generated</p> |

2.1.1.8 Delete All But This Screen

Pressing this control deletes all the Screens except the current Screen (the one with the blue tab).

If you press the **Delete All But This Screen** button, a prompt appears:

“This function will delete all defined screens and their settings, except for the current screen. This action cannot be undone. Do you want to proceed?”

Pressing **OK** or Enter deletes the screen, pressing **Cancel** or ESC does not.

|                |                                                                                                                                                                                                                                                                                                                                             |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:INSTrument:SCReen:DELeTe:ALL</code>                                                                                                                                                                                                                                                                                                  |
| Example        | <code>:INST:SCR:DEL:ALL</code>                                                                                                                                                                                                                                                                                                              |
| Notes          | <p>You can reset the instrument to the power-on configuration by invoking <code>:INST:SCR:DEL:ALL</code> followed by <code>:SYSTem:DEFault ALL</code></p> <p>If the display is disabled (via <code>:DISP:ENAB OFF</code>) then the error message “-221, Settings conflict; Screen SCPI cannot be used when Display is disabled” appears</p> |

### 2.1.1.9 89600 VSA

Pressing this button launches the 89600 VSA software. The 89600 VSA software is powerful, PC-based software, offering the industry's most sophisticated general purpose and standards specific signal evaluation and troubleshooting tools for R&D engineers. Even for proprietary and non-standard signals in SATCOM or MILCOM applications, you can make signal quality measurements with customized IQ constellation.

The 89600 VSA software offers the following features:

- Over 35 general-purpose analog and digital demodulators ranging from 2FSK to 4096QAM
- Flexible and custom IQ and OFDM signal analysis for single carrier
- Standards specific modulation analysis including:
  - Cellular: GSM/EDGE, cdma2000, W-CDMA, TD-SCDMA, LTE(FDD/TDD),
  - LTE-Advanced and more
  - Wireless networking: 802.11a/b/g, 802.11n, 802.ac, 802.16 WiMAX (fixed/mobile), WiSUN (MR-FSK PHY)
  - RFID
  - Digital satellite video and other satellite signals, radar, LMDS
- Up to 400K bin FFT, for the highest resolution spectrum analysis
- A full suite of time domain analysis tools, including signal capture and playback, time gating, and CCDF measurements
- 20 simultaneous trace displays and the industry's most complete set of marker

functions

- Easy-to-use Microsoft Windows graphical user interface

For more information see the Keysight 89600 Series VSA web site at [www.keysight.com/find/89600vsa](http://www.keysight.com/find/89600vsa)

To learn more about how to use the 89600 VSA in the instrument, start the 89600 VSA software, then open the 89600 VSA Help and navigate to the topic "About Keysight X-Series Signal Analyzer with 89600 VSA Software".

---

|         |                                                                |
|---------|----------------------------------------------------------------|
| Example | <code>:INST:SEL VSA89601</code><br><code>:INST:NSEL 101</code> |
|---------|----------------------------------------------------------------|

### 2.1.2 Add Screen

On X-Series analyzers you can configure up to 16 different Screens at one time. Each Screen contains one Mode, each Mode contains one Measurement, and each Measurement contains a number of Windows.

You can add screens by pressing the “+” icon in the "Screen Tabs" on page 54 panel. The icon is shown below:



Every time you add a Screen, the instrument “clones” or “copies” the current Screen into the new Screen. If desired, you can then use the "Mode/Meas/View Dialog" on page 55 to change the Mode, Measurement and/or View of the new Screen, or simply operate a second copy of your previous Screen, thus preserving the settings of your previous Screen.

When you have defined the maximum number of Screens (16), the “+” icon disappears.

For more information about operating the instrument with multiple screens configured, see "Multiscreen" on page 143.

---

|                |                                        |
|----------------|----------------------------------------|
| Remote Command | <code>:INSTrument:SCReen:CREate</code> |
|----------------|----------------------------------------|

---

|         |                            |
|---------|----------------------------|
| Example | <code>:INST:SCR:CRE</code> |
|---------|----------------------------|

---

|       |                                                                                                                                                                                                                                                                                                                                       |
|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Notes | <p>The maximum number of screens is 16. If an attempt to add a screen occurs when the maximum have been defined, the error message “-221, Settings conflict; Screen limit reached” appears</p> <p>When you create a new screen the Screen Name is the current Mode name followed by a number indicating the instance of the Mode.</p> |
|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

---

If the display is disabled (via **:DISP:ENAB OFF**) then the error message “-221, Settings conflict; Screen SCPI cannot be used when Display is disabled” appears

## 2.2 Meas Bar

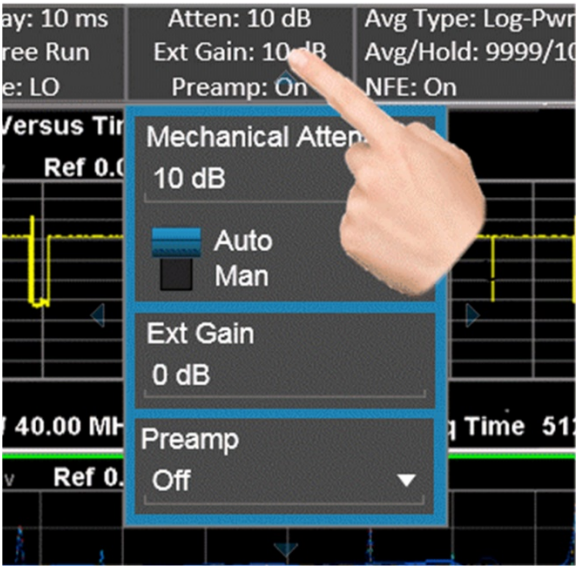
The Meas Bar is used to display annotation for the current measurement. There are three primary uses for the Meas Bar:

1. To show annotation for the most important parameters in the measurement so you can see them at a glance
2. To show the annotation that you will most want to have recorded in a screen dump
3. To give you quick access to settings.



The Meas Bar is made up of a number of annotation panels, each of which, when pressed, opens up a dialog below it which contains controls for those settings.

For example, here is what the display looks like when you touch one of the regions of the Meas Bar:



Touching anywhere off the hotspot panel or pressing any hardkey except **Save** or **Quick Save** closes the hotspot panel.

In a hotspot panel, the control in black with the blue border is the active function. Each panel may have its own default active function.

Settings that are colored amber are those that you need to be particularly aware of; for example, if Alignments are off, this is shown in amber, so you will know that you may not be meeting spec. Similarly, if DC coupling is on, this is shown amber, to alert you to be careful what voltage you put on the input.

You can turn the Meas Bar on and off with a switch on the Annotation tab of the Display menu.

### System Control Panel

The leftmost panel holds the GPIB/Remote annunciators, the Single/Continuous symbol/control, the LXI indicator and the PASS/FAIL indicator. Tapping this panel drops down controls for Single/Continuous, Pause/Resume and restart.



### GPIB/Remote annunciators

The GPIB/Remote annunciators are shown as the letters **KRLTS**. Each letter is shown if the state is true and is not shown if the state is false, as follows:

|          |                         |                                                                                                                              |
|----------|-------------------------|------------------------------------------------------------------------------------------------------------------------------|
| <b>K</b> | Keylock indicator       | This is shown when the instrument is in the Keylock state (turned on and off by the <b>SYST:KLOCK</b> command)               |
| <b>R</b> | Remote annunciator      | Shown when the instrument is in the remote state, as when being controlled via the IEEE-488 bus (GPIB) or TCP/IP connections |
| <b>L</b> | GPIB Listen annunciator | Shown when addressed to listen via GPIB or TCP/IP                                                                            |
| <b>T</b> | GPIB Talk annunciator   | Shown when addressed to talk via GPIB or TCP/IP                                                                              |
| <b>S</b> | GPIB SRQ annunciator    | Shown when the instrument is asserting SRQ on GPIB. This annunciator is an amber color                                       |

### Single/Continuous symbol/control

This annunciator shows as an arrow on an oval line when in Continuous, or an arrow on a straight line when in Single.

LXI indicator

This indicator displays in green when LAN is connected, in white when LAN is not connected, and in red when LAN is connected but has a connection problem.

PASS/FAIL indicator

This annunciator displays when Limits are turned on. It is green if all Limits are passing, and a red FAIL if any limit is not passing.

The following command queries the status of the current measurement limit testing. It returns a 0 if the measured results pass when compared with the current limits. It returns a 1 if the measured results fail any limit tests.

|                |                                                                                                                                            |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | :CALCulate:CLIMits:FAIL?                                                                                                                   |
| Example        | :CALC:CLIM:FAIL?<br><br>queries the current measurement to see if it fails the defined limits<br>Returns a 0 or 1: 0 it passes, 1 it fails |

Trace Detector Settings Panel

In the Swept SA and some other measurements, there is a special panel summarizing the settings for the traces in the measurement:



There is one column for each trace. The rows are as follows:

- The top row shows the Trace Number, in the trace color.
- The second row shows the Trace Type for each trace (W=Clear/Write, A=Trace Average, M=Max Hold, m=Min Hold); this letter is in white if the trace is Active, in gray if the trace is inactive; there is a bar through the letter if the trace is not being displayed
- The third row shows the detector for each trace (N=Normal, S=Sample, A=Average, P=peak, p=negative peak, Q=Quasi Peak, E=EMI Average, R=RMS Average, f=math function)

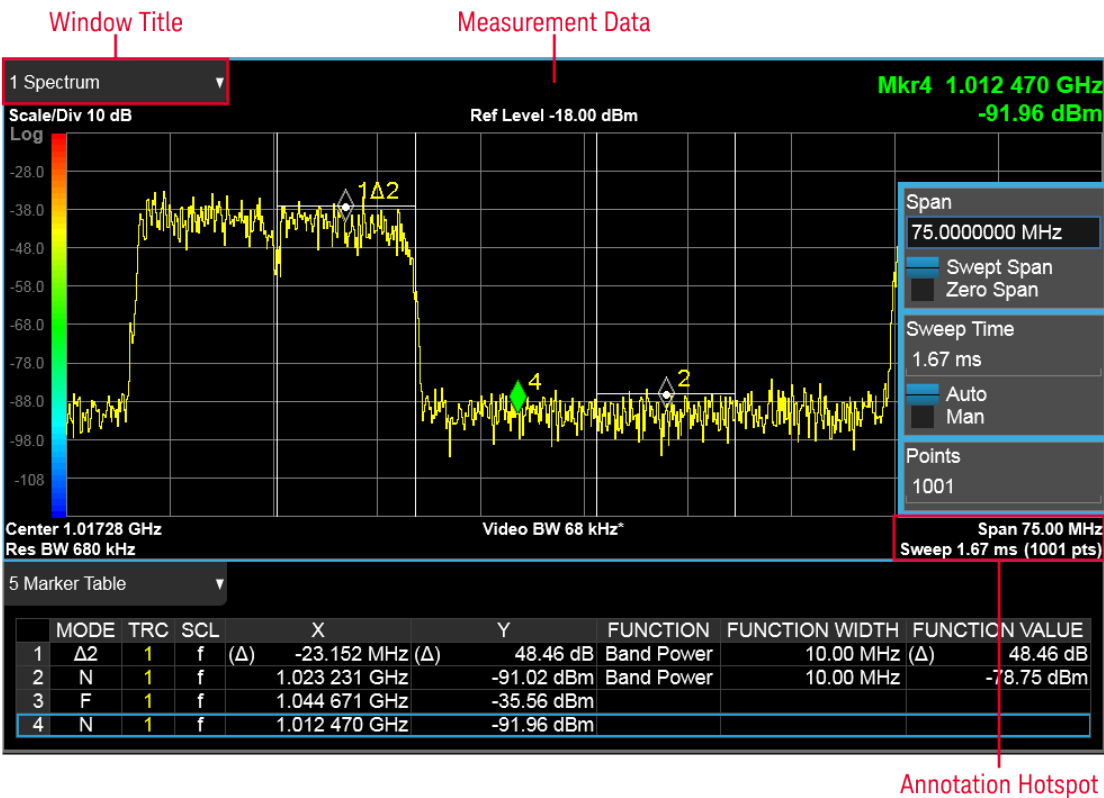


In the example above, trace 1 is active, visible, and in Average using the Sample detector, the other traces are inactive, blanked and in Clear/Write using the Normal detector.

Tapping this panel drops down controls for the Traces.

## 2.3 Measurement Display

The Measurement Display contains one or more data windows displaying the result of the current measurement. These may be graphical or textual windows.



Each window in the Measurement display contains a "Window Title" on page 78, "Measurement Data" on page 82, and graphical windows also may contain "Annotation Hotspot" on page 85.

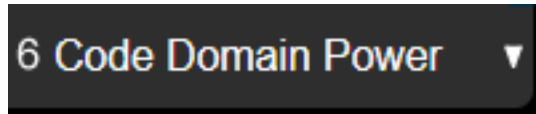
The selected window in the Measurement Display is indicated by a blue border. Window-dependent controls in the menu panel always refer to the selected window.

### 2.3.1 Window Title

The Window Title appears in the upper left hand corner of the window, and includes a title describing the measurement data currently being displayed in the window. The title may also contain additional information about the data in the window, for example in the LTE measurement supplication, the component carrier being displayed in the window will be indicated (e.g., "CC0").

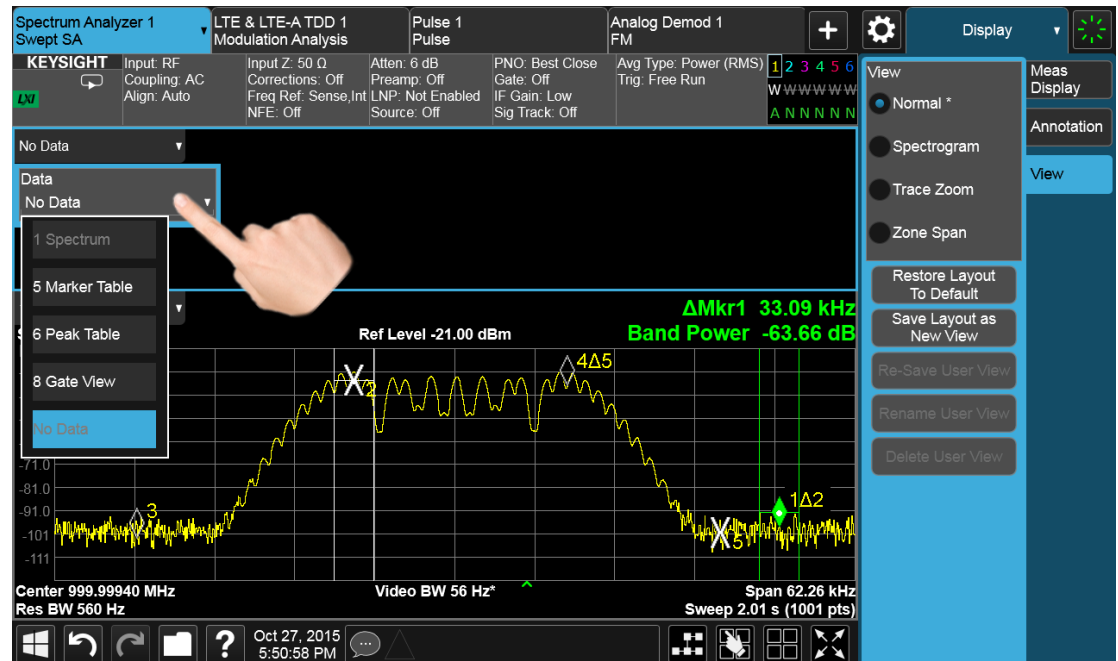
Measurements that support User Views (see ["View Editor" on page 122](#)) also display the Window Number in the Window Title, to enable window addressing from SCPI. The number is the number that will be used in the SCPI command to address that window, for example, in the WCDMA Mod Accuracy measurement, Code Domain Power is assigned window number 6, so you address it with the following SCPI command:

```
:DISP:RHO:WIND6:TRAC:Y:RLEV 0.0
```



Note the arrow pointing down on the right side of the Window Title. This indicates that touching the Window Title will display a dropdown, which enables you to select the Measurement Data to be displayed in the window.

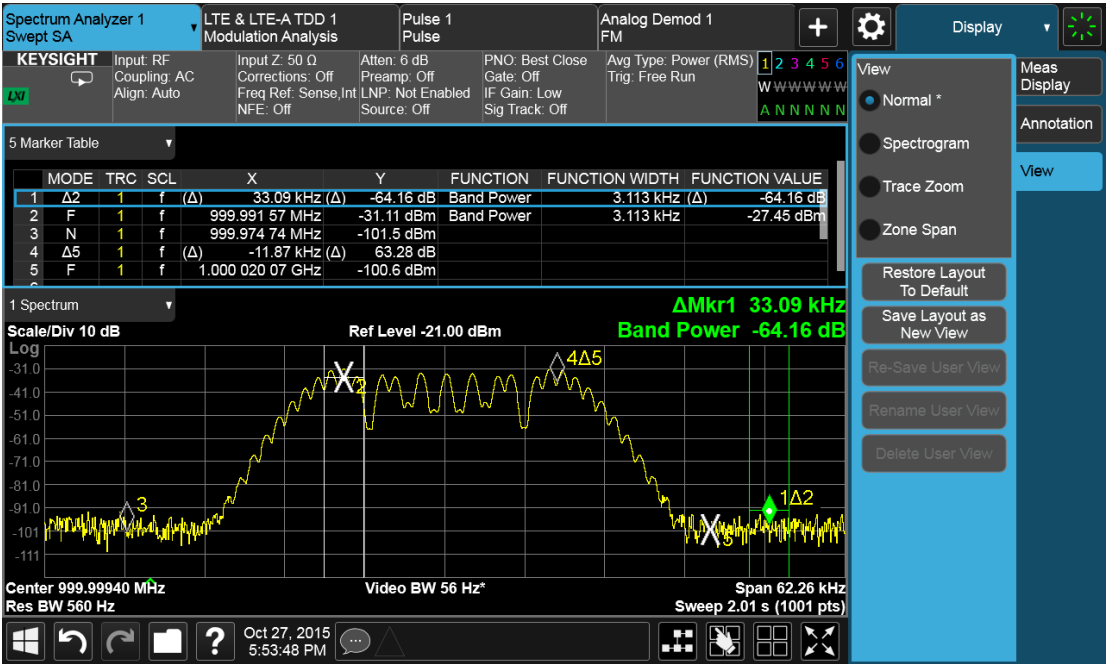
For example, if we wish to assign the results of the upper window in the display below to the Marker Table, we would touch the window title and then the “Data” control that is revealed, as shown:



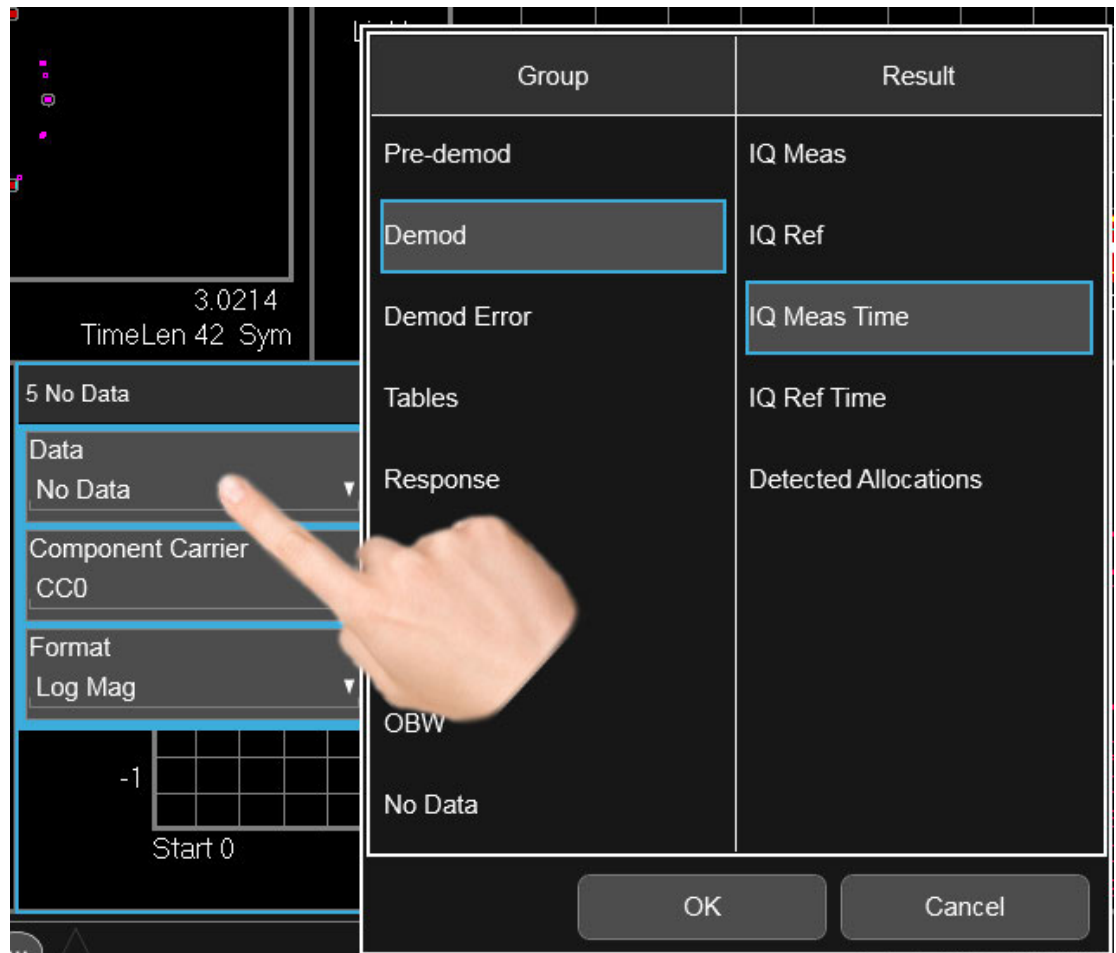
And then select Marker Table, yielding the result below:

2 User Interface

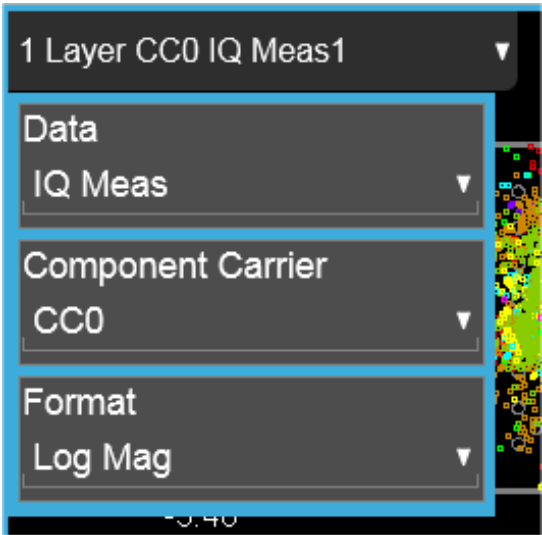
2.3 Measurement Display



Note also that the Window Data dropdown can be a cascaded list, if the number of available results requires categorization to hold them all:



Note also that the Window Data dropdown sometimes includes controls for further configuring the window, for example, in LTE choosing the desired Component Carrier and Data format.



Touching a window's title dropdown also selects the window.

2.3.2 Measurement Data

The Measurement Data region shows graphical or textual data for the Data selected in the Window Title Data control. Below you can see examples of both graphical and textual windows in a four-window display.



There are many gestures which you can use to interact with a measurement display window. They are detailed below.

## Swipe

There are several swipe actions, as listed below. One of the most important actions is swiping a spectrum window to the left or right, or up or down, to adjust the frequency and level of the spectrum, as shown below.



Swipe actions are summarized in the table below. Not all of these may be available, depending on the measurement.

| Object                          | Action                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Spectrum Trace Left/Right       | Drag trace (change Center Frequency)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Spectrum Trace up/down          | Drag trace (change Ref Level)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Marker Left/Right               | Drag marker along trace                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Fixed Marker Left/Right/Up/Down | Drag marker in space                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Scrollable area                 | <p>Scroll vertically or horizontally. Scrollable areas include the Menu Panel (if overfull), tables and lists. A scrollable area is indicated by a vertical or horizontal translucent white bar which can also be dragged by a mouse</p> <p>When scrolling a table:</p> <ul style="list-style-type: none"> <li>Row headers remain in place when the table is scrolled horizontally, and scroll with the table when the table is scrolled vertically</li> <li>Column headers remain in place when the table is scrolled vertically, and scroll with the table when the table is scrolled horizontally</li> </ul> |

| Object         | Action                   |
|----------------|--------------------------|
| Toggle control | Toggle in that direction |

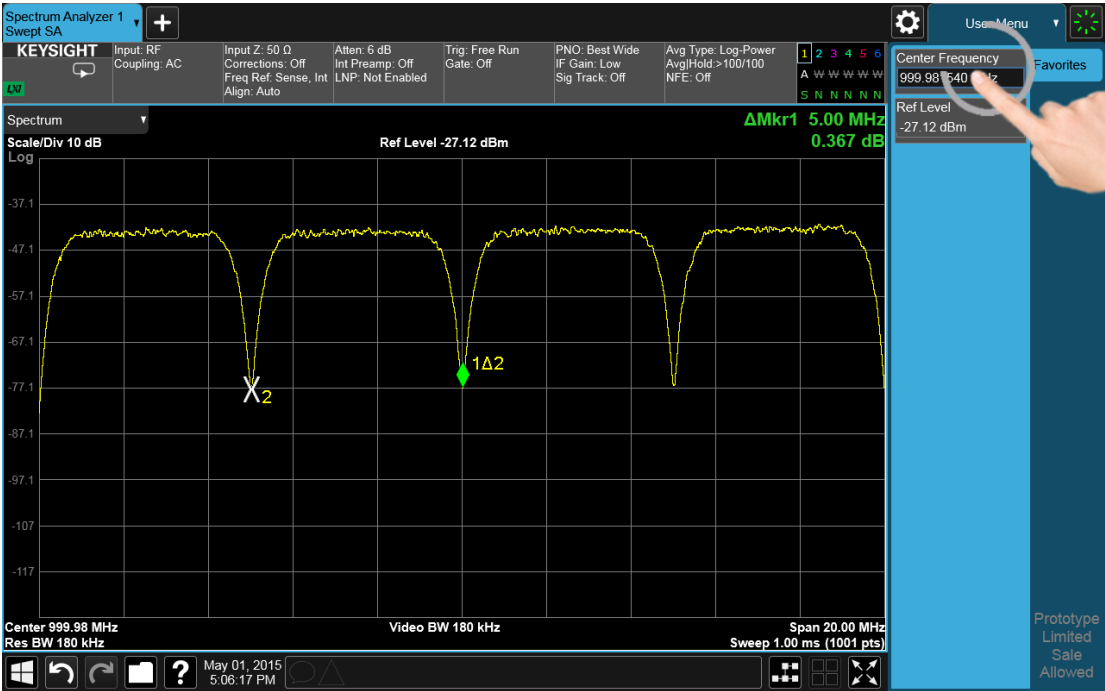
Pinch

You can also pinch in or out either horizontally or vertically to zoom in the x-axis or y-axis dimension. For example, a pinch horizontally lets you adjust the Span of the Spectrum window. Also, pinching on the wings of a Band Power or other Band Function allows you to widen or narrow that Band Function.

Pinching may sometimes be easier if you use the index finger of each hand, rather than pinching with one hand.

Touch-and-Hold

You can also touch-and-hold the display, that is, touch it and hold your finger on the display. A circle is drawn, and when the drawing completes, a right-click gesture is performed that depends on the screen feature touched, as listed in the table below.



|                         |                                                                                                                                                                                               |
|-------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Right Click on a Trace  | Peak Search, Trace Type (Clear/Write, Trace Average, Max Hold, Min Hold), Trace View/Blank (Active, View, Blank, Background). Not all of these may be available, depending on the measurement |
| Right Click on a Marker | Marker Mode (Normal, Delta, Fixed, Off), Peak Search, Next Peak, Next Pk Right, Next Pk Left). Not all of these may be available, depending on the measurement                                |



|                                     |                                                                                    |
|-------------------------------------|------------------------------------------------------------------------------------|
| Right Click on the Background       | Lets you select Help                                                               |
| Right Click on a Menu Panel control | Lets you add or remove that control from the User Menu or get Help on that control |

## Tap

Tapping an object causes the actions defined in the table below:

| Object                            | Action                                                                                                       |
|-----------------------------------|--------------------------------------------------------------------------------------------------------------|
| Marker                            | Select                                                                                                       |
| Marker (repeated taps on stacked) | Cycle through stacked markers                                                                                |
| Trace                             | Select. In addition if Marker is the active function, move the selected marker to the point where you tapped |
| Trace (repeated taps on stacked)  | Cycle through stacked traces                                                                                 |
| Window                            | Select if unselected                                                                                         |
| Screen                            | Select if unselected                                                                                         |

## Double Tap

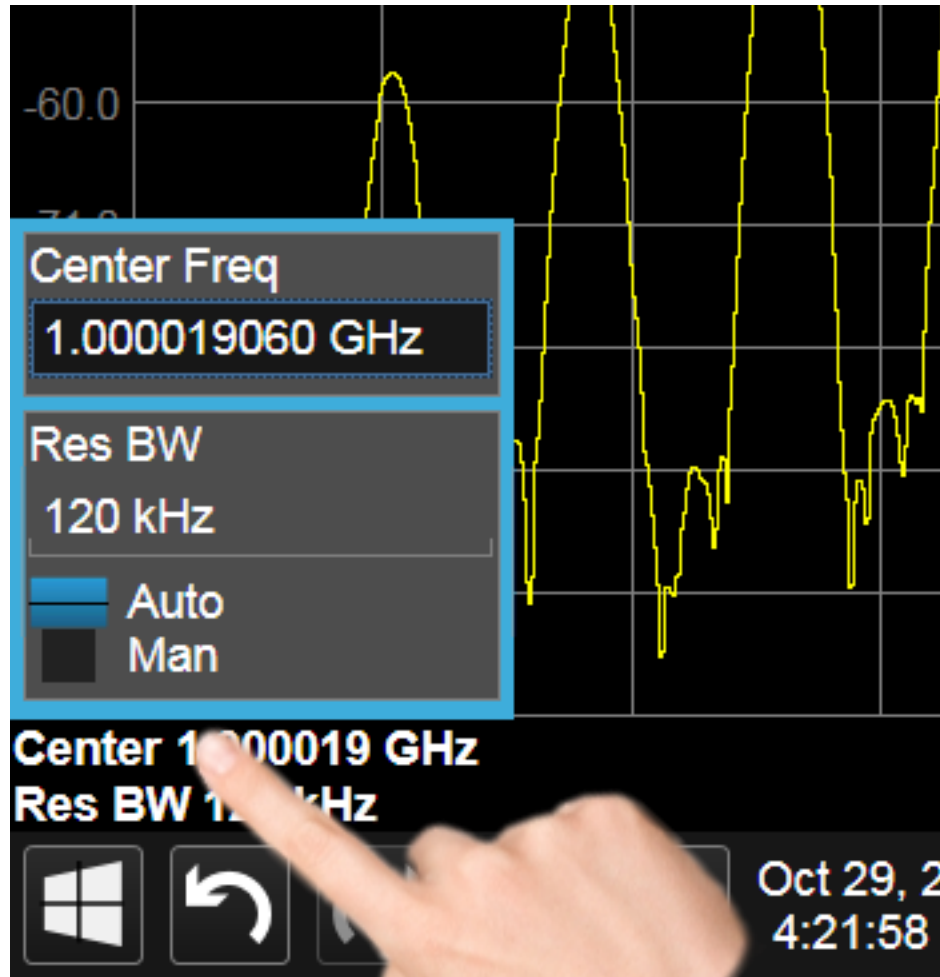
Double-tapping an object causes the actions defined in the table below:

| Object | Action      |
|--------|-------------|
| Window | Zoom/Unzoom |

### 2.3.3 Annotation Hotspot

You can tap on a graticule annotation to modify one of the fields in that annotation. For example if you tap on the region with Center Freq and Res BW in it, a menu panel pops up with just those settings on it.

2 User Interface  
2.3 Measurement Display



Touching anywhere off the hotspot panel or pressing any hardkey except **Save** or **Quick Save** closes the hotspot panel.

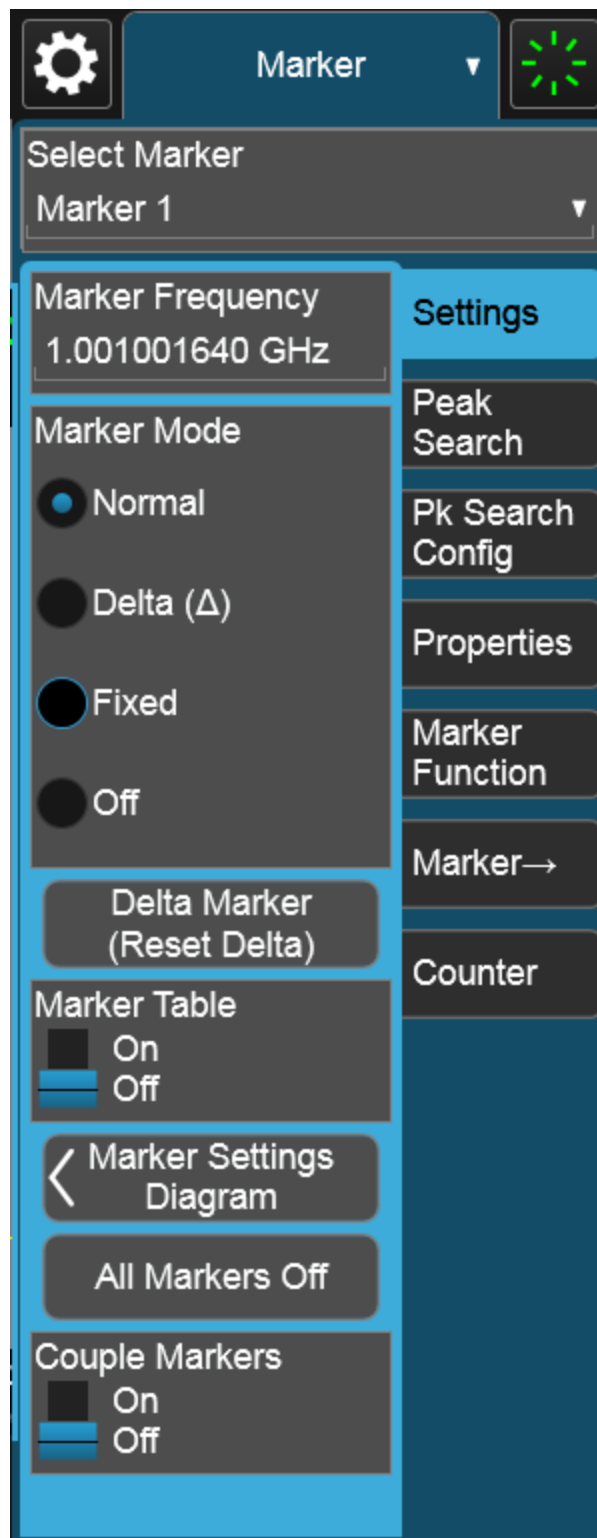
Annotation which is not currently able to be adjusted is not grayed out on the display, but the control in the hotspot that drops down or pops up is grayed out.

In a hotspot panel, the control in black with the blue border is the active function. Each panel may have its own default active function

## 2.4 Menu Panel

The menu panel is the main focus of the X-Series Multitouch user interface. The controls include active functions, dropdowns, action buttons, radio buttons and toggles.

2 User Interface  
2.4 Menu Panel

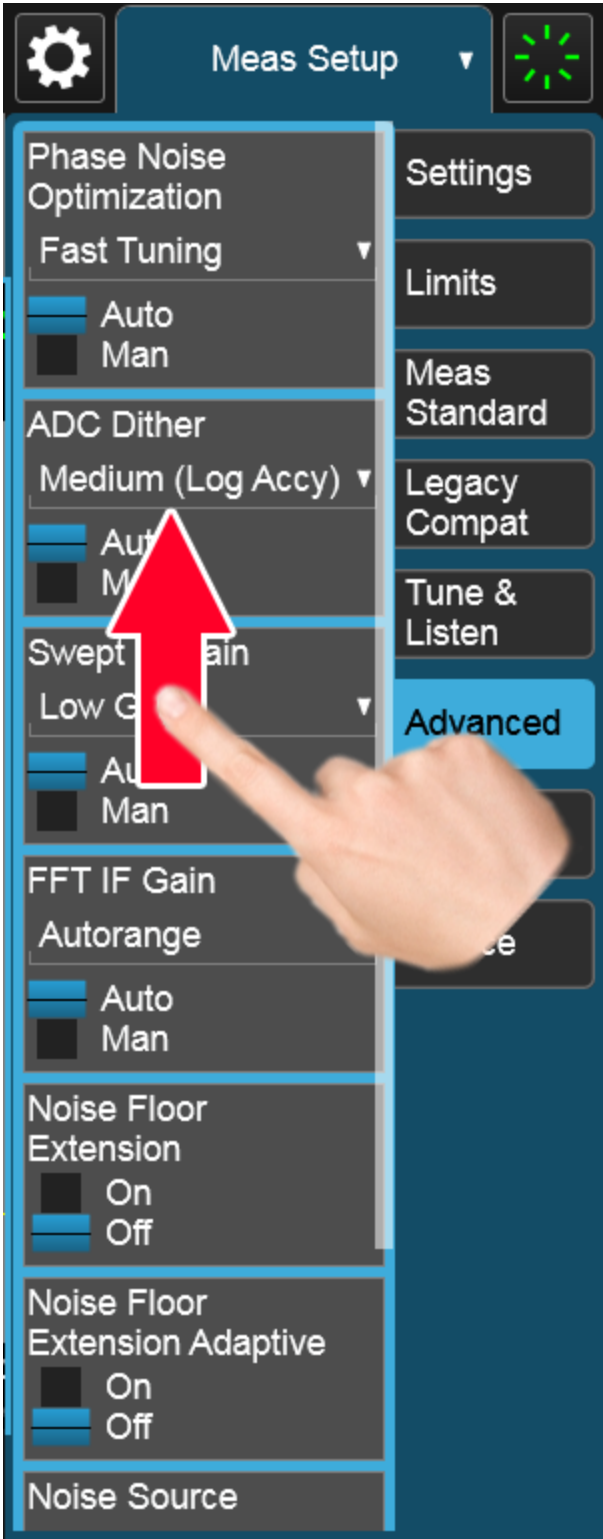


The menu panel normally appears on the right side of the display and consists of a rectangular panel with multiple “sub-panels” lying on top of each other, each sub-panel being accessed by a tab on the right.

You press a front panel key (or “hardkey”) to access a particular menu. On the front panel there are twelve “measurement hardkeys” (the ones in the shaded region in the figures below) – these are the hardkeys that open up menus in the menu panel.

With a menu open, tap a tab to access the controls on its sub-panel. Whenever you press the front panel key associated with a menu, the default (top) tab is selected.

If the number of controls on a panel exceeds the height of the panel, scrolling is enabled, which is indicated by a white bar on the left that fades away after a few seconds. You swipe up or down with your finger to scroll the panel, or you can grab the white bar with a mouse.



If you move to a different menu panel or sub-panel and then come back to a previous panel, the previous panel is always reset to be scrolled all the way back to the top.

### Accessing Menus Without Using Front-Panel Keys

You can access the menu panels without using the front panel keys, as you would need to do if you were operating the instrument using Remote Desktop. Touch or click on the menu title, as shown below. A dropdown containing the twelve measurement hardkeys appears. Selecting a hardkey from the dropdown displays the corresponding menu, and the dropdown disappears.



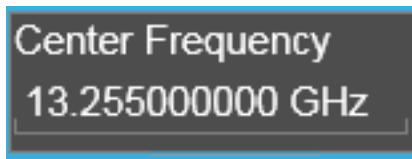
### Entering Numeric Values

Many controls on the menu panel allow you to enter numeric values. These are called “active functions.” An active function control displays a number and a suffix,

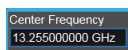
## 2 User Interface

### 2.4 Menu Panel

for example 13.255 GHz, as in the example below:



An active function is “active” if the numeric value is surrounded by a black background with a blue border, as below. In this state, it is ready to receive numeric input from the number pad on the front panel, the knob, or the step keys.



When an active function is in the active state, you can start typing or pressing the number keys on the front panel, which causes the Numeric Entry Panel to appear, as shown below. The Numeric Entry Panel displays the typed value, and the terminators to complete the entry.

Here we see a UXA with an active function control in the active state. Although no Numeric Entry Panel is displayed, you can just touch the “2” key:





This causes the Numeric Entry Panel to pop up to receive the numbers you are typing:



Type in as many digits as required, then touch one of the unit terminator buttons in the Numeric Entry Panel to complete the entry. In this case, 2 GHz was the desired entry, so you just touch the “GHz” terminator:

## 2 User Interface

### 2.4 Menu Panel



The Numeric Entry Panel disappears and, in the example, the active function value becomes 2 GHz.



It is important to note that you can always pop up the Numeric Entry Panel by touching an active function control while it is active; for example, if you were to touch it in the figure above, the Numeric Entry Panel would pop up right next to the control:

2 User Interface  
2.4 Menu Panel



You can display the Numeric Entry Panel by touching any active function control while it is active, but you don't have to pop up the Numeric Entry Panel first, you can just start typing and it will pop up on its own, thus saving you a keystroke.

You can also adjust a value without displaying the Numeric Entry panel by turning the knob or using the step keys while an active function is active. If you turn the knob or use the step keys while the Numeric Entry Panel is displayed, it disappears, allowing you to see the entire screen while you are making the adjustment.

You can also drag the Numeric Entry Panel to another part of the display if it is covering something that you wish to see while it is on the screen.

## 2.4.1 Right-Click Menu

If you click with the right mouse button on any of the menus in measurements, a popup menu appears, which includes:

The items in this menu are:

- ["Add to User Menu" on page 97](#)
- ["Help on this setting" on page 97](#)
- ["Show SCPI Command" on page 97](#)
- ["Add to SCPI Recorder" on page 98](#)
- ["Start/Stop SCPI Recorder" on page 98](#)
- ["Show SCPI Recorder" on page 98](#)

### 2.4.1.1 Add to User Menu

For details, see ["User Menu" on page 98](#).

### 2.4.1.2 Help on this setting

For details, see ["Help" on page 111](#).

### 2.4.1.3 Show SCPI Command

Enabled/visible when the currently-active feature has an associated SCPI command or query. Displays a popup dialog that shows the active GUI selection's SCPI command.

To close the popup dialog, click **OK**

#### 2.4.1.4 Add to SCPI Recorder

Adds SCPI to the recorder from User Interface features that have equivalent SCPI.

This is the manual mode for adding SCPI to the recorder when you do not wish to add SCPI continuously. This control is enabled only when the current active feature has an associated SCPI command or query.

Irrespective of the continuous recording state, clicking this control adds the active entry into the recorder, including the active value if it is a setting.

#### 2.4.1.5 Start/Stop SCPI Recorder

Starts or stops continuous recording mode. After starting the recording, any changes to settings will be recorded.

After continuous recording is enabled, the button label changes to **Stop SCPI Recorder**, which is displayed while recording is in progress. Clicking **Stop SCPI Recorder** halts recording and switches the control label back to **Start SCPI Recorder**.

#### 2.4.1.6 Show SCPI Recorder

This shortcut opens the dialog **"SCPI Recorder"** on page 526.

### 2.4.2 User Menu

Lets you create your own menu, to include controls that you frequently use. You can have one **User Menu** for each measurement, and all User Menus survive a power cycle.

You add a control to the User Menu for the current measurement by right-clicking on the control, then selecting **"Add to User Menu"** on page 97. You can also remove the control from the User Menu using the same right-click menu item.

**User Menu** appears at the bottom of the menu drop-down panel.

## 2.5 Cancel key



This front-panel key has the same functions as the Windows **Esc** (Escape) key. It does the following:

- Cancels dialogs
- Cancels active functions (unless there is an entry in progress, in which case it cancels that, and reverts to the previous value)
- Resets input overloads
- Aborts print operations
- Cancels certain other operations (such as alignments)
- Returns you to Local Control (if in Remote)
- If the backlight is off, turns on the backlight, and does nothing else

Most of this functionality is the same as earlier X-Series models and similar to ESA and PSA operation.

When the instrument is in Remote, any hardkey that is pressed on the front panel displays this message:

**Analyzer is in Remote. Press ESC to return to Local**

The exception is the **Cancel (ESC)** key, which takes the instrument out of Remote.

When the instrument is also in the LLO (local lockout state), the **Local** key is locked out as well. When this is the case, and the **Local** key is pressed, this message is displayed:

**Local key is locked out by remote computer. Cancel Local Lockout on computer or release remote control**

When you see this message, you should disconnect the remote computer, or use it to take the instrument out of the Local Lockout state.

## 2.6 Onscreen Keyboard key



This key turns the onscreen alpha keyboard (OSK) on and off.

There are two onscreen keyboards:

- The Multitouch OSK, which pops up automatically if, while using the analyzer application, a text field becomes the active function
- The Windows OSK, which you must open manually when a text field must be entered while interacting with Windows or other apps



## 2.7 Touch On/Off Key



This front-panel key turns the display touch functionality on and off. If off, you can turn it back on using the front panel **Touch On/Off** key. When the touch functionality is off, you can still use a mouse as a pointer.

When toggled, a dialog box appears midscreen that confirms “Touchscreen On” or “Touchscreen Off”.

This function remains in effect until it is turned off or until the app shuts down. The app always starts up with Touch enabled.

## 2.8 Tab key



This key has the same function as the **Tab** key on a PC keyboard.  
You can use this key to display the Windows Taskbar, as follows.

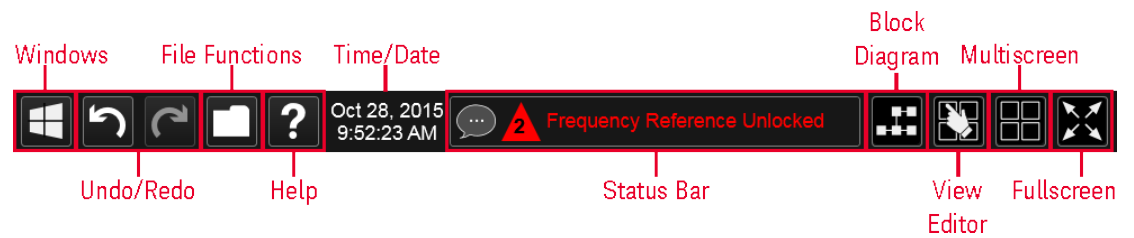
- Alt-Tab to the Desktop
- Touch the desktop
- Touch **TAB**
- The Taskbar appears

## 2.9 Local Button

Appears in the Menu Panel when the instrument is in remote, and can be brought back to local via the **Local (ESC)** Key. See also "[Cancel key](#)" on page 99.

## 2.10 Control Bar

The Control Bar contains controls and readouts that let you control instrument functions independent of the current measurement.



## 2.11 Windows

Pressing the Windows icon on the "Control Bar" on page 104 has the same effect as pressing the Windows icon on the Windows taskbar. It displays the Windows taskbar and Start Menu, which allows you to launch Windows programs and access features such as the Control Panel.

## 2.12 Undo/Redo

The Undo button in the "Control Bar" on page 104,



and the Undo front panel key,

**Ctrl=Redo**



are used to undo the most recently executed function.

If you Undo a function, and then decide you should not have done so, you can use the **Redo** button in the "Control Bar" on page 104 to put it back the way it was. The Redo function may also be executed by pressing **Ctrl+Undo** (holding the **Ctrl** key down while pressing the **Undo** front panel key).



Undo allows you to restore a setting, which you had previously set, back to its value before you changed it. When you press the Undo button or front panel key, the last setting you changed is "undone", that is, its previous setting is restored. You are notified of this fact with an advisory pop up message; for example, if the Center Frequency had been 300 MHz, and you changed it to 1 GHz and then pressed **Undo**, the message would show:

UNDO: Center Freq 1 GHz -> 300 MHz

The instrument can store 5 levels of action for Undo.

To truly understand Undo and Redo, it helps to think of two "stacks", an Undo stack and a Redo stack,

**UNDO stack**

**REDO stack**

Whenever you perform an action, it is placed on the Undo stack. So for example, if you set the Center Frequency to 1 GHz, then set the RBW to 1 MHz, then set the Detector to Peak, each of these actions gets "pushed" onto the Undo stack:

| UNDO stack | REDO stack |
|------------|------------|
| Det = Peak |            |
| RBW = 1MHz |            |
| CF = 1 GHz |            |

When you press **Undo**, the top item on the Undo stack is removed, the action represented by that item is undone, and the item is placed on the Redo stack. So pressing **Undo** once in the above case would undo the setting of the peak detector, and the stacks would look like this:

| UNDO stack | REDO stack |
|------------|------------|
| RBW = 1MHz | Det = Peak |
| CF = 1 GHz |            |

Now pressing **Undo** again would undo the RBW = 1 MHz action, and the stacks would look like this:

| UNDO stack | REDO stack |
|------------|------------|
| CF = 1 GHz | RBW = 1MHz |
|            | Det = Peak |

Now pressing Redo would Redo the RBW = 1 MHz action, and the stacks would again look like this:

| UNDO stack | REDO stack |
|------------|------------|
| RBW = 1MHz | Det = Peak |
| CF = 1 GHz |            |

Also, whenever you set a value, the Redo stack is cleared; you can't redo an action once you have interrupted the original flow of actions. Think of the Undo stack as the past, and the Redo stack as the future; if you have items in both stacks it means you have gone back to a time in the past; if you then *do* something you have changed the future, so the old future (the Redo stack) gets cleared.

For example, in the example above, if you now were to change another setting, such as VBW = 1 kHz, the Redo stack gets cleared, and the stacks would look like this:

| UNDO stack  | REDO stack |
|-------------|------------|
| VBW = 1 kHz |            |
| RBW = 1MHz  |            |
| CF = 1 GHz  |            |

Undo can undo changes you make with the knob or step keys, however all contiguous events that affect the same parameter are aggregated into one event for the sake of Undo. For example, if CF is the active function and is 1 GHz, and you turn the knob back and forth, then enter a value, then use the step keys, when you press **Undo**, the instrument returns to CF = 1 GHz.

### Actions that Cannot be Undone

There are some actions that cannot be undone, because these clear the Undo/Redo stack:

- Restore Mode Defaults clears the stack for that Mode in that Screen
- Sending SCPI commands clears the stack for that Mode in that Screen
- Loading a state file (including User Preset) clears the stack for that Mode in that Screen
- Deleting a Screen clears all the stacks in that screen
- Changing Views

Undo/Redo works within the context of a Mode. Each Mode in each Screen keeps its own record. Settings in the Control Panel or System Settings menus are not undoable.

There are several actions that may change many parameters. Among these are Auto Tune, and Adjust Atten for Min Clipping. After executing such a function, Undo sets all parameters back to their value before the function was selected. Auto Tune appears to be a single action, even though the instrument executes it in several steps.

Redo reverses the effect of the last Undo action, assuming that no other settings have been changed since the last Undo. Changing a setting after an Undo clears memory of all settings after that Undo, that is, it clears the Redo stack, as explained above.



When you press the **Redo** icon or **Ctrl** and the **Undo** hardkey, you are notified with an advisory popup message; for example, if the Center Frequency had been 300 MHz, and you changed it to 1 GHz and then pressed **Undo**, the message would say:

UNDO: Center Freq 1 GHz -> 300 MHz

If you then press **Redo**, the message will say:

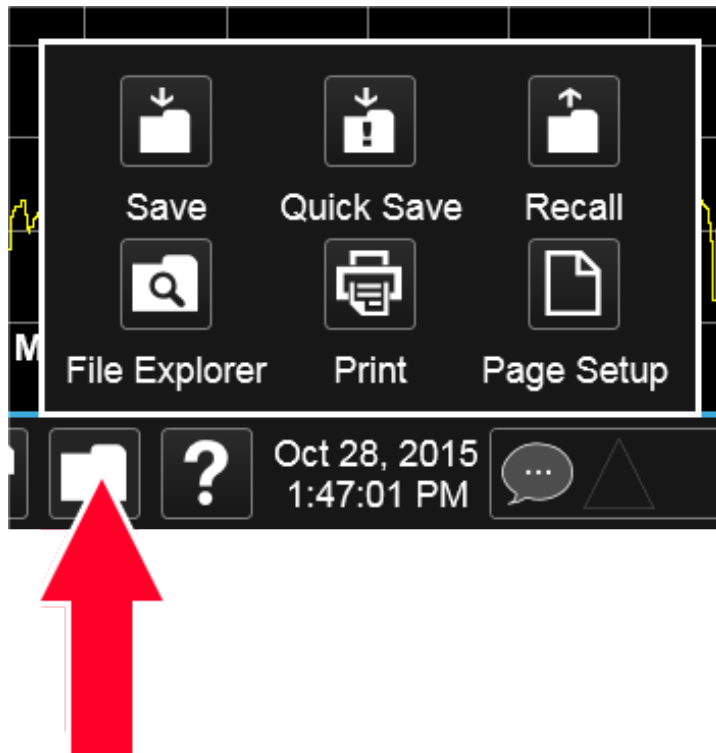
REDO: Center Freq 300 MHz -> 1 GHz

Neither **Undo** nor **Redo** perform any navigation, and have no effect on which menu panel is displayed nor which function is active.

## 2.13 File Functions

The File Functions popup contains controls for executing Save, Recall, File and Print operations. You display the File Functions popup by tapping the File Functions icon in the "Control Bar" on page 104.

For more information on a control, tap an icon in the image below.



Tapping this folder icon displays the File Functions popup

### 2.13.1 File Explorer

Pressing the File Explorer button in the "File Functions" on page 110 dialog opens the Windows File Explorer, which allows you to perform operating system file functions such as Move, Copy and Delete.

File Explorer also allows you to map network drives to drive letters on your PC or intranet, in order to more easily save screen images, states and other data, and load them back into the instrument.

## 2.14 Help



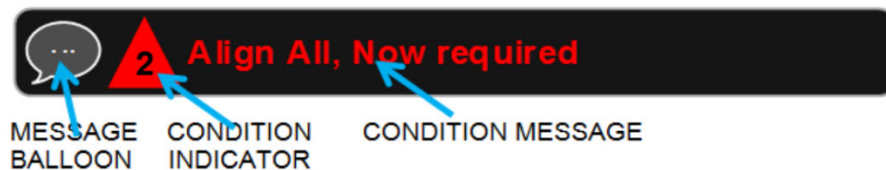
Pressing the **Help** button in the "Control Bar" on page 104, the **Help** front panel key, or the **F1** key if you have a PC keyboard connected, opens the context-sensitive help system. The **Help** button appears in the "Control Bar" on page 104 and in the banner of full-screen dialogs

You can also use the Help window's Contents pane to navigate to Help for any function in the instrument

You can also touch-and-hold a specific control to display a "right-click" menu, in which one of the choices is **Help on this setting**

## 2.15 Status Bar

The Status Panel (or Status Bar) appears at the bottom of the display and contains three fields:



The Message Balloon appears on the left side of the Status Panel and lets you know when there is an unread message in the queue.



No unread messages

Unread messages

The Message Balloon has a gray outline and no fill if there are no unread messages; it has a gray fill and a white outline and displays a white ellipsis in the middle if there are unread messages.

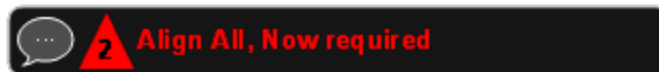
The Condition Indicator appears to the right of the Message Balloon and shows the current number of open conditions. Below are some examples of what the Condition Indicator can look like:



The triangle is unfilled if there are no open conditions, filled with yellow if all open conditions are warnings, and filled with red if at least one open condition is an error. The number displayed is the total number of open conditions.

Touching the Condition Indicator opens up the Show Status dialog (see below) with the Current Conditions tab selected. Touching anywhere else on the Status Bar opens up the Show Status dialog with the History tab selected.

The Condition Message appears to the right of the Condition Indicator. In the example below, the cCondition Message is “Align All, Now required”:



Warning condition messages display in yellow, error condition messages display in red.

If there is more than 1 open condition, the Condition Message cycles through the display of all of the open conditions, one at a time. Each message is displayed for 2 seconds, then the next for 2 seconds, and so on.

### Show Status Dialog

The Show Status dialog appears if you tap anywhere in the Status Bar. Touching the Condition Indicator (the triangle in the Status Bar) opens up the Show Status dialog with the Current Conditions tab selected. Touching anywhere else on the Status Bar opens up the Show Status dialog with the History tab selected.

2 User Interface  
2.15 Status Bar

| Status                                                                                                                                                                                                                                           | History      |      |                                          |         |                         | <div><div>?</div><div>✕</div></div> |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|------|------------------------------------------|---------|-------------------------|-------------------------------------|
| History                                                                                                                                                                                                                                          | Type         | ID   | Message                                  | Repeats | Time                    |                                     |
| Current Conditions                                                                                                                                                                                                                               | <div>✓</div> | 1064 | Align Now All required - CLEARED         |         | 6:37:49 PM<br>2/24/2015 |                                     |
| Settings                                                                                                                                                                                                                                         | <div>✓</div> | 1301 | Meas Uncal - CLEARED                     |         | 6:37:37 PM<br>2/24/2015 |                                     |
|                                                                                                                                                                                                                                                  | <div>✕</div> | 64   | Align Now All required - DETECTED        |         | 6:36:59 PM<br>2/24/2015 |                                     |
|                                                                                                                                                                                                                                                  | <div>⚠</div> | 301  | Meas Uncal - DETECTED                    |         | 6:33:27 PM<br>2/24/2015 |                                     |
|                                                                                                                                                                                                                                                  | <div>✓</div> | 1301 | Meas Uncal - CLEARED                     |         | 6:31:27 PM<br>2/24/2015 |                                     |
|                                                                                                                                                                                                                                                  | <div>⚠</div> | 301  | Meas Uncal - DETECTED                    |         | 6:33:27 PM<br>2/24/2015 |                                     |
|                                                                                                                                                                                                                                                  | <div>✓</div> | 1141 | Input Overload - CLEARED,ADC over range  | 47      | 1:07:56 PM<br>2/24/2015 |                                     |
|                                                                                                                                                                                                                                                  | <div>✕</div> | 141  | Input Overload - DETECTED,ADC over range | 47      | 1:07:56 PM<br>2/24/2015 |                                     |
|                                                                                                                                                                                                                                                  | <div>✕</div> | 780  | No Peak Found                            |         | 1:03:55 PM<br>2/24/2015 |                                     |
| <div><div><div><div>i</div><div>Informational</div></div><div><div>⚠</div><div>Warning</div></div><div><div>✕</div><div>Error</div></div></div><div>Press any row for more info<br/>about that Message</div><div>Clear Message Queue</div></div> |              |      |                                          |         |                         |                                     |

If the display fills up, scrolling is enabled just as in other X-Series Multi-touch UI displays.

The Status dialog automatically refreshes as new messages and conditions occur.

At the bottom of the screen is a Clear Message Queue button. This button clears all errors in all error queues.

Note the following:

- Clear Message Queue does not affect the current status conditions
- Mode Preset does not clear the message queue
- Restore System Defaults (Super Preset) will clear all message queues
- \*CLS only clears the queue if it is sent remotely and \*RST does not affect any error queue
- Switching Modes does not affect any error queues

See "More Information" on page 115

|                |                                   |
|----------------|-----------------------------------|
| Remote Command | :SYSTem:ERRor[:NEXT]?             |
| Example        | :SYST:ERR?                        |
| Notes          | The return string has the format: |

|                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|-------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                               | <p>&lt;Error Number&gt;, &lt;Error&gt;</p> <p>Where &lt;Error Number&gt; and &lt;Error&gt; are those shown on the Show Errors screen</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Backwards Compatibility Notes | <p>In some legacy analyzers, the Repeat field shows the number of times the message has repeated since the last time the error queue was cleared. In the X-Series, the Repeat field shows the number of times the error has repeated since the last intervening error. So the count may very well be different than in the past even for identical signal conditions</p> <p>Unlike previous analyzers, in the X-Series all errors are reported through the Message or Status lines and are logged to the event queue. They never appear as text in the graticule area (as they sometimes do in previous analyzers) and they are never displayed in the settings panel at the top of the screen (as they sometimes do, by changing color, in previous analyzers)</p> <p>As a consequence of the above, the user can only see one status condition (the most recently generated) without looking at the queue. In the past, at least in the Spectrum Analyzer, multiple status conditions might display on the right side of the graticule</p> <p>In general, there is no backwards compatibility specified or guaranteed between the error numbers in the X-Series and those of earlier products. Error, event, and status processing code in customers' software will probably need to be rewritten to work with X-Series</p> <p>In the legacy analyzers, some conditions report as errors and others simply turn on status bits. Conditions that report as errors often report over and over as long as the condition exists. In the X-series, all conditions report as start and stop events. Consequently, software that repeatedly queries for a condition error until it stops reporting will have to be rewritten for the X-series</p> |

## More Information

The Status Dialog has two screens, selectable by the tabs on the right: **History** and **Current Conditions**:

### History

**History** brings up a screen displaying the front panel message queue in chronological order, with the newest event at the top. Remember that the front panel queue contains all of the events generated by front panel actions as well as error events from all of the SCPI queues. A typical History display appears below:

2 User Interface  
2.15 Status Bar

| Status                                                                                                                                                                                                                                                                            | History                                                                           |      |                                          |         | ? X                                               |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------|------------------------------------------|---------|---------------------------------------------------|
| History                                                                                                                                                                                                                                                                           | Type                                                                              | ID   | Message                                  | Repeats | Time                                              |
| Current Conditions                                                                                                                                                                                                                                                                |  | 301  | Meas Uncal - DETECTED                    |         | 5:36:35 PM<br>2/24/2015                           |
| Settings                                                                                                                                                                                                                                                                          |  | 1141 | Input Overload - CLEARED,ADC over range  | 49      | 1:07:56 PM<br>2/24/2015                           |
|                                                                                                                                                                                                                                                                                   |  | 141  | Input Overload - DETECTED,ADC over range | 49      | 1:07:56 PM<br>2/24/2015                           |
|                                                                                                                                                                                                                                                                                   |  | 1141 | Input Overload - CLEARED,ADC over range  |         | 1:07:53 PM<br>2/24/2015                           |
|                                                                                                                                                                                                                                                                                   |                                                                                   |      |                                          |         |                                                   |
|  Informational  Warning  Error |                                                                                   |      |                                          |         | Press any row for more info<br>about that Message |
|                                                                                                                                                                                                                                                                                   |                                                                                   |      |                                          |         | Clear<br>Message Queue                            |

The fields on the History display are:

|              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|--------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Type         | Displays the icon identifying the event or condition as an error or warning                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| ID           | Displays the error number                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Message      | Displays the message text                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Repeat (RPT) | <p>This field shows the number of consecutive instances of the event, uninterrupted by other events. In other words, if an event occurs 5 times with no other intervening event, the value of repeat will be 5</p> <p>If the value of Repeat is 1 the field does not display. If the value of Repeat is &gt;1, the time and date shown are those of the most recent occurrence. If the value of repeat reaches 999,999 it stops there. The Repeat field can run into some pretty large numbers when apps (like the GSM app) report things like “GSM sync burst not found” as events rather than conditions, which is actually fairly common</p> <p>Note that the repeat count is unavailable over SCPI</p> |
| Time         | Shows the most recent time (including the date) at which the event occurred. Time is displayed to the second                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |

To understand the History dialog, and to properly program the instrument’s messaging system, remember that there are two types of occurrences, events and conditions:

- An event is an occurrence of zero duration. Events generate messages which are displayed in the center of the display for a period of time and then fade away. These may be of an advisory nature or may represent errors, for example “No



peak found”

- A condition is an occurrence of finite duration, that is, it has a start and an end. Conditions are states of the analyzer characterized by some combination of settings or some kind of failure that the user needs to be told about while it is happening, but then can stop being told once it goes away; for example “Input overload; ADC over range”

The error queue contains error events as well as the DETECTED and CLEARED events for condition errors, as seen in the figure above.

DETECTED events have numbers less than 1000 and CLEARED events have the same number plus 1000. For example,

301, Meas Uncal – DETECTED

and later

1301, Meas Uncal – CLEARED

To detect a condition error over SCPI, you should read the error queue and note any DETECTED error which is not followed eventually by an associated CLEARED error. This means the condition is still in effect. It is not sufficient to simply read the error queue until you get “No Errors” back. You may still have the condition error; the condition may still be in effect, and if that is the case, all you have done by clearing the error queue is to remove the first event (the DETECTED event) from the queue. For a condition error, you have to read the error queue until you see the CLEARED event for that condition. THEN you know that the condition is gone.

### Current Conditions

The **Current Conditions** display shows all of the open conditions in the instrument. An open condition is a condition error or warning for which a start (detected) event has occurred but for which no corresponding stop (cleared) event has occurred.

An example of the Current Conditions screen appears below:

2 User Interface  
2.15 Status Bar

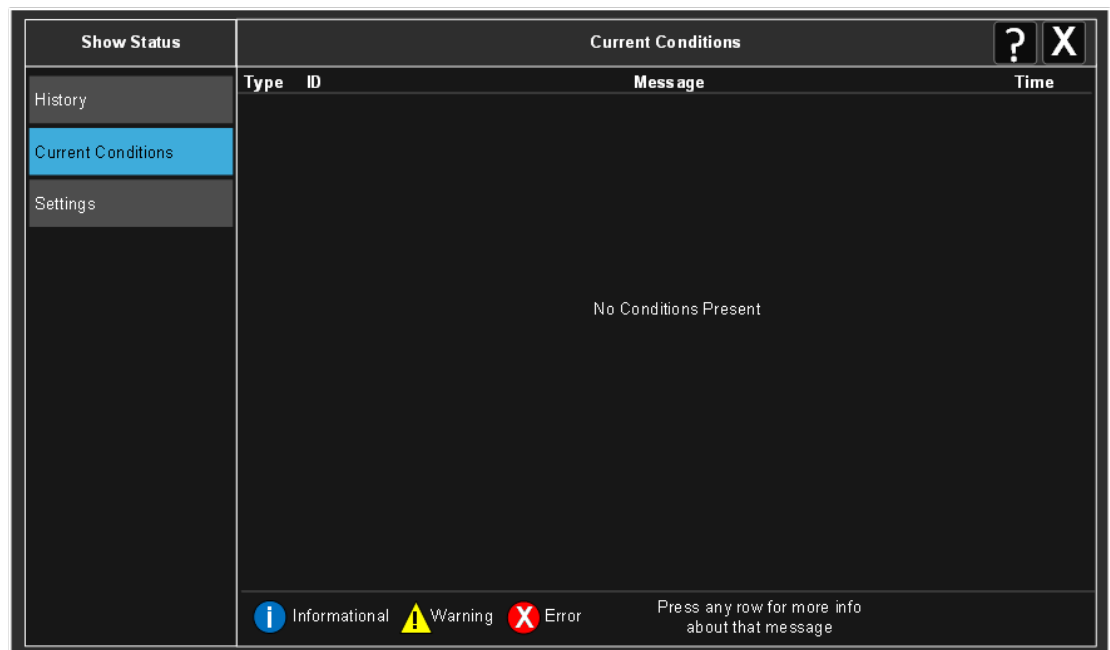
| Status                                                                                                                                                                                                                                                                                                                                                 | Current Conditions                                                                |     |                        |                         |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----|------------------------|-------------------------|
| History                                                                                                                                                                                                                                                                                                                                                | Type                                                                              | ID  | Message                | Time                    |
| Current Conditions                                                                                                                                                                                                                                                                                                                                     |  | 64  | Align Now All required | 6:36:59 PM<br>2/24/2015 |
| Settings                                                                                                                                                                                                                                                                                                                                               |  | 301 | Meas Uncal             | 6:33:27 PM<br>2/24/2015 |
| <div> Informational  Warning  Error</div> <div>Press any row for more info about that Message</div> |                                                                                   |     |                        |                         |

The fields on the Current Conditions display are:

|         |                                                                                                              |
|---------|--------------------------------------------------------------------------------------------------------------|
| Type    | Displays the icon identifying the event or condition as an error or warning or informational                 |
| ID      | Displays the error number                                                                                    |
| Message | Displays the message text                                                                                    |
| Time    | Shows the most recent time (including the date) at which the event occurred. Time is displayed to the second |

Touching a condition message expands the display of that message. Touching again collapses it. The description is the same as the one that appears on the message dialog. An example of this is shown in the History section, below.

When there are no open conditions, the display is as shown below:



## 2.16 Block Diagram

When you press the Block Diagram button in the "Control Bar" on page 104, the display changes to a stylized pictorial representation of the current internal hardware setup and signal processing path. When you touch one of the blocks on the Block Diagram, the corresponding menu panel opens.



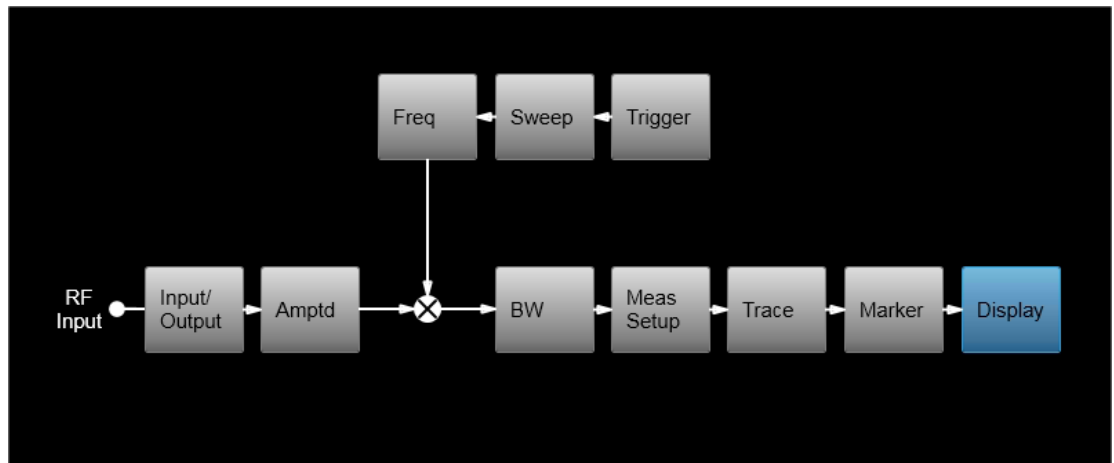
When you press the Block Diagram button, the display changes to a stylized pictorial representation of the current internal hardware setup and signal processing path. When you touch one of the blocks on the Block Diagram, the corresponding menu panel opens.

While in the Block Diagram display, the button is blue colored, as:

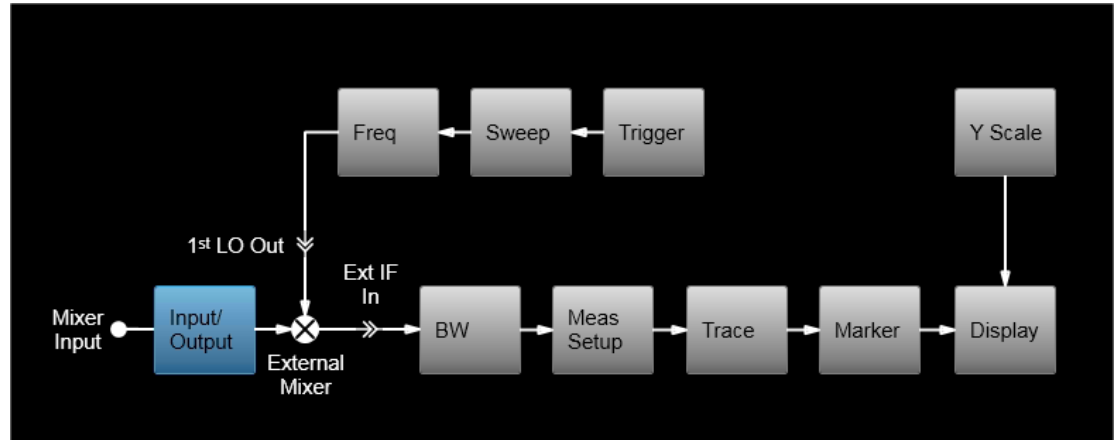


To exit the Block Diagram display, tap the button again.

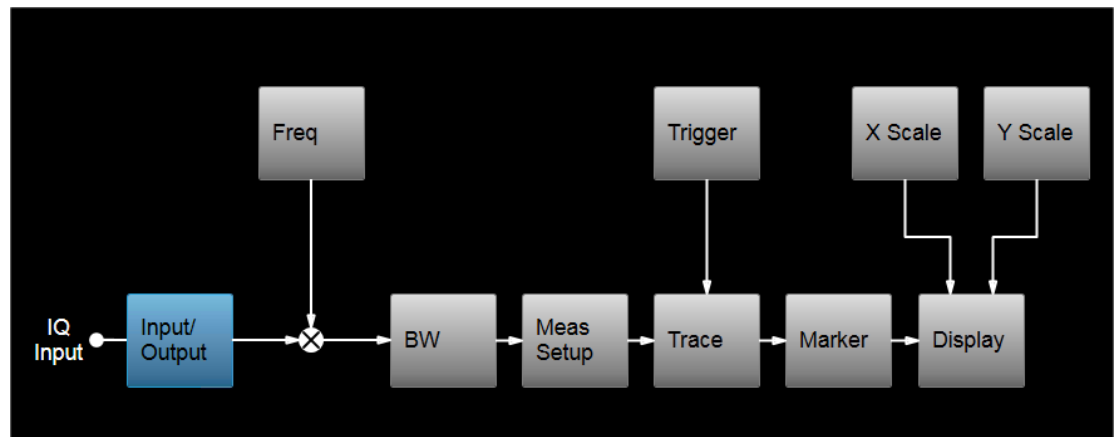
The Block Diagram display is not meant to be a completely accurate representation, but one which can show differences as you change the hardware setup. For example, here is the basic RF Block Diagram:



And here is the Block Diagram when External Mixing is selected:



And here is the Block Diagram when the I/Q inputs are selected:



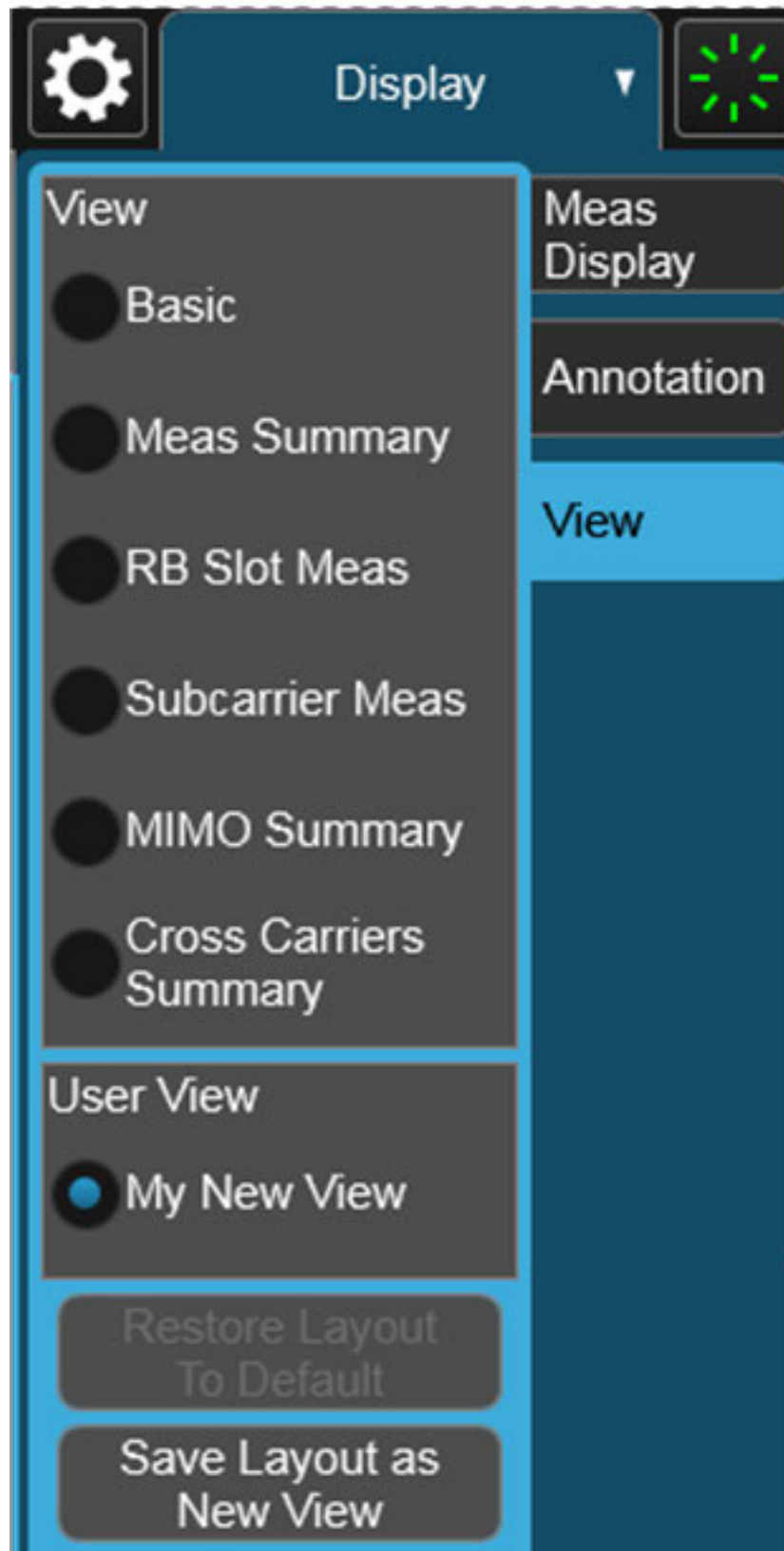
## 2.17 View Editor

This section describes the use of the View Editor, which allows you to:

- Add windows to and delete windows from the current measurement
- Resize and rearrange windows
- Create User Views

User Views are custom Views that you create by adding, deleting, rearranging, resizing, or changing the contents of the windows in an existing View, and then saving the edited View as a new View. The instrument lists the current User Views for a measurement after the Predefined Views, in the Mode/Meas dialog and on the View menu panel under Display:

| ent | View                   |
|-----|------------------------|
|     | Basic                  |
|     | Meas Summary           |
|     | RB Slot Meas           |
|     | Subcarrier Meas        |
|     | MIMO Summary           |
|     | Cross Carriers Summary |
|     | User View              |
|     | My New View            |



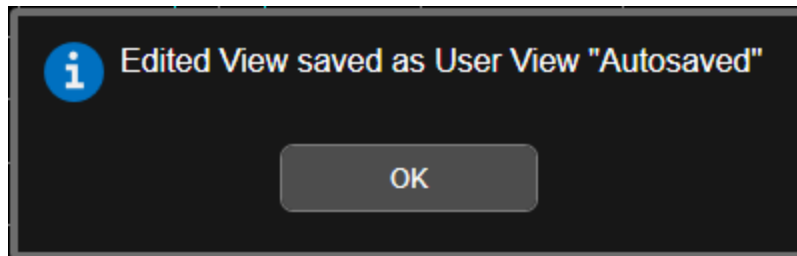


You can save an edited View using the **Save Layout as New View** control in the View menu (see ["To Save a User View" on page 135](#)).

On occasion, the instrument may automatically save an edited View for you. If you have edited a View, so that the \* is displaying next to the View name, you must save that View as a User View before you save State or switch measurements. If you forget that you have made changes to a View, then to keep from losing your edited View when you switch measurements, the instrument will save it for you. If you have an edited View that has not been saved and you try to do any of the following:

- Enter the "Save" menu
- Switch Measurements
- Switch Modes
- Switch Screens

the edited view will be saved for you with the name "Autosaved". When this happens, you will receive the following message:



If an Autosaved User View already exists, the User View called "Autosaved" will be overwritten with the currently edited view. If you have multiple edited views, the selected edited view will be Autosaved. If there is not an edited view selected the last selected edited view will be Autosaved.

### To Open the View Editor



Pressing the View Editor button (shown above) in the ["Control Bar" on page 104](#), at the bottom right of the screen, opens the View Editor.

While in the View Editor, the icon is blue colored, as:



Pressing the View Editor button again exits the View Editor.

## To Close the View Editor

Tap the View Editor button again.

The user chooses the desired View through the use of the Mode/Meas/View dialog (see ["Mode/Meas/View Dialog" on page 55](#)) or the View menu (a tab under the **Display** key). The View menu allows the user to browse the views in the current measurement. The View menu contains a list of Predefined Views for you to use. If you wish to modify a Predefined View or create your own, new View, you use the View Editor.

## User Views & Predefined Views

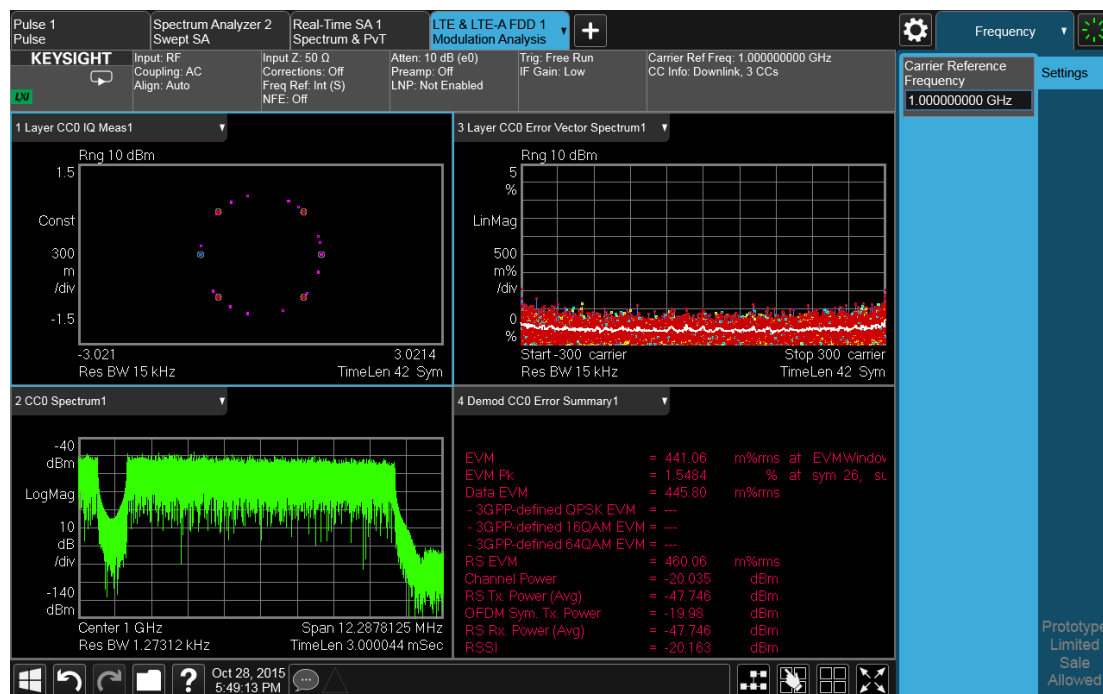
A User View is any View that is not in the list of predefined Views for the current measurement. For example, the Swept SA measurement has four predefined Views: Normal, Spectrogram, Zone Span, and Trace Zoom.

User Views allow you to add, delete, change and rearrange the windows of a predefined View, creating a new custom view.

### 2.17.1 To Create a User View

Whenever you add or delete a window to/from a predefined View, or change what is being displayed in a Predefined View's window, the Predefined View is marked with an asterisk (\*), to show that it has been modified.

For example, to edit the View shown below, you press the Edit View icon.



When you do this, you get the View Editor screen, which appears as below. The menu panel switches to the View menu. Here we see that we are in the Predefined View called “Basic”.

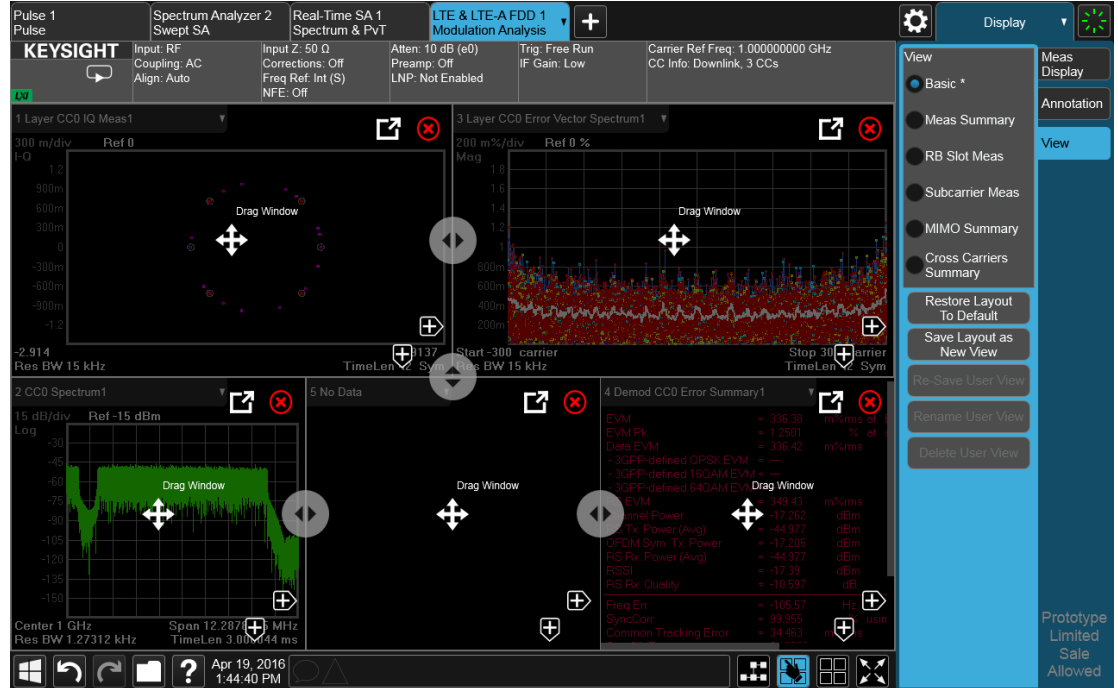


Each window has two arrows containing + signs. Pressing either of the “+” symbols adds a new window on that side. For example, let’s say you press the + symbol on the right of the lower left window:

You would then see this:

## 2 User Interface

### 2.17 View Editor



A fifth window has been added, and is automatically assigned the number 5. (The window number, which is displayed in the Window Title region, is used when sending SCPI commands to that window).

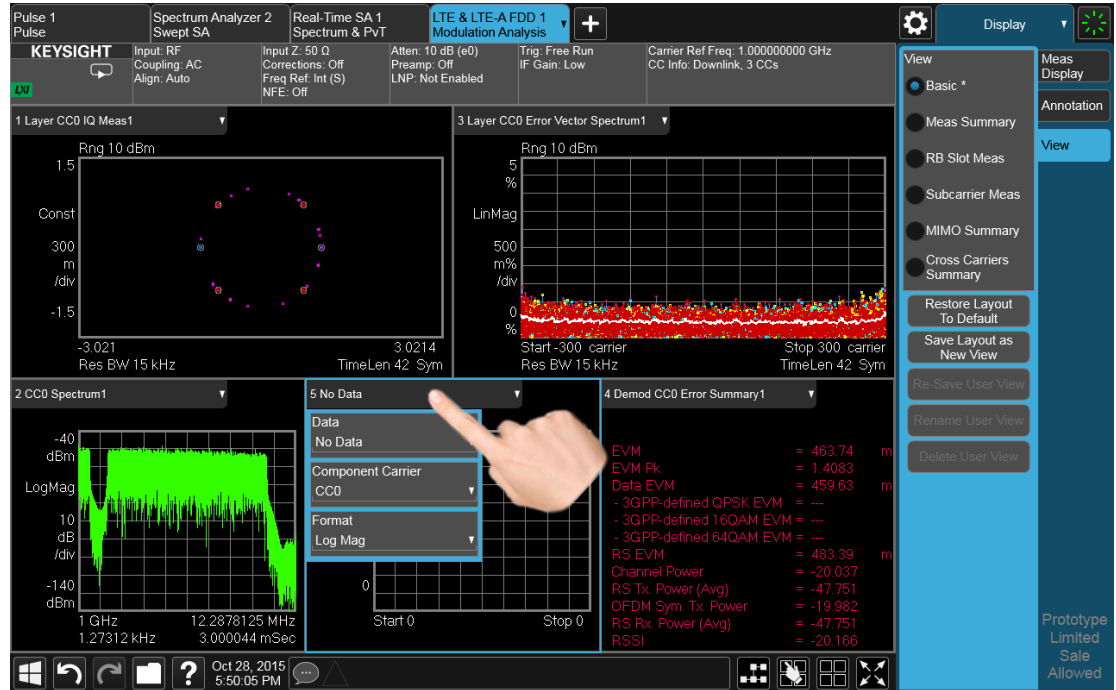
Note the \* that now appears next to Basic in the View menu, indicating that you are now in the **modified** Basic View. You see the \* if you add, delete or rearrange windows, but simply resizing windows does not display the \*. The \* means you are in a modified View, which must be saved as a User View before you leave the measurement (if you don't save it, the instrument will save it for you).

Note also that the Restore Layout to Default control is no longer grayed out. If you press this control it restores the Basic View to its default state. Restore Layout to Default becomes available when you add, delete or rearrange windows **and** when you resize them; otherwise it is grayed out.

You can add more windows with the "+" arrow symbols. Note that the "+" arrow symbols only appear if the current measurement has more windows available to display. If you are already displaying all the measurement's windows, the "+" symbols disappear.

You can exit the View Editor by again tapping the Edit View icon.

You can specify which result you want to see in the new window by tapping its title region.



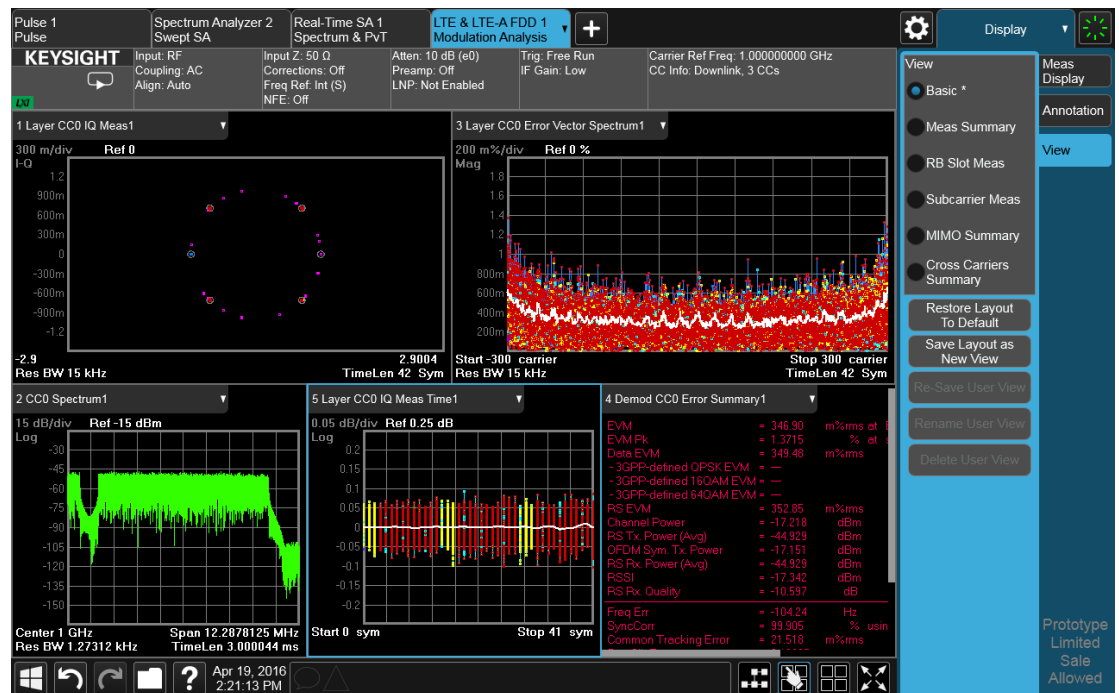
A panel drops down, containing a Data control for specifying window results. Some measurements, such as LTE-A in this example, also provide controls on this dropdown for specifying other window parameters, such as the Component Carrier and Data Format, Tap the Data control and you will see a list of available results for the window. In some cases, as in LTE-A, this will be a cascading list, due to the number of results available:

## 2 User Interface

### 2.17 View Editor



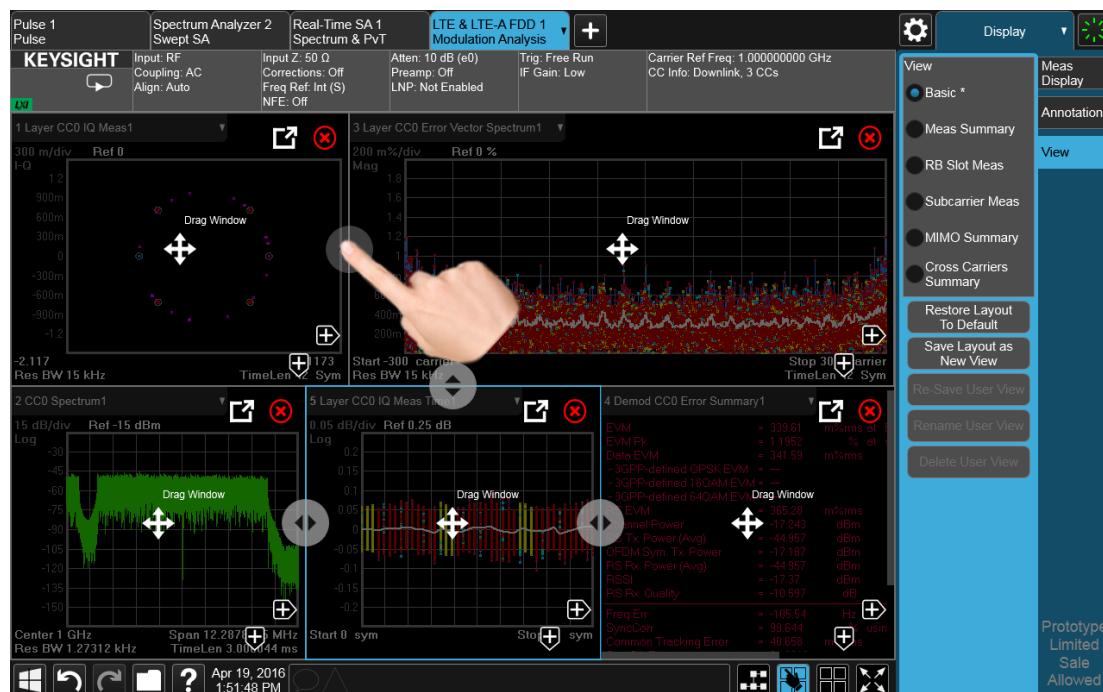
Choose the result you want and tap OK. Here we have chosen IQ Meas Time from the Demod group:



Your new, edited User View is now ready to use.

## 2.17.2 To Resize or Rearrange Windows in a View

Sometimes you may wish to resize a window. To do this go back into the View Editor and note the large, translucent white circles along the edges of the draggable borders. These are the “resize handles”. You can resize the windows by dragging these handles. Note that in their quiescent state they are slightly translucent; when you touch one it turns solid white, indicating that it is draggable. If you touch and drag one of them it moves the axis to which it is attached.



Another feature that comes with the View Editor is the ability to move windows around. You do this by dragging the four-arrow objects in the center of the window; the whole window goes along. Actually you can touch and drag anywhere in the window (except on one of the arrows or the delete circle) and it will drag, but the four-arrow objects give you an indication and a convenient finger target.

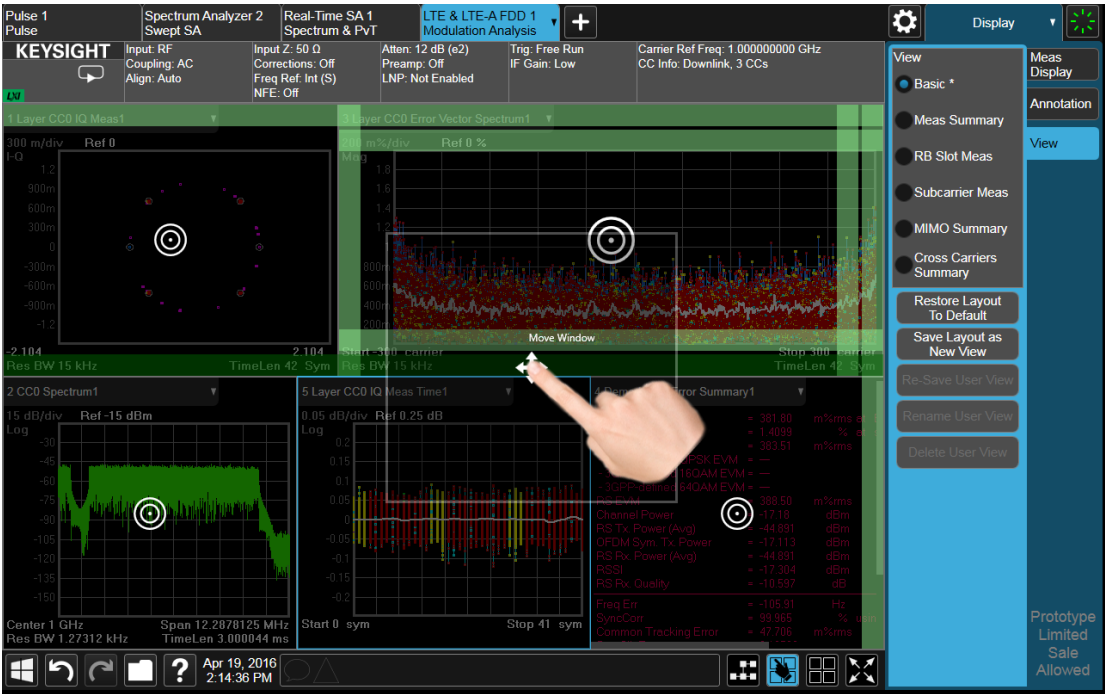


2 User Interface  
2.17 View Editor

The outline of the window appears as it is being dragged. When you start to drag a window, target symbols appear in the other windows:

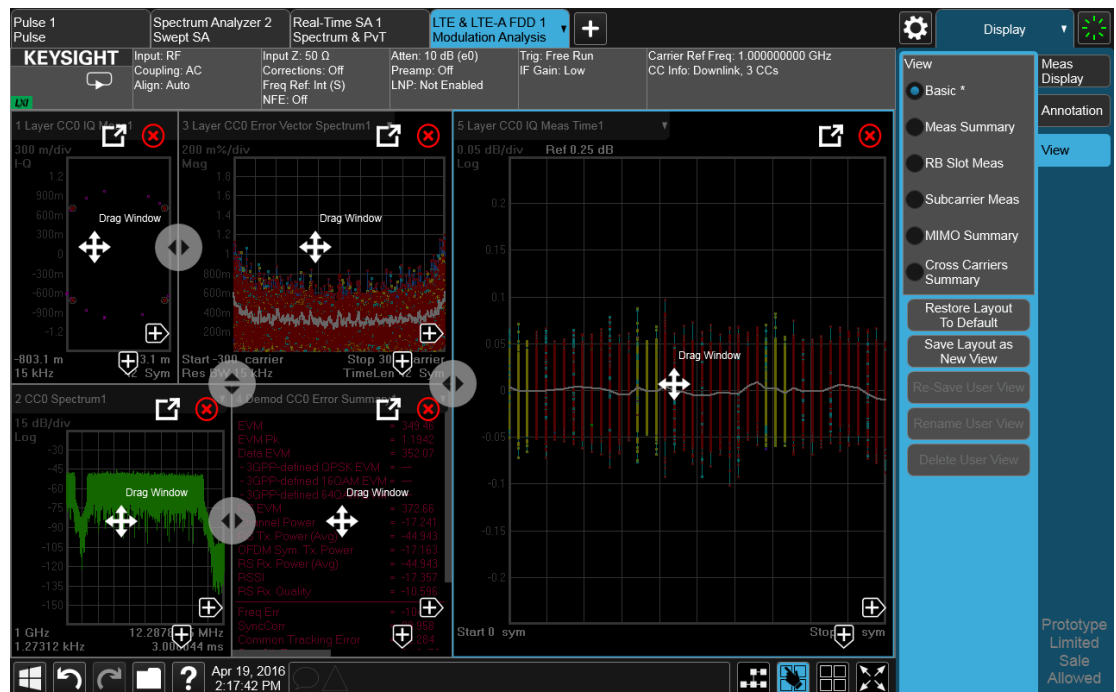
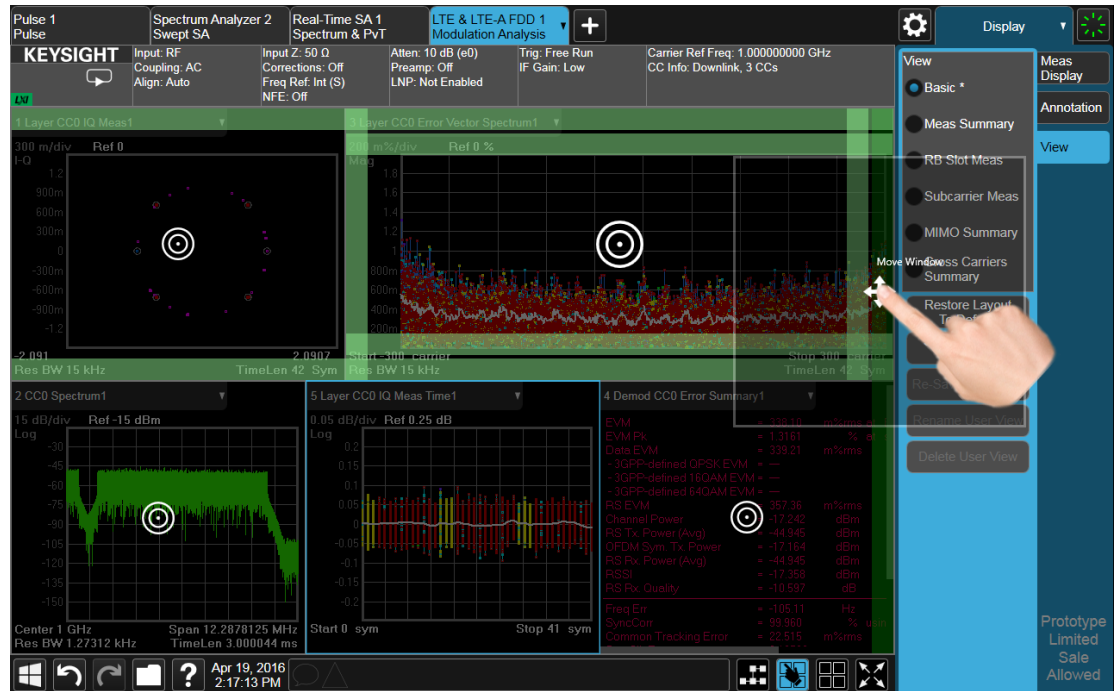


If you drop a window on one of the targets, it swaps positions with the target window. If you drag a window's center into another window, green stripes appear on the edges to show you where the window will go when you release it:





When you hover over one of the stripes it gets dimmer, to show the position the window being dragged will take on. If you release a window over an inner stripe, the window you are dragging and the window over which you were hovering resize to share the space the target window originally occupied. If you release a window over an outer stripe, as shown below, the window you are dragging takes on a new position outside the array of other windows:



## 2 User Interface

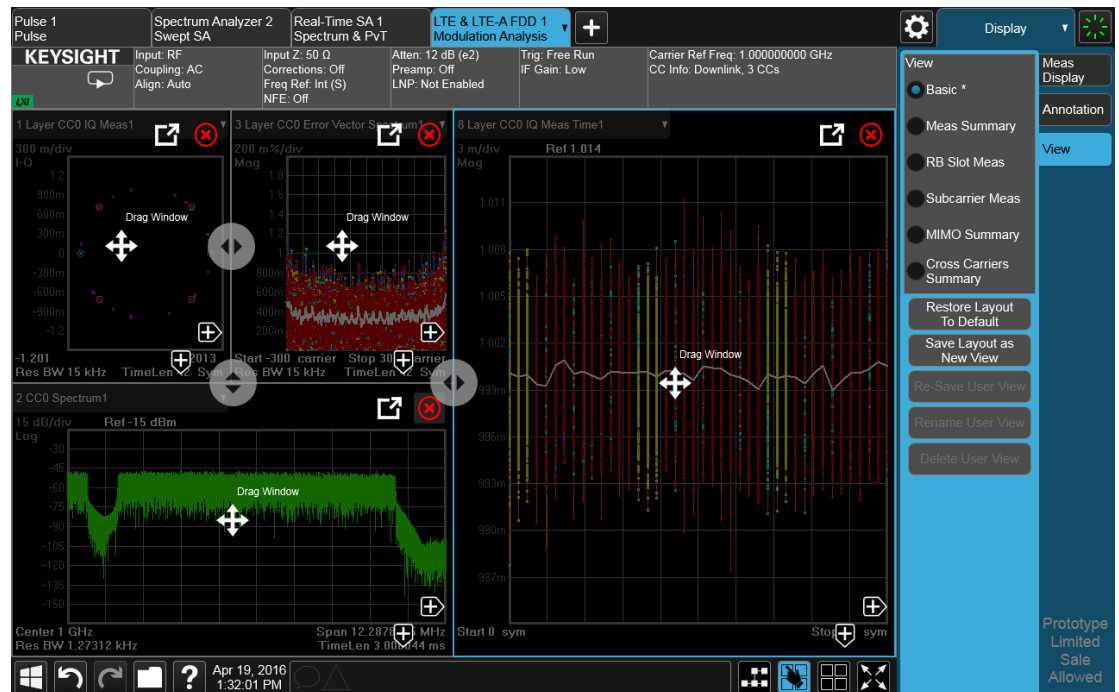
### 2.17 View Editor

In either case, one or more of the remaining windows resize to occupy the space formerly occupied by the window you were dragging.

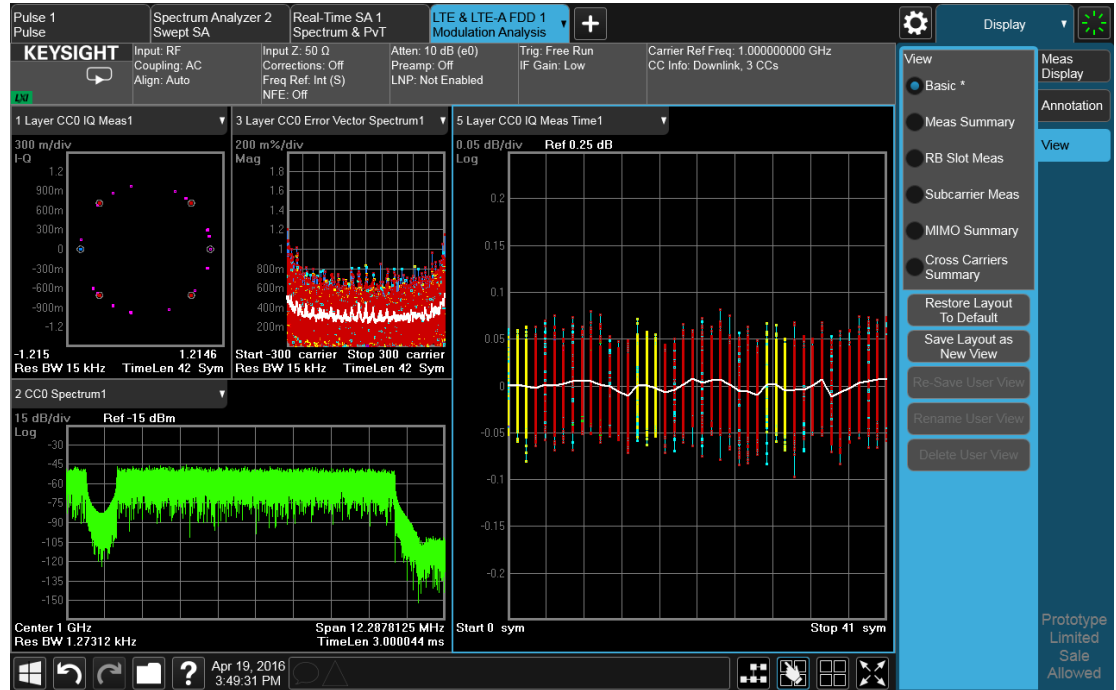
#### 2.17.3 To Delete a Window from a View

The View Editor also lets you delete a window. To do this, tap one of the circled red X's, as shown below.

There has to be more than one window for you to see the circled red Xs.



Now press the View Editor button (the blue hand) to exit the View Editor. At this point, you have an edited Predefined View, as shown by the \* next to Basic:



When you are finished with it, you can restore the Layout to the default for Basic by pressing “Restore Layout to Default”. Or you can save your edited View as a “User View” (if you exit the measurement without saving the edited View, the instrument will save it for you as a User View called “Autosaved”).

If you clone the current Screen by pressing the “+” tab, the modified Predefined View will be saved as a User View called “Autosaved”, and it will be available in the new Screen.

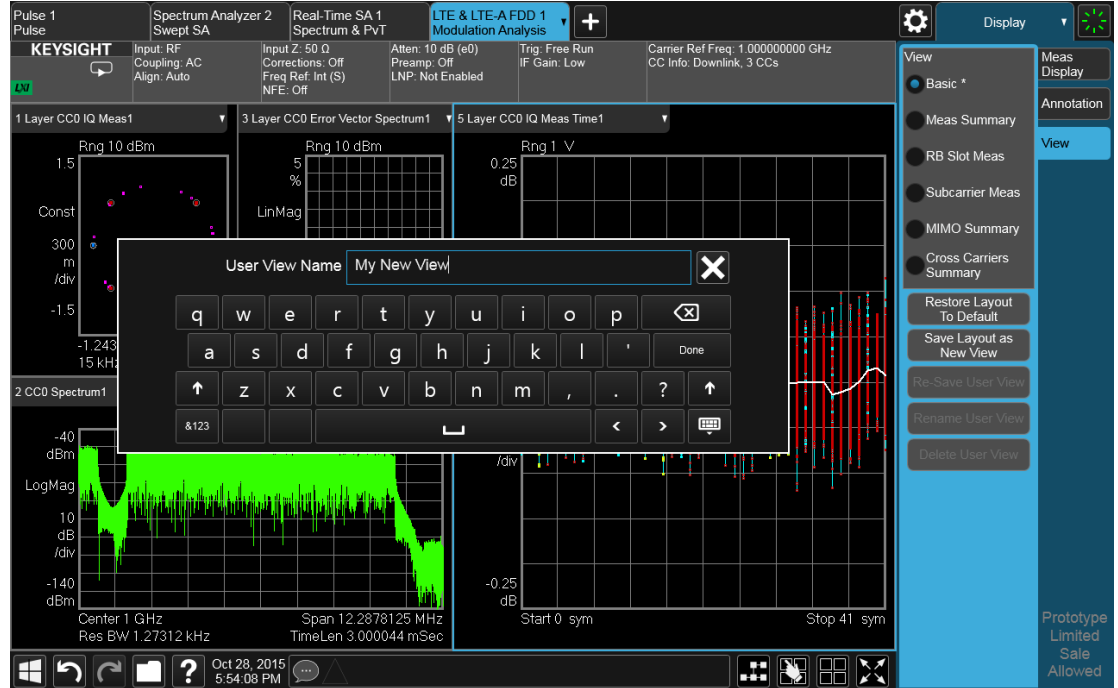
## 2.17.4 To Save a User View

See also ["Transferring User Views Between Instruments" on page 137](#)

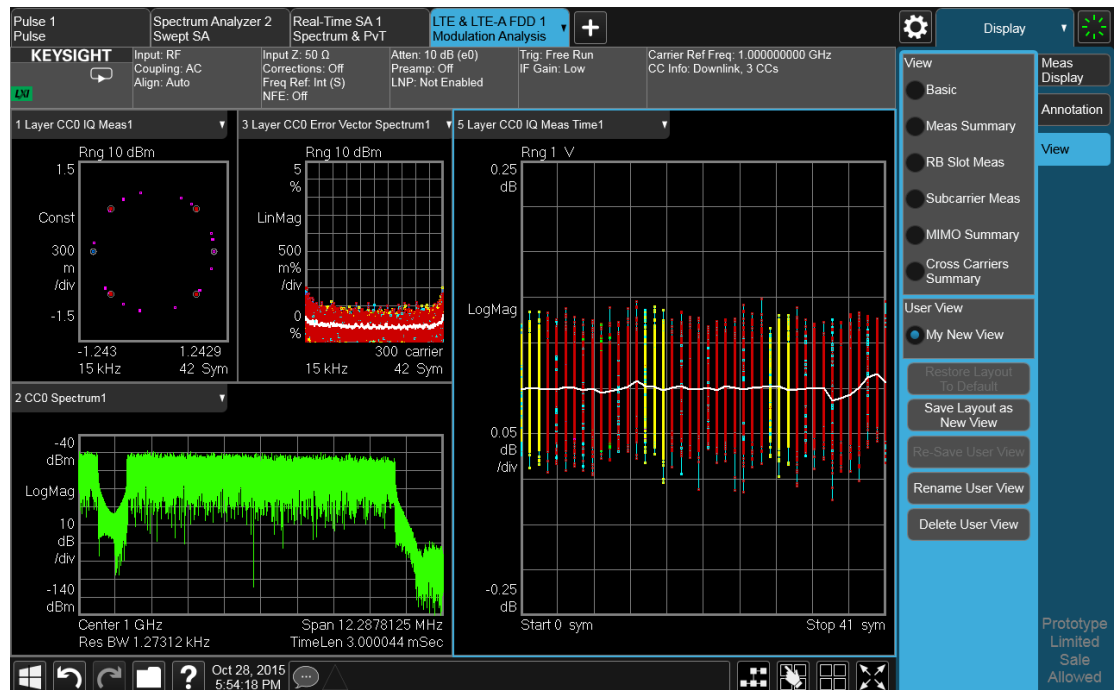
To save your new View as a User View, tap the “Save Layout as New View” control. You will get an alpha keyboard that lets you name your new View; the default is the old View name with a number. Below, we have typed in “My New View”:

## 2 User Interface

### 2.17 View Editor

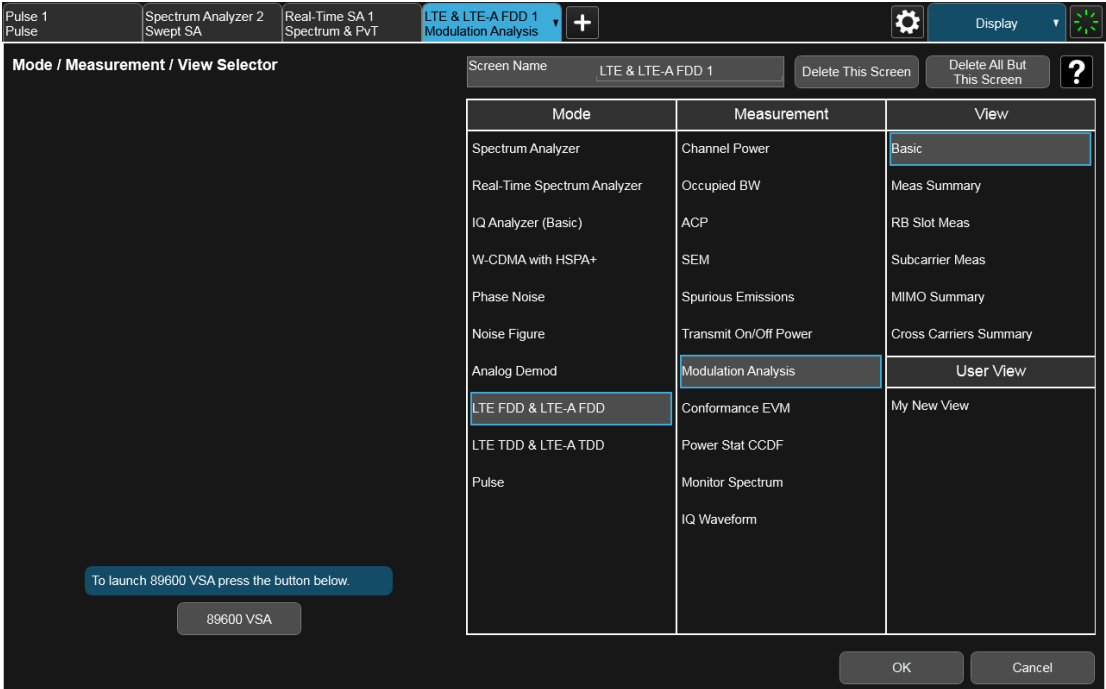


When you tap “Done”, the View is saved:



Notice the User View region which has appeared on the menu panel above, with the new User View called “My New View. Notice also that “Basic” has returned to its original, unedited state and the \* is gone from its name. Note also that “Restore

Layout to Default” is grayed out. Note also that if you go to the Mode/Meas dialog, you will see the User View there as well:



When naming a new View, you must choose a name that is not already in use for any User View in any measurement; this is because User Views get written to permanent memory and are available to all instances of the Measurement in any screen. They survive a Mode Preset and also survive shutdown and restart of the application.

### Transferring User Views Between Instruments

To transfer a User View to another instrument, you must copy the desired file to a portable drive or to your network and then copy it to the target instrument.

When you save a User View, a file is created (or updated if it already exists) containing all the User Views for the current measurement. All of these files are saved on the D: drive in the instrument, in the folder:

D:\Users\Instrument\My Documents\UserViews

(assuming you are logged in as Instrument, which is the default).

Look for the file for your measurement. The file naming convention is:

ModeName.MeasName.layout

Where **ModeName** is the long-form SCPI parameter for the **:INST:SEL** command for your Mode, and **MeasName** is the long-form SCPI parameter for the **:CONF** command for your Measurement.

For a full list of all **ModeName** parameters, see **Index to Modes** in "Mode" on page 56.

The following is a full list of all [MeasName](#) parameters.

| Measurement Name                   | SCPI ID     |
|------------------------------------|-------------|
| ACP, Adjacent Channel Power        | ACPower     |
| AM                                 | AM          |
| AM Depth                           | AMD         |
| Amplitude Probability Distribution | APD         |
| Audio Distortion                   | AUDDist     |
| Audio Frequency                    | AUDFreq     |
| Audio Level                        | AUDLevel    |
| Audio SINAD                        | AUDSinad    |
| Automatic Direction Finder         | ADF         |
| Channel Power                      | CHPower     |
| Code Domain                        | CDPower     |
| Combined GSM                       | CGSM        |
| Combined WCDMA                     | CWCDma      |
| Complex Spectrum                   | SPECTrum    |
| Conformance EVM                    | CEVM        |
| Custom OFDM                        | OFDM        |
| Digital Demod                      | DDEMod      |
| Disturbance Analyzer               | DANalyzer   |
| EDR In-band Spurious Emissions     | IBSPurious  |
| EVM                                | EEVM        |
| Fast Capture                       | FCAPture    |
| Fast Spectrum                      | FSpectrum   |
| FM                                 | FM          |
| FM Deviation                       | FMDeviation |
| FM Stereo                          | FMStereo    |
| Frequency Counter                  | FCOuter     |
| Frequency Scan                     | FSCan       |
| GMSK Phase & Freq Error            | PFError     |
| Group Delay                        | GDElay      |
| Harmonics                          | HARMonics   |
| HRP UWB Demodulation               | HUWB        |
| Instrument Landing System          | ILS         |
| IQ Waveform                        | WAVEform    |
| LE In-band Emissions               | IBEMissions |
| List Power Step                    | LPSTep      |

| Measurement Name            | SCPI ID     |
|-----------------------------|-------------|
| List Sequencer              | LSEQuencer  |
| List Sweep                  | LIST        |
| Log Plot                    | LPLot       |
| LoRa (CSS) Demodulation     | LORA        |
| Marker Beacon               | MBE         |
| Mod Accuracy                | RHO         |
| Modulation Analysis         | EVM         |
| Modulation Distortion       | MODDist     |
| Modulation Rate             | MODRate     |
| Modulation SINAD            | MODSinad    |
| Monitor Spectrum            | MONitor     |
| Noise Figure                | NFIGure     |
| Occupied BW /               | OBWidth     |
| Output Spectrum BW          |             |
| Output RF Spectrum          | EORFspectr  |
| Phase and Amplitude vs Time | PAVTime     |
| PM                          | PM          |
| PM Deviation                | PMDeviation |
| Power Amplifier             | PAMplifier  |
| Power Control               | PCONtrol    |
| Power Stat CCDF             | PSTatistic  |
| Power vs Time               | EPVTime     |
| Pulse                       | PULSe       |
| QPSK EVM                    | EVMQpsk     |
| Real Time Scan              | RTSC        |
| RF Power                    | RFPower     |
| SEM                         | SEMask      |
| Spectral Flatness           | FLATness    |
| Spectrum & PVT              | RTSA        |
| Spot Frequency              | SFRequency  |
| Spurious Emissions          | SPURious    |
| Streaming                   | STReaming   |
| Strip Chart                 | SCHart      |
| Swept SA                    | SANalyzer   |
| TOI                         | TOI         |

| Measurement Name                | SCPI ID  |
|---------------------------------|----------|
| Transmit Analysis               | TX       |
| Transmit On/Off Power           | PVTime   |
| Transmit Power<br>(Burst Power) | TXPower  |
| Tuned RF Level                  | TRFLevel |
| Tuned RF Level with Tracking    | TTRF     |
| Tx Band Spur                    | ETSPur   |
| VHF Omni-Directional Range      | VOR      |

Examples:

- The User View file for the Swept SA measurement is [SA.SANalyzer.layout](#)
- The User View file for the ACP measurement in the WCDMA mode is [WCDMA.ACPower.layout](#)

Copy the desired file to a thumb drive or to your network. Then go to the target instrument and copy the file into the [D:\Users\Instrument\My Documents\UserViews](#) directory on that instrument (again, assuming you are logged in as Instrument).

Note that copying this file to another instrument will overwrite the file already in that instrument, if any, and will destroy any User Views that might have been created on that instrument.

Note that when you delete the last User View for a measurement, the file is removed.

### 2.17.5 To Rename a User View

You can rename a User View by selecting that View and tapping “Rename User View.” You can also re-edit a User View; if you do this, an asterisk will appear next to the User View’s name. You can then tap “Re-Save User View to save it back to its existing name, or “Save Layout as New View” to add another, new User View.

### 2.17.6 To Delete a User View

You can delete a User View by doing the following:

1. From the ["Mode/Meas/View Dialog"](#) on [page 55](#), or from the **View** menu, select the User View that you want to delete
2. Switch to the **Display** menu



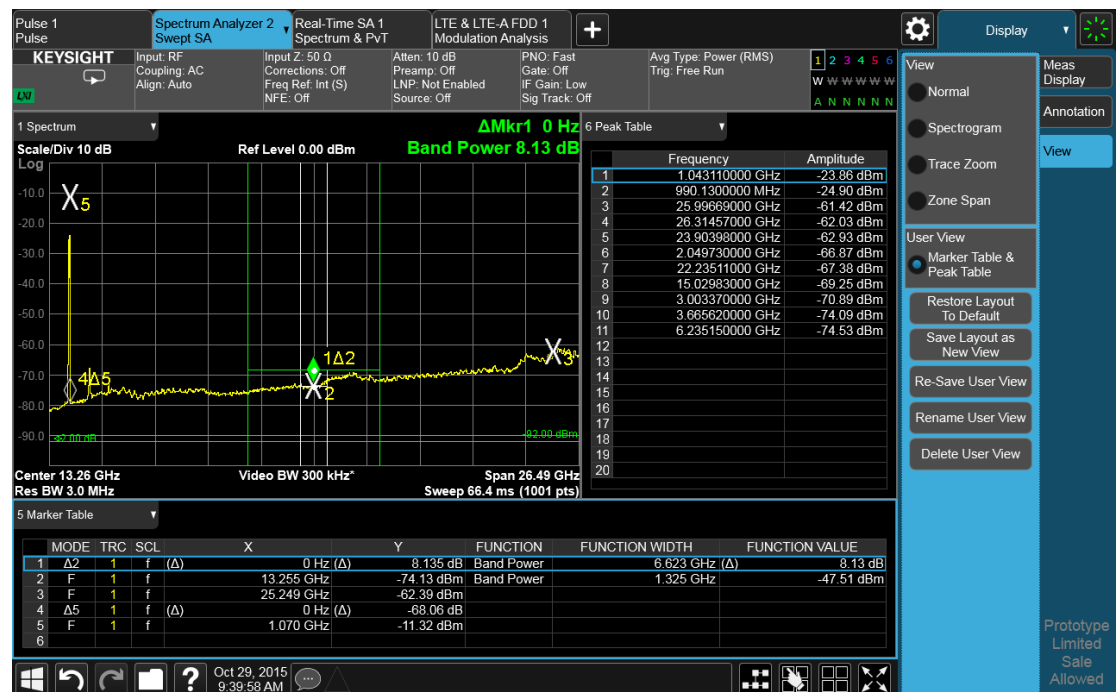
3. Select the **View** tab
4. Tap **Delete User View**

### 2.17.7 To Delete All User Views

You can delete all User Views by tapping “Delete All User Views.” The default view becomes the current view for the Measurement if a User View was the current view when this control was pressed.

### 2.17.8 Use Case: Displaying Marker and Peak Tables

One common application for User Views is to create a View that allows the Spectrum Analyzer to display both a Marker Table and a Peak Table at the same time. To do this, simply add a Marker Table Window and a Peak Table window to the Spectrum window of the Swept SA measurement. The result is shown below; note that the new View has been named “Marker Table & Peak Table”:



NOTE: There are legacy displays like Marker Table, Peak Table, Measure at Marker and Gate View, which are not Views but special display modes. These are retained for backwards compatibility, however they are turned on and off with switches and do not use the View system. Turning on one of these switches does not create a modified View, it merely adds the specified window to the current View; turning the switch back off removes the window. While the switch is on, NO View shows as

selected in the View menu. These switches are grayed out if you are in a modified View or a User View. Since only one of these switches can be on at a time, and because these switches turn off on a Preset, User Views offer a superior way of adding windows than using the switches.

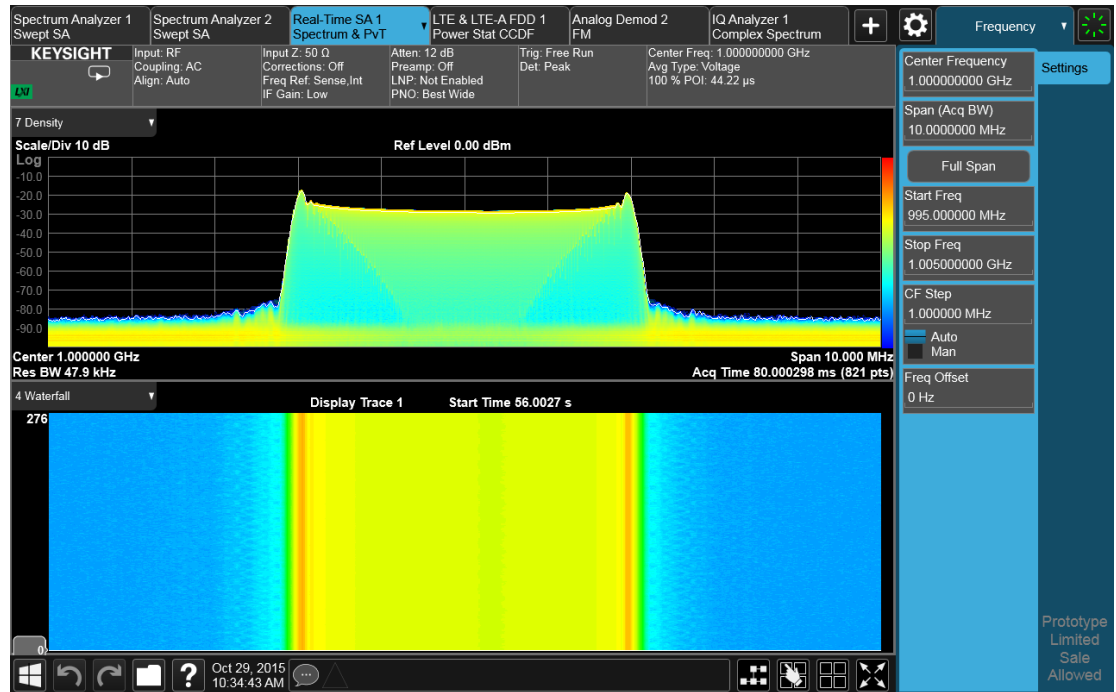
Some measurements do not support User Views; these do not allow adding, deleting or rearranging windows, however they do allow resizing windows. In these measurements you can get into the View Editor but the Add icons, Delete icons and Move icons will not appear. You can still resize the windows and in some cases (e.g. Noise Figure) you can still change window contents.

### **2.17.9 View Editor Remote Commands**

Remote Commands for User Views can be found in the documentation for the **Display, View** tab.

## 2.18 Multiscreen

You can configure up to 16 different Screens at a time. Normally, you only see one Screen, and the set of configured screens is shown across the top of the display in a series of "Screen Tabs" on page 54. Touching any screen's tab brings it to the foreground, makes it the current Screen and starts it updating.



Multiscreen view lets you display all of the configured Screens at once.

You can switch to Multiscreen View by pressing this button in the "Control Bar" on page 104 at the bottom right of the screen:



Multiscreen View looks like this:

## 2 User Interface

### 2.18 Multiscreen



While in Multiscreen View, the button changes from a black background to a blue background:



To exit Multiscreen view, tap the button again.

Multiscreen View cannot be activated if only one screen is configured.

Each Screen contains one Mode, each Mode contains one Measurement, and each Measurement contains a number of Windows arranged in Views. You can configure multiple instances of the same Mode along with any combination of other Modes.

In Multiscreen View, just as in Single Screen View, only one screen is active.

You switch Screens by tapping the Screen Tab you want, or when in Multiscreen View, you can tap the Screen itself. When you switch Screens, the current Screen's state and measurement results are preserved, the new Screen's previous state and data are loaded, and the new Screen starts running its Mode.

In Multiscreen View:

- The Meas Bar does not display
- The Screens are presented in an array of equal size boxes, except where the number of Screens means some have to be different sizes (as when you have 3 Screens, 5 Screens, etc.).

- Each Screen has a tab that contains the name of the Mode and Measurement in the box and a number associated with the instance of that Mode. You can enter a custom Screen name that replaces the Mode name, by going into the Mode/Meas dialog
- There is always one and only one selected Screen. It is indicated by a blue tab. Only the selected Screen is actually running a measurement and updating its display
- The selected window in the selected screen is the context for the current menus. It is the only window on the display with a blue border
- As you go from screen to screen, each screen remembers the last menu that was active in that screen and restores it as the active menu

In Multiscreen View, as in Single Screen View, tapping the blue tab or pressing the Mode/Meas front panel key opens the ["Mode/Meas/View Dialog" on page 55](#) which allows you to change the Mode (or Measurement or View) being displayed in that Screen.

|                |                                                                                                                                                    |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:INSTrument:SCReen:MULTiple[:STATe] OFF   ON   0   1</code><br><code>:INSTrument:SCReen:MULTiple?</code>                                     |
| Example        | <code>:INST:SCR:MULT ON</code>                                                                                                                     |
| Notes          | If only one screen is configured, attempting to set Multi-Screen ON generates the error “-221, Settings conflict; Multi-Screen requires >1 screen” |
| Preset         | OFF                                                                                                                                                |

For more information, see the following:

- ["Select Screen" on page 145](#)
- ["Screen List \(Remote only command\)" on page 146](#)

## 2.18.1 Select Screen

You can select a screen by touching its tab or, in ["Multiscreen" on page 143](#) mode, touching the screen itself. Selecting the Screen activates the screen and suspends the previously selected screen (if any).

|                |                                                                                                                                                                                                                                                                                                                                                   |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:INSTrument:SCReen:SElect &lt;screen name&gt;</code><br><code>:INSTrument:SCReen:SElect?</code>                                                                                                                                                                                                                                             |
| Example        | <code>:INST:SCR:SEL "Baseband"</code>                                                                                                                                                                                                                                                                                                             |
| Notes          | If the <screen name> is specified but not found in the list of Screens, the error message “-224, Illegal parameter value; Screen Name not found” is generated<br>If the display is disabled (via <code>:DISP:ENAB OFF</code> ) then the error message “-221, Settings conflict; Screen SCPI cannot be used when Display is disabled” is generated |

---

|        |                                       |
|--------|---------------------------------------|
| Preset | Returns the name of the active screen |
|--------|---------------------------------------|

**2.18.2 Screen List (Remote only command)**

You can obtain a list of currently configured Screens. This permits your remote program to manage screens for selection, renaming, or deletion.

---

|                |                                                                                                                                                                                                                                                       |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:INSTrument:SCReen:CATalog?</code>                                                                                                                                                                                                              |
| Example        | <code>:INST:SCR:CAT?</code>                                                                                                                                                                                                                           |
| Notes          | <p>The query response is a comma separated list of Screen Names. If only 1 Screen is configured, there is no trailing comma</p> <p>For R&amp;S compatibility, the following query is also available:</p> <p><code>:INSTrument:SCReen:LIST?</code></p> |
| Preset         | Returns list of currently configured Screens                                                                                                                                                                                                          |

## 2.19 Fullscreen

The Fullscreen button is in the "Control Bar" on page 104, at the lower right corner of the display.



When **Full Screen** is pressed the measurement window expands horizontally over the entire instrument display. The screen graticule area expands to fill the available display area.

It turns off the display of the menu panel, however the controls that drop down from the Meas Bar and on-screen annotation are still available, and you can still drag the trace and markers and perform a pinch zoom, so you can still operate the instrument.

Pressing **Full Screen** again while Full Screen is in effect cancels Full Screen.

You can get even more screen area for your data display by turning off the Meas Bar using the Annotation tab of the Display menu)

Full Screen is canceled by the **Preset** key.

|                               |                                                                                                                                                                                                                                                                                                               |
|-------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command                | <code>:DISPlay:FSCreen[:STATe] OFF   ON   0   1</code><br><code>:DISPlay:FSCreen[:STATe]?</code>                                                                                                                                                                                                              |
| Notes                         | This was set to Off by :SYST:DEF MISC in MXA1, but not by Preset. It is no longer set Off by :SYST:DEF MISC, since it is now meas global instead of mode global                                                                                                                                               |
| Preset                        | Unaffected by Preset but set to Off by Restore Misc Defaults or shutdown and restart                                                                                                                                                                                                                          |
| State Saved                   | Not saved in instrument state                                                                                                                                                                                                                                                                                 |
| Backwards Compatibility SCPI  | <code>:DISPlay:MENU[:STATe] OFF   ON   0   1</code><br>This emulates ESA full screen functionality, which is the same as the FSCreen command in PSA except that the sense of on/off is reversed (that is, OFF means the menus are OFF, so Fullscreen is ON) and the default is ON (meaning Fullscreen is OFF) |
| Backwards Compatibility Notes | In ESA/PSA, Full Screen was turned on with a softkey, so pressing any other key turned Full Screen off. In the X-Series, because a hardkey is provided to turn this function on and off, pressing any other key no longer turns off Full Screen                                                               |

### 3 Noise Figure Mode

Noise Figure Mode is used for Noise Figure measurements using a Noise Source from the Keysight 346, 347 or N4000 (SNS) Noise Source families. It is the default application in the N8973B Noise Figure Analyzer.

Noise Figure Mode contains one measurement, the "Noise Figure Measurement" on [page 149](#).

NOTE

When Noise Figure Mode is exited, both SNS and Normal noise sources are switched **Off**. This prevents any hardware damage if you connect other instruments to the 28V noise source control. When you access Noise Figure Mode again, the noise sources will only turn on when a valid measurement is initiated.

|                                                                                                                                                                 |                                                                                                                                                                                        |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| To access the built-in help for this Mode, it must be the currently-active Mode. If it is not, exit help ( <b>Esc</b> key), select this Mode, then reopen help. |                                                                                                                                                                                        |
| Example                                                                                                                                                         | <code>:INST:SEL NFIGURE</code><br><code>:INST:NSEL 219</code>                                                                                                                          |
| Dependencies                                                                                                                                                    | The Mode must be installed and licensed in your instrument before it is available for use                                                                                              |
| Status Bits/OPC dependencies                                                                                                                                    | Changing Modes resets all SCPI status registers and mask registers to their power-on defaults. Therefore, event or condition register masks must be re-established after a Mode change |



## 3.1 Noise Figure Measurement

The Noise Figure measurement makes individual noise figure measurements over the range of frequencies specified by the frequency parameters. After each frequency point has been measured, the results are displayed on screen. See ["Layouts" on page 155](#) for a description of the various formats in which the data may be displayed, depending on the Format selected under ["Sweep" on page 356](#), or the Layout selected under ["Display" on page 175](#).

### NOTE

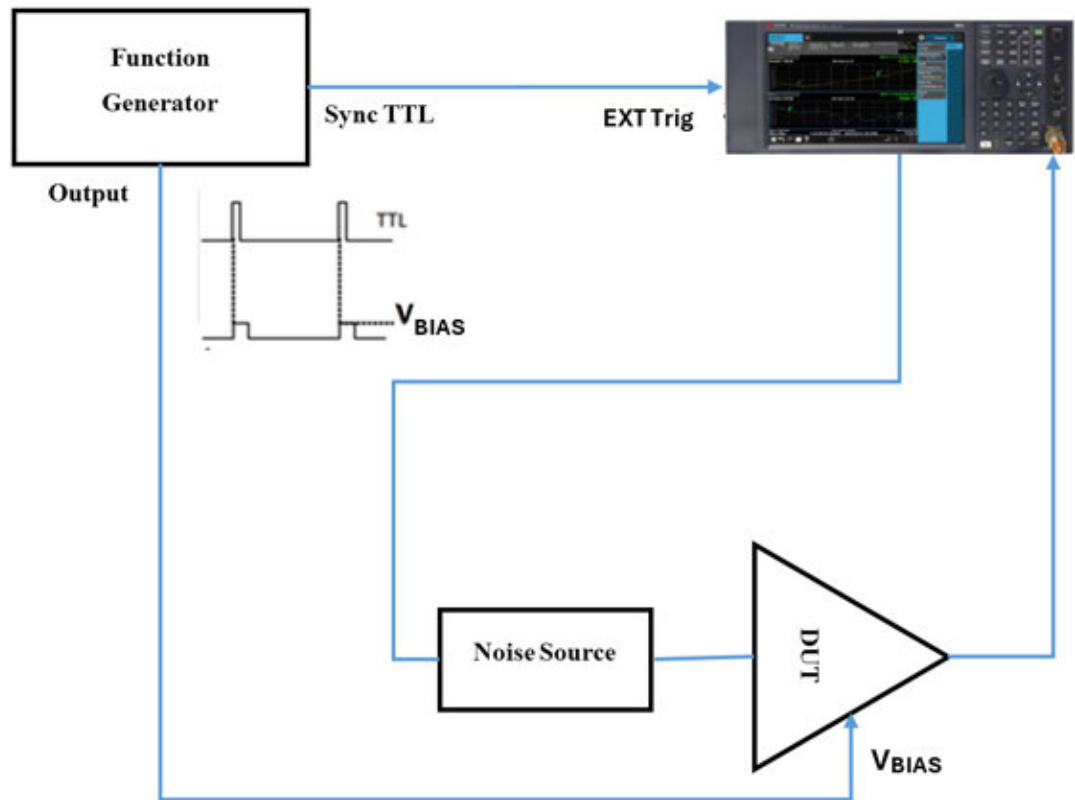
The ENR, Loss Compensation Lists, User Calibration data and Frequency List tables are all stored in the Instrument State file, which means that they may be stored for later use simply by using 'Power-On, Last State' or 'Power-On, User' (if you stored the files under Save User Preset) Preset features of the instrument. If these features are not saved in the State file, the measurement will appear to 'clear' these tables every time a Mode Preset is performed. Alternatively, the tables may be saved to internal or external storage and loaded at a later date.

---

### Pulsed Noise Figure Measurement

In the Y-factor method, each measurement consists of the pHot/pCold measurement that is made while the noise source is On/Off. In a Pulsed Noise Figure measurement, these two measurements need to be performed only in the active part of the pulse. To ensure this, a gated trigger signal must be used to synchronize the active part of the pulse to the data acquisition. Then, the gate settings, such as **Gate Delay** and **Gate Holdoff**, can be used to further synchronize the data acquisition to the on-period of the pulse. Use the controls in ["Gate Settings" on page 987](#), under **Trigger**, to adjust the gate parameters.

For more details, see ["Avg Time/Pt" on page 356](#).



## Noise Figure Measurement Commands

The general functionality of "CONFigure" on page 1040, "INITiate" on page 1041, "FETCh" on page 1041, "MEASure" on page 1043, and "READ" on page 1042 are described in the section **SCPI Operation and Results Query** in the topic **Programming the Instrument**.

The following commands and queries are used to configure the measurement:

|                                          |                                                                                                                                                           |
|------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|
| <code>:INITiate:NFIGure</code>           | Initiates a trigger cycle for the measurement, but does not return any data. You must then use <code>:FETCh :READ :MEAS:NFIG:...?</code> to retrieve data |
| <code>:CONFigure?</code>                 | Does not change any measurement settings<br>Returns the long form name of current measurement, in this case, <code>NFIGure</code>                         |
| <code>:CONFigure:NFIGure</code>          | Selects <code>NFIG</code> measurement with Meas Setup settings in preset state – same as "Meas Preset" on page 320                                        |
| <code>:CONFigure:NFIGure:NDEFault</code> | Selects <code>NFIG</code> measurement <i>without</i> affecting settings                                                                                   |

### 3 Noise Figure Mode

#### 3.1 Noise Figure Measurement

#### Remote Command Results

Use **:FETCh**, **:READ** or **:MEASure** to retrieve measurement results.

The tables below describe the data returned by the queries:

|                               |                                                                                                            |
|-------------------------------|------------------------------------------------------------------------------------------------------------|
| Remote Command                | <b>:FETCh MEASure READ:NFIGure?</b>                                                                        |
| Notes                         | Returns comma-separated results of the last point from the last swept measurement, in the following order: |
|                               | 1 T cold Scalar Value                                                                                      |
|                               | 2 Corrected Noise Figure                                                                                   |
|                               | 3 Corrected Noise Factor                                                                                   |
|                               | 4 Corrected Gain                                                                                           |
|                               | 5 Corrected Effective Temperature                                                                          |
|                               | 6 Corrected Hot Power Density                                                                              |
|                               | 7 Corrected Cold Power Density                                                                             |
|                               | 8 Uncorrected Noise Figure                                                                                 |
|                               | 9 Uncorrected Noise Factor                                                                                 |
|                               | 10 Uncorrected Gain                                                                                        |
|                               | 11 Uncorrected Effective Temperature                                                                       |
|                               | 12 Uncorrected Hot Power Density                                                                           |
|                               | 13 Uncorrected Cold Power Density                                                                          |
| Backwards Compatibility SCPI  | <b>:FETCh MEASure READ[:NFIGure]?</b>                                                                      |
| Backwards Compatibility Notes | Optional <b>[:NFIGure]</b> node supported for Backwards Compatibility with PSA/ESA                         |

#### Last Swept T Cold

|                               |                                                                                                                                                   |
|-------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command                | <b>:FETCh MEASure READ:NFIGure[:ARRay][:DATA]:TCOLd?</b>                                                                                          |
| Notes                         | Returns an array of the most recently used T Cold values from the last swept measurement. One value is returned for each frequency point measured |
| Backwards Compatibility SCPI  | <b>:FETCh MEASure READ[:NFIGure][:ARRay][:DATA]:TCOLd?</b>                                                                                        |
| Backwards Compatibility Notes | Optional <b>[:NFIGure]</b> node supported for Backwards Compatibility with PSA/ESA                                                                |

### Last Fixed T Cold

|                               |                                                                                          |
|-------------------------------|------------------------------------------------------------------------------------------|
| Remote Command                | <code>:FETCh MEASure READ:NFIGure:SCALar[:DATA]:TCOLd?</code>                            |
| Notes                         | Returns the most recently used T Cold value from the last fixed measurement              |
| Backwards Compatibility SCPI  | <code>:FETCh MEASure READ[:NFIGure]:SCALar[:DATA]:TCOLd?</code>                          |
| Backwards Compatibility Notes | Optional <code>[:NFIGure]</code> node supported for Backwards Compatibility with PSA/ESA |

### Last Corrected Swept

|                               |                                                                                                                                                                                  |
|-------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command                | <code>:FETCh MEASure READ:NFIGure[:ARRay][:DATA]:CORRec-ted:NFIGure NFACTOR GAIN TEFFective PHOT PCOLd?</code>                                                                   |
| Notes                         | Returns an array of the most recently completed data from the last swept measurement, taking account of correction data. One value is returned for each frequency point measured |
| Backwards Compatibility SCPI  | <code>:FETCh   MEASure   READ[:NFIGure][:ARRay][:DATA]:CORRected:NFIGure   NFACTOR   GAIN   TEFFective   PHOT   PCOLd?</code>                                                    |
| Backwards Compatibility Notes | Optional <code>[:NFIGure]</code> node supported for Backwards Compatibility with PSA/ESA                                                                                         |

### Last Corrected Fixed

|                               |                                                                                                                              |
|-------------------------------|------------------------------------------------------------------------------------------------------------------------------|
| Remote Command                | <code>:FETCh MEASure READ:NFIGure:SCALar[:DATA]:CORRec-ted:NFIGure NFACTOR GAIN TEFFective PHOT PCOLd?</code>                |
| Notes                         | Returns the most recently completed data from the last fixed measurement, taking account of correction data                  |
| Backwards Compatibility SCPI  | <code>:FETCh   MEASure   READ[:NFIGure]:SCALar[:DATA]:CORRected:NFIGure   NFACTOR   GAIN   TEFFective   PHOT   PCOLd?</code> |
| Backwards Compatibility Notes | Optional <code>[:NFIGure]</code> node supported for Backwards Compatibility with PSA/ESA                                     |

### Last Uncorrected Swept

|                |                                                                                                                     |
|----------------|---------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:FETCh MEASure READ:NFIGure[:ARRay][:DATA]:UNCOR-rected:NFIGure NFACTOR YFACTOR TEFFective PHOT PCOLd?</code> |
|----------------|---------------------------------------------------------------------------------------------------------------------|

### 3 Noise Figure Mode

#### 3.1 Noise Figure Measurement

|                                  |                                                                                                                                               |
|----------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| Notes                            | Returns an array of the most recently completed data from the last swept measurement. One value is returned for each frequency point measured |
| Backwards Compatibility<br>SCPI  | <code>:FETCh   MEASure   READ[:NFIGure][:ARRay][:DATA]:UNCorrected:NFIGure   NFACTOR   YFACTOR   TEFFective   PHOT   PCOLd?</code>            |
| Backwards Compatibility<br>Notes | Optional <code>[:NFIGure]</code> node supported for Backwards Compatibility with PSA/ESA                                                      |

#### Last Uncorrected Fixed

|                                  |                                                                                                                                   |
|----------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|
| Remote Command                   | <code>:FETCh MEASure READ:NFIGure:SCALar[:DATA]:UNCOr-<br/>rected:NFIGure NFACTOR YFACTOR TEFFective PHOT PCOLd?</code>           |
| Notes                            | Returns the most recently completed data from the last fixed measurement                                                          |
| Backwards Compatibility<br>SCPI  | <code>:FETCh   MEASure   READ[:NFIGure]:SCALar[:DATA]:UNCorrected:NFIGure   NFACTOR   YFACTOR   TEFFective   PHOT   PCOLd?</code> |
| Backwards Compatibility<br>Notes | Optional <code>[:NFIGure]</code> node supported for Backwards Compatibility with PSA/ESA                                          |

#### Maximum

For NFA backwards compatibility

|                                 |                                                                                                                        |
|---------------------------------|------------------------------------------------------------------------------------------------------------------------|
| Notes                           | Returns the max value of the trace along with the freq which this max occurs, taking account of correction data        |
| Backwards Compatibility<br>SCPI | <code>:TRACe[:NFIGure][:DATA]:CORRected:AMPLitude:MAXimum? NFIGure   NFACTOR   GAIN   PHOT   PCOLd   TEFFective</code> |

#### Minimum

For NFA backwards compatibility

|                                 |                                                                                                                        |
|---------------------------------|------------------------------------------------------------------------------------------------------------------------|
| Notes                           | Returns the min value of the trace along with the freq which this min occurs, taking account of correction data        |
| Backwards Compatibility<br>SCPI | <code>:TRACe[:NFIGure][:DATA]:CORRected:AMPLitude:MINimum? NFIGure   NFACTOR   GAIN   PHOT   PCOLd   TEFFective</code> |

#### Value at Specified Freq

For NFA backwards compatibility

|       |                                                                                                                                                                        |
|-------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Notes | Returns the value of the trace at the specified freq, taking account of correction data. If the freq is not part of the measurement, returns <b>NAN</b> (Not A Number) |
|-------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                                    |                                                                                                                                          |
|------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|
| Backwards<br>Compatibility<br>SCPI | <code>:TRACe[:NFIGure][:DATA]:CORReCted:AMPLitude[:VALue]? NFIGure   NFACTOR   GAIN   PHOT   PCOLd   TEFFective,&lt;frequency&gt;</code> |
|------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|

### Delta

For NFA backwards compatibility

|       |                                                                                                                                  |
|-------|----------------------------------------------------------------------------------------------------------------------------------|
| Notes | Returns the value obtained by subtracting the amplitude at frequency1 from that at frequency2, taking account of correction data |
|-------|----------------------------------------------------------------------------------------------------------------------------------|

|                                    |                                                                                                                                          |
|------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|
| Backwards<br>Compatibility<br>SCPI | <code>:TRACe[:NFIGure][:DATA]:CORReCted:DELTA? NFIGure   NFACTOR   GAIN   PHOT   PCOLd   TEFFective, &lt;freq1&gt;, &lt;freq2&gt;</code> |
|------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|

### Pk-Pk Value

For NFA backwards compatibility

|       |                                                                                                                                                                                                                                                                                                                          |
|-------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Notes | Returns the difference between the maximum and minimum amplitude values on the given trace and the frequency difference between the two frequency points where the maximum and minimum occur, taking account of correction data. The returned values are comma-separated, and the amplitude value precedes the frequency |
|-------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                                    |                                                                                                             |
|------------------------------------|-------------------------------------------------------------------------------------------------------------|
| Backwards<br>Compatibility<br>SCPI | <code>:TRACe[:NFIGure][:DATA]:CORReCted:PTPeak? NFIGure   NFACTOR   GAIN   PHOT   PCOLd   TEFFective</code> |
|------------------------------------|-------------------------------------------------------------------------------------------------------------|

### Max Uncorrected

For NFA backwards compatibility

|       |                                                                              |
|-------|------------------------------------------------------------------------------|
| Notes | Returns the max value of the trace along with the freq which this max occurs |
|-------|------------------------------------------------------------------------------|

|                                    |                                                                                                                             |
|------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|
| Backwards<br>Compatibility<br>SCPI | <code>:TRACe[:NFIGure][:DATA]:UNCORReCted:AMPLitude:MAXimum? NFIGure   NFACTOR   YFACTOR   PHOT   PCOLd   TEFFective</code> |
|------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|

### Min Uncorrected

For NFA backwards compatibility

|       |                                                                              |
|-------|------------------------------------------------------------------------------|
| Notes | Returns the min value of the trace along with the freq which this min occurs |
|-------|------------------------------------------------------------------------------|

|                                    |                                                                                                                             |
|------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|
| Backwards<br>Compatibility<br>SCPI | <code>:TRACe[:NFIGure][:DATA]:UNCORReCted:AMPLitude:MINimum? NFIGure   NFACTOR   YFACTOR   PHOT   PCOLd   TEFFective</code> |
|------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|

### 3 Noise Figure Mode

#### 3.1 Noise Figure Measurement

##### Value at Specified Freq Uncorrected

For NFA backwards compatibility

|                                 |                                                                                                                                               |
|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| Notes                           | Returns the value of the trace at the specified freq. If the freq is not part of the measurement, it returns NAN (Not a Number)               |
| Backwards Compatibility<br>SCPI | <code>:TRACe[:NFIGure][:DATA]:UNCorrected:AMPLitude[:VALue]? NFIGure   NFACTOR   YFACTOR   PHOT   PCOLd   TEFFective,&lt;frequency&gt;</code> |

##### Delta Uncorrected

For NFA backwards compatibility

|                                 |                                                                                                                                               |
|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| Notes                           | Returns the value obtained by subtracting the amplitude at frequency1 from that at frequency2                                                 |
| Backwards Compatibility<br>SCPI | <code>:TRACe[:NFIGure][:DATA]:UNCorrected:DELTA? NFIGure   NFACTOR   YFACTOR   PHOT   PCOLd   TEFFective, &lt;freq1&gt;, &lt;freq2&gt;</code> |

##### Pk-Pk Uncorrected

For NFA backwards compatibility

|                                 |                                                                                                                                                                                                                                                                                       |
|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Notes                           | Returns the difference between the maximum and minimum amplitude values on the given trace and the frequency difference between the two frequency points where the maximum and minimum occur. The returned values are comma-separated, and the amplitude value precedes the frequency |
| Backwards Compatibility<br>SCPI | <code>:TRACe[:NFIGure][:DATA]:UNCorrected:PTPeak? NFIGure   NFACTOR   YFACTOR   PHOT   PCOLd   TEFFective</code>                                                                                                                                                                      |

##### Meter

|                |                                                                              |
|----------------|------------------------------------------------------------------------------|
| Remote Command | <code>:FETCh READ[:NFIGure]:METer?</code>                                    |
| Notes          | Return the measured 61 noise figure results in fixed "Freq Mode" on page 191 |

##### Meter Minimum

|                |                                                                                                      |
|----------------|------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:FETCh READ[:NFIGure]:METer:MINimum?</code>                                                    |
| Notes          | Returns the current measured minimum noise figure within 61 results in fixed "Freq Mode" on page 191 |

### 3.1.1 Layouts

There are three predefined layouts: **Graph**, **Table**, and **Meter**.

These are multiple-window layouts. When in a multiple-window layout, you select a window by touching it. The menu controls may sometimes change depending on which window is selected.

When "Layout" on page 175 (under Display) is in AUTO, the layout changes when "Freq Mode" on page 191 (under Frequency) changes, as follows:

| Freq Mode | Layout              |
|-----------|---------------------|
| Swept     | "Graph" on page 156 |
| Fixed     | "Meter" on page 156 |
| List      | "Table" on page 157 |

NOTE

The Noise Figure measurement uses **Layout** to control the result display instead of **View**. This is the same as the N9069A Noise Figure Measurement.

|                                 |                                                                           |
|---------------------------------|---------------------------------------------------------------------------|
| Remote Command                  | :DISPlay:NFIGure:FORMat GRAPh   TABLe   METer<br>:DISPlay:NFIGure:FORMat? |
| Example                         | :DISP:NFIG:FORM GRAP                                                      |
| Preset                          | GRAPh                                                                     |
| State Saved                     | Saved in instrument state                                                 |
| Backwards Compatibility<br>SCPI | :DISPlay[:NFIGure]:FORMat                                                 |

Graph

Draws two selected results in two graph windows respectively. A caret (^) is displayed below each trace at the position of the current measurement when the total sweep time exceeds 300 ms (total sweep time = avg sweep time per point \* number of points).

If "Overlay / Combined" on page 183 (under Display) is ON, draws both results as two traces on the same graph with two sets of Y-axis notation. This layout can be useful for printing both results together on a larger graph. A caret (^) is displayed below each trace at the position of the current measurement.

|         |                      |
|---------|----------------------|
| Example | :DISP:NFIG:FORM GRAP |
|---------|----------------------|

Meter

Shows results for a single frequency point. The Stripchart window always shows the Noise Figure result. The meter window shows the results in a large font for one frequency point.

|         |                     |
|---------|---------------------|
| Example | :DISP:NFIG:FORM MET |
|---------|---------------------|



## Table

Shows discrete results for each frequency point in a tabular form. The headings show the data types selected and the data within the table shows the results for each data type at the given frequency point. All values are displayed according to their defined 'Display Format' (see "Results" on page 157).

Example :DISP:NFIG:FORM TABL

### 3.1.2 Results

This measurement supports seven result (window) types. The calculation of these results is described in detail in:

<https://www.keysight.com/us/en/assets/7018-06829/application-notes/5952-3706.pdf>

| Name                                    | Display Format |
|-----------------------------------------|----------------|
| "Noise Figure" on page 158              | 0.001 dB       |
| "Noise Factor" on page 158              | 0.000          |
| "Gain" on page 158                      | 0.001 dB       |
| "Y-Factor" on page 159                  | 0.001 dB       |
| "T effective" on page 159               | 0.001 K        |
| P hot (see "P hot/P cold" on page 159)  | 0.001 dB       |
| P cold (see "P hot/P cold" on page 159) | 0.001 dB       |

For each of these result types, a window is available (in the **Graph** Layout), a column is available (in the **Table** Layout), and a window and column are available (in the **Meter** Layout).

## ENR Calibration & Results

The availability of the results of each type is shown in the following table:

| Result Type                | No ENR,<br>Uncalibrated | Valid ENR,<br>Uncalibrated | Valid ENR, Calibrated |
|----------------------------|-------------------------|----------------------------|-----------------------|
| Noise Figure/ Noise Factor |                         | Uncorrected                | Uncorrected/Corrected |
| Gain                       |                         |                            | Corrected             |
| Y Factor                   |                         | Uncorrected                | Uncorrected           |
| T-Effective                |                         | Uncorrected                | Uncorrected/Corrected |
| P hot                      |                         | Uncorrected                | Uncorrected/Corrected |
| P cold                     |                         | Uncorrected                | Uncorrected/Corrected |

NOTE

When calibrated, use **Noise Figure Corrections On/Off** under **Meas Setup** to toggle between corrected and uncorrected results.

---

### 3.1.2.1 Noise Figure

For an active device, **Noise Figure** is the contribution by the device itself to thermal noise at its output, over the bandwidth of interest. **Noise Figure** is usually expressed in decibels (dB) and is with respect to thermal noise power at the system impedance, at a standard noise temperature (usually 290 K) over the bandwidth of interest. It is determined by (a) measuring (determining) the ratio, usually expressed in dB, of the thermal noise power at the output, to that at the input, and (b) subtracting from that result the gain, in dB, of the system. Typical noise figures range from 0.5 dB for very low noise devices, to 4 to 8 dB.

In some systems, for example: heterodyne systems, total output noise power includes noise from other than thermal sources, such as spurious contributions from image-frequency transformation, but noise from these sources is not considered in determining the Noise Figure.

### 3.1.2.2 Noise Factor

This is the same as "**Noise Figure**" on page 158, but expressed using linear units rather than dB.

### 3.1.2.3 Gain

The amplification factor, also called **Gain**, is the extent to which an analog amplifier boosts the strength of a signal. Amplification factors are usually expressed in terms of power.

The most common way of quantifying the gain of an amplifier is in decibels (dB), a logarithmic unit. For power, doubling the signal strength (an output-to-input power ratio of 2:1) translates into a gain of 3 dB; a tenfold increase in power (output-to-input ratio of 10:1) equals a gain of 10 dB; a hundredfold increase in power (output-to-input ratio of 100:1) represents 20 dB gain. If the output power is less than the input power, the amplification factor in decibels is negative. If the output-to-input signal power ratio is 1:1, then the amplification factor is 0 dB.

Power amplifiers typically have gain figures from a few decibels up to about 20 dB. Sensitive amplifiers used in wireless communications equipment can show gain of up to about 30 dB. If higher gain is needed, amplifiers can be cascaded, that is, hooked up one after another. But there is a limit to the amplification that can be attained this way. When amplifiers are cascaded, the later circuits receive noise at

their inputs along with the signals. This noise can cause distortion. Also, if the amplification factor is too high, the slightest feedback can trigger oscillation, rendering an amplifier system inoperative.

### 3.1.2.4 Y-Factor

This is the ratio of two noise power levels, one measured with the noise source **ON**, and the other with the noise source **OFF**, that is,  $Y = N_{ON}/N_{OFF}$ . Because noise power is proportional to noise temperature, it can be stated that  $Y = T_{ON}/T_{OFF}$ . The **Y-Factor** measurement is the most common method of measuring the quantities required to calculate **Noise Figure** and **Gain**.

### 3.1.2.5 T effective

All types of random noise can be expressed as the equivalent amount of thermal noise that would be generated at a physical temperature  $T_e$ . Generally, the word *effective* (or equivalent) is taken as understood, and the normal term is simply 'noise temperature'.

### 3.1.2.6 P hot/P cold

The level of the noise floor observed by a spectrum analyzer depends, in part, on the selected bandwidth of the measurement. The wider the bandwidth, the more noise is measured for each data point. If the instrument can display noise density, it simply normalizes the power measurements to a 1 Hz bandwidth and references it to  $kTB - 173.88$  dBm/Hz; the displayed function is equivalent to power spectral density referenced to  $kTB$  that is 15 dB would mean the power spectral density =  $-158.88$  dBm/Hz. When the unit is set to dBm/Hz, the instrument will not reference it to  $kTB$ ; the absolute power density will be displayed.

Hot Power Density simply refers to the power density measured when the noise source is on, and Cold Power Density is the same, but with the noise source off.

### 3.1.2.7 Indicating an Invalid Result

Several invalid result conditions may exist simultaneously. These conditions are ranked in order of severity (1 being worst) and only the most severe condition present is displayed.

The ranking order is:

| Ranking Order | Invalid Result Condition               | Result Indicator | Color |
|---------------|----------------------------------------|------------------|-------|
| 1             | Hot power $\leq$ cold power            | ==               | Red   |
| 2             | Corrected calculation not possible     | xx               | Amber |
| 3             | Measurement result calculation invalid | ---              | White |

Rank order 2 only occurs if a corrected measurement is requested and *either*:

- The input range used at this measurement point is not calibrated, *or*,
- The input range is calibrated, but the calibration data is invalid at this point

All types of invalid result are returned as *Not A Number* (9.91e37).

## 3.2 Amplitude

Activates the **Amplitude** menu and selects **Reference Level** or **Reference Value** as the active function, depending on the measurement.

Some features in this menu apply to multiple measurements. Some other features apply only to specific measurements and their controls are blanked or grayed-out in measurements that do not support the feature.

### 3.2.1 Y Scale

Contains controls that pertain to the Y axis parameters of the measurement. These parameters control how data on the vertical (Y) axis is displayed and control instrument settings that affect the vertical axis.

#### 3.2.1.1 Ref Value

Sets the reference value (level) to be used in the graph window specified by `<result>`. If the **Graph** window is not currently visible (if you are using the SCPI command), the new reference value will take effect next time the window is displayed. Values entered via SCPI here are in the default units only. The front panel lets you enter log or linear units and converts these to the default unit for each result type. For "**T effective**" on page 159, you can only enter values of K (Kelvin).

##### Details

| Result          | Noise Figure / Noise Factor       | Gain      | Y-Factor  | T Effective                  | P hot     | P cold    |
|-----------------|-----------------------------------|-----------|-----------|------------------------------|-----------|-----------|
| Default:        | 4.00 dB / 2.51189                 | 15.00 dB  | 5.00 dB   | 1000.0 K                     | 5.00 dB   | 5.00 dB   |
| Range (Min):    | -100.0 dB / 0                     | -100.0 dB | -100.0 dB | -1000000000K                 | -100.0 dB | -100.0 dB |
| Range (Max):    | 100.0 dB / 1E9                    | 100.0 dB  | 100.0 dB  | 1000000000K                  | 100.0 dB  | 100.0 dB  |
| Step Increment: | 0.1 dB / 1, 1.5, 2, 3, 5, 7.5, 10 | 0.1 dB    | 0.1 dB    | 1, 1.5, 2, 3, 5, 7.5, 10 ... | 0.1 dB    | 0.1 dB    |
| Knob Increment: | 0.1 dB / 1, 1.5, 2, 3, 5, 7.5, 10 | 0.1 dB    | 0.1 dB    | 1, 1.5, 2, 3, 5, 7.5, 10 ... | 0.1 dB    | 0.1 dB    |
| Resolution:     | 0.1 dB                            | 0.1 dB    | 0.1 dB    | 0.1 K                        | 0.1 dB    | 0.1 dB    |

The functionality depends on the selected result. To use the form for a particular result, that result needs to be selected as one of the displayed results. For example, to use the **Noise Figure** form, **Noise Figure** needs to be selected as one of the displayed results.

|                |                                                                                                                                                                                                 |                                   |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|
| Remote Command | :DISPlay:NFIGure:TRACe:<window>:Y[:SCALe]:RLEVel <value><br>:DISPlay:NFIGure:TRACe:<window>:Y[:SCALe]:RLEVel?<br>For the possible values of <window>, see "Window (Result) Options" on page 162 |                                   |
| Example        | Noise Figure window                                                                                                                                                                             | :DISP:NFIG:TRAC:NFIG:Y:RLEV 4 DB  |
|                | Noise Factor window                                                                                                                                                                             | :DISP:NFIG:TRAC:NFAC:Y:RLEV 2.5   |
|                | Gain window                                                                                                                                                                                     | :DISP:NFIG:TRAC:GAIN:Y:RLEV 15 DB |
|                | Y-Factor window                                                                                                                                                                                 | :DISP:NFIG:TRAC:YFAC:Y:RLEV 5 DB  |
|                | T effective window                                                                                                                                                                              | :DISP:NFIG:TRAC:TEFF:Y:RLEV 1000  |
|                | P hot window                                                                                                                                                                                    | :DISP:NFIG:TRAC:PHOT:Y:RLEV 5 DB  |
|                | P cold window                                                                                                                                                                                   | :DISP:NFIG:TRAC:PCOL:Y:RLEV 5 DB  |
|                | Meter Layout                                                                                                                                                                                    | :DISP:NFIG:TRAC:MET:Y:RLEV 0 DB   |
| Preset         | <b>Result</b>                                                                                                                                                                                   | <b>Value</b>                      |
|                | Noise Figure                                                                                                                                                                                    | 4.0 dB                            |
|                | Noise Factor                                                                                                                                                                                    | 2.5                               |
|                | Gain                                                                                                                                                                                            | 15 dB                             |
|                | Y-Factor                                                                                                                                                                                        | 5 dB                              |
|                | T effective                                                                                                                                                                                     | 1000 K                            |
|                | P Hot                                                                                                                                                                                           | 5 dB                              |
|                | P Cold                                                                                                                                                                                          | 5 dB                              |
|                | Meter Layout                                                                                                                                                                                    | 0 dB                              |
| Range          | <b>Result</b>                                                                                                                                                                                   | <b>Value</b>                      |
|                | Noise Factor                                                                                                                                                                                    | 0 / 1E9                           |
|                | T effective                                                                                                                                                                                     | -100000000 K / 100000000 K        |
|                | All others                                                                                                                                                                                      | -100 dB / 100 dB                  |

## Window (Result) Options

| Layout/Window Name | Option <window> |
|--------------------|-----------------|
| Noise Figure       | NFIGure         |
| Noise Factor       | NFACtor         |
| Gain               | GAIN            |
| Y-Factor           | YFACtor         |
| T effective        | TEFFective      |

### 3 Noise Figure Mode

#### 3.2 Amplitude

| Layout/Window Name | Option <window> |
|--------------------|-----------------|
| P hot              | PHOT            |
| P cold             | PCOLd           |
| Meter              | METer           |

#### 3.2.1.2 Scale/Div

Sets the scaling to be used in the **Graph** window specified by **<result>**. If the **Graph** window is not currently visible (you are using the SCPI command), the new scaling will take effect next time the window is displayed. Values entered via SCPI here are in the default units only. The front panel allows log or linear units, but converts to the default unit for each result type. In the case of **T effective**, you can only enter values of Kelvin.

##### Details

| Result   | Noise Figure/ Noise Factor | Gain     | Y-Factor | T effective | P hot    | P cold   |
|----------|----------------------------|----------|----------|-------------|----------|----------|
| Default: | 1.00 dB / 0.71489          | 5.00 dB  | 1.00 dB  | 200.0 K     | 1.00 dB  | 1.00 dB  |
| Min:     | 0.001 dB / 0.001           | 0.001 dB | 0.001 dB | 0.1 K       | 0.001 dB | 0.001 dB |
| Max:     | 20.0 dB / 100              | 20.0 dB  | 20.0 dB  | 20000000 K  | 20.0 dB  | 20.0 dB  |

The functionality depends on the selected result. To use the form for a particular result, that result needs to be selected as one of the displayed results. For example, to use the **Noise Figure** form, **Noise Figure** needs to be selected as one of the displayed results.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | :DISPlay:NFIGure:TRACe:NFIGure:Y[:SCALe]:PDIVision <value><br>:DISPlay:NFIGure:TRACe:NFACTor:Y[:SCALe]:PDIVision <value><br>:DISPlay:NFIGure:TRACe:GAIN:Y[:SCALe]:PDIVision <value><br>:DISPlay:NFIGure:TRACe:YFACTor:Y[:SCALe]:PDIVision <value><br>:DISPlay:NFIGure:TRACe:TEFFective:Y[:SCALe]:PDIVision <value><br>:DISPlay:NFIGure:TRACe:PHOT:Y[:SCALe]:PDIVision <value><br>:DISPlay:NFIGure:TRACe:PCOLd:Y[:SCALe]:PDIVision <value><br>:DISPlay:NFIGure:TRACe:METer:Y[:SCALe]:PDIVision <value><br>:DISPlay:NFIGure:TRACe:NFIGure:Y[:SCALe]:PDIVision?<br>:DISPlay:NFIGure:TRACe:NFACTor:Y[:SCALe]:PDIVision?<br>:DISPlay:NFIGure:TRACe:GAIN:Y[:SCALe]:PDIVision?<br>:DISPlay:NFIGure:TRACe:YFACTor:Y[:SCALe]:PDIVision?<br>:DISPlay:NFIGure:TRACe:TEFFective:Y[:SCALe]:PDIVision? |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|               | :DISPlay:NFIGure:TRACe:PHOT:Y[:SCALe]:PDIVision?                                                                                                                                                                                                                                           |  |               |        |              |              |             |                     |            |                |            |                   |
|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|---------------|--------|--------------|--------------|-------------|---------------------|------------|----------------|------------|-------------------|
|               | :DISPlay:NFIGure:TRACe:PCOLd:Y[:SCALe]:PDIVision?                                                                                                                                                                                                                                          |  |               |        |              |              |             |                     |            |                |            |                   |
|               | :DISPlay:NFIGure:TRACe:METer:Y[:SCALe]:PDIVision?                                                                                                                                                                                                                                          |  |               |        |              |              |             |                     |            |                |            |                   |
| Example       | :DISP:NFIG:TRAC:NFIG:Y:PDIV 1 DB<br>:DISP:NFIG:TRAC:NFAC:Y:PDIV 0.7<br>:DISP:NFIG:TRAC:GAIN:Y:PDIV 1 DB<br>:DISP:NFIG:TRAC:YFAC:Y:PDIV 1 DB<br>:DISP:NFIG:TRAC:TEFF:Y:PDIV 200K<br>:DISP:NFIG:TRAC:PHOT:Y:PDIV 1 DB<br>:DISP:NFIG:TRAC:PCOL:Y:PDIV 1 DB<br>:DISP:NFIG:TRAC:MET:Y:PDIV 1 DB |  |               |        |              |              |             |                     |            |                |            |                   |
| Preset        | <table><tr><th>Result</th><th>Value</th></tr><tr><td>Noise Factor</td><td>0.7</td></tr><tr><td>T effective</td><td>200k</td></tr><tr><td>All others</td><td>1 dB</td></tr></table>                                                                                                         |  | Result        | Value  | Noise Factor | 0.7          | T effective | 200k                | All others | 1 dB           |            |                   |
| Result        | Value                                                                                                                                                                                                                                                                                      |  |               |        |              |              |             |                     |            |                |            |                   |
| Noise Factor  | 0.7                                                                                                                                                                                                                                                                                        |  |               |        |              |              |             |                     |            |                |            |                   |
| T effective   | 200k                                                                                                                                                                                                                                                                                       |  |               |        |              |              |             |                     |            |                |            |                   |
| All others    | 1 dB                                                                                                                                                                                                                                                                                       |  |               |        |              |              |             |                     |            |                |            |                   |
| Range         | <table><tr><th>Result/Layout</th><th>Values</th></tr><tr><td>Noise Factor</td><td>0.001 to 100</td></tr><tr><td>T effective</td><td>0.1 K to 20000000 K</td></tr><tr><td>Meter</td><td>0.1 dB to 5 dB</td></tr><tr><td>All others</td><td>0.001 dB to 20 dB</td></tr></table>              |  | Result/Layout | Values | Noise Factor | 0.001 to 100 | T effective | 0.1 K to 20000000 K | Meter      | 0.1 dB to 5 dB | All others | 0.001 dB to 20 dB |
| Result/Layout | Values                                                                                                                                                                                                                                                                                     |  |               |        |              |              |             |                     |            |                |            |                   |
| Noise Factor  | 0.001 to 100                                                                                                                                                                                                                                                                               |  |               |        |              |              |             |                     |            |                |            |                   |
| T effective   | 0.1 K to 20000000 K                                                                                                                                                                                                                                                                        |  |               |        |              |              |             |                     |            |                |            |                   |
| Meter         | 0.1 dB to 5 dB                                                                                                                                                                                                                                                                             |  |               |        |              |              |             |                     |            |                |            |                   |
| All others    | 0.001 dB to 20 dB                                                                                                                                                                                                                                                                          |  |               |        |              |              |             |                     |            |                |            |                   |

### 3.2.1.3 Ref Position

Sets the reference position to be used in the **Graph** window. The "Ref Value" on [page 161](#) is positioned relative to this point on the graph. If the **Graph** window is not currently visible (you are using the SCPI command), the new reference position will take effect next time the window is displayed.

The functionality depends on the selected result. To use the form for a particular result, that result needs to be selected as one of the displayed results. For example, to use the Noise Figure form, Noise Figure needs to be selected as one of the displayed results.

|                |                                                                                                                                                                                                                               |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | :DISPlay:NFIGure:TRACe:NFIGure:Y[:SCALe]:RPOSition TOP   CENTer   BOTTOm<br>:DISPlay:NFIGure:TRACe:NFACTOR:Y[:SCALe]:RPOSition TOP   CENTer   BOTTOm<br>:DISPlay:NFIGure:TRACe:GAIN:Y[:SCALe]:RPOSition TOP   CENTer   BOTTOm |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|



### 3 Noise Figure Mode

#### 3.2 Amplitude

|             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|             | <pre> :DISPlay:NFIGure:TRACe:YFACTOR:Y[:SCALE]:RPOSition TOP   CENTer   BOTTom :DISPlay:NFIGure:TRACe:TEFFective:Y[:SCALE]:RPOSition TOP   CENTer   BOTTom :DISPlay:NFIGure:TRACe:PHOT:Y[:SCALE]:RPOSition TOP   CENTer   BOTTom :DISPlay:NFIGure:TRACe:PCOLd:Y[:SCALE]:RPOSition TOP   CENTer   BOTTom :DISPlay:NFIGure:TRACe:NFIGure:Y[:SCALE]:RPOSition? :DISPlay:NFIGure:TRACe:NFACTOR:Y[:SCALE]:RPOSition? :DISPlay:NFIGure:TRACe:GAIN:Y[:SCALE]:RPOSition? :DISPlay:NFIGure:TRACe:YFACTOR:Y[:SCALE]:RPOSition? :DISPlay:NFIGure:TRACe:TEFFective:Y[:SCALE]:RPOSition? :DISPlay:NFIGure:TRACe:PHOT:Y[:SCALE]:RPOSition? :DISPlay:NFIGure:TRACe:PCOLd:Y[:SCALE]:RPOSition? </pre> |
| Example     | <pre> :DISP:NFIG:TRAC:NFIG:Y:RPOS TOP :DISP:NFIG:TRAC:NFAC:Y:RPOS TOP :DISP:NFIG:TRAC:GAIN:Y:RPOS TOP :DISP:NFIG:TRAC:YFAC:Y:RPOS TOP :DISP:NFIG:TRAC:TEFF:Y:RPOS TOP :DISP:NFIG:TRAC:PHOT:Y:RPOS TOP :DISP:NFIG:TRAC:PCOL:Y:RPOS TOP </pre>                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Preset      | CENTer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| State Saved | Yes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |

#### 3.2.1.4 Auto Scaling

Automatically sets "Ref Value" on page 161 and "Scale/Div" on page 163 based on the current trace data. These are set such that the trace fills 90% of the graticule.

There are different SCPI commands for **Auto Scaling**, depending on whether you are using "Graph Layout" on page 165 or "Meter Layout" on page 166.

##### Graph Layout

|                |                                                                                                                                                                                                                                                                                                                                                                                   |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <pre> :DISPlay:NFIGure:VIEW[1]:WINDow[1] 2:TRACe:Y[:SCALE]:COUPle 0   1   OFF   ON :DISPlay:NFIGure:VIEW[1]:WINDow[1] 2:TRACe:Y[:SCALE]:COUPle? </pre>                                                                                                                                                                                                                            |
| Example        | <pre> :DISP:NFIG:VIEW:WIND:TRAC:Y:COUP ON :DISP:NFIG:VIEW:WIND:TRAC:Y:COUP? </pre>                                                                                                                                                                                                                                                                                                |
| Couplings      | <p>When <b>Auto Scaling</b> is <b>ON</b>, and the <b>Restart</b> front-panel key is pressed, this function automatically determines the scale per division and reference values based on the measurement results</p> <p>When you set the value of either "Scale/Div" on page 163 or "Ref Value" on page 161 manually, <b>Auto Scaling</b> automatically changes to <b>OFF</b></p> |

|                              |                                                                                           |
|------------------------------|-------------------------------------------------------------------------------------------|
| Preset                       | ON                                                                                        |
| State Saved                  | Yes                                                                                       |
| Range                        | ON   OFF                                                                                  |
| Backwards Compatibility SCPI | :DISPlay[:WINDow]:TRACe[1] 2:Y[:SCALe]:AUTO<br>:DISPlay:WINDow1:TRACe[1] 2:Y[:SCALe]:AUTO |

### Meter Layout

|                |                                                                                                                                                                                                                                                                                                                                                          |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | :DISPlay:NFIGure:VIEW3:WINDow[1]:TRACe:Y[:SCALe]:COUPle 0   1   OFF   ON<br>:DISPlay:NFIGure:VIEW3:WINDow[1]:TRACe:Y[:SCALe]:COUPle?                                                                                                                                                                                                                     |
| Example        | :DISP:NFIG:VIEW3:WIND:TRAC:Y:COUP ON<br>:DISP:NFIG:VIEW3:WIND:TRAC:Y:COUP?                                                                                                                                                                                                                                                                               |
| Couplings      | When <b>Auto Scaling</b> is <b>ON</b> , this function automatically determines the scale per division to be 1/8 of the highest value in the strip chart and sets the <b>Ref Level</b> to 0.0 dB<br>When you set the value of either "Scale/Div" on page 163 or "Ref Value" on page 161 manually, <b>Auto Scaling</b> automatically changes to <b>OFF</b> |
| Preset         | ON                                                                                                                                                                                                                                                                                                                                                       |
| State Saved    | Yes                                                                                                                                                                                                                                                                                                                                                      |
| Range          | ON   OFF                                                                                                                                                                                                                                                                                                                                                 |

## 3.2.2 Attenuation

Controls the attenuator functions and interactions between the attenuation system components.

Not available in VXT models M9410A, M9411A, M9415A, M9416A, M9410E, M9411E, M9415E, M9416E.

### 3.2.2.1 Attenuation

Only applies to the mechanical attenuator. The electronic attenuator (which is limited to below 3.6 GHz) is disabled in Noise Figure Mode.

In this application, the attenuators cannot autorange. There is therefore a risk of overdriving the instrument. In most cases, 0 dB attenuation is adequate. To check for overdriving of the instrument (that is, compression occurring at the preamp stage) set the attenuation to 0 dB and note the Noise Figure of your DUT. Now increase the attenuation by one step. If the Noise Figure changes by more than 0.5 dB, attenuation is required. Repeat this process until you have found the lowest

level of attenuation that gives you a stable noise figure result and use this attenuation level for your measurements.

NOTE

The Full Range Attenuator in N9041B, which is at the front end of RF Input 2, is disabled. When doing measurement above 50 GHz with RF Input 2, the total attenuation is 0 dB. You may need to add an external attenuator to avoid overdriving the instrument.

|                                 |                                                                                                                                                            |
|---------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command                  | <code>[ :SENSe]:NFIGure:POWer[:RF]:ATTenuation &lt;float&gt;</code><br><code>[ :SENSe]:NFIGure:POWer[:RF]:ATTenuation?</code>                              |
| Example                         | <code>:NFIG:POW:ATT 4dB</code><br><code>:NFIG:POW:ATT?</code>                                                                                              |
| Preset                          | 0 dB                                                                                                                                                       |
| State Saved                     | Yes                                                                                                                                                        |
| Range                           | With FSA option: 0 dB to 8 dB<br>Without FSA option: 0 dB to 10 dB                                                                                         |
| Min                             | 0 dB                                                                                                                                                       |
| Max                             | 40 dB                                                                                                                                                      |
| Backwards Compatibility<br>SCPI | <code>:INPut[:NFIGure]:ATTenuation:VALue</code><br><code>[ :SENSe][:NFIGure]:MANual:RF:FIXed</code><br><code>[ :SENSe][:NFIGure]:MANual:MWAVe:FIXed</code> |

### 3.2.3 Range (Non-attenuator models)

Only available for Keysight's modular signal analyzers and certain other Keysight products, such as VXT and M941xE.

|             |    |
|-------------|----|
| State Saved | No |
|-------------|----|

#### 3.2.3.1 Range

Represents the amplitude of the largest sinusoidal signal that could be present within the IF without being clipped by the ADC. For signals with high peak-to-average ratios, the range may need to exceed the rms signal power by a significant amount to avoid clipping.

This is a measurement global setting.

|                |                                                                                                  |
|----------------|--------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:POWer[:RF]:RANGe &lt;real&gt;</code><br><code>[ :SENSe]:POWer[:RF]:RANGe?</code> |
| Example        | <code>:POW:RANG 10 dBm</code>                                                                    |

|             |                                                                                                                                                                                         |
|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|             | <b>:POW:RANG?</b>                                                                                                                                                                       |
| Notes       | The MIN and MAX values are affected by the External Gain parameters, and by the <b>Center Frequency</b> . The hardware compensates for frequency response and alters the Range setting. |
| Preset      | 0 dBm                                                                                                                                                                                   |
| State Saved | Yes                                                                                                                                                                                     |
| Min/Max     | -/+100                                                                                                                                                                                  |
| Annotation  | Meas Bar                                                                                                                                                                                |

### 3.2.3.2 Adjust Range for Min Clipping

Sets the combination of attenuation and gain based on the current measured signal level so that clipping will be at a minimum.

This is an "immediate action" function, that is, it executes once, when the key is pressed.

This key does not appear in measurements that do not support this functionality.

|                |                                                                    |
|----------------|--------------------------------------------------------------------|
| Remote Command | <b>[ :SENSe]:POWer[:RF]:RANGe:OPTimize IMMEDIATE</b>               |
| Notes          | Executing Adjust Range for Min Clipping initiates the measurement. |
| Dependencies   | Does not appear in the Swept SA and Monitor Spectrum measurements. |

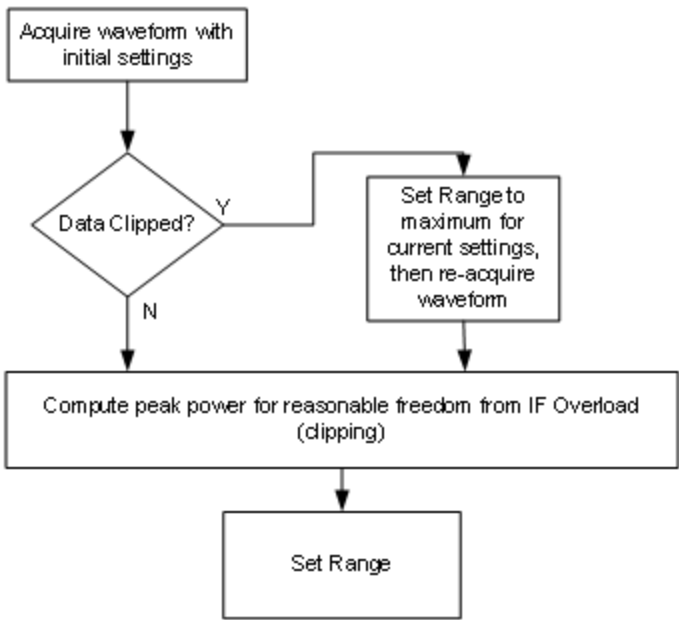
### 3.2.3.3 Pre-Adjust for Min Clipping

If this function is **ON**, it applies the adjustment described under Adjust Range For Min Clipping each time a measurement restarts. Therefore, in Continuous measurement mode, it only executes before the first measurement.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                  |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <b>[ :SENSe]:POWer[:RF]:RANGe:OPTimize:ATTenuation OFF   ON   ELECTrical   COMBined</b><br><b>[ :SENSe]:POWer[:RF]:RANGe:OPTimize:ATTenuation?</b>                                                                                                                                                                                                                                                               |
| Notes          | Because there is no attenuator control available in these models, the control displays only <b>ON</b> and <b>OFF</b> choices. However, for SCPI compatibility with other platforms, all three parameters ( <b>ELECTrical</b> , <b>COMBined</b> , and <b>ON</b> ) are honored and all are mapped to <b>ELECTrical</b> , so if any of these three parameters is sent, a subsequent query will return <b>ELEC</b> . |
| Dependencies   | Does not appear in the Swept SA and Monitor Spectrum measurements.                                                                                                                                                                                                                                                                                                                                               |
| Preset         | <b>OFF</b> for Swept SA measurement; <b>ON</b> for all other measurements that support <b>Pre-Adjust for Min Clipping</b> .                                                                                                                                                                                                                                                                                      |
| State Saved    | Saved in instrument state.                                                                                                                                                                                                                                                                                                                                                                                       |

#### Adjustment Algorithm

The algorithm for the adjustment is documented below:



3.2.3.4 Peak-to-Average Ratio

Used with "[Range \(Non-attenuator models\)](#)" on page 167 to optimize the level control in the instrument. The value is the ratio, in dB, of the peak power to the average power of the signal to be measured. A ratio of 0 should be used for sinusoidal signals; for 802.11g OFDM signals use 9 dB.

All Modes show the current value of Peak-to-Average ratio on the control. However, some Modes do not permit changing the value. In these situations, the control is grayed-out.

|                |                                                                                                                                                                                                                                                                          |       |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| Remote Command | <code>[ :SENSe]:POWer[:RF]:RANGe:PARatio &lt;real&gt;</code><br><code>[ :SENSe]:POWer[:RF]:RANGe:PARatio?</code>                                                                                                                                                         |       |
| Example        | <code>:POW:RANG:PAR 12 dB</code>                                                                                                                                                                                                                                         |       |
| Notes          | In some Modes, this parameter is read-only; meaning the value will appear on the control and query via SCPI, but is not changeable. In such applications the control is grayed-out. Attempts to change the value via SCPI are ignored, but no error message is generated |       |
| Dependencies   | Does not appear in Spectrum Analyzer Mode                                                                                                                                                                                                                                |       |
| Preset         | VXT Models M9410A/11A                                                                                                                                                                                                                                                    | 0 dB  |
|                | All Others                                                                                                                                                                                                                                                               | 10 dB |
| State Saved    | Saved in instrument state                                                                                                                                                                                                                                                |       |

|     |                       |       |
|-----|-----------------------|-------|
| Min | 0 dB                  |       |
| Max | VXT Models M9410A/11A | 50 dB |
|     | All Others            | 20 dB |

### 3.2.3.5 Mixer Lvl Offset

This is an advanced setting to adjust target Range at the input mixer, which in turn affects the signal level in the instrument's IF. This setting can be used when additional optimization is needed after setting "[Peak-to-Average Ratio](#)" on page 169. Positive values of offset optimize noise performance over distortion, negative values optimize distortion performance over noise.

|                |                                                                                          |        |
|----------------|------------------------------------------------------------------------------------------|--------|
| Remote Command | [:SENSe]:POWer[:RF]:RANGe:MIXer:OFFSet <real><br>[:SENSe]:POWer[:RF]:RANGe:MIXer:OFFSet? |        |
| Example        | :POW:RANG:MIX:OFFS -5 dB                                                                 |        |
| Preset         | 0 dB                                                                                     |        |
| State Saved    | Saved in instrument state                                                                |        |
| Min            | VXT Models M9410A/11A                                                                    | -34 dB |
|                | All Others                                                                               | -35 dB |
| Max            | 30 dB                                                                                    |        |

## 3.2.4 Signal Path

Contains controls that pertain to the routing of the signal through the frontend of the instrument.

Not available in VXT models M9410A, M9411A, M9415A, M9416A, M9410E, M9411E, M9415E, M9416E.

### 3.2.4.1 Internal Preamp

Turning on **Internal Preamp** improves noise figure and thus better uncertainties. In some cases, with high gain DUTs, especially when tested with wide RBWs, noise compression may occur. In this case, increasing the input attenuation or turning off the preamp are recommended. This control lets you set the Internal Preamp to **AUTO**, on, or off.

### 3 Noise Figure Mode

#### 3.2 Amplitude

When **Internal Preamp** is set to **AUTO = ON**, and no USB Preamp is connected, the Internal Preamp is turned on. If a USB Preamp is connected, the Internal Preamp turns off to optimize the dynamic range over which the user calibration should be run.

If the current IF frequency range falls completely or partially outside the internal preamp range, a warning message “Hardware missing; Internal preamp not available at all frequency points” is displayed.

Note that the default input attenuation calibration range is:

|                    |                                         |
|--------------------|-----------------------------------------|
| With FSA option    | 0 dB to 8 dB, and a step size of 4 dB   |
| Without FSA option | 0 dB to 10 dB, and a step size of 10 dB |

|                              |                                                                                                                                                                                                                                                                             |
|------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command               | <code>[ :SENSe]:NFIGure:POWer[:RF]:GAIN[:STATe] OFF   ON   0   1</code><br><code>[ :SENSe]:NFIGure:POWer[:RF]:GAIN[:STATe]?</code>                                                                                                                                          |
| Example                      | <code>:NFIG:POW:GAIN OFF</code>                                                                                                                                                                                                                                             |
| Couplings                    | When <b>AUTO = ON</b> , if there is a U7227 Series USB Preamp connected to one of the instrument's USB ports, the Internal Preamp is turned off to optimize the dynamic range. If no USB Preamp is connected, the Internal Preamp is turned on to optimize the noise figure |
| Preset                       | <b>ON</b>                                                                                                                                                                                                                                                                   |
| State Saved                  | Yes                                                                                                                                                                                                                                                                         |
| Range                        | <b>ON OFF 1 0</b>                                                                                                                                                                                                                                                           |
| Annunciation                 | In Meas Bar                                                                                                                                                                                                                                                                 |
| Backwards Compatibility SCPI | <code>[ :SENSe][:NFIGure]:POWer[:RF]:GAIN[:STATe]</code><br><code>:INPut:GAIN:STATe</code>                                                                                                                                                                                  |
| Auto Function                |                                                                                                                                                                                                                                                                             |
| Remote Command               | <code>[ :SENSe]:NFIGure:POWer[:RF]:GAIN:AUTO OFF   ON   0   1</code><br><code>[ :SENSe]:NFIGure:POWer[:RF]:GAIN:AUTO?</code>                                                                                                                                                |
| Example                      | <code>:NFIG:POW:GAIN:AUTO ON</code>                                                                                                                                                                                                                                         |
| Preset                       | <b>ON</b>                                                                                                                                                                                                                                                                   |

#### 3.2.4.2 LNA

Lets you turn the Low Noise Amplifier (**LNA**) on or off.

**LNA** is an additional preamplifier that provides superior DANL and frequency range compared to "**Internal Preamp**" on [page 170](#). **LNA** provides lower system noise figure, especially at frequencies above 100 MHz, and can be operated up to the full range of 50 GHz instruments.

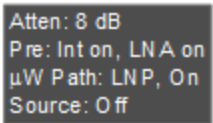
For best possible sensitivity, **LNA** can be turned on *together* with **Internal Preamp**, although if you operate both preamps together, note that the TOI (distortion) specifications are impacted. The sensitivity improvement of this combination is substantial when operating in high band (frequencies above 3.6 GHz).

For more details about annotation, see ["More Information" on page 172](#)

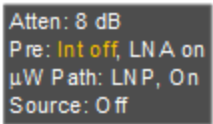
|                |                                                                                                                                                                                                                          |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:POWer[:RF]:GAIN:LNA[:STATe] OFF   ON   0   1</code><br><code>[ :SENSe]:POWer[:RF]:GAIN:LNA[:STATe]?</code>                                                                                               |
| Example        | <code>:POW:GAIN:LNA ON</code>                                                                                                                                                                                            |
| Dependencies   | Requires Option LNA, except for VXT models M9415A/16A<br>Does not appear in VXT models M9420A/10A/11A<br>M9410E/11E/15E/16E do support LNA<br><b>LNA</b> is not available when the electronic/soft attenuator is enabled |
| Preset         | <code>OFF</code>                                                                                                                                                                                                         |
| State Saved    | Saved in State                                                                                                                                                                                                           |

More Information

When **LNA** is installed, the preamp annotation changes to show the state of both **LNA** and **Internal Preamp**. Below is an example:



Note that when operating entirely in the low band (below about 3.6 GHz), if **LNA** is on, **Internal Preamp** is switched off (even if you have its switch set to **ON**). This is because the noise performance is actually degraded in low band if both preamps are on. In this case, the annotation reflects the actual state of the two preamps, but the **Internal Preamp** annotation displays in amber, to warn you that the actual state of **Internal Preamp** does not match its switch control display:





### 3.3 BW

Contains controls for the Resolution Bandwidth and Video Bandwidth functions of the instrument.

#### 3.3.1 Settings

Contains the Resolution Bandwidth control.

##### 3.3.1.1 Res BW

Sets the resolution bandwidth (**RBW**) to be used in Noise Figure measurement.

When this function is set to **Auto** (default setting), the bandwidth is set automatically, and is dependent on the measurement frequency:

- At measurement frequencies of 9.9 MHz or above, the resolution bandwidth is set automatically to 4 MHz
- At measurement frequencies less than 9.9 MHz, the resolution bandwidth is set automatically to approximately one third of the measurement frequency

When the resolution bandwidth is set to manual (**Man**), you can manually specify the resolution bandwidth from a minimum of 1 Hz to a maximum of 8 MHz. The lower the resolution bandwidth setting, the longer the measurement will take. With a resolution bandwidth setting of 1 Hz, each measurement point may take up to 6000 seconds.

|                              |                                                                                                                                                                                                                                            |
|------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command               | <code>[ :SENSe]:NFIGure:BWIDth BANDwidth[:RESolution] &lt;freq&gt;</code><br><code>[ :SENSe]:NFIGure:BWIDth BANDwidth[:RESolution]?</code>                                                                                                 |
| Example                      | <code>:NFIG:BWID:RES 1 MHz</code>                                                                                                                                                                                                          |
| Preset                       | 4 MHz                                                                                                                                                                                                                                      |
| State Saved                  | Saved in instrument state                                                                                                                                                                                                                  |
| Min                          | 1 Hz                                                                                                                                                                                                                                       |
| Max                          | 8 MHz                                                                                                                                                                                                                                      |
| Annotation                   | In the lower left corner of the screen, “Res BW <value>” will indicate the current setting of the resolution bandwidth<br>A “#” mark appears before “RBW” in the annotation when it is switched from <b>AUTO</b> to <b>MANual</b> coupling |
| Backwards Compatibility SCPI | <code>[ :SENSe][ :NFIGure]:BWIDth BANDwidth[:RESolution]</code><br>(Default RBW in PSA ESA apps was 1 MHz)                                                                                                                                 |

Auto Function

|                              |                                                                                                                                                          |
|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command               | <code>[ :SENSe]:NFIGure:BWIDth BANDwidth[:RESolution]:AUTO ON   OFF   1   0</code><br><code>[ :SENSe]:NFIGure:BWIDth BANDwidth[:RESolution]:AUTO?</code> |
| Example                      | <code>:NFIG:BWID:AUTO ON</code><br><code>:NFIG:BWID:AUTO?</code>                                                                                         |
| Preset                       | <code>ON</code>                                                                                                                                          |
| Backwards Compatibility SCPI | <code>[ :SENSe][:NFIGure]:BWIDth BANDwidth[:RESolution]:AUTO</code>                                                                                      |

## 3.4 Display

Opens the **Display** menu, which lets you configure display items for the current Mode, Measurement, Layout, or Window.

### 3.4.1 Format

Contains controls for setting up the display for the current Measurement, Layout, or Window.

#### 3.4.1.1 Layout

Selects the format in which the measurement results should be displayed on screen. Results can be displayed in **Graph**, **Table** or **Meter** form. The **AUTO** option couples the layout to "Freq Mode" on page 191.

When **Layout** is in **AUTO**, the layout changes when "Freq Mode" on page 191 (under **Frequency**) changes, as follows:

| Freq Mode    | Layout                     |
|--------------|----------------------------|
| Swept        | "Graph Layout" on page 176 |
| <b>FIXed</b> | "Meter" on page 180        |
| List         | "Table" on page 182        |

No matter which layout you choose, you have the choice of one or more of the seven possible results:

| Result                             | Option            |
|------------------------------------|-------------------|
| Noise Figure                       | <b>NFIGure</b>    |
| Noise Factor (Linear Noise Figure) | <b>NFACTOR</b>    |
| Gain                               | <b>GAIN</b>       |
| Y Factor                           | <b>YFACTOR</b>    |
| Effective Temperature              | <b>TEFFective</b> |
| Hot Power Density                  | <b>PHOT</b>       |
| Cold Power Density                 | <b>PCOLD</b>      |

See "Results" on page 157 for more information.

NOTE

The Noise Figure measurement uses **Layout** to control the result display instead of **View**.

|                              |                                                                                                                                                                                                                                                                                                                                                                                                                      |
|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command               | <code>:DISPlay:NFIGure:FORMat GRAPH   TABLE   METer</code><br><code>:DISPlay:NFIGure:FORMat?</code>                                                                                                                                                                                                                                                                                                                  |
| Example                      | <code>:DISP:NFIG:FORM GRAP</code>                                                                                                                                                                                                                                                                                                                                                                                    |
| Couplings                    | <ul style="list-style-type: none"> <li>When "Freq Mode" on page 191 is Swept, Auto rules select <b>Graph</b></li> <li>When <b>Freq Mode</b> is List, selects <b>Table</b></li> <li>When <b>Freq Mode</b> is Fixed, selects <b>Meter</b></li> </ul> <p>If you change the <b>Layout</b> selection manually, <b>AUTO</b> selection becomes <b>Man</b>, and <b>Freq Mode</b> and <b>Layout</b> are no longer coupled</p> |
| Preset                       | <b>GRAPH</b>                                                                                                                                                                                                                                                                                                                                                                                                         |
| State Saved                  | Yes                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Range                        | <b>GRAPH   TABLE   METer</b>                                                                                                                                                                                                                                                                                                                                                                                         |
| Backwards Compatibility SCPI | <code>:DISPlay[:NFIGure]:FORMat</code>                                                                                                                                                                                                                                                                                                                                                                               |

#### Auto Function

|                |                                                                                                                                                                                                                                                                                                                                                                                                        |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:DISPlay:NFIGure:FORMat:AUTO OFF   ON   0   1</code><br><code>:DISPlay:NFIGure:FORMat:AUTO?</code>                                                                                                                                                                                                                                                                                               |
| Example        | <code>:DISP:NFIG:FORM:AUTO ON</code><br><code>:DISP:NFIG:FORM:AUTO?</code>                                                                                                                                                                                                                                                                                                                             |
| Couplings      | <ul style="list-style-type: none"> <li>When <b>Freq Mode</b> is Swept, Auto rules select <b>Graph</b></li> <li>When <b>Freq Mode</b> is List, selects <b>Table</b></li> <li>When <b>Freq Mode</b> is Fixed, selects <b>Meter</b></li> </ul> <p>If you change the Layout selection manually, <b>AUTO</b> selection becomes <b>Man</b>, and <b>Freq Mode</b> and <b>Layout</b> are no longer coupled</p> |
| Preset         | <b>ON</b>                                                                                                                                                                                                                                                                                                                                                                                              |
| State Saved    | Yes                                                                                                                                                                                                                                                                                                                                                                                                    |

## Graph Layout

Two results are displayed simultaneously. There are two types of **Graph** layout: "Graph (Split)" on page 177 and "Graph (Overlaid Traces)" on page 178.

The command below lets you set the result for either trace.

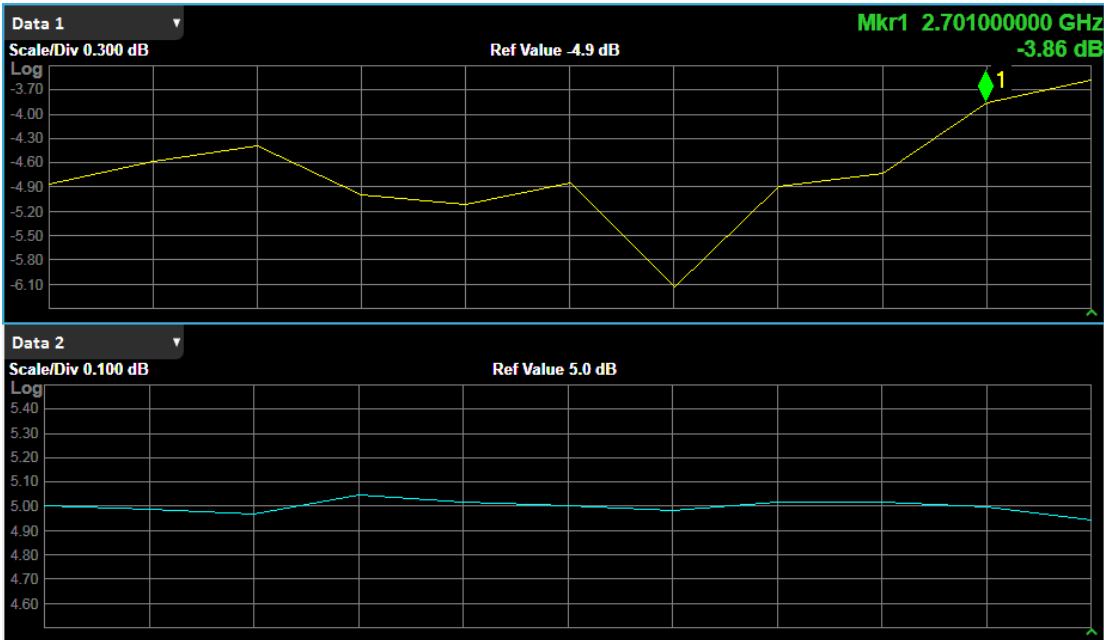
|                |                                                                                                                                                                |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:DISPlay:NFIGure:DATA:TRACe[1] 2 NFIGure   NFACTOR   GAIN   YFACTOR   TEFFective   PHOT   PCOLD</code><br><code>:DISPlay:NFIGure:DATA:TRACe[1] 2?</code> |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|

3 Noise Figure Mode  
3.4 Display

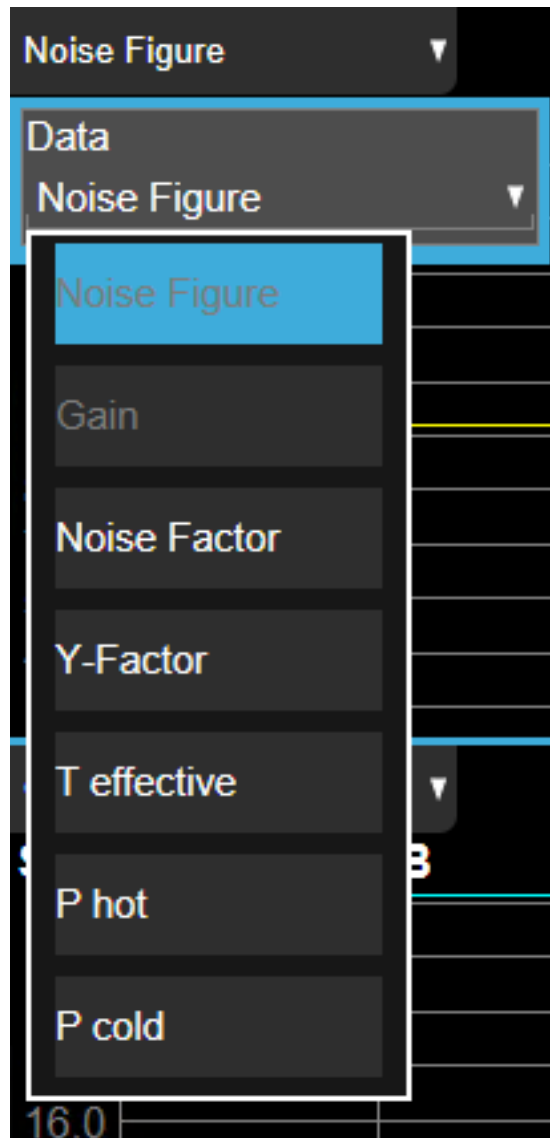
|                              |                                                                |
|------------------------------|----------------------------------------------------------------|
| Example                      | :DISP:NFIG:DATA:TRAC1 NFIG                                     |
| Preset                       | NFIGure for Data 1<br>GAIN for Data 2                          |
| State Saved                  | Yes                                                            |
| Range                        | NFIGure   NFACTOR   GAIN   YFACTOR   TEFFECTive   PHOT   PCOLD |
| Backwards Compatibility SCPI | :DISPlay[:NFIGure]:DATA:TRACe[1] 2[:RESult]                    |

Graph (Split)

Draws the 'Data1 and 'Data2 results on two graphs in window 1 (top) and window 2 (bottom) respectively. A caret (^) is displayed below each trace at the position of the current measurement when the total sweep time exceeds 300 ms (total sweep time = avg sweep time per point \* number of points). Both graphs use the same Y-Axis Scale settings.



In **Graph** layout mode, "Data 1" and "Data 2" show the current result type. To select a result for either window, tap the window name (**Noise Figure** in the example below), tap **Data**, and select the desired result:

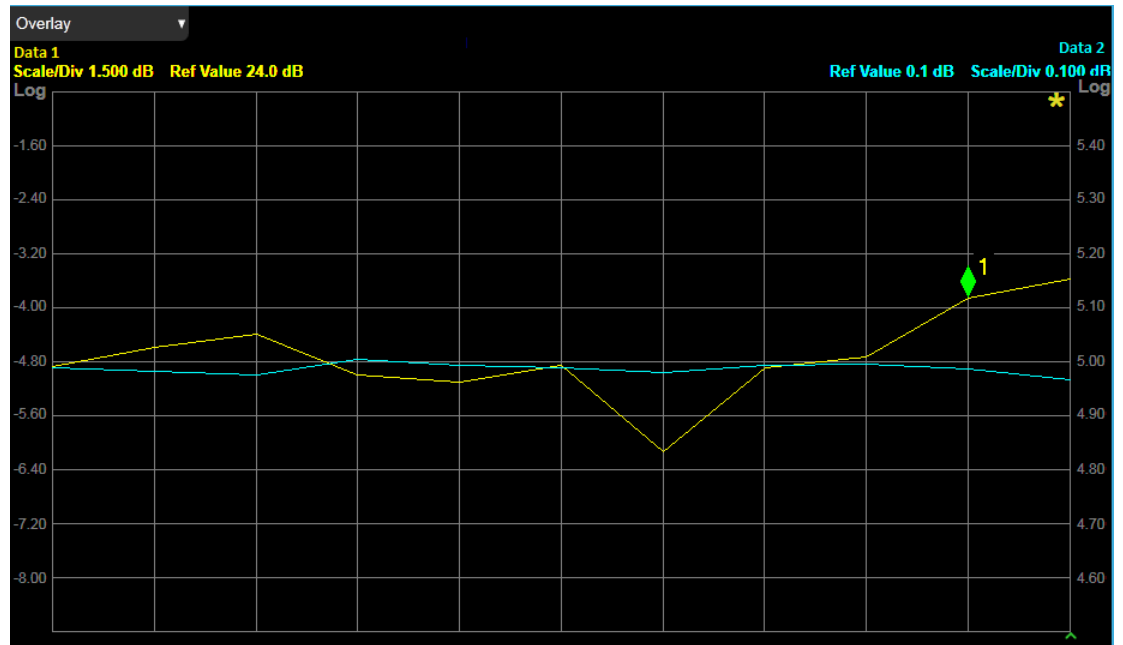


#### Graph (Overlaid Traces)

Draws both results as two traces on the same graph with two sets of Y-axis notation. This layout can be useful for printing both results together on a bigger graph. A caret (^) is displayed below each trace at the position of the current measurement.

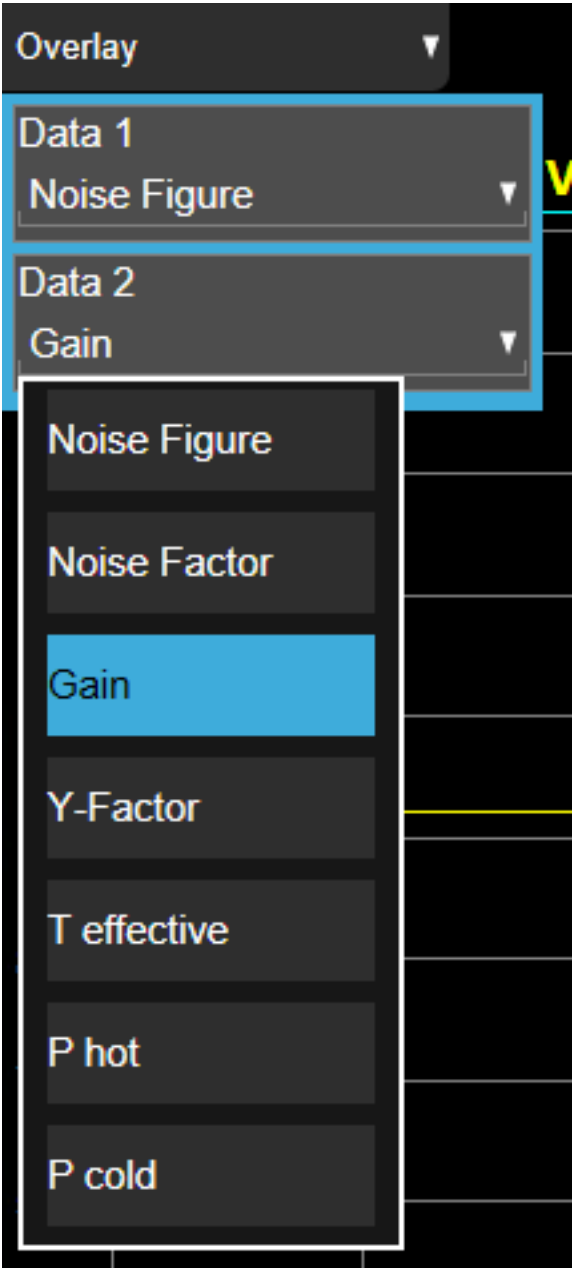
### 3 Noise Figure Mode

#### 3.4 Display



In this mode, "Data 1" and "Data 2" show the current result type. All annotation in yellow refers to Trace 1 (displaying Data1) and all annotation in blue refers to Trace 2 (displaying Data2).

To select a result for either trace, tap the window name (**Overlay**), tap **Data 1** or **Data 2**, and select the desired result:



**Meter**

Displays a strip chart graph and a meter (bar graph style), as well as results in a one-row table. The **Meter** window shows results for one frequency point.

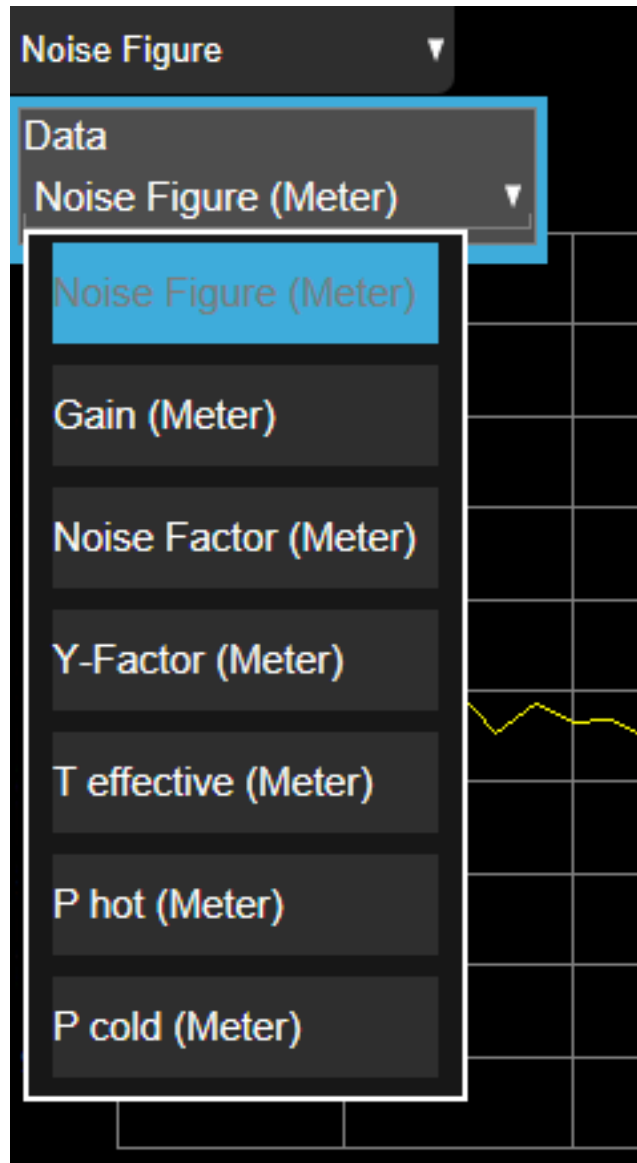
By default, only “Data 1” and “Data 2” results in graph layout are displayed in the table. You can use the “Result Table” panel to turn on more results. Note that only the latest measured results are displayed on the screen.



### 3 Noise Figure Mode

#### 3.4 Display

The graphic window contains two graphs, strip chart and bar graph. The data displayed in the graph is set by tapping the window name (**Noise Figure (Meter)** in the example below), then **Data**, then selecting the desired result:

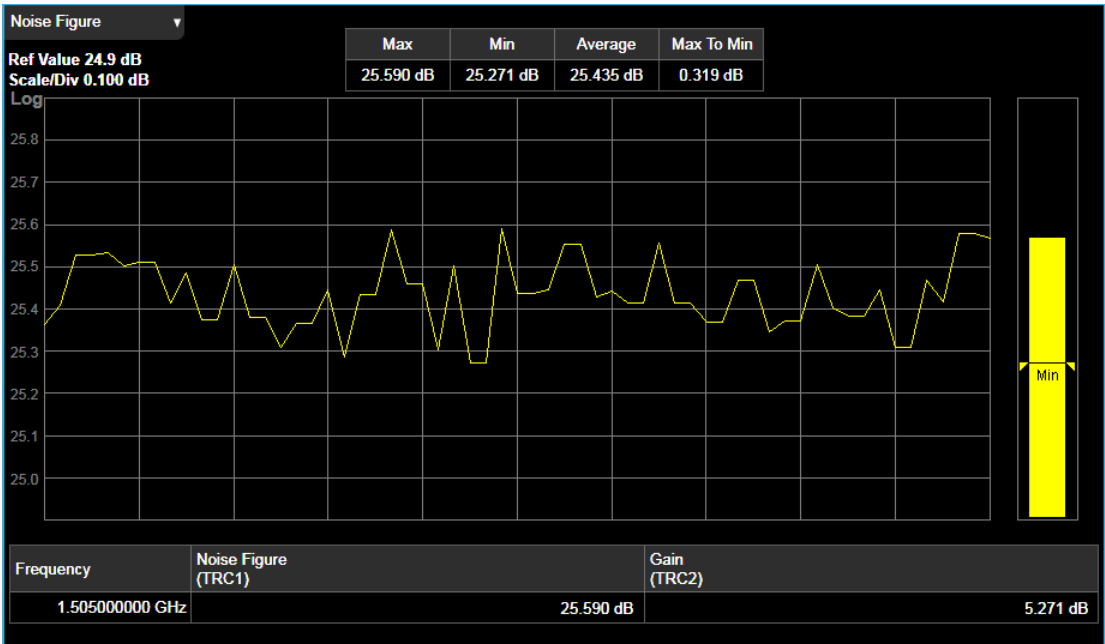


Note that there is no horizontal scale in Strip chart, the displayed points will always be 61. The graph and strip chart do not update when "Freq Mode" on page 191 is not **FIXed**.

There 4 readouts on the strip chart's top area: "Max NF", "Avg NF", "Max-to-Min" and "Min NF". No marker is provided in strip chart. All readouts are one line, with 0.001dB resolution, for example "Max NF: 12.300 dB"

The bar chart draws a black line at the minimum level, and with two yellow triangle indicators on both sides.

The Strip Chart and Bar Graph are not affected by the setting of "View/Blank" on page 368 in the **Trace** menu.



The command below lets you set the result for the **Meter** trace:

|                |                                                                                                                                                        |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:DISPlay:NFIGure:DATA:TRACe3 NFIGure   NFACTOR   GAIN   YFACTOR   TEFFective   PHOT   PCOLd</code><br><code>:DISPlay:NFIGure:DATA:TRACe3?</code> |
| Example        | <code>:DISP:NFIG:DATA:TRAC3 NFIG</code>                                                                                                                |
| Preset         | <code>NFIGure</code>                                                                                                                                   |
| State Saved    | Yes                                                                                                                                                    |
| Range          | <code>NFIGure   NFACTOR   GAIN   YFACTOR   TEFFective   PHOT   PCOLd</code>                                                                            |

**Table**

Displays discrete results for each frequency point in a tabular form. The results are updated for each frequency in turn as they are measured. By default, only "Data 1" and "Data 2" results in graph layout are displayed in the table. You can use the "Result Table" panel to turn on more results.

All values are displayed according to their defined 'Display Format' (see appropriate SCPI table).

3 Noise Figure Mode

3.4 Display

Table ▼

| Frequency      | Noise Figure (TRC1) | Gain (TRC2) |
|----------------|---------------------|-------------|
| 10.000000 MHz  | -4.8652 dB          | 5.0016 dB   |
| 309.000000 MHz | -4.5841 dB          | 4.9858 dB   |
| 608.000000 MHz | -4.3937 dB          | 4.9673 dB   |
| 907.000000 MHz | -4.9982 dB          | 5.0459 dB   |
| 1.20600000 GHz | -5.1073 dB          | 5.0166 dB   |
| 1.50500000 GHz | -4.8447 dB          | 5.0021 dB   |
| 1.80400000 GHz | -6.1325 dB          | 4.9812 dB   |
| 2.10300000 GHz | -4.8928 dB          | 5.0174 dB   |
| 2.40200000 GHz | -4.7276 dB          | 5.0197 dB   |
| 2.70100000 GHz | -3.8586 dB          | 4.9984 dB   |
| 3.00000000 GHz | -3.5805 dB          | 4.9429 dB   |

3.4.1.2 Table Position

Sets the view position in the current measurement. Only displayed when "Layout" on page 175 is TABLE, and controls the selected row in the table. If the selected row is not currently displayed on-screen, the table scrolls automatically so that the selected row is centered.

|             |                                                            |
|-------------|------------------------------------------------------------|
| Couplings   | Max value coupled to "Points" on page 195(under Frequency) |
| Preset      | 1                                                          |
| State Saved | No                                                         |
| Min         | 1                                                          |
| Max         | Dependent on Frequency > "Points" on page 195              |

3.4.1.3 Overlay / Combined

If this parameter is ON, the current two traces appear on the screen, trace 1 in yellow and trace 2 in blue. Each trace displays its own data type name on the right side of the trace, and two sets of graph annotations use the same color as the corresponding trace. This is only displayed when "Layout" on page 175 is set to GRAPH.

|                |                                                                                                      |
|----------------|------------------------------------------------------------------------------------------------------|
| Remote Command | :DISPlay:NFIGure:TRACe:COMBined[:STATe] OFF   ON   0   1<br>:DISPlay:NFIGure:TRACe:COMBined[:STATe]? |
|----------------|------------------------------------------------------------------------------------------------------|

|                                 |                                                                                                                                                             |
|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Example                         | <code>:DISP:NFIG:TRAC:COMB:STAT ON</code>                                                                                                                   |
| Couplings                       | Only enabled when <b>Layout</b> is set to <b>GRAPH</b> , or <b>Layout</b> is set to <b>AUTO</b> and " <b>Freq Mode</b> " on page 191 is set to <b>SWEPT</b> |
| Preset                          | <b>OFF</b>                                                                                                                                                  |
| State Saved                     | Yes                                                                                                                                                         |
| Range                           | On   Off                                                                                                                                                    |
| Backwards Compatibility<br>SCPI | <code>:DISPlay[:NFIGure]:TRACe:COMBined[:STATE]</code>                                                                                                      |

### 3.4.1.4 Data Display

Lets you select which trace to be displayed. Available selections are:

|                             |                                                                                                                                                                          |
|-----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Current Trace</b>        | Displays the current measurement trace<br>This is the default setting                                                                                                    |
| <b>Memory</b>               | Displays the measurement trace you saved to memory by pressing " <b>Current Trace -&gt; Memory</b> " on page 185                                                         |
| <b>Current Trace+Memory</b> | Displays both the measurement trace you saved to memory by pressing <b>Current Trace-&gt; Memory</b> and the current measurement trace. This lets you compare two traces |

If the measurement frequencies are changed after the reference trace was saved, and there is an overlapped area of the current frequency range and the frequency range when the reference trace was saved, the reference trace in the overlapped frequency range will be displayed. If there is on overlap, only a **Reference** label will be displayed to indicate that the reference trace is enabled, but out of the current frequency range.

When the current measurement frequency range is wider than the reference trace, the start and stop frequencies of the reference trace will be displayed.

|              |                                                                                                                                                                                                                                            |
|--------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Dependencies | Only available when 2FP license is installed                                                                                                                                                                                               |
| Couplings    | <b>Memory</b> and <b>Current Trace+Memory</b> keys only become available after you press the <b>Current Trace-&gt;Memory</b> control<br>When sweep points changes, <b>Memory</b> and <b>Current Trace+Memory</b> options will be displayed |
| Preset       | Data                                                                                                                                                                                                                                       |
| State Saved  | Yes                                                                                                                                                                                                                                        |
| Range        | Current Trace   Memory   Current Trace+Memory                                                                                                                                                                                              |

### 3.4.1.5 Current Trace -> Memory

Stores the current trace in memory, where it remains until you do any of the following:

- Change **Sweep** "Points" on page 363
- Change "Freq Context" on page 218
- Preset the measurement
- Press **Current Trace->Memory** again to save another trace

After you have pressed **Current Trace->Memory**, "Data Display" on page 184 becomes available. **Current Trace->Memory** is only available after a complete sweep of data is made.

|              |                                                               |
|--------------|---------------------------------------------------------------|
| Dependencies | Only available when 2FP license is installed                  |
| Couplings    | Only becomes available after a complete sweep of data is made |
| State Saved  | No                                                            |

## 3.4.2 Result Table (Front Panel Only)

Contains controls that enable you to select which result will be displayed in the result table on the **Table** and **Meter** layout. The "Data 1" and "Data 2" results on the **Graph** layout are always displayed.

### 3.4.2.1 Noise Figure

Turns on or off Noise Figure result in the result table for **Table** and **Meter** Layouts.

|             |                                                                                         |
|-------------|-----------------------------------------------------------------------------------------|
| Couplings   | Disabled when "Data 1" or "Data 2" result on <b>Graph</b> layout is <b>Noise Figure</b> |
| Preset      | On                                                                                      |
| State Saved | Saved in instrument state                                                               |

### 3.4.2.2 Gain (Front Panel Only)

Turns on or off the Gain result in the result table for **Table** and **Meter** Layouts.

|             |                                                                                         |
|-------------|-----------------------------------------------------------------------------------------|
| Couplings   | Disabled when the "Data 1" or "Data 2" result on the <b>Graph</b> layout is <b>Gain</b> |
| Preset      | On                                                                                      |
| State Saved | Saved in instrument state                                                               |

### 3.4.2.3 Noise Factor (Front Panel Only)

Turns on or off the Noise Factor result in the result table for **Table** and **Meter** Layouts.

|             |                                                                                                 |
|-------------|-------------------------------------------------------------------------------------------------|
| Couplings   | Disabled when the “Data 1” or “Data 2” result on the <b>Graph</b> layout is <b>Noise Factor</b> |
| Preset      | On                                                                                              |
| State Saved | Saved in instrument state                                                                       |

### 3.4.2.4 Y-Factor (Front Panel Only)

Turns on or off the Y-Factor result in the result table for **Table** and **Meter** Layouts.

|             |                                                                                             |
|-------------|---------------------------------------------------------------------------------------------|
| Couplings   | Disabled when the “Data 1” or “Data 2” result on the <b>Graph</b> layout is <b>Y-Factor</b> |
| Preset      | On                                                                                          |
| State Saved | Saved in instrument state                                                                   |

### 3.4.2.5 T effective (Front Panel Only)

Turns on or off the T effective result in the result table of the **Table** and **Meter** layout.

|             |                                                                                                |
|-------------|------------------------------------------------------------------------------------------------|
| Couplings   | Disabled when the “Data 1” or “Data 2” result on the <b>Graph</b> layout is <b>T effective</b> |
| Preset      | On                                                                                             |
| State Saved | Saved in instrument state                                                                      |

### 3.4.2.6 P hot (Front Panel Only)

Turns on or off the P hot result in the result table of the **Table** and **Meter** layout.

|             |                                                                                          |
|-------------|------------------------------------------------------------------------------------------|
| Couplings   | Disabled when the “Data 1” or “Data 2” result on the <b>Graph</b> layout is <b>P hot</b> |
| Preset      | On                                                                                       |
| State Saved | Saved in instrument state                                                                |

### 3.4.2.7 P cold (Front Panel Only)

Turns on or off the P cold result in the result table of the **Table** and **Meter** layout.

|             |                                                                                           |
|-------------|-------------------------------------------------------------------------------------------|
| Couplings   | Disabled when the “Data 1” or “Data 2” result on the <b>Graph</b> layout is <b>P cold</b> |
| Preset      | On                                                                                        |
| State Saved | Saved in instrument state                                                                 |

### 3.4.3 Annotation

Contains controls for setting up the annotation for the current Mode or Measurement.

#### 3.4.3.1 Graticule

Turns the display graticule On or Off for all windows with graticules in all measurements in the current Mode. Also turns the graticule Y-Axis annotation on and off.

|                              |                                                                                                                                                                                                                                                                                                            |
|------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command               | <code>:DISPlay:GRATicule[:STATe] OFF   ON   0   1</code><br><code>:DISPlay:GRATicule[:STATe]?</code>                                                                                                                                                                                                       |
| Example                      | <code>:DISP:GRAT OFF</code>                                                                                                                                                                                                                                                                                |
| Notes                        | The graticule is the set of horizontal and vertical lines that make up the grid/divisions for the X-Axis and Y-Axis                                                                                                                                                                                        |
| Preset                       | <b>ON</b>                                                                                                                                                                                                                                                                                                  |
| State Saved                  | Saved in instrument state                                                                                                                                                                                                                                                                                  |
| Backwards Compatibility SCPI | <code>:DISPlay:WINDow[1]:TRACe:GRATicule:GRID[:STATe] OFF   ON   0   1</code><br><code>:DISPlay:WINDow[1]:TRACe:GRATicule:GRID[:STATe]?</code><br>This command is accepted for backwards compatibility with older instruments, but the <b>WINDow</b> , <b>TRACe</b> and <b>GRID</b> parameters are ignored |

#### 3.4.3.2 Screen Annotation

Controls the display of the annunciation and annotation around the graticule, including any annotation on lines (such as the display line, the threshold line, etc.) and the Y-Axis annotation, for all windows with screen annotation in all measurements in the current Mode.

This does *not* include marker annotation (or the N dB result). When **OFF**, the graticule expands to fill the entire graticule area, leaving only the 1.5% gap above the graticule, as described in the **Trace** section.

|                |                                                                                                                            |
|----------------|----------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:DISPlay:ANNotation:SCReen[:STATe] OFF   ON   0   1</code><br><code>:DISPlay:ANNotation:SCReen[:STATe]?</code>       |
| Example        | <code>:DISP:ANN:SCR OFF</code>                                                                                             |
| Dependencies   | Grayed-out and forced to <b>OFF</b> when <b>System Display Settings, Annotation</b> is <b>OFF</b>                          |
| Preset         | <b>ON</b><br>This remains <b>OFF</b> through a Preset when <b>System Display Settings, Annotation</b> is set to <b>OFF</b> |
| State Saved    | Saved in instrument state                                                                                                  |

### 3.4.3.3 Trace Annotation

Turns on and off the labels on the traces, showing their detector (or their Math Mode) as described in the **Trace** section, for all windows in all measurements in the current Mode for which Trace Annotation on/off is supported.

If Trace Math is being performed on a trace, then the Trace Math annotation replaces the detector annotation.

For measurements that support limit lines, this key also turns on and off the labels on the Limit Lines. The label is the Limit number annotation and Limit Comment displayed on the graph. If the length of the comment is greater than 20 characters, the first 8 characters and the last 8 characters are displayed, joined with ....

|                |                                                                                                                    |
|----------------|--------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:DISPlay:ANNotation:TRACe[:STATe] ON   OFF   1   0</code><br><code>:DISPlay:ANNotation:TRACe[:STATe]?</code> |
| Example        | <code>:DISP:ANN:TRAC OFF</code>                                                                                    |
| Preset         | <b>OFF</b>                                                                                                         |
| State Saved    | Saved in instrument state                                                                                          |

### 3.4.3.4 Control Annotation

Turns on and off the display of values on the Active Function controls for all measurements in the current Mode. This is a security feature.

|                |                                                                                                                            |
|----------------|----------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:DISPlay:ACTivefunc[:STATe] ON   OFF   1   0</code><br><code>:DISPlay:ACTivefunc[:STATe]?</code>                     |
| Example        | <code>:DISP:ACT OFF</code>                                                                                                 |
| Dependencies   | Grayed out and forced to <b>OFF</b> when <b>System Display Settings, Annotation</b> is <b>OFF</b>                          |
| Preset         | <b>ON</b><br>This remains <b>OFF</b> through a Preset when <b>System Display Settings, Annotation</b> is set to <b>OFF</b> |
| State Saved    | Saved in instrument state                                                                                                  |

### 3.4.3.5 Meas Bar

Turns the Measurement Bar at the top of the screen on and off for all measurements in the current Mode. When **OFF**, the graticule area expands to fill the area formerly occupied by the Measurement Bar.

|                |                                                                                                                  |
|----------------|------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:DISPlay:ANNotation:MBAR[:STATe] OFF   ON   0   1</code><br><code>:DISPlay:ANNotation:MBAR[:STATe]?</code> |
|----------------|------------------------------------------------------------------------------------------------------------------|



### 3 Noise Figure Mode

#### 3.4 Display

|              |                                                                                                                                |
|--------------|--------------------------------------------------------------------------------------------------------------------------------|
| Example      | <code>:DISP:ANN:MBAR OFF</code>                                                                                                |
| Dependencies | Grayed out and forced to <b>OFF</b> when <b>System Display Settings, Annotation</b> is <b>OFF</b>                              |
| Preset       | <b>ON</b><br><br>This remains <b>OFF</b> through a Preset when <b>System Display Settings, Annotation</b> is set to <b>OFF</b> |
| State Saved  | Saved in instrument state                                                                                                      |

##### 3.4.3.6 Display Enable (Remote Command Only)

Turns the display on/off, including the display drive circuitry. The backlight stays lit to confirm that the instrument is on. The display enable setting is mode global. There are three reasons for turning the display off:

1. To increase speed as much as possible by freeing the instrument from having to update the display
2. To reduce emissions from the display, drive circuitry
3. For security purposes

If you have turned off the display:

- and you are in local operation, the display can be turned back on by pressing any key or by sending `:SYSTem:DEFaults MISC` or `:DISPlay:ENABle ON` (neither `*RST` nor `:SYSTem:PRESet` enable the display)
- and you are in remote operation, the display can be turned back on by pressing the **Local** or **Esc** keys, or by sending `:SYSTem:DEFaults MISC` or `:DISPlay:ENABle ON` (neither `*RST` nor `:SYSTem:PRESet` enable the display)
- and you are using either the `:SYSTem:KLOCK` command or GPIB local lockout, then *no* front-panel key press will turn the display back on. You must turn it back on remotely.

If the display is **OFF**, many SCPI commands related to User Views and Multiscreen functionality do not work, and return the error messages “-221, Settings conflict; Screen SCPI cannot be used when Display is disabled” or “221, Settings conflict; View SCPI cannot be used while Display is disabled”. These commands include:

| Name             | Command                                    |
|------------------|--------------------------------------------|
| Select User View | <code>:DISPlay:VIEW:ADVanced:SElect</code> |
| Rename User View | <code>:DISPlay:VIEW:ADVanced:REName</code> |
| Delete User View | <code>:DISPlay:VIEW:ADVanced:DELeTe</code> |
| Create User View | <code>:DISPlay:VIEW:ADVanced:NAME</code>   |
| Select Screen    | <code>:INSTrument:SCReen:SElect</code>     |
| Delete Screen    | <code>:INSTrument:SCReen:DELeTe</code>     |

| Name                       | Command                                    |
|----------------------------|--------------------------------------------|
| Delete All But This Screen | <code>:INSTrument:SCReen:DELeTe:ALL</code> |
| Add Screen                 | <code>:INSTrument:SCReen:CREate</code>     |
| Rename Screen              | <code>:INSTrument:SCReen:REName</code>     |
| Sequencer On/Off           | <code>:SYSTem:SEQuencer</code>             |

|                               |                                                                                                                                                                                                               |
|-------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command                | <code>:DISPlay:ENABle OFF   ON   0   1</code><br><code>:DISPlay:ENABle?</code>                                                                                                                                |
| Example                       | <code>:DISP:ENAB OFF</code>                                                                                                                                                                                   |
| Couplings                     | <code>:DISP:ENAB OFF</code> turns Backlight <b>OFF</b> and <code>:DISP:ENAB ON</code> turns Backlight <b>ON</b> , but changing Backlight settings does <i>not</i> change the state of <code>:DISP:ENAB</code> |
| Preset                        | <b>ON</b><br>Set by <code>:SYST:DEF MISC</code> , but not affected by <code>*RST</code> or <code>:SYSTem:PRESet</code>                                                                                        |
| State Saved                   | Not saved in instrument state                                                                                                                                                                                 |
| Backwards Compatibility Notes | <code>:SYST:PRES</code> no longer turns on <code>:DISPlay:ENABle</code> as it did in legacy analyzers                                                                                                         |

## 3.5 Frequency

Accesses a menu of controls that let you control the frequency parameters of the instrument.

### 3.5.1 Settings

Contains controls for frequently used functions.

#### 3.5.1.1 Freq Mode

Determines how the list of frequencies to be measured is calculated. The options are:

- SWEpt** Points are linearly distributed between start and stop frequencies, where the number of points is determined by the **Points** parameter. **Start Freq**, **Stop Freq**, **Center Frequency**, and **Span** parameters are coupled  
In this mode, **Fixed Freq** and **Edit Freq List** are invisible
- FIXed** A single frequency (supplied by "**Fixed Freq**" on page 195) is measured. **Meter** View is ideal for this mode  
In this mode, **Start/Stop/Center Frequency**, **Span**, **Points** and **Edit Freq List** are invisible
- LIST** A user-specified list of frequencies is measured. The list of frequencies can be supplied using the respective SCPI commands, loading the frequency list from file, or by entering the data manually into the frequency list. Duplicate frequencies are not acceptable. In this mode, **Start/Stop/Center/Fixed Freq**, **Span**, and **Points** are invisible

When "**Layout**" on page 175 (in the **Display** menu) is **AUTO**, the layout changes when **Freq Mode** changes, as follows:

| Freq Mode | Layout                     |
|-----------|----------------------------|
| Swept     | "Graph Layout" on page 176 |
| Fixed     | "Meter" on page 180        |
| List      | "Table" on page 182        |

NOTE

When **DUT** is **MCONverter**, you need to specify the DUTs Input(RF), DUTs Output(IF) and LO (if the DUTs LO is Swept) frequency list respectively. Switching the DUT type does not change the frequency lists for **MCONverter**, that is, when you switch to **MCONverter** from other DUT types, the DUT Input(RF), DUT Output(IF) and LO frequency lists are restored to the latest values.

## NOTE

Frequency Mode is global to all frequency contexts (see ["Freq Context" on page 218](#)). When it is changed in one frequency context, the change is mirrored in all other frequency contexts. When **Freq Mode** changes, the frequency parameters in all other contexts are recalculated to reflect the frequency parameters in the current context.

When **Freq Mode** is **LIST** and the context changes, the list values are recalculated, to satisfy the new context.

|                              |                                                                                                                      |
|------------------------------|----------------------------------------------------------------------------------------------------------------------|
| Remote Command               | <code>[ :SENSe]:NFIGure:FREQuency:MODE SWEpt   FIXed   LIST</code><br><code>[ :SENSe]:NFIGure:FREQuency:MODE?</code> |
| Example                      | <code>:NFIG:FREQ:MODE FIX</code>                                                                                     |
| Couplings                    | See above                                                                                                            |
| Preset                       | <b>SWEpt</b>                                                                                                         |
| State Saved                  | Yes                                                                                                                  |
| Range                        | <b>SWEpt   FIXed   LIST</b>                                                                                          |
| Backwards Compatibility SCPI | <code>[ :SENSe][ :NFIGure]:FREQuency:MODE</code>                                                                     |

### 3.5.1.2 Center Frequency

Sets the **Center Frequency** to be used when ["Freq Mode" on page 191](#) is **SWEpt**.

This control is blanked when ["Freq Mode" on page 191](#) is **FIXed** or **LIST**.

The Start, Stop, Center, and Span frequencies are all coupled. Changing one causes the others to be recalculated, to satisfy the equations:

- $\text{Span} = \text{Stop} - \text{Start}$
- $\text{Center} = \text{Start} + (\text{Span} / 2)$

## NOTE

Unless the number of Points is odd, **Center Frequency** is not actually measured, because the measured points are evenly distributed between the start and stop frequencies.

|                |                                                                                                                         |
|----------------|-------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:NFIGure:FREQuency:CENTer &lt;freq&gt;</code><br><code>[ :SENSe]:NFIGure:FREQuency:CENTer?</code>        |
| Example        | <code>:NFIG:FREQ:CEN 1.5 GHz</code>                                                                                     |
| Notes          | Preset value differs from legacy apps, in which it was 1.505 GHz                                                        |
| Couplings      | Lets you set <b>Center Frequency</b> for a swept measurement. Appears only when <a href="#">"Freq Mode" on page 191</a> |

### 3 Noise Figure Mode

#### 3.5 Frequency

|                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                              | is set to <b>SWEPT</b> . Coupled to <b>Start Freq</b> , <b>Stop Freq</b> , and <b>Span</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Preset                       | 1.505 GHz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| State Saved                  | Yes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Min                          | 10.005 kHz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Max                          | There are a few conditions related to the frequency context (see " <b>Freq Context</b> " on page 218) where the max will be 3.30 THz less half of the min span of 10 Hz: <ul style="list-style-type: none"> <li>– When "<b>DUT</b>" on page 219 is <b>AMPLifier</b>, and the system downconverter is <i>not</i> in use with DSB, the frequency context is set to <b>RF</b> (DUT Input)</li> <li>– When <b>DUT</b> is <b>AMPLifier</b>, and the system downconverter is in use with DSB, the frequency context will be enabled. The <b>RF</b> and <b>SysDownConvLO</b> contexts are available</li> <li>– When <b>DUT</b> is <b>DOWNconv</b>, and the frequency context is set to <b>RF</b> (DUT Input)</li> </ul> |
| Backwards Compatibility SCPI | <b>[ :SENSe ] [ :NFIGure ] :FREQuency :CENTer</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |

##### 3.5.1.3 Span

Sets the displayed frequency range symmetrically about the "**Center Frequency**" on page 192.

This control is blanked when "**Freq Mode**" on page 191 is **FIXed** or **LIST**.

The Start, Stop, and Center parameters are **Span** frequencies and are all coupled. Changing one causes the others to be recalculated to satisfy the equations:

- $\text{Span} = \text{Stop} - \text{Start}$
- $\text{Center} = \text{Start} + (\text{Span} / 2)$

|                              |                                                                                                                                                                                                |
|------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command               | <b>[ :SENSe ] :NFIGure :FREQuency :SPAN &lt;freq&gt;</b><br><b>[ :SENSe ] :NFIGure :FREQuency :SPAN?</b>                                                                                       |
| Example                      | <b>:NFIG:FREQ:SPAN 10 MHz</b>                                                                                                                                                                  |
| Couplings                    | Lets you set the span at which the measurement sweeps. Appears only when <b>Freq Mode</b> is set to <b>SWEPT</b> . Coupled to <b>Start Freq</b> , <b>Stop Freq</b> and <b>Center Frequency</b> |
| Preset                       | 2.99 GHz                                                                                                                                                                                       |
| State Saved                  | Yes                                                                                                                                                                                            |
| Min                          | 10 Hz                                                                                                                                                                                          |
| Max                          | 3.30 THz                                                                                                                                                                                       |
| Backwards Compatibility SCPI | <b>[ :SENSe ] [ :NFIGure ] :FREQuency :SPAN</b>                                                                                                                                                |

### 3.5.1.4 Start Freq

Sets the start frequency that will be used when "Freq Mode" on page 191 is **SWEpt**. A separate start frequency is maintained for each frequency context (DUT Input(RF), LO, DUT Output(IF), SysDownConvLO – see "Freq Context" on page 218). The control displays and controls the start frequency for the current context.

The Start, Stop, Center, and Span frequencies are all coupled. Altering one causes the others to be recalculated, to satisfy the equations:

- $\text{Span} = \text{Stop} - \text{Start}$
- $\text{Center} = \text{Start} + (\text{Span} / 2)$

|                                 |                                                                                                                                                                                                                                                                                                            |
|---------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command                  | <code>[ :SENSe]:NFIGure:FREQuency:STARt &lt;freq&gt;</code><br><code>[ :SENSe]:NFIGure:FREQuency:STARt?</code>                                                                                                                                                                                             |
| Example                         | <code>:NFIG:FREQ:STAR 11 MHz</code>                                                                                                                                                                                                                                                                        |
| Couplings                       | Lets you set the frequency at which the swept measurement starts. Active only when "Freq Mode" on page 191 is <b>SWEpt</b> . Coupled to stop freq, center freq, and span<br>When the selected cal/meas freq goes below 10 MHz, the AC flag displays the exclamation mark to warn you of inaccurate results |
| Preset                          | 10 MHz                                                                                                                                                                                                                                                                                                     |
| State Saved                     | Yes                                                                                                                                                                                                                                                                                                        |
| Min                             | –325 GHz                                                                                                                                                                                                                                                                                                   |
| Max                             | 3.2999999999 THz                                                                                                                                                                                                                                                                                           |
| Backwards Compatibility<br>SCPI | <code>[ :SENSe][ :NFIGure]:FREQuency:STARt</code>                                                                                                                                                                                                                                                          |

### 3.5.1.5 Stop Freq

Sets the stop frequency that will be used when "Freq Mode" on page 191 is **SWEpt**. A separate stop frequency is maintained for each frequency context (DUT Input (RF), LO, DUT Output (IF), SysDownConvLO – see "Freq Context" on page 218). The control displays and controls the stop frequency for the current context.

The Start, Stop, Center, and Span frequencies are all coupled. Altering one causes the others to be recalculated, to satisfy the equations:

- $\text{Span} = \text{Stop} - \text{Start}$
- $\text{Center} = \text{Start} + (\text{Span} / 2)$

|        |                                                            |
|--------|------------------------------------------------------------|
| Remote | <code>[ :SENSe]:NFIGure:FREQuency:STOP &lt;freq&gt;</code> |
|--------|------------------------------------------------------------|

### 3 Noise Figure Mode

#### 3.5 Frequency

|                                    |                                                                                                        |
|------------------------------------|--------------------------------------------------------------------------------------------------------|
| Command                            | <code>[ :SENSe]:NFIGure:FREQuency:STOP?</code>                                                         |
| Example                            | <code>:NFIG:FREQ:STOP 11 MHz</code>                                                                    |
| Couplings                          | Active only when <b>Freq Mode</b> is set to <b>SWEPT</b> . Coupled to start freq, center freq and span |
| Preset                             | 3.0 GHz                                                                                                |
| State Saved                        | Yes                                                                                                    |
| Min                                | -3.2999999999 THz                                                                                      |
| Max                                | 3.30 THz                                                                                               |
| Backwards<br>Compatibility<br>SCPI | <code>[ :SENSe][ :NFIGure]:FREQuency:STOP</code>                                                       |

##### 3.5.1.6 Points

Sets the number of frequency points to be used when "**Freq Mode**" on page 191 is **SWEPT**. The frequency points are distributed evenly between the start and stop frequencies.

Suppressed when "**Freq Mode**" on page 191 is set to **FIXed** or **LIST**.

|                                    |                                                                                                           |
|------------------------------------|-----------------------------------------------------------------------------------------------------------|
| Remote<br>Command                  | <code>[ :SENSe]:NFIGure:SWEp:POINts &lt;integer&gt;</code><br><code>[ :SENSe]:NFIGure:SWEp:POINts?</code> |
| Example                            | <code>:NFIG:SWE:POIN 201</code>                                                                           |
| Couplings                          | Coupled to max value of " <b>Table Position</b> " on page 183 (under <b>Display</b> )                     |
| Preset                             | 11                                                                                                        |
| State Saved                        | Yes                                                                                                       |
| Min                                | 2                                                                                                         |
| Max                                | 1301                                                                                                      |
| Backwards<br>Compatibility<br>SCPI | <code>[ :SENSe][ :NFIGure]:SWEp:POINts</code>                                                             |

##### 3.5.1.7 Fixed Freq

Sets the fixed frequency that will be measured when "**Freq Mode**" on page 191 is **FIXed**.

Blanked when **Freq Mode** is set to **SWEPT** or **LIST**.

|                   |                                                                                                                |
|-------------------|----------------------------------------------------------------------------------------------------------------|
| Remote<br>Command | <code>[ :SENSe]:NFIGure:FREQuency:FIXed &lt;freq&gt;</code><br><code>[ :SENSe]:NFIGure:FREQuency:FIXed?</code> |
|-------------------|----------------------------------------------------------------------------------------------------------------|

|                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Example                      | <code>:NFIG:FREQ:FIX 2 GHz</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Couplings                    | Active if <b>Freq Mode</b> is set to <b>FIXed</b> : Warning –221 is displayed otherwise                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Preset                       | 1.505 GHz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| State Saved                  | Yes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Range                        | –325 GHz to 3.30 THz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Min                          | 10 kHz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Max                          | <p>There are a few conditions related to the frequency context (see "<b>Freq Context</b>" on page 218) where the max will be 3.30 THz less half of the min span of 10 Hz:</p> <ul style="list-style-type: none"> <li>– When "<b>DUT</b>" on page 219 is <b>AMPLifier</b>, and System Downconverter is <i>not</i> in use with DSB, the frequency context is set to <b>RF (DUT Input)</b></li> <li>– When <b>DUT</b> is <b>AMPLifier</b>, and System Downconverter <i>is</i> in use with DSB, the frequency context is enabled. The <b>RF</b> and <b>SysDownConvLO</b> contexts are available</li> <li>– When <b>DUT</b> is <b>DOWNconv</b>, and the frequency context is set to <b>RF(DUT Input)</b></li> </ul> |
| Backwards Compatibility SCPI | <code>[ :SENSe ][ :NFIGure ] :FREQuency :FIXed</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |

### 3.5.1.8 Edit Freq List

Lets you edit the frequency lists for Noise Figure measurement.

- When "**DUT**" on page 219 is not **MCONverter**, only the frequency list for the current frequency context (see "**Freq Context**" on page 218) is editable. Entered frequencies can be arbitrary values within the frequency range of the current frequency context. Values will be displayed in sorted order. Duplicates are not allowed in the frequency list
- When **DUT** is **MCONverter**, three frequency lists are all editable. You can use "**Selected Freq List**" on page 197 to specify which frequency list to be edited. Entered frequencies can be arbitrary values within the frequency range of the selected frequency context. Values for the current frequency context are displayed in sorted order. Duplicates are not allowed in the frequency list for the current frequency context

Once a new list is entered, the application stores this table in non-volatile memory, to allow for restoration after a power cycle.

If the frequency context changes while "**Freq Mode**" on page 191 is **LIST**, the frequency list values must be recalculated, to satisfy the new context.



## Selected Freq List

Specifies the frequency list when "DUT" on page 219 is **MCONverter**. Only enabled when DUT is **MCONverter**.

When "Freq Mode" on page 191 is **LIST** and DUT type is **MCONverter**, you must enter the frequency list for RF, LO and IF before calibration and measurement.

|                |                                                                                                                             |
|----------------|-----------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:NFIgure:FREQuency:LIST RF   LO   IF   SYSDwnconvlo</code><br><code>[ :SENSe]:NFIgure:FREQuency:LIST?</code> |
| Example        | <code>:NFIg:FREQ:LIST RF</code>                                                                                             |
| Couplings      | Only enabled when DUT is <b>MCONverter</b><br>Coupled to "Freq Context" on page 218                                         |
| Preset         | <b>IF</b>                                                                                                                   |
| State Saved    | Yes                                                                                                                         |
| Range          | <b>RF LO IF</b>                                                                                                             |

## Go to Row (Front Panel Only)

Specify a row and make it the selected row.

## Insert Row Below (Front Panel Only)

Inserts a row below the current row. The new row is a copy of the current row, and becomes the current row. The new row is not yet entered into the underlying table, and the data in the row is displayed in light gray.

## Delete Row (Front Panel Only)

This is an immediate action control. It immediately deletes the currently-selected row, whether or not that point is being edited, and selects **Navigate**. The point following the currently-selected row (or the preceding row if there is none) is selected.

## Start Freq (Front Panel Only)

Used only by "Fill Using Start and Stop Freq (Front Panel Only)" on page 199 to generate a frequency list. Note that it is not the same parameter as "Start Freq" on page 194, which is used in the Noise Figure measurement when "Freq Mode" on page 191 is **SWEPT**.

Switching to List mode updates this parameter to the latest start frequency value of the Swept mode.

|             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Preset      | 10 MHz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| State Saved | Yes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Range       | –325 GHz to 3.30 THz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Min         | 10 kHz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Max         | <p>There are a few conditions related to the frequency context (see "Freq Context" on page 218) where the max will be 3.30 THz less the min span of 10 Hz:</p> <ul style="list-style-type: none"> <li>– When "DUT" on page 219 is <b>AMPLifier</b>, and System Downconverter is <i>not</i> in use with DSB, the frequency context is set to RF (DUT Input)</li> <li>– When DUT is <b>AMPLifier</b>, and System Downconverter <i>is</i> in use with DSB, the frequency context is enabled. The <b>RF</b> and <b>SysDownConvLO</b> contexts are available</li> <li>– When DUT is <b>DOWNconv</b>, and the frequency context is set to <b>RF</b> DUT Input</li> </ul> |

### Stop Freq (Front Panel Only)

Only used by "Fill Using Start and Stop Freq (Front Panel Only)" on page 199 to generate frequency list. Note that it is not the same parameter as "Stop Freq" on page 194, which is used in the Noise Figure measurement when "Freq Mode" on page 191 is **SWEPT**.

Switching to List mode updates this parameter to the latest stop frequency value of the Swept mode.

|             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Preset      | 3.0 GHz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| State Saved | Yes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Range       | –325 GHz to 3.30 THz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Min         | 10.01 kHz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Max         | <p>There are a few conditions related to the frequency context (see "Freq Context" on page 218) where the max will be 3.30 THz</p> <ul style="list-style-type: none"> <li>– When "DUT" on page 219 is <b>AMPLifier</b>, and System Downconverter is <i>not</i> in use with DSB, the frequency context is set to <b>RF</b> (DUT Input)</li> <li>– When DUT is <b>AMPLifier</b>, and System Downconverter <i>is</i> in use with DSB, the frequency context is enabled. The <b>RF</b> and <b>SysDownConvLO</b> contexts are available</li> <li>– When DUT is <b>DOWNconv</b>, and the frequency context is set to <b>RF</b> DUT Input</li> </ul> |

### Points (Front Panel Only)

Only used by "Fill Using Start and Stop Freq (Front Panel Only)" on page 199 to generate a frequency list. Note that this is *not* the same parameter as "Points" on

page 195, which is used in the Noise Figure measurement when "Freq Mode" on page 191 is **SWEPT**.

Switching to **LIST** mode updates this parameter to the latest **Points** value of **SWEPT Freq Mode**.

|             |                                                                              |
|-------------|------------------------------------------------------------------------------|
| Couplings   | Coupled to max value of "Table Position" on page 183 (under <b>Display</b> ) |
| Preset      | 11                                                                           |
| State Saved | Yes                                                                          |
| Min         | 2                                                                            |
| Max         | 1301                                                                         |

**Fill Using Start and Stop Freq (Front Panel Only)**

Clears the existing frequency list table, and replaces it with an auto-generated table according to "Start Freq (Front Panel Only)" on page 197, "Stop Freq (Front Panel Only)" on page 198 and "Points (Front Panel Only)" on page 198.

The frequency points are linearly distributed between **Start Freq** and **Stop Freq**, and the number of points generated is determined by **Points**.

NOTE

This function can be used to set the template frequencies which can then be modified for the exact "sweet spots" in the DUT.

**Clear Table**

This function clears all data from the frequencies list.

|                |                                                                                                                                                                                                                                                                            |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | [ :SENSe]:NFIgure:FREQuency:LIST:DATA:DELeTe                                                                                                                                                                                                                               |
| Notes          | Clears all entries in the selected Frequency List table. If in <b>LIST</b> "Freq Mode" on page 191, clearing the freq list of the current "Freq Context" on page 218 will make the measurement hang, and "Insufficient Data; Frequency list empty" error will be displayed |

## 3.6 Marker

Accesses the **Marker** menu. A marker can be placed on a trace to allow the value of the trace at the marker point to be determined precisely.

### 3.6.1 Select Marker

Specifies the selected marker. The term “selected marker” is used throughout this document to specify which marker will be affected when you change marker settings, perform a peak search, etc.

This control appears above the menu panel, indicating that it applies to all controls in the **Marker** menu. **Select Marker** is blanked if you select a tab whose controls do *not* depend on the selected marker (for example, **Counter**).

In any menu that includes **Select Marker**, the first control is always **Marker Frequency** on page 200.

|              |                                                                                                                                                                                          |
|--------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Notes        | The selected marker is remembered even when not in the <b>Marker</b> menu and is used if a search is performed, or a Band Function is turned on, or for Signal Track, or Continuous Peak |
| Preset       | Marker 1                                                                                                                                                                                 |
| State Saved  | The number of the selected marker is saved in instrument state                                                                                                                           |
| Annunciation | Appears in the marker results block label for <b>Normal</b> , <b>Delta</b> and <b>Fixed</b> markers                                                                                      |

### 3.6.2 Settings

The controls on this tab include the **Marker** active function, and a radio button selection for **Marker Mode** on page 202 (**Normal**, **Delta**, **Fixed**, or **Off**) for the selected marker, as well as additional functions that help you use markers.

#### 3.6.2.1 Marker Frequency

Sets the marker X Axis value in the current marker X Axis Scale unit. It has no effect if the control mode is **Off**, but is the SCPI equivalent of entering an X value if the control mode is **Normal** or **Delta**.

|                |                                                                                                                            |
|----------------|----------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALCulate:NFIGure:MARKer[1] 2 ... 12:X &lt;freq&gt;</code><br><code>:CALCulate:NFIGure:MARKer[1] 2 ... 12:X?</code> |
| Example        | <code>:CALC:NFIG:MARK2:X 1GHz</code><br><code>:CALC:NFIG:MARK2:X?</code>                                                   |
| Notes          | If no suffix is sent, uses the fundamental units for the current marker X Axis Scale. If a suffix is sent that             |

### 3 Noise Figure Mode

#### 3.6 Marker

|             |                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|             | <p>does not match the current marker X Axis Scale unit, an error “Invalid suffix” is generated</p> <p>The query returns the marker’s absolute X Axis value if the control mode is <b>Normal</b>, or the offset from the marker’s reference marker if the control mode is <b>Delta</b>. The query is returned in the fundamental units for the current marker X Axis scale: Hz for Frequency; Inverse Time, seconds for Period and Time</p> |
| Preset      | Preset turns <b>Off</b> all markers, so the query returns Not A Number ( <b>NAN</b> )                                                                                                                                                                                                                                                                                                                                                      |
| State Saved | Saved in instrument state                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Min/Max     | –/+9.9E+37                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Annotation  | Mkr # <X value> and <Marker value> upper right on graph                                                                                                                                                                                                                                                                                                                                                                                    |

#### Marker X Axis Position (Remote Command Only)

Sets the marker X Axis Scale position in trace points. Has no effect if the control mode is **Off** but is the SCPI equivalent of entering a value if the control mode is **Normal** or **Delta**. The entered value is immediately translated into the current X Axis Scale units for setting the value of the marker.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALCulate:NFIGure:MARKer[1] 2 ... 12:X:POStion &lt;real&gt;</code><br><code>:CALCulate:NFIGure:MARKer[1] 2 ... 12:X:POStion?</code>                                                                                                                                                                                                                                                                                                                                                                                                                |
| Example        | <code>:CALC:NFIG:MARK4:X:POS 0</code><br><code>:CALC:NFIG:MARK4:X:POS?</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Notes          | The query returns the marker’s absolute X Axis value in trace points if the control mode is <b>Normal</b> , or the offset from the marker’s reference marker in trace points if the control mode is <b>Delta</b> . The value is returned as a real number, not an integer, corresponding to the translation from X Axis Scale units to trace points. When a Marker is turned on, it is placed center of the screen on the trace. Therefore, the default value depends on instrument condition. If the marker is <b>Off</b> , the response is Not A Number |
| Preset         | Preset turns <b>Off</b> all markers, so the query returns Not A Number ( <b>NAN</b> )                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| State Saved    | Saved in instrument state                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Min/Max        | –/+9.9E+37                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |

#### Marker Y Axis Value (Remote Query only)

Returns the marker Y Axis value in the current marker Y Axis unit.

|                              |                                                                                                                                                     |
|------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command               | <code>:CALCulate:NFIGure:MARKer[1] 2 ... 12:Y?</code>                                                                                               |
| Example                      | <code>:CALC:NFIG:MARK2:Y?</code>                                                                                                                    |
| Notes                        | Returns the marker Y-axis result, if the control mode is <b>Normal</b> or <b>Delta</b> . If the marker is <b>Off</b> , the response is Not A Number |
| Preset                       | Depends on <b>Marker</b> setup and signal source                                                                                                    |
| State Saved                  | No                                                                                                                                                  |
| Backwards Compatibility SCPI | <code>:CALCulate:NFIGure:MARKer[1] 2 ... 12:FUNCTION:RESult?</code>                                                                                 |

### 3.6.2.2 Marker Mode

Sets the marker control mode to **POSition** (Normal), **DELta**, or **OFF**. All interactions and dependencies detailed under the control description are enforced when the remote command is sent. If the selected marker is **OFF**, pressing **Marker** sets it to **Normal** and places it at the center of the screen on the trace determined by the **Marker Trace** rules. At the same time, the Marker X Axis Value appears on the Active Function area.

The default active function is the active function for the currently selected marker control mode. If the current control mode is **OFF**, there is no active function, and the active function is turned off.

|                |                                                                                                                                                                                                             |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALCulate:NFIGure:MARKer[1] 2 ... 12:MODE POSition   DELta   OFF</code><br><code>:CALCulate:NFIGure:MARKer[1] 2 ... 12:MODE?</code>                                                                  |
| Example        | <code>:CALC:NFIG:MARK:MODE POS</code><br><code>:CALC:NFIG:MARK:MODE?</code>                                                                                                                                 |
| Preset         | <b>OFF</b>                                                                                                                                                                                                  |
| State Saved    | Saved in instrument state                                                                                                                                                                                   |
| Range          | <b>POSition DELta OFF</b>                                                                                                                                                                                   |
| Annotation     | Mkr # <X value> and <Marker value> upper right on graph<br>When Marker Trace is Polar in WCDMA mode:<br>Mkr # <Chip Value (RHO & QPSKEVM)/Symbol Value (CDP)>, <X value> and <Y value> upper right on graph |

### 3.6.2.3 Delta Marker (Reset Delta)

Pressing this control has the same effect as pressing **Delta** in "**Marker Mode**" on [page 202](#). The selected marker becomes a **Delta** marker. If the selected marker is already a **Delta** marker, the reference marker is moved to the current position of the selected marker, thus resetting the delta to zero.

### 3.6.2.4 Marker Table

When **ON**, the display is split into a measurement window and a marker data display window. For each marker that is on, information is displayed in the data display window, which includes the marker number, control mode, trace number, X axis scale, X axis value, and the Y-axis result. Additional information is shown for markers that have marker functions **ON**.

Turning **Marker Table** on turns **Peak Table** off and *vice versa*.

### 3 Noise Figure Mode

#### 3.6 Marker

|                |                                                                                                                                |
|----------------|--------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALCulate:NFIGure:MARKer:TABLE[:STATe] OFF   ON   0   1</code><br><code>:CALCulate:NFIGure:MARKer:TABLE[:STATe]?</code> |
| Example        | <code>:CALC:NFIG:MARK:TABL ON</code><br><code>:CALC:NFIG:MARK:TABL?</code>                                                     |
| Preset         | <code>OFF</code>                                                                                                               |
| State Saved    | The on/off state of <b>Marker Table</b> is saved in instrument state                                                           |

#### 3.6.2.5 Marker Settings Diagram

Lets you configure the **Marker** system using a visual utility, showing you all markers at once.

The top row (labeled **Marker**) shows each of the markers, with a label showing the Mode and a visual representation of the Mode (diamond for **Normal** or **Delta**, nothing for **Off**). The selected **Marker** has a blue outline with the figure in green.

The second row (labeled **Reference Marker**) shows the reference marker for each marker in the top row. If a marker in the top row is a **Delta** marker, an arrow points down to its reference marker. You can drag a top row marker down to any position in the bottom row to make it the reference marker for any other marker.

At the bottom is an image of the **Selected Marker** and dropdowns, allowing you to change the mode and the window of the selected Marker. The **Marker Window** number appears in the trace color of the trace in question.

#### 3.6.2.6 All Markers Off

Turns off all markers.

|                |                                             |
|----------------|---------------------------------------------|
| Remote Command | <code>:CALCulate:NFIGure:MARKer:AOff</code> |
| Example        | <code>:CALC:NFIG:MARK:AOff</code>           |

#### 3.6.2.7 Couple Markers

When **ON**, moving any marker causes an equal X Axis movement of every other marker that is not **Off**. By “equal X Axis movement” we mean that we preserve the difference between each marker’s X Axis value (in the fundamental x-axis units of the trace that marker is on) and the X Axis value of the marker being moved (in the same fundamental x-axis units).

|                |                                                                                                                                  |
|----------------|----------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALCulate:NFIGure:MARKer:COUPle[:STATe] ON   OFF   1   0</code><br><code>:CALCulate:NFIGure:MARKer:COUPle[:STATe]?</code> |
| Example        | <code>:CALC:NFIG:MARK:COUP ON</code>                                                                                             |

|             |                                                                       |
|-------------|-----------------------------------------------------------------------|
|             | <code>:CALC:NFIG:MARK:COUP?</code>                                    |
| Preset      | <b>OFF</b><br>Preset by <b>Mode Preset</b> and <b>All Markers Off</b> |
| State Saved | Saved in instrument state                                             |

### 3.6.2.8 Marker Compatibility

Controls whether the marker readout is compatible with earlier instruments. When **Marker Compatibility** is **ON**, it affects the SCPI query response, as well as the marker display.

If this parameter is **ON**, querying a marker returns two comma-separated values: the **Noise Figure** value first, followed by the **Gain** value. If this parameter is **OFF**, the response to a marker query is a single value, for whichever trace the marker is on (**Noise Figure** or **Gain**).

When "**Overlay / Combined**" on page 183 (under **Display**) is **ON**, the Marker value displays in the middle at the top of the screen, and displays only one value if **Marker Compatibility** is **OFF**, but displays both values (**Noise Figure** and **Gain**) if **Marker Compatibility** is **ON**.

This parameter affects the marker display in the **Graph** view. If **Marker Compatibility** is **ON**, the marker is placed on both upper and lower windows at the same frequency point, and the Marker value will be displayed on both windows.

Affects the marker table display in the **Graph** Layout (see "**Layouts**" on page 155). When **Marker Compatibility** is **ON**, the **Marker Table** has two columns for the Y value; one labeled **Noise Figure** and the other **Gain**. When **Marker Compatibility** is **OFF**, each column shows only one valid value, the one for the trace the Marker is on; the other column shows ---. When **Marker Compatibility** is **ON**, both columns show valid values.

In addition, this parameter allows the marker to be scrolled along the x-axis, which allows data to be viewed outside of measured points.

This setting is persistent and survives both **Mode Preset** and power cycle, but is reset to **OFF** by **Restore Mode Defaults**.

|                |                                                                                                                              |
|----------------|------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALCulate[:NFIGure]:MARKer:COMPAtible OFF   ON   0   1</code><br><code>:CALCulate[:NFIGure]:MARKer:COMPAtible?</code> |
| Example        | <code>:CALC:MARK:COMP ON</code><br><code>:CALC:MARK:COMP?</code>                                                             |
| Preset         | NFA-B: <b>ON</b><br>Others: <b>OFF</b>                                                                                       |
| State Saved    | Yes                                                                                                                          |
| Range          | <b>OFF</b>   <b>ON</b>                                                                                                       |



### 3.6.3 Peak Search

The controls on this tab let you move the marker to selected peaks of the signal, giving you powerful analysis capabilities, particularly when combined with the delta marker function.

NOTE

Pressing the **Peak Search** hardkey automatically moves you to the **Peak Search** page of the **Marker** menu *and* performs a peak search.  
Pressing the **Peak Search** tab once you are already *in* the **Marker** menu does *not* perform a peak search.

#### 3.6.3.1 Marker Frequency

This is the fundamental control that you use to move a marker around on the trace. It is the same as "[Marker Frequency](#)" on [page 200](#) under **Settings**.

#### 3.6.3.2 Peak Search

Moves the selected marker to the trace point which has the maximum y-axis value for that marker's trace.

NOTE

Pressing the **Peak Search** hardkey automatically moves you to the **Peak Search** page of the **Marker** menu *and* performs a peak search.

|                |                                                                                                                                                                                          |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | :CALCulate:NFIGure:MARKer[1] 2 ... 12:MAXimum                                                                                                                                            |
| Example        | :CALC:NFIG:MARK2:MAX<br><br>:SYST:ERR?<br><br>can be used to query the errors to determine if a peak is found. The message "No peak found" will be returned after an unsuccessful search |
| Notes          | Sending this command selects the subopcoded marker                                                                                                                                       |

#### 3.6.3.3 Next Peak

Moves the selected marker to the peak that is next lower in amplitude than the current marker value. Only peaks that meet all enabled peak criteria are considered.

If there is no valid peak lower than the current marker position, a "No peak found" message is generated, and the marker is not moved.

If the selected marker was **Off**, then it is turned on as a **Normal** marker and a peak search is performed.

|                |                                                                 |
|----------------|-----------------------------------------------------------------|
| Remote Command | <code>:CALCulate:NFIGure:MARKer[1] 2 ... 12:MAXimum:NEXT</code> |
| Example        | <code>:CALC:NFIG:MARK2:MAX:NEXT</code>                          |
| Notes          | Sending this command selects the subopcoded marker              |
| State Saved    | Not part of saved state                                         |

### 3.6.3.4 Next Pk Right

Moves the selected marker to the nearest peak right of the current marker that meets all enabled peak criteria.

If there is no valid peak to the right of the current marker position, a “No peak found” message is generated, and the marker is not moved. If the selected marker was off, then it is turned on as a **Normal** marker and a peak search is performed.

|                |                                                                  |
|----------------|------------------------------------------------------------------|
| Remote Command | <code>:CALCulate:NFIGure:MARKer[1] 2 ... 12:MAXimum:RIGHT</code> |
| Example        | <code>:CALC:NFIG:MARK2:MAX:RIGH</code>                           |
| Notes          | Sending this command selects the subopcoded marker               |
| State Saved    | Not part of saved state                                          |

### 3.6.3.5 Next Pk Left

Moves the selected marker to the nearest peak left of the current marker that meets all enabled peak criteria. If there is no valid peak to the left of the current marker position, a “No peak found” message is generated, and the marker is not moved.

If the selected marker was **Off**, then it is turned on as a **Normal** marker and a peak search is performed.

|                |                                                                 |
|----------------|-----------------------------------------------------------------|
| Remote Command | <code>:CALCulate:NFIGure:MARKer[1] 2 ... 12:MAXimum:LEFT</code> |
| Example        | <code>:CALC:NFIG:MARK2:MAX:LEFT</code>                          |
| State Saved    | Not part of saved state                                         |

### 3.6.3.6 Minimum Peak

Moves the selected marker to the minimum y-axis value on the current trace. Minimum (negative) Peak searches do not have to meet the peak search criteria. It just looks for the lowest y-axis value.

If the selected marker is **Off**, it is turned on before the minimum search is performed.

|                |                                                            |
|----------------|------------------------------------------------------------|
| Remote Command | <code>:CALCulate:NFIGure:MARKer[1] 2 ... 12:MINimum</code> |
| Example        | <code>:CALC:NFIG:MARK:MIN</code>                           |
| Notes          | Sending this command selects the subopcoded marker         |
| State Saved    | Not part of saved state                                    |

### 3.6.3.7 Pk-Pk Search

Finds and displays the amplitude and frequency (or time, if in zero span) differences between the highest and lowest y-axis value. Places the selected marker on the minimum value on its selected trace, and places that marker's reference marker on the peak of its selected trace.

This function turns on the reference marker and sets its mode to **Normal** if it is not already on. (These markers may be on two different traces.)

The rules for finding the maximum peak are the same as for **Peak Search**. However, the minimum trace value is not required to meet any criteria other than being the minimum y-axis value in the trace.

If the selected marker is **Off**, a **Delta** type marker is turned on and the peak-to-peak search is done. If the selected marker is on, but it is not a **Delta** marker, then it is changed to **Delta**, which turns on the reference marker if needed, then it performs the peak-to-peak function.

|                |                                                                                             |
|----------------|---------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALCulate:NFIGure:MARKer[1] 2 ... 12:PTPeak</code>                                   |
| Example        | <code>:CALC:NFIG:MARK:PTP</code>                                                            |
| Notes          | Turns on the Marker D active function<br>Sending this command selects the subopcoded marker |
| Dependencies   | Not available when " <b>Couple Markers</b> " on page 203 is <b>ON</b>                       |
| Couplings      | The selected marker becomes a <b>Delta</b> marker if not already in delta mode              |
| State Saved    | Not part of saved state                                                                     |

### 3.6.3.8 Marker Delta

Pressing this control has the same effect as pressing **Delta** in "**Marker Mode**" on page 202 on the **Settings** tab. The selected marker becomes a **Delta** marker. If the selected marker is already a **Delta** marker, the reference marker is moved to the current position of the selected marker, thus resetting the Delta to zero.

The control is duplicated here to allow you to conveniently perform a peak search and change the marker's control mode to **Delta** without having to access two separate menus.

### 3.6.3.9 Continuous Peak Search

Sets **Continuous Peak Search** on or off. When **ON**, a peak search is automatically performed for the *selected* marker after each sweep. The rules for finding the peak are the same as for **Peak Search**, including the peak criteria rules. If no valid peak is found, a warning is generated after each sweep.

|                              |                                                                                                                            |
|------------------------------|----------------------------------------------------------------------------------------------------------------------------|
| Remote Command               | :CALCulate:NFIGure:MARKer[1] 2 ... 4:CPEak[:STATe] ON   OFF   1   0<br>:CALCulate:NFIGure:MARKer[1] 2 ... 4:CPEak[:STATe]? |
| Example                      | :CALC:NFIG:MARK:CPE ON                                                                                                     |
| Preset                       | OFF                                                                                                                        |
| State Saved                  | Yes                                                                                                                        |
| Range                        | ON OFF                                                                                                                     |
| Backwards Compatibility SCPI | :CALCulate[:NFIGure]:MARKer[1]   2   ...   4:SEARch:CONTInuous[:STATe]                                                     |

## 3.6.4 Pk Search Config

Contains controls that allow you to set up **Peak Search** functions.

Since the **Pk Search Config** functions are independent of the selected Marker, **Select Marker** does not display while in **Pk Search Config**.

### 3.6.4.1 Peak Search Mode

Selects the type of peak search to be performed when the **Peak Search** front-panel key is pressed:

|       |     |                                |
|-------|-----|--------------------------------|
| Min   | MAX | Performs a minimum peak search |
| Max   | MIN | Performs a maximum peak search |
| Pk Pk | PPK | Performs a peak-to-peak search |

|                |                                                                                                 |
|----------------|-------------------------------------------------------------------------------------------------|
| Remote Command | :CALCulate:NFIGure:MARKer:SEARch:TYPE MAX   MIN   PPK<br>:CALCulate:NFIGure:MARKer:SEARch:TYPE? |
| Example        | :CALC:NFIG:MARK:SEAR:TYPE MIN                                                                   |
| Couplings      | Performing a <b>PPK</b> search turns a marker's relative marker on if it is currently off       |
| Preset         | MAXimum                                                                                         |
| State Saved    | Yes                                                                                             |
| Range          | MINimum MAXimum PTPeak                                                                          |

|               |                                         |
|---------------|-----------------------------------------|
| Backwards     | :CALCulate[:NFIGure]:MARKer:SEARch:TYPE |
| Compatibility |                                         |
| SCPI          |                                         |

## 3.6.5 Properties

The controls on this tab are used to set certain properties of the selected marker.

### 3.6.5.1 Marker Frequency

This is the fundamental control that you use to move a marker around on the trace. It is the same as ["Marker Frequency" on page 200](#) under **Settings**.

### 3.6.5.2 Relative To

Selects the marker to which the selected marker is relative (its reference marker).

Every marker has another marker to which it is relative. This marker is referred to as the “reference marker” for that marker. The marker must be a **Delta** marker to make this relevant. If it is a **Delta** marker, the reference marker determines how the marker is controlled and how its value is displayed. A marker cannot be relative to itself.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                          |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | :CALCulate:NFIGure:MARKer[1] 2 ... 12:REference <integer><br>:CALCulate:NFIGure:MARKer[1] 2 ... 12:REference?                                                                                                                                                                                                                                                                                                            |
| Example        | :CALC:NFIG:MARK3:REF 2<br>:CALC:NFIG:MARK3:REF?                                                                                                                                                                                                                                                                                                                                                                          |
| Notes          | Causes the marker specified with the subopcode to become selected<br>A marker cannot be relative to itself so that choice is not available, and if sent from SCPI generates error -221: “Settings conflict; marker cannot be relative to itself”<br>The query returns a single value (the specified marker numbers relative marker)                                                                                      |
| Couplings      | The act of specifying the selected marker’s reference marker makes the selected marker a <b>Delta</b> marker<br>If the reference marker is <b>Off</b> , it is turned on in <b>Fixed</b> or <b>Normal</b> mode at the delta marker location                                                                                                                                                                               |
| Preset         | The preset default “Relative To” marker (reference marker) is the next higher numbered marker (current marker +1). For example, if marker 2 is selected, then its default reference marker is marker 3. The exception is marker 12, which has a default reference of marker 1<br>Set to the defaults by <b>Restore Mode Defaults</b> . <i>Not</i> reset by <b>Marker Off</b> , <b>All Markers Off</b> , or <b>Preset</b> |
| State Saved    | Saved in instrument state. Not affected by <b>Marker Off</b> and hence not affected by Preset or power cycle                                                                                                                                                                                                                                                                                                             |
| Range          | (For SCPI command): 1 to 12<br>If the range is exceeded, the value is clipped                                                                                                                                                                                                                                                                                                                                            |
| Min            | 1                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Max            | 12                                                                                                                                                                                                                                                                                                                                                                                                                       |

|              |                                                      |
|--------------|------------------------------------------------------|
| Annunciation | Appears in the marker label of a <b>Delta</b> marker |
|--------------|------------------------------------------------------|

### 3.6.5.3 Marker Window

Assigns the specified marker to one of the traces. A marker can be assigned to any trace.

|                |                                                                                                                                     |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALCulate:NFIGure:MARKer[1] 2 ... 4:TRACe TRACe1   TRACe2</code><br><code>:CALCulate:NFIGure:MARKer[1] 2 ... 4:TRACe?</code> |
| Example        | <code>:CALC:NFIG:MARK2:TRAC TRACe2</code><br><code>:CALC:NFIG:MARK2:TRAC?</code>                                                    |
| Preset         | 1                                                                                                                                   |
| State Saved    | Yes                                                                                                                                 |
| Range          | <code>TRACe1 TRACe2</code>                                                                                                          |

### 3.6.5.4 Marker Settings Diagram

Lets you configure the Marker system using a visual utility. It is the same as "**Marker Settings Diagram**" on [page 203](#) under **Settings**.

## 3.7 Meas Setup

Contains functions for setting up measurement parameters, and parameters global to all measurements in the Mode.

NOTE

In the **Meas Setup** menu, you may configure **"Averaging"** on page 211, and set the **"Average/Hold Num"** on page 211.

### 3.7.1 Settings

Contains frequently used **Meas Setup** functions to which you will want the fastest access.

#### 3.7.1.1 Average/Hold Num

Sets the number of data acquisitions that will be averaged. **"Averaging"** on page 211 can be turned on or off.

NOTE

During calibration, the value you select for Average Count is translated into a sweep time for each point. An Average Count of 10 results in a sweep time of 160ms (160ms at each measurement point if you are using the default sweep time). There are 2 measurement points per freq point; one measurement for noise source **Off** and one for **On**. If **Averaging** is **ON**, then for a Cal the app uses effectively point type averaging, and for Meas, it reverts to sweep type averaging.

|                                 |                                                                                                                       |
|---------------------------------|-----------------------------------------------------------------------------------------------------------------------|
| Remote Command                  | <code>[ :SENSe ] :NFIGure :AVERage :COUNT &lt;integer&gt;</code><br><code>[ :SENSe ] :NFIGure :AVERage :COUNT?</code> |
| Preset                          | 10                                                                                                                    |
| State Saved                     | Saved in instrument state                                                                                             |
| Min                             | 1                                                                                                                     |
| Max                             | 10000                                                                                                                 |
| Backwards Compatibility<br>SCPI | <code>[ :SENSe ] [ :NFIGure ] :AVERage :COUNT</code><br><code>[ :SENSe ] :SWEEp :COUNT</code>                         |

#### 3.7.1.2 Averaging

Turns **Averaging** on or off.

|                                 |                                                                                                                    |
|---------------------------------|--------------------------------------------------------------------------------------------------------------------|
| Remote Command                  | <code>[ :SENSe]:NFIGure:AVERage[:STATe] ON   OFF   1   0</code><br><code>[ :SENSe]:NFIGure:AVERage[:STATe]?</code> |
| Preset                          | OFF                                                                                                                |
| State Saved                     | Saved in instrument state                                                                                          |
| Backwards Compatibility<br>SCPI | <code>[ :SENSe][:NFIGure]:AVERage[:STATe]</code>                                                                   |

### 3.7.1.3 DUT Profile

Specifies which DUT profile is being used for the current measurement.

A **DUT Profile** contains a group of DUT related measurement settings (see ["More Information" on page 212](#) below). You can save these parameters for multiple DUTs into different DUT profiles. By changing the DUT profile, you can switch measurement settings for different DUTs.

When you change a measurement setting in the group, it will be automatically saved into the selected profile. When you change the DUT profile, the settings saved in the profile will be automatically loaded.

#### NOTE

The settings saved in DUT profiles are preset by **Mode Preset** or **Meas Preset**.

|                |                                                                                                                 |
|----------------|-----------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:NFIGure:MODE:PROFile &lt;integer&gt;</code><br><code>[ :SENSe]:NFIGure:MODE:PROFile?</code>     |
| Example        | <code>:NFIG:MODE:PROF 1</code>                                                                                  |
| Couplings      | When you change the <b>DUT Profile</b> , the measurement settings saved in the profile are automatically loaded |
| Preset         | 1                                                                                                               |
| State Saved    | Yes                                                                                                             |
| Min            | 1                                                                                                               |
| Max            | 12                                                                                                              |

### More Information

The following settings are included in a DUT profile:

#### Meas Setup

All settings under:

- DUT Setup & Calibration, Measurement
- Ext LO Setup
- Cal Setup



### 3 Noise Figure Mode

#### 3.7 Meas Setup

|           |                                     |
|-----------|-------------------------------------|
|           | - Noise Source                      |
|           | - Loss Comp                         |
| Frequency | All settings under <b>Frequency</b> |
| Amplitude | Internal Preamp, Attenuation        |
| BW        | Res BW                              |
| Sweep     | Avg Time/Pt                         |

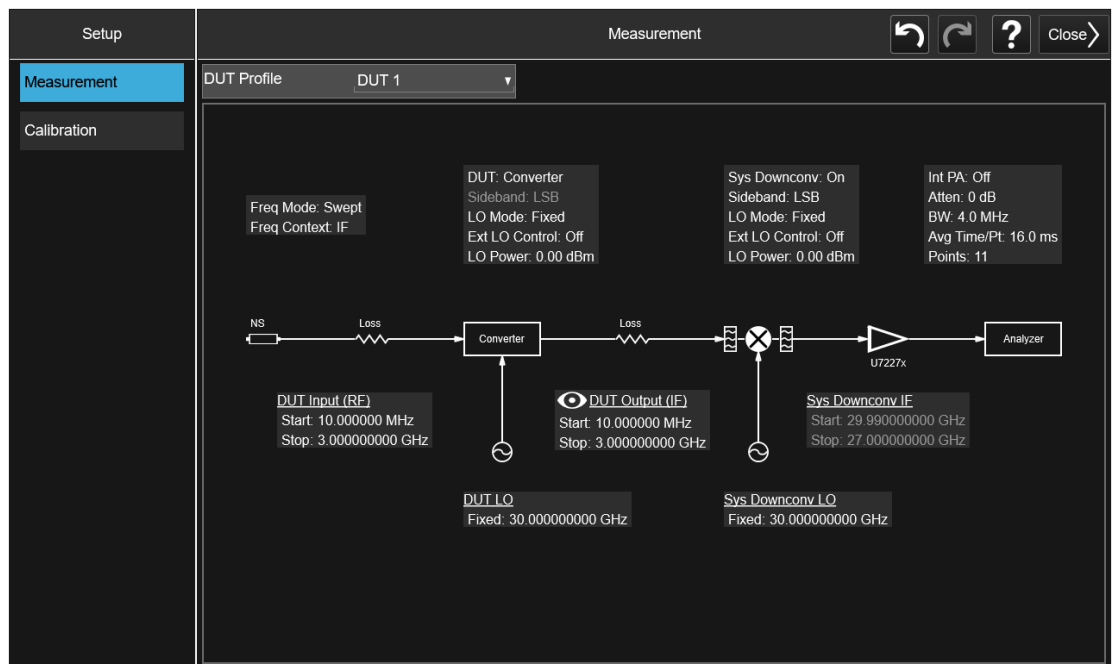
The DUT profile also contains Cal Data and Calibration Status. Cal Data is saved to the DUT profile when you perform a calibration on that profile using ["Profile Calibration" on page 256](#) under the **DUT Setup & Calibration, Calibration** tab.

#### 3.7.1.4 DUT Setup & Calibration

Lets you prepare the application for measuring specific devices and setups. It also provides information about how to set up the instrumentation for calibration and measurement.

**Noise Figure** can measure a wide range of different device types. Figuring out how to connect each of these devices for calibration and measurement is not immediately obvious, so to simplify things, diagrams are provided.

The IF/RF frequencies are displayed below the diagram (and the LO frequency or Factor if appropriate). A small 'eye' icon is displayed next to the frequencies that are used. This can be toggled between **RF/IF/LO** using ["Freq Context" on page 218](#).



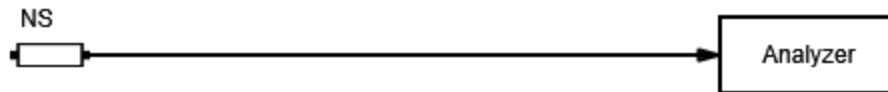
To allow you to change the DUT profile easily, there is a shortcut to the **DUT Profile** parameter in each tab..

In the **Measurement** tab, there is a **DUT Setup** diagram that tells you how to set up the connection. There are four groups of parameters at the top of the **DUT Setup** diagram. Parameters in the left group are **Frequency** parameters; parameters in the middle two groups are **DUT** parameters and System down converter parameters; parameters in the right group are **Analyzer** parameters. The **Analyzer** parameter group displays several important measurement settings, which can also be found under **Amplitude**, **BW** and **Sweep** panels.

The measurement related frequencies are displayed below the **DUT Setup** diagram. The blue eyeball icon goes with "**Freq Context**" on page 218), when **Freq Context** = **RF**, the eyeball is displayed next to the DUT Input (RF) frequencies. Similarly, for IF and LO, the eyeball is near the LO and the DUT Output (IF) frequencies.

In the **Calibration** tab, there is a **Calibration Setup** diagram that tells you how to set up the connection for calibration. There is a group of check boxes at the bottom, which lets you do a calibration using the settings saved in selected DUT profiles. The Cal Data is saved into each selected profile when the calibration is finished. When you change the profile, the Cal Data is loaded automatically, and Apply Cal is set to **ON**.

The diagrams update in real-time as the settings on the form are changed, and the respective Calibration or Measurement diagram is displayed depending on the selection made in the form.



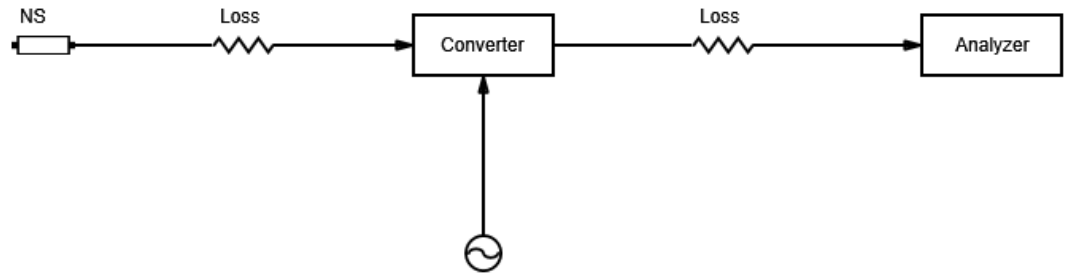
Calibration Diagram



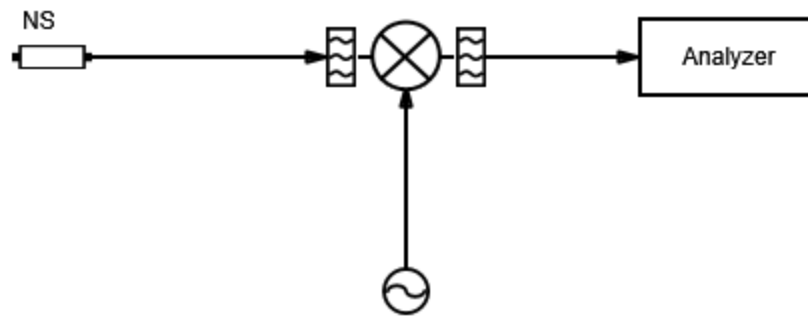
Amplifier Measurement Diagram

### 3 Noise Figure Mode

#### 3.7 Meas Setup

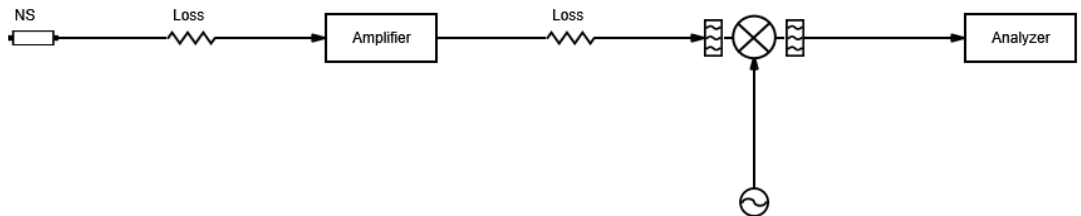


Frequency Converter Measurement Diagram

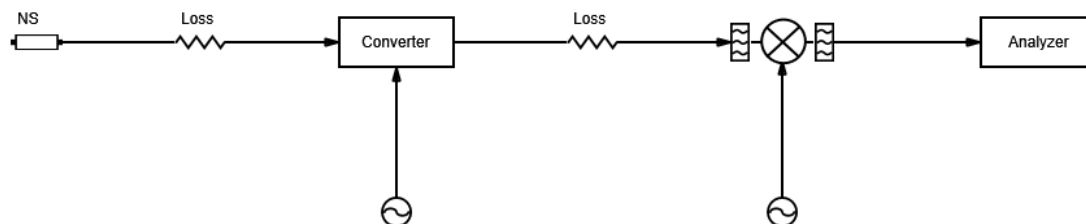


System Downconverter Calibration Diagram

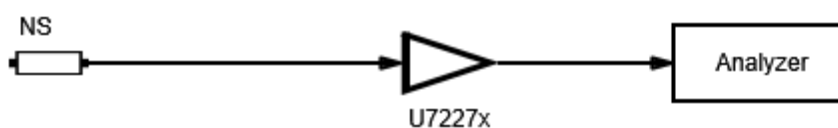
For DSB measurements in System Downconverter mode, the filter at the RF port is removed from the diagram. This can be misleading, because this filter is normally used to remove one of the sidebands. In some cases, the LPF at the output of the mixer is not needed if the 3.6 GHz LPF in the RF front end of signal analyzer will suffice.



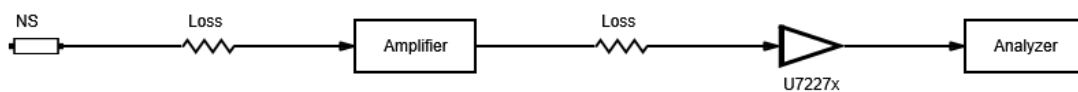
System Downconverter Measurement Diagram



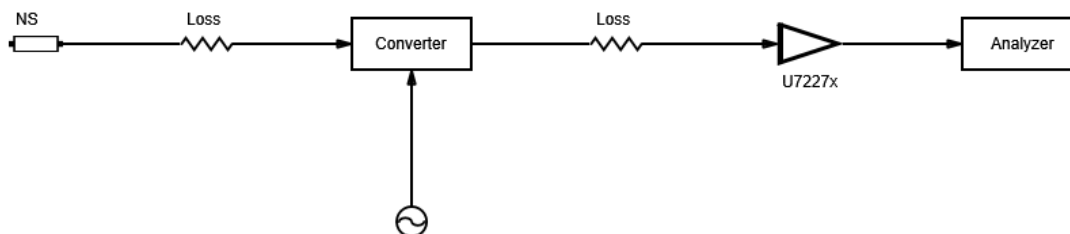
Frequency Converter with System Downconverter Diagram



USB Preamp Calibration Diagram



Amplifier with USB Preamp Measurement Diagram



Frequency Converter with USB Preamp Measurement Diagram

## DUT Profile

This is the same as "DUT Profile" on page 212 under **Settings**.

## Measurement

Displays the block diagram for the measurement and lets you change some parameters.

The SCPI is for Backwards Compatibility only.

|                         |                                              |
|-------------------------|----------------------------------------------|
| Example                 | :NFIG:MODE:DIAG MEAS                         |
| Backwards Compatibility | [ :SENSe ] :NFIGure:MODE:DIAGram MEASurement |
| SCPI                    | [ :SENSe ] :NFIGure:MODE:DIAGram?            |

## Freq Block

Contains controls that let you set "Freq Mode" on page 191 and Context.

## Frequency Mode

Provides a shortcut to "Freq Mode" on page 191 in Frequency.

When the frequency mode is set to LIST via the DUT Setup form, the form and the menus do not change. The Frequency List Editor can be opened from the "Frequency" on page 191 menu.

Editing the frequency list updates the start/stop frequencies in the DUT form to match, depending on which one is in the frequency context (see "Freq Context" on page 218). Changing the frequencies in the frequency list does not update the start, stop, center and span frequencies under Frequency. They are only altered when in SWEpt frequency mode. This is how the instrument operates.

If the DUT setup requires a frequency conversion (down, up, system down converter), then the frequency context is important to the frequency list. When the Freq LIST mode is selected and the Freq Context is changed, an advisory message is displayed warning that frequencies in the Frequency menu will change. The frequencies in the list are recalculated in keeping with the new context. The previous frequencies can be recovered if the original context is restored. There are conditions where you may change context, then the sideband and then restoring the original context will not obtain the original frequency list. This original frequency list can however be restored by retracing your steps.

NOTE

When DUT is MCONverter, you must specify the RF, IF and LO (if DUT LO is Swept) frequency list respectively. Switching DUT types does not change the frequency lists for the MCONverter, that is, when you switch to MCONverter from other DUT types, RF, IF and LO frequency lists will be restored to the latest values.

See "DUT Block" on page 219 for more details on how to specify the frequency for an MCONverter.

## Freq Context

Defines the way frequencies are shown in the results window when using a frequency converting device:

|                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>RF</b>            | Frequencies are displayed as they are before they enter the DUT and before any frequency conversion takes place. In the case of Sideband = DSB measurements, the RF frequencies represented are only that of the LSB Start and Stop range. If a frequency conversion is taking place, then the RF frequencies are not the ones being measured at the signal analyzer RF input port                                                                                                                              |
| <b>IF</b>            | Frequencies are displayed as they are when they leave the DUT after the conversion takes place. If a system downconverter is not used, these are the frequencies that the instrument is physically measuring. If a system downconverter is used, these are the frequencies that enter the system downconverter                                                                                                                                                                                                  |
| <b>LO</b>            | Frequencies at the DUT's external LO are displayed. These are NOT the frequencies that the instrument is physically measuring. This context lets you review the LO frequencies required to program the external LO or those set by the instrument. The LO context is only selectable when the DUT's external LO frequency mode is swept                                                                                                                                                                         |
| <b>SysDownConvLO</b> | Frequencies at the system downconverter's external LO are displayed. DSB system downconverter measurements have implicit linear averaging of DUT characteristics and ENR values between the USB and LSB frequencies. Results are made against the average frequency of the two bands – the system downconverter LO frequency. The <b>SysDownConvLO</b> context is only selectable when the DUT is set to <b>Amplifier</b> , system downconverter is in use, and the system downconverter sideband is set to DSB |

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:NFIGure:MODE:FREQuency:CONText RF   IF   LO   SYSDwnconvLo</code><br><code>[ :SENSe]:NFIGure:MODE:FREQuency:CONText?</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Example        | <code>:NFIG:MODE:FREQ:CONT RF</code><br><code>:NFIG:MODE:FREQ:CONT?</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Couplings      | <p>Disabled (grayed-out) when "DUT" on page 219 is <b>AMPLifier</b>, and when System Downconverter is <i>not</i> in use with DSB. Context in this case defaults to <b>RF</b></p> <p>When DUT is <b>AMPLifier</b>, and System Downconverter <i>is</i> in use with DSB, the frequency context is enabled. The <b>RF</b> and <b>SysDownConvLO</b> contexts are available. Context in this case defaults to <b>RF</b></p> <p>When DUT is <b>DOWNconv</b> or <b>UPConv</b>, the context defaults to <b>IF</b> if the LO <b>Freq Mode</b> in the DUT group is set to <b>FIXed</b>. The context defaults to <b>RF</b> if the LO <b>Freq Mode</b> in the DUT group is set to <b>SWEPT</b></p> <p>A small 'eye' icon is displayed next to the current context frequencies</p> <p>The frequencies under <b>Frequency</b> are changed to match the frequencies of the selected context. For example: if context is <b>IF</b>, then changed to <b>RF</b>, the RF frequencies shown in the diagram remain the same, but the frequencies set under the <b>Frequency</b> key change to reflect RF frequencies</p> <p>Context can be set to <b>LOonly</b> when the LO <b>Freq Mode</b> in the DUT group is set to <b>SWEPT</b>, and the DUT is</p> |

|                              |                                                                                                               |
|------------------------------|---------------------------------------------------------------------------------------------------------------|
|                              | <b>DOWNconv, UPConv or MCONverter</b><br>A Panel in the Meas Bar displays the context, for example, FREQ = RF |
| Preset                       | RF (Amplifier), IF (Downconv, Fixed LO), RF (Downconv, Swept LO) IF (Upconv, fixed LO), RF (Upconv, Swept LO) |
| Range                        | <b>RF   IF   LO   SYSDwnconvLO</b>                                                                            |
| Annunciation                 | FREQ=RF   FREQ=IF   FREQ=LO   FREQ = Sys DownConv LO                                                          |
| Backwards Compatibility SCPI | <b>[ :SENSe ] :CONFigure:MODE:DOWNconv   SYSTem   UPConv:FREQuency:CONText</b>                                |

DUT Block

Contains controls pertinent to the DUT.

DUT

Lets you select the type of DUT to be measured:

|                         |                   |
|-------------------------|-------------------|
| Amplifier               | <b>AMPLifier</b>  |
| Down Converter          | <b>DOWNconv</b>   |
| Up Converter            | <b>UPConv</b>     |
| Converter (Multi-stage) | <b>MCONverter</b> |

The DUT type **MCONverter** represents a combination of multi-stage converters, which perform internal frequency conversion. For this type of DUT, the frequency range is *not* calculated or checked, so you must set both the input, output, and LO frequency ranges respectively and correctly.

NOTE

1. DSB frequency converting device should not be used in the combination of converters

2. Only one Swept LO is allowed to connect to a converting device in the combination

|                |                                                                                                                                                                                                                                                                                                                                                                                                                  |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <b>[ :SENSe ] :NFIGure:MODE:DUT AMPLifier   DOWNconv   UPConv   MCONverter</b><br><b>[ :SENSe ] :NFIGure:MODE:DUT?</b>                                                                                                                                                                                                                                                                                           |
| Example        | <b>:NFIG:MODE:DUT AMPL</b><br><b>:NFIG:MODE:DUT?</b>                                                                                                                                                                                                                                                                                                                                                             |
| Couplings      | When "DUT" on page 219 is <b>AMPLifier</b> and System Downconverter is <i>not</i> in use with DSB, "Freq Context" on page 218 is automatically set to <b>RF</b> and grayed-out<br>When DUT is <b>AMPLifier</b> , and System Downconverter <i>is</i> in use with DSB, the frequency context is enabled. The <b>RF</b> and <b>SysDownConvLO</b> contexts are available. Context in this case defaults to <b>RF</b> |

|                              |                                                                                                                                                                                                                                                                                                                                            |
|------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                              | <p>When <b>DUT</b> is <b>AMPLifier</b>, the Sideband and LO "<b>Freq Mode</b>" on page 191 in the DUT group are disabled (grayed-out)</p> <p>When <b>DUT</b> is <b>UPConv</b>, the DSB sideband option in the DUT group is invalid</p> <p>When <b>DUT</b> is <b>MCONverter</b>, the Sideband in the DUT group is disabled (grayed-out)</p> |
| Preset                       | <b>AMPLifier</b>                                                                                                                                                                                                                                                                                                                           |
| State Saved                  | Yes                                                                                                                                                                                                                                                                                                                                        |
| Range                        | <b>AMPLifier</b>   <b>DOWNconv</b>   <b>UPConv</b>   <b>MCONverter</b>                                                                                                                                                                                                                                                                     |
| Annunciation                 | DUT: Amplifier   DUT: Downconv   DUT: Upconv   DUT: Converter                                                                                                                                                                                                                                                                              |
| Backwards Compatibility SCPI | <b>[ :SENSe ] : CONFigure : MODE : DUT</b><br>(PSA/ESA/NFA/FSP)                                                                                                                                                                                                                                                                            |

### DUT Setup Scenarios

The following table summarizes each of the parameters and display items for each DUT type.

| DUT Type             | Sys Down Conv | LO Type | Sideband | Context | DUT Setup Diagram |                |          |          |          |              |                |
|----------------------|---------------|---------|----------|---------|-------------------|----------------|----------|----------|----------|--------------|----------------|
|                      |               |         |          |         | RF Freqs          | IF Freqs       | Lo Freqs | Cal ENR  | Meas ENR | Display Freq | Tuned Freq     |
| Amplifier            | Off           | ---     | ---      | RF only | RF Freqs          | IF Freqs       | ---      | RF Freqs | RF Freqs | IF Freqs     | IF Freqs       |
| Default Context = RF |               |         |          |         |                   |                |          |          |          |              |                |
| Amplifier            | On            | Fixed   | LSB      | RF only | RF Freqs          | IF Freqs Hi-Lo | LO Fixed | RF Freqs | RF Freqs | RF Freqs     | IF Freqs Hi-Lo |
| Default Context = RF |               |         | USB      | RF only | RF Freqs          | IF Freqs       | LO Fixed | RF Freqs | RF Freqs | RF Freqs     | IF Freqs       |
|                      |               |         | DSB      | RF      | RF Freqs          | IF Freqs Hi-Lo | LO Fixed | LO Fixed | LO Fixed | RF Freqs     | IF Freqs Hi-Lo |
| Amplifier            | On            | Var     | LSB      | RF only | RF Freqs          | IF Fixed       | LO Freqs | RF Freqs | RF Freqs | RF Freqs     | IF Fixed       |
| Default Context =    |               |         | USB      | RF only | RF Freq           | IF Fixed       | LO Freq  | RF Freq  | RF Freq  | RF Freqs     | IF Fixed       |



3 Noise Figure Mode  
3.7 Meas Setup

| DUT Type             | Sys Down Conv | LO Type | Sideband | Context | DUT Setup Diagram |                |          |                |                |              |                |
|----------------------|---------------|---------|----------|---------|-------------------|----------------|----------|----------------|----------------|--------------|----------------|
|                      |               |         |          |         | RF Freqs          | IF Freqs       | Lo Freqs | Cal ENR        | Meas ENR       | Display Freq | Tuned Freq     |
| RF                   |               |         | DSB      | RF      | s                 |                | s        | s              | s              |              |                |
|                      |               |         |          |         | RF Freqs          | IF Fixed       | LO Freqs | LO Freqs       | LO Freqs       | RF Freqs     | IF Fixed       |
| Downconv             | Off           | Fixed   | LSB      | RF      | RF Freqs          | IF Freqs Hi-Lo | LO Fixed | IF Freqs Hi-Lo | RF Freqs       | RF Freqs     | IF Freqs Hi-Lo |
| Default Context = IF |               |         | LSB      | IF      | RF Freqs Hi-Lo    | IF Freqs       | LO Fixed | IF Freqs       | RF Freqs Hi-Lo | IF Freqs     | IF Freqs       |
|                      |               |         | USB      | RF      | RF Freqs          | IF Freqs       | LO Fixed | IF Freqs       | RF Freqs       | RF Freqs     | IF Freqs       |
|                      |               |         | USB      | IF      | RF Freqs          | IF Freqs       | LO Fixed | IF Freqs       | RF Freqs       | IF Freqs     | IF Freqs       |
|                      |               |         | DSB      | RF      | RF Freqs          | IF Freqs Hi-Lo | LO Fixed | IF Freqs Hi-Lo | LO Fixed       | RF Freqs     | IF Freqs Hi-Lo |
|                      |               |         | DSB      | IF      | RF Freqs Hi-Lo    | IF Freqs       | LO Fixed | IF Freqs       | LO Fixed       | RF Freqs     | IF Freqs       |
| Downconv             | Off           | Var     | LSB      | RF      | RF Freqs          | IF Fixed       | LO Freqs | IF Fixed       | RF Freqs       | RF Freqs     | IF Fixed       |
| Default Context = RF |               |         | LSB      | LO      | RF Freqs          | IF Fixed       | LO Freqs | IF Fixed       | RF Freqs       | LO Freqs     | IF Fixed       |
|                      |               |         | USB      | RF      | RF Freqs          | IF Fixed       | LO Freqs | IF Fixed       | RF Freqs       | RF Freqs     | IF Fixed       |
|                      |               |         | USB      | LO      | RF Freqs          | IF Fixed       | LO Freqs | IF Fixed       | RF Freqs       | LO Freqs     | IF Fixed       |
|                      |               |         | DSB      | RF      | RF                | IF             | LO       | IF             | LO             | RF           | IF             |

| DUT Type             | Sys Down Conv | LO Type                  | Sideband             | Context | DUT Setup Diagram |                |          |                |                |              |                    |
|----------------------|---------------|--------------------------|----------------------|---------|-------------------|----------------|----------|----------------|----------------|--------------|--------------------|
|                      |               |                          |                      |         | RF Freqs          | IF Freqs       | Lo Freqs | Cal ENR        | Meas ENR       | Display Freq | Tuned Freq         |
| Downconv             | On            | DUT: Fixed<br>Sys: Fixed | DSB                  | LO      | Freqs             | Fixed          | Freqs    | Fixed          | Freqs          | Freqs        | Fixed              |
|                      |               |                          |                      |         | RF Freqs          | IF Fixed       | LO Freqs | IF Fixed       | LO Freqs       | LO Freqs     | IF Fixed           |
| Default Context = IF |               |                          | DUT: LSB<br>Sys: LSB | RF      | RF Freqs          | IF Freqs Hi-Lo | LO Fixed | IF Freqs Hi-Lo | RF Freqs       | RF Freqs     | Sys IF Freqs       |
|                      |               |                          | DUT: LSB<br>Sys: LSB | IF      | RF Freqs Hi-Lo    | IF Freqs       | LO Fixed | IF Freqs       | RF Freqs Hi-Lo | IF Freqs     | Sys IF Freqs Hi-Lo |
|                      |               |                          | DUT: LSB<br>Sys: USB | RF      | RF Freqs          | IF Freqs Hi-Lo | LO Fixed | IF Freqs Hi-Lo | RF Freqs       | RF Freqs     | Sys IF Freqs Hi-Lo |
|                      |               |                          | DUT: LSB<br>Sys: USB | IF      | RF Freqs Hi-Lo    | IF Freqs       | LO Fixed | IF Freqs       | RF Freqs Hi-Lo | IF Freqs     | Sys IF Freqs       |
|                      |               |                          | DUT: USB<br>Sys: LSB | RF      | RF Freqs          | IF Freqs       | LO Fixed | IF Freqs       | RF Freqs       | RF Freqs     | Sys IF Freqs Hi-Lo |
|                      |               |                          | DUT: USB<br>Sys: LSB | IF      | RF Freqs          | IF Freqs       | LO Fixed | IF Freqs       | RF Freqs       | IF Freqs     | Sys IF Freqs Hi-Lo |
|                      |               |                          | DUT: USB<br>Sys: USB | RF      | RF Freqs          | IF Freqs       | LO Fixed | IF Freqs       | RF Freqs       | RF Freqs     | Sys IF Freqs       |
|                      |               |                          | DUT: USB<br>Sys:     | IF      | RF Freqs          | IF Freqs       | LO Fixed | IF Freqs       | RF Freqs       | IF Freqs     | Sys IF Freqs       |

3 Noise Figure Mode  
3.7 Meas Setup

| DUT Type             | Sys Down Conv | LO Type                | Sideband             | Context | DUT Setup Diagram |                |          |                |                |              |                    |
|----------------------|---------------|------------------------|----------------------|---------|-------------------|----------------|----------|----------------|----------------|--------------|--------------------|
|                      |               |                        |                      |         | RF Freqs          | IF Freqs       | Lo Freqs | Cal ENR        | Meas ENR       | Display Freq | Tuned Freq         |
| Downconv             | On            | DUT: Fixed<br>Sys: Var | USB                  | RF      | RF Freqs          | IF Freqs Hi-Lo | LO Fixed | IF Freqs Hi-Lo | LO Fixed       | RF Freqs     | Sys IF Freqs       |
|                      |               |                        | DUT: DSB<br>Sys: LSB |         |                   |                |          |                |                |              |                    |
|                      |               |                        | DUT: DSB<br>Sys: LSB | IF      | RF Freqs Hi-Lo    | IF Freqs       | LO Fixed | IF Freqs       | LO Fixed       | IF Freqs     | Sys IF Freqs Hi-Lo |
|                      |               |                        | DUT: DSB<br>Sys: USB |         |                   |                |          |                |                |              |                    |
|                      |               |                        | DUT: DSB<br>Sys: USB | RF      | RF Freqs          | IF Freqs Hi-Lo | LO Fixed | IF Freqs Hi-Lo | LO Fixed       | RF Freqs     | Sys IF Freqs Hi-Lo |
|                      |               |                        | DUT: DSB<br>Sys: USB |         |                   |                |          |                |                |              |                    |
|                      |               |                        | DUT: DSB<br>Sys: USB | IF      | RF Freqs Hi-Lo    | IF Freqs       | LO Fixed | IF Freqs       | LO Fixed       | IF Freqs     | Sys IF Freqs       |
|                      |               |                        | DUT: DSB<br>Sys: USB |         |                   |                |          |                |                |              |                    |
|                      |               |                        | DUT: DSB<br>Sys: USB | RF      | RF Freqs          | IF Freqs Hi-Lo | LO Fixed | IF Freqs Hi-Lo | RF Freqs       | RF Freqs     | Sys IF Fixed       |
|                      |               |                        | DUT: DSB<br>Sys: USB |         |                   |                |          |                |                |              |                    |
|                      |               |                        | DUT: DSB<br>Sys: USB | IF      | RF Freqs Hi-Lo    | IF Freqs       | LO Fixed | IF Freqs       | RF Freqs Hi-Lo | IF Freqs     | Sys IF Fixed       |
|                      |               |                        | DUT: DSB<br>Sys: USB |         |                   |                |          |                |                |              |                    |
| Default Context = IF |               |                        | DUT: DSB<br>Sys: USB | RF      | RF Freqs          | IF Freqs       | LO Fixed | IF Freqs       | RF Freqs       | RF Freqs     | Sys IF Fixed       |
|                      |               |                        | DUT: DSB<br>Sys: USB |         |                   |                |          |                |                |              |                    |
|                      |               |                        | DUT: DSB<br>Sys: USB | IF      | RF Freqs Hi-Lo    | IF Freqs       | LO Fixed | IF Freqs       | RF Freqs Hi-Lo | IF Freqs     | Sys IF Fixed       |
|                      |               |                        | DUT: DSB<br>Sys: USB |         |                   |                |          |                |                |              |                    |

| DUT Setup Diagram    |               |         |                        |         |                |                |          |                |          |              |              |
|----------------------|---------------|---------|------------------------|---------|----------------|----------------|----------|----------------|----------|--------------|--------------|
| DUT Type             | Sys Down Conv | LO Type | Sideband               | Context | RF Freqs       | IF Freqs       | Lo Freqs | Cal ENR        | Meas ENR | Display Freq | Tuned Freq   |
|                      |               |         | LSB                    | IF      | RF Freqs       | IF Freqs       | LO Fixed | IF Freqs       | RF Freqs | IF Freqs     | Sys IF Fixed |
|                      |               |         | DUT: USB<br>Sys: LSB   |         |                |                |          |                |          |              |              |
|                      |               |         | DUT: USB<br>Sys: USB   | RF      | RF Freqs       | IF Freqs       | LO Fixed | IF Freqs       | RF Freqs | RF Freqs     | Sys IF Fixed |
|                      |               |         |                        |         |                |                |          |                |          |              |              |
|                      |               |         | DUT: USB<br>Sys: USB   | IF      | RF Freqs       | IF Freqs       | LO Fixed | IF Freqs       | RF Freqs | IF Freqs     | Sys IF Fixed |
|                      |               |         |                        |         |                |                |          |                |          |              |              |
|                      |               |         | DUT: DSB<br>Sys: LSB   | RF      | RF Freqs       | IF Freqs Hi-Lo | LO Fixed | IF Freqs Hi-Lo | LO Fixed | RF Freqs     | Sys IF Fixed |
|                      |               |         |                        |         |                |                |          |                |          |              |              |
|                      |               |         | DUT: DSB<br>Sys: LSB   | IF      | RF Freqs Hi-Lo | IF Freqs       | LO Fixed | IF Freqs       | LO Fixed | IF Freqs     | Sys IF Fixed |
|                      |               |         |                        |         |                |                |          |                |          |              |              |
| Downconv             | On            |         | DUT: Var<br>Sys: Fixed | RF      | RF Freqs       | IF Fixed       | LO Freqs | IF Fixed       | RF Freqs | RF Freqs     | Sys IF Fixed |
|                      |               |         |                        |         |                |                |          |                |          |              |              |
|                      |               |         |                        | LO      | RF Freqs       | IF Fixed       | LO Freqs | IF Fixed       | RF Freqs | LO Freqs     | Sys IF Fixed |
|                      |               |         |                        |         |                |                |          |                |          |              |              |
| Default Context = IF |               |         | DUT: LSB<br>Sys: LSB   |         |                |                |          |                |          |              |              |

3 Noise Figure Mode  
3.7 Meas Setup

| DUT Type | Sys<br>Down<br>Conv | LO<br>Type | Sideband    | Context | DUT Setup Diagram |                 |                 |             |                 |                 |                 |
|----------|---------------------|------------|-------------|---------|-------------------|-----------------|-----------------|-------------|-----------------|-----------------|-----------------|
|          |                     |            |             |         | RF<br>Freq<br>s   | IF<br>Freq<br>s | Lo<br>Freq<br>s | Cal<br>ENR  | Meas<br>ENR     | Display<br>Freq | Tuned<br>Freq   |
|          |                     |            | DUT:<br>LSB | RF      | RF<br>Freq<br>s   | IF<br>Fixed     | LO<br>Freq<br>s | IF<br>Fixed | RF<br>Freq<br>s | RF<br>Freqs     | Sys IF<br>Fixed |
|          |                     |            | Sys:<br>USB |         |                   |                 |                 |             |                 |                 |                 |
|          |                     |            | DUT:<br>LSB | LO      | RF<br>Freq<br>s   | IF<br>Fixed     | LO<br>Freq<br>s | IF<br>Fixed | RF<br>Freq<br>s | LO<br>Freqs     | Sys IF<br>Fixed |
|          |                     |            | Sys:<br>USB |         |                   |                 |                 |             |                 |                 |                 |
|          |                     |            | DUT:<br>USB | RF      | RF<br>Freq<br>s   | IF<br>Fixed     | LO<br>Freq<br>s | IF<br>Fixed | RF<br>Freq<br>s | RF<br>Freqs     | Sys IF<br>Fixed |
|          |                     |            | Sys:<br>LSB |         |                   |                 |                 |             |                 |                 |                 |
|          |                     |            | DUT:<br>USB | LO      | RF<br>Freq<br>s   | IF<br>Fixed     | LO<br>Freq<br>s | IF<br>Fixed | RF<br>Freq<br>s | LO<br>Freqs     | Sys IF<br>Fixed |
|          |                     |            | Sys:<br>LSB |         |                   |                 |                 |             |                 |                 |                 |
|          |                     |            | DUT:<br>USB | RF      | RF<br>Freq<br>s   | IF<br>Fixed     | LO<br>Freq<br>s | IF<br>Fixed | RF<br>Freq<br>s | RF<br>Freqs     | Sys IF<br>Fixed |
|          |                     |            | Sys:<br>USB |         |                   |                 |                 |             |                 |                 |                 |
|          |                     |            | DUT:<br>USB | LO      | RF<br>Freq<br>s   | IF<br>Fixed     | LO<br>Freq<br>s | IF<br>Fixed | RF<br>Freq<br>s | LO<br>Freqs     | Sys IF<br>Fixed |
|          |                     |            | Sys:<br>USB |         |                   |                 |                 |             |                 |                 |                 |
|          |                     |            | DUT:<br>DSB | RF      | RF<br>Freq<br>s   | IF<br>Fixed     | LO<br>Freq<br>s | IF<br>Fixed | LO<br>Freq<br>s | RF<br>Freqs     | Sys IF<br>Fixed |
|          |                     |            | Sys:<br>LSB |         |                   |                 |                 |             |                 |                 |                 |
|          |                     |            | DUT:<br>DSB | LO      | RF<br>Freq<br>s   | IF<br>Fixed     | LO<br>Freq<br>s | IF<br>Fixed | LO<br>Freq<br>s | LO<br>Freqs     | Sys IF<br>Fixed |
|          |                     |            | Sys:<br>LSB |         |                   |                 |                 |             |                 |                 |                 |
|          |                     |            | DUT:<br>DSB | RF      | RF<br>Freq<br>s   | IF<br>Fixed     | LO<br>Freq<br>s | IF<br>Fixed | LO<br>Freq<br>s | RF<br>Freqs     | Sys IF<br>Fixed |
|          |                     |            | Sys:<br>USB |         |                   |                 |                 |             |                 |                 |                 |
|          |                     |            | DUT:        | LO      | RF                | IF              | LO              | IF          | LO              | LO              | Sys IF          |

|          |               |            |                      |         | DUT Setup Diagram |                |                |                |                |              |                |
|----------|---------------|------------|----------------------|---------|-------------------|----------------|----------------|----------------|----------------|--------------|----------------|
| DUT Type | Sys Down Conv | LO Type    | Sideband             | Context | RF Freqs          | IF Freqs       | Lo Freqs       | Cal ENR        | Meas ENR       | Display Freq | Tuned Freq     |
| Upconv   | Off           | Fixed      | DSB                  |         | Freqs             | Fixed          | Freqs          | Fixed          | Freqs          | Freqs        | Fixed          |
|          |               |            | Sys: USB             |         |                   |                |                |                |                |              |                |
|          |               |            | LSB                  | RF      | RF Freqs          | IF Freqs Hi-Lo | LO Fixed       | IF Freqs Hi-Lo | RF Freqs       | RF Freqs     | IF Freqs Hi-Lo |
|          |               |            | Default Context = IF |         |                   |                |                |                |                |              |                |
|          |               |            | LSB                  | IF      | RF Freqs Hi-Lo    | IF Freqs       | LO Fixed       | IF Freqs       | RF Freqs Hi-Lo | IF Freqs     | IF Freqs       |
| Upconv   | Off           | Var        | USB                  | RF      | RF Freqs          | IF Freqs       | LO Fixed       | IF Freqs       | RF Freqs       | RF Freqs     | IF Freqs       |
|          |               |            | USB                  | IF      | RF Freqs          | IF Freqs       | LO Fixed       | IF Freqs       | RF Freqs       | IF Freqs     | IF Freqs       |
|          |               |            | DSB                  | ---     | ---               | ---            | ---            | ---            | ---            | ---          | ---            |
|          |               |            | DSB                  | ---     | ---               | ---            | ---            | ---            | ---            | ---          | ---            |
|          |               |            | LSB                  | RF      | RF Freqs          | IF Fixed       | LO Freqs       | IF Fixed       | RF Freqs       | RF Freqs     | IF Fixed       |
| Upconv   | On            | DUT: Fixed | LSB                  | LO      | RF Freqs          | IF Fixed       | LO Freqs       | IF Fixed       | RF Freqs       | LO Freqs     | IF Fixed       |
|          |               |            | USB                  | RF      | RF Freqs          | IF Fixed       | LO Freqs Hi-Lo | IF Fixed       | RF Freqs       | RF Freqs     | IF Fixed       |
|          |               |            | USB                  | LO      | RF Freqs Hi-Lo    | IF Fixed       | LO Freqs       | IF Fixed       | RF Freqs Hi-Lo | LO Freqs     | IF Fixed       |
|          |               |            | DSB                  | ---     | ---               | ---            | ---            | ---            | ---            | ---          | ---            |
|          |               |            | DSB                  | ---     | ---               | ---            | ---            | ---            | ---            | ---          | ---            |
| Upconv   | On            | DUT: Fixed | DUT: LSB Sys:        | RF      | RF Freqs          | IF Freqs Hi-   | LO Fixed       | IF Freqs Hi-   | RF Freqs       | RF Freqs     | Sys IF Freqs   |

3 Noise Figure Mode  
3.7 Meas Setup

| DUT Type                   | Sys Down Conv | DUT Setup Diagram      |          |         |                     |                     |          |                     |                     |              |                       |
|----------------------------|---------------|------------------------|----------|---------|---------------------|---------------------|----------|---------------------|---------------------|--------------|-----------------------|
|                            |               | LO Type                | Sideband | Context | RF Freqs            | IF Freqs            | Lo Freqs | Cal ENR             | Meas ENR            | Display Freq | Tuned Freq            |
| Default<br>Context =<br>RF |               | Sys:<br>Fixed          | LSB      |         |                     |                     | Lo       | Lo                  |                     |              |                       |
|                            |               |                        | DUT: LSB |         |                     |                     |          |                     |                     |              |                       |
|                            |               |                        | Sys: LSB | IF      | RF Freqs<br>s Hi-Lo | IF Freqs            | LO Fixed | IF Freqs            | RF Freqs<br>s Hi-Lo | IF Freqs     | Sys IF Freqs<br>Hi-Lo |
|                            |               |                        | DUT: LSB |         |                     |                     |          |                     |                     |              |                       |
|                            |               |                        | Sys: USB | RF      | RF Freqs            | IF Freqs<br>s Hi-Lo | LO Fixed | IF Freqs<br>s Hi-Lo | RF Freqs            | RF Freqs     | Sys IF Freqs<br>Hi-Lo |
|                            |               |                        | DUT: USB |         |                     |                     |          |                     |                     |              |                       |
|                            |               |                        | Sys: USB | IF      | RF Freqs<br>s Hi-Lo | IF Freqs            | LO Fixed | IF Freqs            | RF Freqs<br>s Hi-Lo | IF Freqs     | Sys IF Freqs          |
|                            |               |                        | DUT: USB |         |                     |                     |          |                     |                     |              |                       |
|                            |               |                        | Sys: LSB | RF      | RF Freqs            | IF Freqs            | LO Fixed | IF Freqs            | RF Freqs            | RF Freqs     | Sys IF Freqs<br>Hi-Lo |
|                            |               |                        | DUT: USB |         |                     |                     |          |                     |                     |              |                       |
|                            |               |                        | Sys: LSB | IF      | RF Freqs            | IF Freqs            | LO Fixed | IF Freqs            | RF Freqs            | IF Freqs     | Sys IF Freqs<br>Hi-Lo |
|                            |               |                        | DUT: USB |         |                     |                     |          |                     |                     |              |                       |
| Upconv                     | On            | DUT: Fixed<br>Sys: Var | DUT: LSB | RF      | RF Freqs            | IF Freqs<br>s Hi-Lo | LO Fixed | IF Freqs<br>s Hi-Lo | RF Freqs            | RF Freqs     | Sys IF Fixed          |
|                            |               |                        | Sys: LSB |         |                     |                     |          |                     |                     |              |                       |
| Default<br>Context =       |               |                        | DUT: LSB | IF      | RF Freq             | IF Freq             | LO Fixed | IF Freq             | RF Freq             | IF Freqs     | Sys IF Fixed          |

| DUT Type             | Sys Down Conv | LO Type                | Sideband | Context | DUT Setup Diagram |                |          |                |                |              |              |
|----------------------|---------------|------------------------|----------|---------|-------------------|----------------|----------|----------------|----------------|--------------|--------------|
|                      |               |                        |          |         | RF Freqs          | IF Freqs       | Lo Freqs | Cal ENR        | Meas ENR       | Display Freq | Tuned Freq   |
| IF                   |               |                        | Sys: LSB | RF      | s Hi-Lo           | s              |          | s              | s Hi-Lo        |              |              |
|                      |               |                        | DUT: LSB |         | RF Freqs          | IF Freqs Hi-Lo | LO Fixed | IF Freqs Hi-Lo | RF Freqs       | RF Freqs     | Sys IF Fixed |
|                      |               |                        | Sys: USB |         |                   |                |          |                |                |              |              |
|                      |               |                        | DUT: LSB | IF      | RF Freqs Hi-Lo    | IF Freqs       | LO Fixed | IF Freqs       | RF Freqs Hi-Lo | IF Freqs     | Sys IF Fixed |
|                      |               |                        | Sys: USB |         |                   |                |          |                |                |              |              |
|                      |               |                        | DUT: USB |         | RF Freqs          | IF Freqs       | LO Fixed | IF Freqs       | RF Freqs       | RF Freqs     | Sys IF Fixed |
|                      |               |                        | Sys: LSB | RF      |                   |                |          |                |                |              |              |
|                      |               |                        | DUT: USB |         | RF Freqs          | IF Freqs       | LO Fixed | IF Freqs       | RF Freqs       | RF Freqs     | Sys IF Fixed |
|                      |               |                        | Sys: USB |         |                   |                |          |                |                |              |              |
|                      |               |                        | DUT: USB | IF      | RF Freqs          | IF Freqs       | LO Fixed | IF Freqs       | RF Freqs       | IF Freqs     | Sys IF Fixed |
|                      |               |                        | Sys: LSB |         |                   |                |          |                |                |              |              |
|                      |               |                        | DUT: USB |         | RF Freqs          | IF Freqs       | LO Fixed | IF Freqs       | RF Freqs       | RF Freqs     | Sys IF Fixed |
| Upconv               | On            | DUT: Var<br>Sys: Fixed | DUT: LSB | RF      | RF Freqs          | IF Fixed       | LO Freqs | IF Fixed       | RF Freqs       | RF Freqs     | Sys IF Fixed |
|                      |               |                        | Sys: LSB |         |                   |                |          |                |                |              |              |
| Default Context = IF |               |                        | DUT: LSB | LO      | RF Freqs          | IF Fixed       | LO Freqs | IF Fixed       | RF Freqs       | LO Freqs     | Sys IF Fixed |
|                      |               |                        | Sys: LSB |         |                   |                |          |                |                |              |              |
|                      |               |                        | DUT: LSB | RF      | RF Freqs          | IF Fixed       | LO Freqs | IF Fixed       | RF Freqs       | RF Freqs     | Sys IF Fixed |
|                      |               |                        | Sys: LSB |         |                   |                |          |                |                |              |              |



3 Noise Figure Mode  
3.7 Meas Setup

| DUT Type   | Sys Down Conv | LO Type    | Sideband             | Context | DUT Setup Diagram |          |                |          |                |              |              |
|------------|---------------|------------|----------------------|---------|-------------------|----------|----------------|----------|----------------|--------------|--------------|
|            |               |            |                      |         | RF Freqs          | IF Freqs | Lo Freqs       | Cal ENR  | Meas ENR       | Display Freq | Tuned Freq   |
| MCONverter | Off           | Fixed      | Sys: USB             | LO      | RF Freqs          | IF Fixed | LO Freqs       | IF Fixed | RF Freqs       | LO Freqs     | Sys IF Fixed |
|            |               |            | DUT: LSB             |         |                   |          |                |          |                |              |              |
|            |               |            | Sys: USB             | RF      | RF Freqs          | IF Fixed | LO Freqs Hi-Lo | IF Fixed | RF Freqs       | RF Freqs     | Sys IF Fixed |
|            |               |            | DUT: USB             |         |                   |          |                |          |                |              |              |
|            |               |            | Sys: LSB             | LO      | RF Freqs Hi-Lo    | IF Fixed | LO Freqs       | IF Fixed | RF Freqs Hi-Lo | LO Freqs     | Sys IF Fixed |
|            |               |            | DUT: USB             |         |                   |          |                |          |                |              |              |
|            |               |            | Sys: LSB             | RF      | RF Freqs          | IF Fixed | LO Freqs Hi-Lo | IF Fixed | RF Freqs       | RF Freqs     | Sys IF Fixed |
|            |               |            | DUT: USB             |         |                   |          |                |          |                |              |              |
| MCONverter | Off           | Fixed      | ---                  | RF      | RF Freqs          | IF Freqs | LO Fixed       | IF Freqs | RF Freqs       | RF Freqs     | IF Freqs     |
|            |               |            | Default Context = RF |         |                   |          |                |          |                |              |              |
| MCONverter | Off           | Var        | ---                  | RF      | RF Freqs          | IF Fixed | LO Freqs       | IF Fixed | RF Freqs       | RF Freqs     | IF Fixed     |
| MCONverter | On            | DUT: Fixed | Sys: LSB             | RF      | RF Freqs          | IF Freqs | LO Fixed       | IF Freqs | RF Freqs       | RF Freqs     | Sys IF Freqs |

| DUT Setup Diagram    |               |                        |          |         |          |          |          |          |          |              |              |
|----------------------|---------------|------------------------|----------|---------|----------|----------|----------|----------|----------|--------------|--------------|
| DUT Type             | Sys Down Conv | LO Type                | Sideband | Context | RF Freqs | IF Freqs | Lo Freqs | Cal ENR  | Meas ENR | Display Freq | Tuned Freq   |
| Default Context = RF |               | Fixed                  | Sys: LSB | IF      | RF Freqs | IF Freqs | LO Fixed | IF Freqs | RF Freqs | RF Freqs     | Sys IF Freqs |
|                      |               |                        | Sys: USB | RF      | RF Freqs | IF Freqs | LO Fixed | IF Freqs | RF Freqs | RF Freqs     | Sys IF Freqs |
|                      |               |                        | Sys: USB | IF      | RF Freqs | IF Freqs | LO Fixed | IF Freqs | RF Freqs | RF Freqs     | Sys IF Freqs |
| MCONverter           | On            | DUT: Fixed<br>Sys: Var | Sys: LSB | RF      | RF Freqs | IF Freqs | LO Fixed | IF Freqs | RF Freqs | RF Freqs     | Sys IF Fixed |
| Default Context = RF |               |                        | Sys: LSB | IF      | RF Freqs | IF Freqs | LO Fixed | IF Freqs | RF Freqs | RF Freqs     | Sys IF Fixed |
|                      |               |                        | Sys: USB | RF      | RF Freqs | IF Freqs | LO Fixed | IF Freqs | RF Freqs | RF Freqs     | Sys IF Fixed |
|                      |               |                        | Sys: USB | IF      | RF Freqs | IF Freqs | LO Fixed | IF Freqs | RF Freqs | RF Freqs     | Sys IF Fixed |
| MCONverter           | On            | DUT: Var<br>Sys: Fixed | Sys: LSB | RF      | RF Freqs | IF Freqs | LO Fixed | IF Freqs | RF Freqs | RF Freqs     | Sys IF Fixed |
| Default Context = RF |               |                        | Sys: USB | RF      | RF Freqs | IF Freqs | LO Fixed | IF Freqs | RF Freqs | RF Freqs     | Sys IF Fixed |

## Sideband (For DUT)

Sets the LO offset of the DUT.

### 3 Noise Figure Mode

#### 3.7 Meas Setup

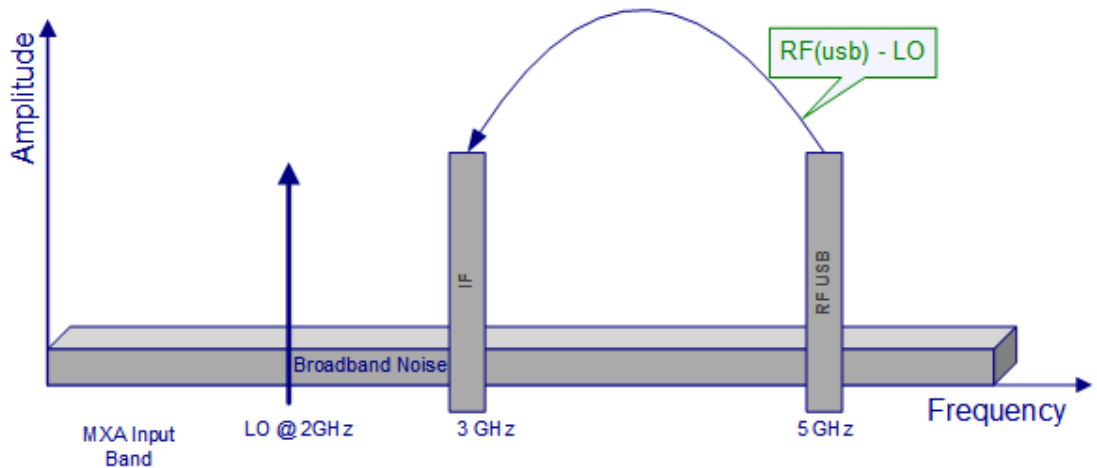
|            |                                                              |
|------------|--------------------------------------------------------------|
| <b>LSB</b> | Lower Sideband (Signal Frequency < LO Frequency)             |
| <b>USB</b> | Upper Sideband (Signal Frequency > LO Frequency)             |
| <b>DSB</b> | Double Sideband (Only available when <b>DUT = DOWNconv</b> ) |
|            | Double sideband means both upper and lower sidebands         |

See ["More Information" on page 231](#)

|                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command               | <code>[ :SENSe]:NFIgure:MODE:DOWNconv UPConv:LOSCillator:OFFSet LSB   USB   DSB</code><br><code>[ :SENSe]:NFIgure:MODE:DOWNconv UPConv:LOSCillator:OFFSet?</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Example                      | <code>:NFIg:MODE:DOWN:LOSC:OFFS LSB</code><br><code>:NFIg:MODE:DOWN:LOSC:OFFS?</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Couplings                    | Valid only when <b>DUT</b> is <b>DOWNconv</b> or <b>UPConv</b><br><b>DSB</b> is valid only when <b>DUT</b> is <b>DOWNconv</b> . Disabled for other <b>DUT</b> types<br>When Sideband, <a href="#">"Freq Context" on page 218</a> and LO <a href="#">"Freq Mode" on page 191</a> are disabled and you try to set them remotely, an advisory message appears "Settings conflict; Parameter only available when .DUT is a downconverter (or upconverter)" number -221<br>When <b>DSB</b> is selected, an advisory message is shown<br>If <b>DSB</b> is selected and the <b>DUT</b> changes to <b>UPConv</b> , <b>LSB</b> is selected by default |
| Preset                       | <b>LSB</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| State Saved                  | Yes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Range                        | <b>LSB   USB   DSB</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Annunciation                 | (LSB USB DSB) added to System Downconverter Annunciation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Backwards Compatibility SCPI | <code>[ :SENSe]:CONFIgure:MODE:DOWNconv UPConv:LOSCillator:OFFSet</code><br>(ESA/PSA/NFA)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |

#### More Information

In most cases, for downconverters, the IF is always lower than the LO, however since mixers perform a sum and difference term, that is, LO-RF and RF-LO, there are corner cases that are still valid where the IF is not less than the LO. See the following diagram, which illustrates such a case.



## DSB

Making accurate measurements using DSB essentially requires that the IF is small, and that the DUT is a broadband device. The main advantage of using DSB is that the filtering requirement is substantially reduced. In the X-Series Signal Analyzer application we will return the values for the LSB only when the RF context (see "[Freq Context](#)" on page 218) is set. When the frequency context is set to SysDownConvLO, the results are returned with RF values equal to the LO. Using DSB is a trade-off between filtering needs and result accuracy.

For DSB measurements, noise from two separated RF bands is mixed into the IF band, where a power addition takes place. Measurements are made with the noise from a pair of separate bands, symmetrically arranged about the LO frequency. The selection of the IF frequency value should be a low frequency. Hence this technique maintains the two bands close together. The reason is to justify making the assumption that the variations in noise source ENR, gain and noise figure are linear between the two bands. This means that the averaging of results for the two bands, due to the power summation, gives a result which can be assigned to the center frequency – the LO frequency.

For the downconverter DUT, the noise from two bands is combined during the measurement, while during calibration, when the DUT was not connected, only one band (at the IF frequency) was used. If the assumptions about the parameters being flat over frequency between the two sidebands are valid, this causes a doubling in power (3.01 dB increase) in noise level during the measurement. This does not happen during calibration. This can be corrected for, using the Loss Compensation facility, and entering Before DUT Value of -3.01 dB and selecting Fixed in the Before DUT field. The DSB power addition occurs for both the Hot and Cold noise from the noise source, and the noise created in the input of the DUT. A temperature value can be assigned to this loss using the Before Temperature. Using the Cold temperature of the noise source (often assumed to be 290 Kelvin) corrects for this, and the X-

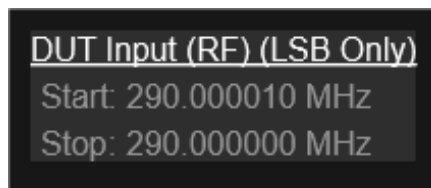
### 3 Noise Figure Mode

#### 3.7 Meas Setup

Series Signal Analyzer will give corrected results comparable to those that would have been given by an SSB measurement.

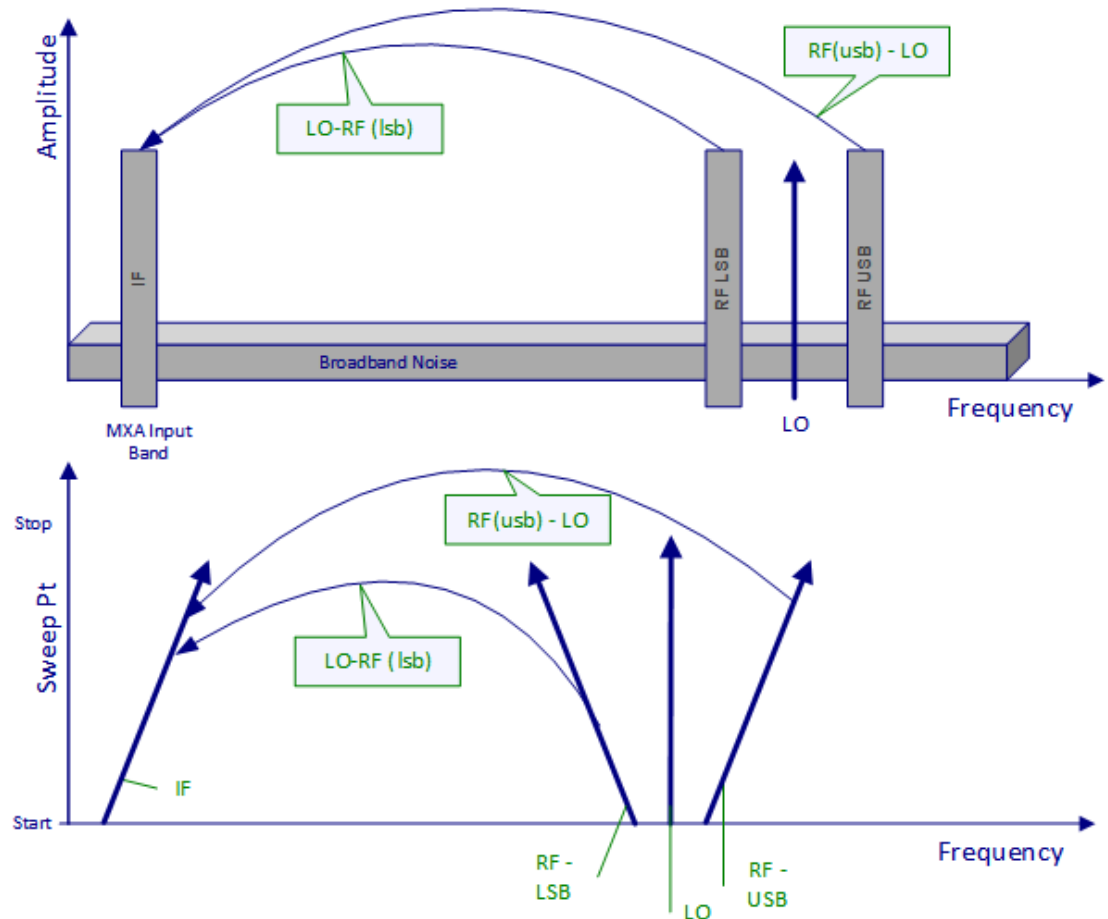
If you must use a high IF frequency, or if it has variations in performance over frequency, then the assumption is invalid. DSB measurements are not appropriate for making measurements where DUT performance, or noise source ENR, have significant variation over the frequency range  $LO \pm IF$ . DSB measurements need care to determine their filtering needs.

In all cases where DSB is selected, advisory message 0.2191 will be displayed and "(LSB only)" will also be appended to the 'RF' label on the DUT setup form to remind users that only the LSB frequencies are displayed.



There are two conditions where DSB could be used.

### DUT = DOWNconv, LO = Fixed



### DSB - Downconv, Fixed LO

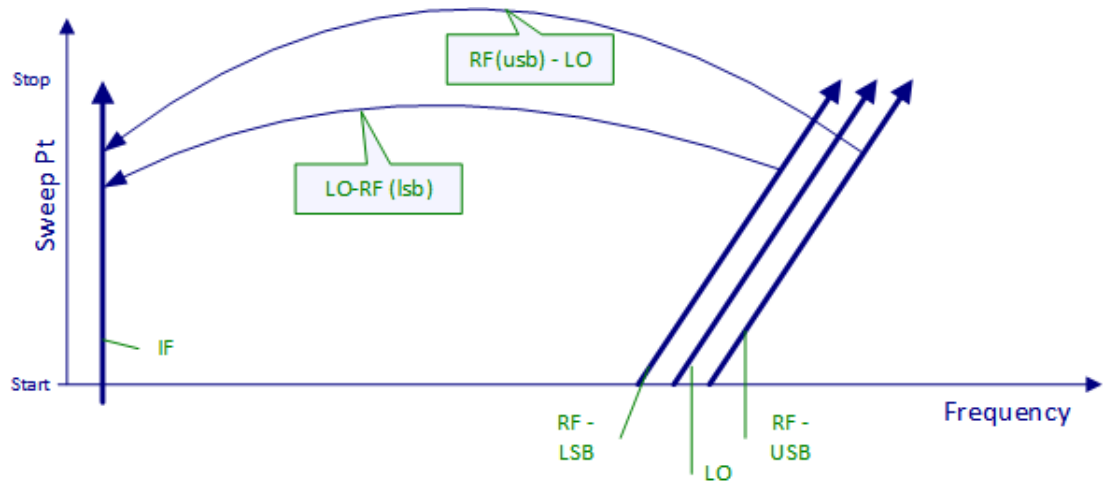
The fixed LO mode produces no sweep at the DUT input, as the two sideband input pairs diverge their average remains fixed. This mode could be useful for measuring a complex DUT where the effect of variation of performance of the post-mixer stage over IF frequency is of interest. Because the LO frequency is held constant it is the IF frequency at the X-Series Signal Analyzer input that is swept. The figure illustrates this mode. Note again that the ENR values for the measurement are taken at the LO frequency that is, effectively the average of both sidebands.

### DUT = DOWNconv, LO = Swept

In the fixed IF (swept LO) mode, the IF frequency at the input of the signal analyzer is constant, and the LO frequency is swept to perform the measurement.

### 3 Noise Figure Mode

#### 3.7 Meas Setup

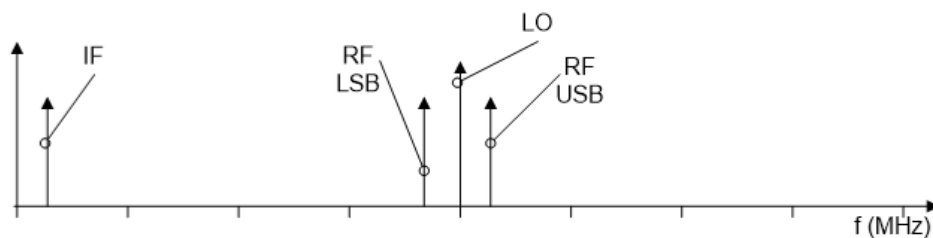


DSB – Downconv, Swept LO. Note Y axis is Sweep Pts.

The figure shows how the different frequencies in a DSB, downconverter, fixed IF, measurement vary as the measurement sweep proceeds. This mode measures the DUT's noise figure across a range of DUT input frequencies. This is the main use of the DSB mode. A similar diagram could be drawn, if needed, showing the LO harmonic mixing modes at higher frequencies, with flatter slopes due to frequency multiplication. Note again that the ENR values for the measurement are taken at the LO frequency, that is, effectively the average of both sidebands.

#### Sideband Interaction

Let's look at some examples as to how Sideband interacts with other DUT setup parameters.



Sidebands

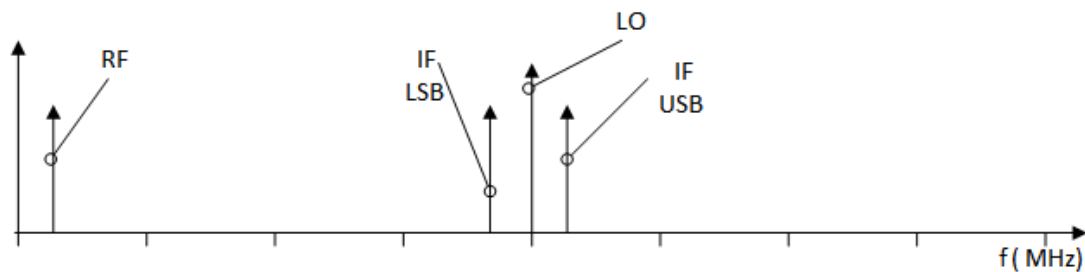
Case 1:

DUT = **DOWNconv**, Sideband = LSB, LO Mode = Fixed, RF is Fixed, Freq Context = RF (default Freq Context is IF). Picture above is valid accept the USB has been filtered out (removed). So, LO and LSB RF mix to give the IF = LO-RF. Let's now say the user now selects USB, what happens? Since the freq context = RF, then the frequency that is auto calculated is the IF frequency leaving the LO and RF untouched. In this

condition the IF cannot change to a frequency that will satisfy these conditions and an error like "System input freq out of range" will be flagged. If, however the Freq Context was IF and the user changed from LSB to USB, then under these conditions the RF is auto calculated and could then change to the USB freq above the LO as shown in the diagram. A similar scenario can be deduced if the RF and IF are both swept. Note the default Freq Context for a downconverter DUT is IF.

Case 2:

DUT = **UPConv**, Sideband = LSB, LO Mode = Fixed, RF is Fixed, Freq Context = RF (default Freq Context is IF). Picture below shows the setup accept the USB has been filtered out (removed). Note the IF and RF terms have been swapped from the above diagram. So, LO and RF mix to give the IF = LO-RF. Let's now say the user now selects USB, what happens? Since the Freq Context = RF, then the frequency that is auto calculated is the IF frequency leaving the LO and RF untouched. Under these conditions the IF is auto calculated and can change to the USB freq above the LO as shown in the diagram below. However, if the Freq Context was IF and the user changed from LSB to USB, then under these conditions the RF cannot change to a frequency that will satisfy these conditions and an error like "System input freq out of range" will be flagged. A similar scenario can be deduced if the RF and IF are both swept. Note the default Freq Context for a downconverter DUT is IF.



Upconverter Sidebands

LO Mode (For DUT)

Set the mode of the external LO frequency for DUT. This can be **FIXed**, where a constant LO frequency is being used, or **SWEPt**, where the LO frequency changes between sweep points.

|                |                                                                                                                                                                                               |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:NFIGure:MODE:DUT:LOSCillator FIXed   SWEPt</code><br><code>[ :SENSe]:NFIGure:MODE:DUT:LOSCillator?</code>                                                                     |
| Example        | <code>:NFIG:MODE:DUT:LOSC FIX</code><br><code>:NFIG:MODE:DUT:LOSC?</code>                                                                                                                     |
| Couplings      | Valid only when "DUT" on page 219 is <b>DOWNconv</b> , <b>UPConv</b> , or <b>MCONverter</b><br>When set to <b>SWEPt</b> (IF is <b>FIXed</b> ), "Freq Context" on page 218 is set to <b>RF</b> |



Changing from **SWEPT** to **FIXed** sets **Freq Context** to **IF**

When **DUT** is **DOWNconv** or **UPConv**, LO Freq Mode in DUT group is set to **SWEPT**, if **Freq Context** is **RF**, LO Frequency start stop are auto-calculated from the RF and IF frequencies. If **Freq Context** is **LO**, then the RF frequencies are auto calculated from the LO and IF frequencies

Changing **LO Freq Mode** in DUT group from **FIXed** to **SWEPT** sets the **LO Freq Mode** in System Downconverter group to **FIXed** automatically if its current setting is **SWEPT**

When "**Freq Mode**" on page 191 is set to **FIXed**, LO Freq Mode in DUT group is set to **FIXed** automatically and grayed-out

When **LO Freq Mode** in DUT group is **FIXed**, **Freq Context** cannot be set to **LO**

|                              |                                                                                                                                     |
|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|
| Preset                       | <b>FIXed</b>                                                                                                                        |
| State Saved                  | Yes                                                                                                                                 |
| Range                        | <b>FIXed</b>   <b>SWEPT</b>                                                                                                         |
| Backwards Compatibility SCPI | <b>[ :SENSe ] :CONFigure:MODE:SYSTem:LOSCillator</b><br>(FSP)<br><b>[ :SENSe ] :CONFigure:MODE:DUT:LOSCillator</b><br>(ESA/PSA/NFA) |

## Ext LO Control (For DUT)

Toggles external LO control on/off for DUT. This is the same as "**DUT LO Control (on/off)**" on page 261.

## LO Power (For DUT)

Lets you set the LO Power. This is the same as "**LO Power**" on page 262.

## Sys Downconv Block

Contains controls pertinent to the System Downconverter.

## Sys Downconv

Selects whether the system downconverter is active. A system downconverter effectively increases the range of the measurement by downconverting high frequencies to those that the instrument can measure. The system downconverter is similar to the standard downconverting DUT, although because it is not actually a part of the DUT, it can be calibrated out of the measurement. This is used normally for testing DUTs outside the range of the signal analyzer or possibly to move the frequencies into the range of the specified (not nominal specs) signal analyzer frequencies.

|                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command               | <code>[ :SENSe]:NFIGure:MODE:SYSTem:DOWNconv[:STATe] ON   OFF   1   0</code><br><code>[ :SENSe]:NFIGure:MODE:SYSTem:DOWNconv[:STATe]?</code>                                                                                                                                                                                                                                                                                                                                                    |
| Example                      | <code>:NFIG:MODE:SYST:DOWN ON</code><br><code>:NFIG:MODE:SYST:DOWN?</code>                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Couplings                    | Disabled (grayed-out) when N9069C-2FP is not installed for <b>DOWNconv</b> or <b>UPConv</b> "DUT" on page 219<br>When <b>Sys Downconv</b> is <b>ON</b> , <b>Internal Cal</b> under the <b>Cal Setup</b> menu is disabled, and the Cal Type is set to <b>User</b> . <b>Apply Calibration</b> then couples correctly if there is no valid user cal data<br>When <b>Sys Downconv</b> is <b>OFF</b> , all parameters in the system downconverter group, except for the Ext LO Control, are disabled |
| Preset                       | <b>OFF</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| State Saved                  | Yes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Range                        | <b>OFF ON 0 1</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Annunciation                 | Sys Downconv Off   Sys Downconv On                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Backwards Compatibility SCPI | <code>[ :SENSe]:CONFIGure:MODE:SYSTem:DOWNconv[:STATe]</code><br>(ESA/PSA/NFA)                                                                                                                                                                                                                                                                                                                                                                                                                  |

## Sideband (For Sys Downconv)

Sets the LO offset of the system downconverter.

|            |                                                                                                                                                                  |
|------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>LSB</b> | Lower Sideband (Signal Frequency < LO Frequency)                                                                                                                 |
| <b>USB</b> | Upper Sideband (Signal Frequency > LO Frequency)                                                                                                                 |
| <b>DSB</b> | Double Sideband (Only available when <b>DUT</b> = <b>AMPLifier</b> and <b>Sys Downconv</b> = <b>ON</b> )<br>Double sideband means both upper and lower sidebands |

|                              |                                                                                                                                                 |
|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command               | <code>[ :SENSe]:NFIGure:MODE:SYSTem:LOSCillator:OFFSet LSB   USB   DSB</code><br><code>[ :SENSe]:NFIGure:MODE:SYSTem:LOSCillator:OFFSet?</code> |
| Example                      | <code>:NFIG:MODE:SYST:LOSC:OFFS LSB</code><br><code>:NFIG:MODE:SYST:LOSC:OFFS?</code>                                                           |
| Couplings                    | Disabled (grayed out) when <b>Sys Downconv</b> is <b>OFF</b><br><b>DSB</b> is only available when "DUT" on page 219 is <b>AMPLifier</b>         |
| Preset                       | <b>LSB</b>                                                                                                                                      |
| State Saved                  | Yes                                                                                                                                             |
| Range                        | <b>LSB   USB   DSB</b>                                                                                                                          |
| Annunciation                 | (LSB   USB   DSB) added to System Downconverter Annunciation                                                                                    |
| Backwards Compatibility SCPI | <code>[ :SENSe]:CONFIGure:MODE:SYSTem:LOSCillator:OFFSet</code><br>(ESA/PSA/NFA)                                                                |

## DSB

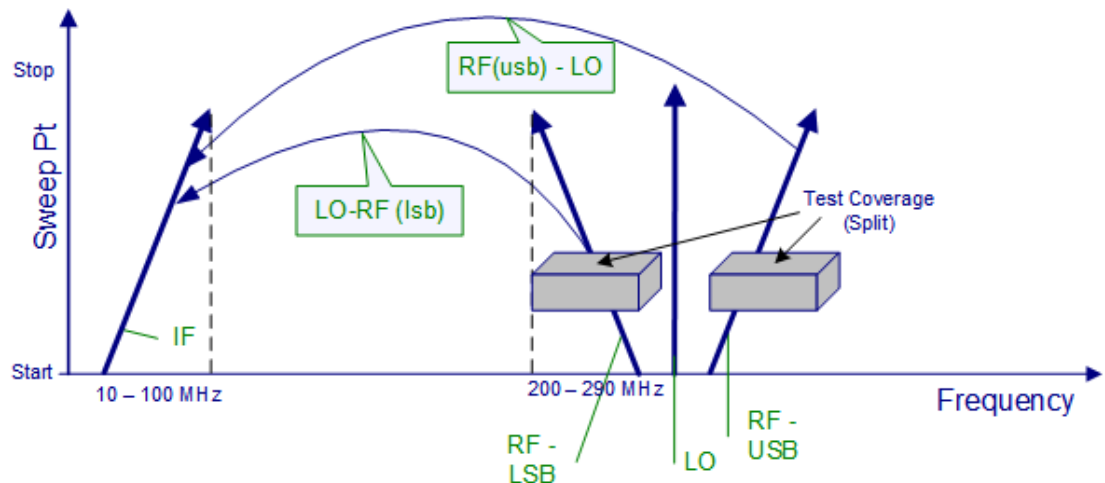
For an Amplifier with a system downconverter, the  $-3.01$  dB adjustment is not needed since the doubling of the power is made in both the calibration stage and the measurement stage.

There are two conditions where DSB could be used.

### DUT = Amplifier, Sys Downconv = ON, LO = Fixed

With the fixed LO, there may be a gap in the coverage of the DUT test (see figure below), and hence will limit the usefulness of the measurement. With the swept LO, fixed IF (assuming the conditions mentioned are met) causes no gaps in the coverage. Another issue here (also the same for downconverter DUT's) is that the values being averaged are getting further apart as the sweep takes place, increasing the possibility of accuracy errors.

X-Series Analyzers do not restrict this mode of operation; however, a warning message is displayed when DSB is selected. You enter the LSB range and the diagram on the DUT setup form shows "(LSB range only)" alerting you to consider the USB, also.

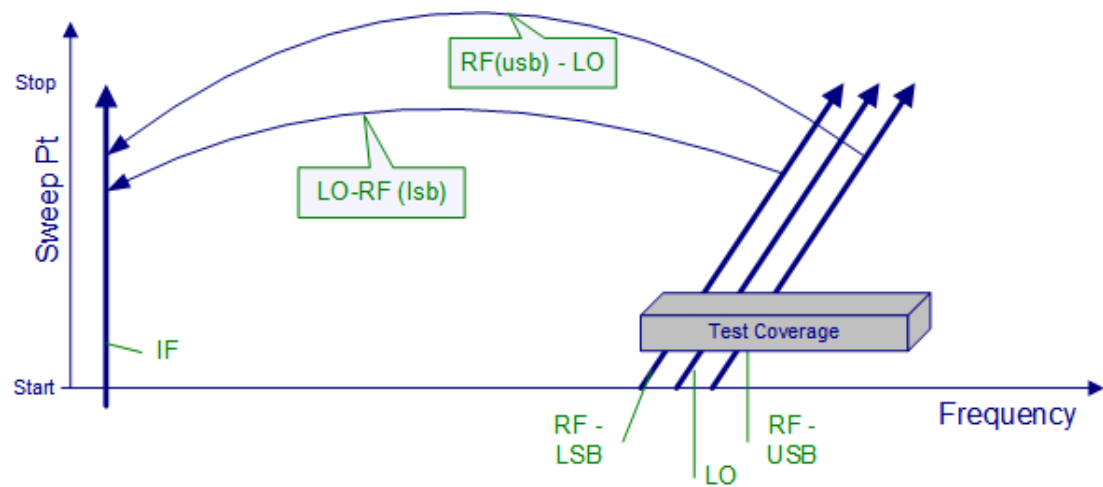


Note that in the amp "test coverage" area the results will effectively be the average of both upper and lower sidebands.

### DUT = Amplifier, Sys Downconv = ON, LO = Swept

This condition is similar to the downconverter DUT above (see figure below), however in this case the DUT is an amplifier and the setting of the sweep span and IF, are important to the results obtained. If the span of the sweep is not large enough compared to the IF, then the results are split into two bands that do not overlap leaving an area in the middle untested. The sweep span needs to be approximately 10 times the IF to allow a sensible overlap. In NFA, the results are returned with the

RF values equal to the LO, so the overlap condition may not be obvious. In the X-Series Signal Analyzer application we return the values for the LSB only when the RF context (see "Freq Context" on page 218) is set. When the frequency context is set to **SysDownConvLO**, the results are returned with RF values equal to the LO.



Note that in the amp "test coverage" area the results will effectively be the average of both upper and lower sidebands.

LO Freq Mode (For Sys Downconv)

Lets you set the mode of the external LO frequency for the system downconverter. This can be **FIXed**, where a constant LO frequency is being used, or **SWEPT**, where the LO frequency changes between sweep points.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:NFIgure:MODE:SYSTem:LOSCillator FIXed   SWEPT</code><br><code>[ :SENSe]:NFIgure:MODE:SYSTem:LOSCillator?</code>                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Example        | <code>:NFIg:MODE:SYST:LOSC FIX</code><br><code>:NFIg:MODE:SYST:LOSC?</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Couplings      | Disabled (grayed-out) when <b>Sys Downconv</b> is <b>OFF</b><br><b>SWEPT</b> is disabled when LO Freq Mode in the DUT group is <b>SWEPT</b><br>When <b>FIXed</b> is selected, the Sys DownConv IF frequency is grayed-out and calculated automatically from the DUT IF and Sys Downconv LO<br>When <b>SWEPT</b> is selected, the Sys Downconv LO frequency is grayed-out and calculated automatically from the DUT IF and Sys Downconv IF<br>Changes to <b>FIXed</b> automatically, and grayed-out, when "Freq Mode" on page 191 is set to <b>FIXed</b> |
| Preset         | <b>FIXed</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| State Saved    | Yes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Range          | <b>FIXed</b>   <b>SWEPT</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |

### Ext LO Control (on/off) (For Sys Downconv)

Toggles the external LO control on/off for the System Downconverter. This is the same as ["DUT LO Control \(on/off\)" on page 261](#).

### LO Power (For Sys Downconv)

Lets you set the LO Power. This is the same as ["LO Power" on page 273](#).

### Misc Block

Contains copies of various controls for your convenience.

### Int Preamp

This is the same as ["Internal Preamp" on page 170](#) under **Amplitude, Signal Path**.

### Mech Atten

This is the same as **Mech Atten** under **Amplitude, Attenuation**.

### Res BW

This is the same as ["Res BW" on page 173](#) under **BW, Settings**.

### Avg Time/Pt

This is the same as ["Avg Time/Pt" on page 356](#) under **Sweep, Sweep/Control**.

### Points

This is the same as ["Points" on page 363](#) under **Sweep, Sweep/Control**.

### RF, LO and IF Frequencies (For DownConv and Upconv)

This section describes the RF, LO and IF frequencies when the DUT is a Downconv or Upconv.

## DUT Input

The DUT Input Start, Stop and Fixed frequencies can be changed via the DUT setup dialog. These parameters mirror those in the **Frequency** menu (see ["Settings" on page 191](#)) when ["Freq Context" on page 218](#) is **RF**. The **Fixed** frequency menu appears only when the LO is **FIXed**, and ["Freq Mode" on page 191](#) is set to **FIXed**.

### DUT Input Start Frequency

Sets the start frequency for a swept RF.

|                |                                                                                                                                                                                                                                                                 |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:NFIGure:FREQuency:START &lt;freq&gt;</code><br><code>[ :SENSe]:NFIGure:FREQuency:START?</code>                                                                                                                                                  |
| Example        | <code>FREQ:NFIG:STAR 11 MHz</code>                                                                                                                                                                                                                              |
| Couplings      | Disabled and hidden when <b>Freq Mode</b> is <b>FIXed</b><br>Grayed-out when <a href="#">"Freq Mode" on page 191</a> is <b>LIST</b><br>Grayed-out when <a href="#">"Freq Context" on page 218</a> is <b>LO</b> or <b>IF</b><br>Coupled to LO and IF frequencies |
| Preset         | 10 MHz                                                                                                                                                                                                                                                          |
| State Saved    | Yes                                                                                                                                                                                                                                                             |
| Min            | 1 Hz                                                                                                                                                                                                                                                            |
| Max            | 329.9 THz                                                                                                                                                                                                                                                       |

### DUT Input Stop Frequency

Sets the stop frequency for a swept RF.

|                |                                                                                                                                                                                                                                                                     |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:NFIGure:FREQuency:STOP &lt;freq&gt;</code><br><code>[ :SENSe]:NFIGure:FREQuency:STOP?</code>                                                                                                                                                        |
| Example        | <code>FREQ:NFIG:STOP 11 MHz</code>                                                                                                                                                                                                                                  |
| Couplings      | Disabled and hidden when <a href="#">"Freq Mode" on page 191</a> is <b>FIXed</b><br>Grayed-out when <b>Freq Mode</b> is <b>LIST</b><br>Grayed-out when <a href="#">"Freq Context" on page 218</a> is <b>LO</b> or <b>IF</b><br>Coupled to the LO and IF frequencies |
| Preset         | 3 GHz                                                                                                                                                                                                                                                               |
| State Saved    | Yes                                                                                                                                                                                                                                                                 |
| Min            | 2 Hz                                                                                                                                                                                                                                                                |
| Max            | 3.30 THz                                                                                                                                                                                                                                                            |

DUT Input Fixed Frequency

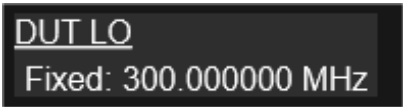
Sets the RF fixed frequency.

|                                 |                                                                                                                                                                |
|---------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command                  | <code>[ :SENSe]:NFIGure:MODE:DOWNconv UPConv:RF:FREQuency &lt;freq&gt;</code><br><code>[ :SENSe]:NFIGure:MODE:DOWNconv UPConv:RF:FREQuency?</code>             |
| Example                         | <code>:NFIG:MODE:DOWN:RF:FREQ 10 MHz</code><br><code>:NFIG:MODE:DOWN:RF:FREQ?</code>                                                                           |
| Couplings                       | Only available when "Freq Mode" on page 191 is <b>FIXed</b><br>Grayed-out when "Freq Context" on page 218 is <b>IF</b><br>Coupled to the LO and IF frequencies |
| Preset                          | 30 GHz                                                                                                                                                         |
| State Saved                     | Yes                                                                                                                                                            |
| Min                             | 1 Hz                                                                                                                                                           |
| Max                             | 3.30 THz                                                                                                                                                       |
| Annunciation                    | LO Freq: <LO Frequency value> when <b>FIXed</b><br>IF Freq: <IF Frequency value> when <b>SWEpt</b>                                                             |
| Backwards Compatibility<br>SCPI | <code>[ :SENSe]:CONFigure:MODE:DOWNconv   UPConv:LOSCillator:FREQuency</code><br>(PSA/NFA/FSP)                                                                 |

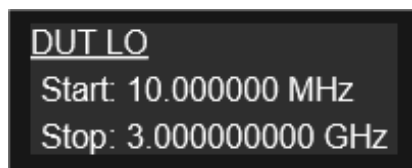
DUT LO

The LO Start, Stop and Fixed frequencies can be changed via the DUT setup form. These parameters mirror those in the **Frequency** menu (see "Settings" on page 191) when "Freq Context" on page 218 is **LO**. If any of the LO frequencies lie outside of the range defined by the LO "Min Freq" on page 266 and "Max Freq" on page 267, message 525 is displayed.

When the LO is fixed, the Start and Stop LO frequencies are disabled and hidden, and the **Fixed** frequency parameter are enabled and displayed for changing the LO frequency.



When the LO is swept, the Start and Stop frequencies are enabled and displayed and the **Fixed** frequency parameter is disabled and hidden.



## LO Start Frequency

Sets the start frequency for a swept LO.

|                |                                                                                                                         |
|----------------|-------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:NFIGure:FREQuency:STARt &lt;freq&gt;</code><br><code>[ :SENSe]:NFIGure:FREQuency:STARt?</code>          |
| Example        | <code>FREQ:NFIG:STAR 11 MHz</code>                                                                                      |
| Couplings      | Disabled and hidden when <b>LO Freq Mode</b> is <b>FIXed</b><br>Coupled to IF and RF frequencies                        |
| Preset         | Depends on IF/RF Frequencies<br>Only displayed when External LO Frequency Mode = <b>SWEpt</b> (Preset is <b>FIXed</b> ) |
| State Saved    | Yes                                                                                                                     |
| Min            | 1 Hz                                                                                                                    |
| Max            | 324.9 GHz                                                                                                               |

## LO Stop Frequency

Sets the stop frequency for a swept LO.

|                |                                                                                                                         |
|----------------|-------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:NFIGure:FREQuency:STOP &lt;freq&gt;</code><br><code>[ :SENSe]:NFIGure:FREQuency:STOP?</code>            |
| Example        | <code>FREQ:NFIG:STOP 11 MHz</code>                                                                                      |
| Couplings      | Disabled and hidden when <b>LO Freq Mode</b> is <b>FIXed</b><br>Coupled to IF and RF frequencies                        |
| Preset         | Depends on IF/RF Frequencies<br>Only displayed when External LO Frequency Mode = <b>SWEpt</b> (Preset is <b>FIXed</b> ) |
| State Saved    | Yes                                                                                                                     |
| Min            | 2 Hz                                                                                                                    |
| Max            | 3.30 THz                                                                                                                |

## LO Fixed Frequency

Sets the External LO frequency when **LO Freq Mode** is set to **FIXed**, when measuring frequency converting devices.



### 3 Noise Figure Mode

#### 3.7 Meas Setup

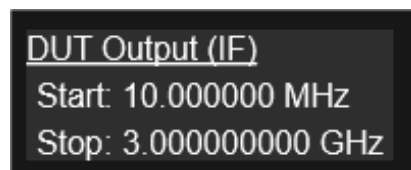
When using a fixed LO, this parameter becomes active along with the frequency in context (RF or IF; see ["Freq Context" on page 218](#)). The frequencies used in the measurement can then be set between this parameter and the RF/IF. When a Swept LO is selected, this parameter is disabled and hidden, and the LO Start and Stop frequency boxes are enabled and displayed to allow swept frequency adjustments.

|                                 |                                                                                                                                                                      |
|---------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command                  | <code>[ :SENSe]:NFIGure:MODE:DOWNconv UPConv:LOSCillator:FREQuency &lt;freq&gt;</code><br><code>[ :SENSe]:NFIGure:MODE:DOWNconv UPConv:LOSCillator:FREQuency?</code> |
| Example                         | <code>:NFIG:MODE:DOWN:LOSC:FREQ 10 MHz</code><br><code>:NFIG:MODE:DOWN:LOSC:FREQ?</code>                                                                             |
| Couplings                       | Only available when <b>LO Freq Mode</b> is <b>FIXed</b><br>Coupled to IF and RF frequencies                                                                          |
| Preset                          | 30 GHz                                                                                                                                                               |
| State Saved                     | Yes                                                                                                                                                                  |
| Min                             | 1 Hz                                                                                                                                                                 |
| Max                             | 3.30 THz                                                                                                                                                             |
| Annunciation                    | LO Freq: <LO Frequency value> when <b>FIXed</b><br>IF Freq: <IF Frequency value> when <b>SWEpt</b>                                                                   |
| Backwards Compatibility<br>SCPI | <code>[ :SENSe]:CONFigure:MODE:DOWNconv   UPConv:LOSCillator:FREQuency</code><br>(PSA/NFA/FSP)                                                                       |

## DUT Output

The IF Start, Stop and Fixed frequencies can be configured via the DUT Setup form. These parameters mirror those in the **Frequency** menu (see ["Settings" on page 191](#)) when ["Freq Context" on page 218](#) is **IF**. The Start and Stop frequencies are only available when the context is IF.

When the DUT setup requires a frequency conversion (downconverter, upconverter), and the External LO Frequency Mode is **FIXed**, and ["Freq Mode" on page 191](#) is **SWEpt**, the IF Start and Stop frequencies are enabled and displayed. The IF Fixed frequency is disabled and hidden.



When the DUT setup requires a frequency conversion (downconverter, upconverter), and the External LO Frequency Mode is **SWEpt** or ["Freq Mode" on page 191](#) is **FIXed**, the Start and Stop frequency parameters are disabled and hidden and the Fixed frequency is enabled and displayed.

**DUT Output (IF)**  
Fixed: 30.000000 MHz

## DUT Output Start Frequency

Sets the start frequency for a swept IF. This parameter is only available when External LO Frequency Mode is **FIXed** and "**Freq Mode**" on page 191 is **SWEpt**.

|                |                                                                                                                                                                                                                   |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:NFIGure:FREQuency:START &lt;freq&gt;</code><br><code>[ :SENSe]:NFIGure:FREQuency:START?</code>                                                                                                    |
| Example        | <code>FREQ:NFIG:STAR 11 MHz</code>                                                                                                                                                                                |
| Couplings      | Disabled and hidden when <b>LO Freq Mode</b> is Swept<br>Disabled and hidden when <b>Freq Mode</b> is <b>FIXed</b><br>Grayed-out when <b>Freq Mode</b> is <b>LIST</b><br>Coupled to RF and LO frequencies         |
| Preset         | 10 MHz                                                                                                                                                                                                            |
| State Saved    | Yes                                                                                                                                                                                                               |
| Min            | 1 Hz                                                                                                                                                                                                              |
| Max            | Hardware Dependent:<br><ul style="list-style-type: none"> <li>– Opt503 = 3.599999990 GHz</li> <li>– Opt508 = 8.399999990 GHz</li> <li>– Opt513 = 13.599999990 GHz</li> <li>– Opt526 = 26.499999990 GHz</li> </ul> |

## DUT Output Stop Frequency

Sets the stop frequency for a swept IF. This parameter is only available when External LO Frequency Mode is **FIXed** and "**Freq Mode**" on page 191 is **SWEpt**.

|                |                                                                                                                                                                                                                  |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:NFIGure:FREQuency:STOP &lt;freq&gt;</code><br><code>[ :SENSe]:NFIGure:FREQuency:STOP?</code>                                                                                                     |
| Example        | <code>FREQ:NFIG:STOP 11 MHz</code>                                                                                                                                                                               |
| Couplings      | Disabled and hidden when <b>LO Freq Mode</b> is <b>SWEpt</b><br>Disabled and hidden when <b>Freq Mode</b> is <b>FIXed</b><br>Grayed-out when <b>Freq Mode</b> is <b>LIST</b><br>Coupled to RF and LO frequencies |
| Preset         | 3 GHz                                                                                                                                                                                                            |

### 3 Noise Figure Mode

#### 3.7 Meas Setup

|             |                                                                                                                                                                                |
|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| State Saved | Yes                                                                                                                                                                            |
| Min         | 2 Hz                                                                                                                                                                           |
| Max         | Hardware Dependent: <ul style="list-style-type: none"> <li>– Opt503 = 3.6 GHz</li> <li>– Opt508 = 8.4 GHz</li> <li>– Opt513 = 13.6 GHz</li> <li>– Opt526 = 26.5 GHz</li> </ul> |

#### DUT Output Fixed Frequency

Sets the tuned frequency at the input of the instrument. This parameter is only available when External LO Frequency Mode is **SWEPT**, or "**Freq Mode**" on page 191 is set to **FIXed**.

|                              |                                                                                                                                                       |
|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command               | <code>[ :SENSe]:NFIgure:MODE:DOWNconv UPConv:IF:FREQuency &lt;freq&gt;</code><br><code>[ :SENSe]:NFIgure:MODE:DOWNconv UPConv:IF:FREQuency?</code>    |
| Example                      | <code>:NFIg:MODE:DOWN:IF:FREQ 15 GHz</code><br><code>:NFIg:MODE:DOWN:IF:FREQ?</code>                                                                  |
| Couplings                    | Available only when <b>LO Freq Mode</b> is <b>SWEPT</b> or " <b>Freq Mode</b> " on page 191 is <b>FIXed</b>                                           |
| Preset                       | None<br>Only displayed when " <b>DUT</b> " on page 219 is a mixing device ( <b>UPConv</b> , <b>DOWNconv</b> ). Default <b>DUT</b> is <b>AMPLifier</b> |
| State Saved                  | Yes                                                                                                                                                   |
| Range                        | Depends on the frequency range of purchased model                                                                                                     |
| Min                          | 1 Hz                                                                                                                                                  |
| Max                          | Depends on the instrument frequency range                                                                                                             |
| Annunciation                 | IF Freq: <value>                                                                                                                                      |
| Backwards Compatibility SCPI | <code>[ :SENSe]:CONFIgure:MODE:DOWNconv UPConv:IF:FREQuency</code>                                                                                    |

#### RF, LO and IF Frequencies (For Converter)

When measuring Converter (multi-stage), RF, LO and IF frequencies should be set by editing Start, Stop and Fixed frequencies (when "**Freq Mode**" on page 191 is **SWEPT** or **FIXed**), or by editing RF, LO and IF frequency list (when **Freq Mode** is **LIST**). The application does not calculate and check these frequencies for this type of DUT.

There is no requirement that Stop frequency must be greater than Start frequency. For example, when External LO Frequency Mode is **FIXed** and Frequency Mode is **SWEpt**, IF Start and Stop frequencies could be equal if there was a swept LO in the combination of multi-stage converter. However, it is not controlled by the application.

## DUT Input

The RF Start, Stop and Fixed frequencies can be changed via the DUT setup form. These parameters mirror those in the **Frequency** menu (see "**Settings**" on page 191) when "**Freq Context**" on page 218 is **RF**.

The commands in this section are used to set the RF Start, Stop and Fixed frequencies when "**DUT**" on page 219 is **MCONverter**.

## RF Start Frequency

Used to set the RF start frequency when "**DUT**" on page 219 type is **MCONverter**. When "**Freq Context**" on page 218 is **RF**, you can use **[ :SENSe ] :NFIGure:FREQuency:STARt** or this command to set RF start frequency; When **Freq Context** is **LO/IF**, you can use *only* this command to set RF start frequency.

|                |                                                                                                                                              |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <b>[ :SENSe ] :NFIGure:MODE:MCONverter:RF:FREQuency:STARt &lt;freq&gt;</b><br><b>[ :SENSe ] :NFIGure:MODE:MCONverter:RF:FREQuency:STARt?</b> |
| Example        | <b>FREQ:NFIG:MCON:RF:FREQ:STAR 11 MHz</b>                                                                                                    |
| Couplings      | Disabled and hidden when " <b>Freq Mode</b> " on page 191 is <b>FIXed</b><br>Grayed-out when <b>Freq Mode</b> is <b>LIST</b>                 |
| Preset         | 10MHz                                                                                                                                        |
| State Saved    | Yes                                                                                                                                          |
| Min            | 1 Hz                                                                                                                                         |
| Max            | 324.9 GHz                                                                                                                                    |

## RF Stop Frequency

Used to set the RF stop frequency when "**DUT**" on page 219 type is **MCONverter**. When "**Freq Context**" on page 218 is **RF**, you can use **[ :SENSe ] :NFIGure:FREQuency:STOP** or this command to set RF stop frequency; When **Freq Context** is **LO/IF**, you can use *only* this command to set RF stop frequency.

|                |                                                                                                                                            |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <b>[ :SENSe ] :NFIGure:MODE:MCONverter:RF:FREQuency:STOP &lt;freq&gt;</b><br><b>[ :SENSe ] :NFIGure:MODE:MCONverter:RF:FREQuency:STOP?</b> |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------|

### 3 Noise Figure Mode

#### 3.7 Meas Setup

|             |                                                                                                                     |
|-------------|---------------------------------------------------------------------------------------------------------------------|
| Example     | <code>:FREQ:NFIG:MCON:RF:FREQ:STOP 11 MHz</code>                                                                    |
| Couplings   | Disabled and hidden when "Freq Mode" on page 191 is <b>FIXed</b><br>Grayed-out when <b>Freq Mode</b> is <b>LIST</b> |
| Preset      | 3 GHz                                                                                                               |
| State Saved | Yes                                                                                                                 |
| Min         | 2 Hz                                                                                                                |
| Max         | 3.30 THz                                                                                                            |

#### RF Fixed Frequency

Sets the fixed RF Frequency for Converter (multi-stage) when **Freq Mode** is set to **FIXed**.

|                |                                                                                                                                              |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe ] :NFIGure:MODE:MCONverter:RF:FREQuency &lt;freq&gt;</code><br><code>[ :SENSe ] :NFIGure:MODE:MCONverter:RF:FREQuency?</code> |
| Example        | <code>:NFIG:MODE:MCON:RF:FREQ 15 GHz</code><br><code>:NFIG:MODE:MCON:RF:FREQ?</code>                                                         |
| Couplings      | Only available when "Freq Mode" on page 191 is <b>FIXed</b>                                                                                  |
| Preset         | 30 MHz                                                                                                                                       |
| State Saved    | Yes                                                                                                                                          |
| Min            | 1 Hz                                                                                                                                         |
| Max            | Depends on instrument frequency range                                                                                                        |

#### DUT LO

The LO Start, Stop and Fixed frequencies can be changed via the DUT setup form. These parameters mirror those in the **Frequency** menu (see "Settings" on page 191) when "Freq Context" on page 218 is **LO**.

The following commands are used to set the LO Start, Stop and Fixed frequencies when "DUT" on page 219 is **MCONverter**.

#### LO Start Frequency

Used to set the LO start frequency when "DUT" on page 219 type is **MCONverter**. When "Freq Context" on page 218 is **LO**, you can use `[ :SENSe ] :NFIGure:FREQuency:START` or this command to set LO start frequency; When **Freq Context** is **IF/RF**, you can use *only* this command to set LO start frequency.

|                |                                                                                                                                                                        |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:NFIGure:MODE:MCONverter:LOSCillator:FREQuency:STARt &lt;freq&gt;</code><br><code>[ :SENSe]:NFIGure:MODE:MCONverter:LOSCillator:FREQuency:STARt?</code> |
| Example        | <code>:FREQ:NFIG:MCON:LOSC:FREQ:STAR 11 MHz</code>                                                                                                                     |
| Couplings      | Disabled and hidden when LO "Freq Mode" on page 191 is <b>FIXed</b>                                                                                                    |
| State Saved    | Yes                                                                                                                                                                    |
| Min            | 1 Hz                                                                                                                                                                   |
| Max            | 324.9 GHz                                                                                                                                                              |

## LO Stop Frequency

Used to set the LO stop frequency when "DUT" on page 219 type is **MCONverter**. When "Freq Context" on page 218 is **LO**, you can use `[ :SENSe]:NFIGure:FREQuency:STOP` or this command to set LO stop frequency; When **Freq Context** is **IF/RF**, you can use *only* this command to set LO stop frequency.

|                |                                                                                                                                                                      |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:NFIGure:MODE:MCONverter:LOSCillator:FREQuency:STOP &lt;freq&gt;</code><br><code>[ :SENSe]:NFIGure:MODE:MCONverter:LOSCillator:FREQuency:STOP?</code> |
| Example        | <code>:FREQ:NFIG:MCON:LOSC:FREQ:STOP 11 MHz</code>                                                                                                                   |
| Couplings      | Disabled and hidden when LO "Freq Mode" on page 191 is <b>FIXed</b>                                                                                                  |
| State Saved    | Yes                                                                                                                                                                  |
| Min            | 2 Hz                                                                                                                                                                 |
| Max            | 3.30 THz                                                                                                                                                             |

## LO Fixed Frequency

Sets the External LO frequency when the LO Frequency Mode is set to **FIXed**. When a Swept LO is selected, this parameter is disabled and hidden, and the LO Start and Stop frequency boxes are enabled and displayed to allow swept frequency adjustments.

When measuring Converter (multi-stage) using a fixed LO, RF, LO and IF frequency parameters are always active, no matter which "Freq Context" on page 218 is selected.

|                |                                                                                                                                                            |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:NFIGure:MODE:MCONverter:LOSCillator:FREQuency &lt;freq&gt;</code><br><code>[ :SENSe]:NFIGure:MODE:MCONverter:LOSCillator:FREQuency?</code> |
| Example        | <code>:NFIG:MODE:MCON:LOSC:FREQ 15 GHz</code>                                                                                                              |
| Couplings      | Disabled when LO "Freq Mode" on page 191 is <b>SWEpt</b>                                                                                                   |
| Preset         | 30 MHz                                                                                                                                                     |

|             |          |
|-------------|----------|
| State Saved | Yes      |
| Min         | 1 Hz     |
| Max         | 3.30 THz |

## DUT Output

The IF Start and Stop frequencies can be changed via the DUT setup form. These parameters mirror those in the **Frequency** menu (see "**Settings**" on page 191) when "**Freq Context**" on page 218 is **IF**.

The commands in this section are used to set the IF Start, Stop and Fixed frequencies when "**DUT**" on page 219 is **MCONverter**.

## IF Start Frequency

Used to set the IF start frequency when "**DUT**" on page 219 type is **MCONverter**. When "**Freq Context**" on page 218 is **IF**, you can use `[ :SENSe ] :NFIGure:FREQuency:STARt` or this command to set IF start frequency; When **Freq Context** is **RF/LO**, you can use *only* this command to set IF start frequency.

|                |                                                                                                                                                          |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe ] :NFIGure:MODE:MCONverter:IF:FREQuency:STARt &lt;freq&gt;</code><br><code>[ :SENSe ] :NFIGure:MODE:MCONverter:IF:FREQuency:STARt?</code> |
| Example        | <code>:NFIG:MODE:MCON:IF:FREQ:STAR 30MHz</code>                                                                                                          |
| Couplings      | Disabled and hidden when " <b>Freq Mode</b> " on page 191 is <b>FIXed</b><br>Grayed-out when <b>Freq Mode</b> is <b>LIST</b>                             |
| Preset         | 10 MHz                                                                                                                                                   |
| State Saved    | Yes                                                                                                                                                      |
| Min            | 1 Hz                                                                                                                                                     |
| Max            | Hardware Dependent                                                                                                                                       |

## IF Stop Frequency

Used to set the IF stop frequency when "**DUT**" on page 219 type is **MCONverter**. When "**Freq Context**" on page 218 is **IF**, you can use `[ :SENSe ] :NFIGure:FREQuency:STOP` or this command to set IF stop frequency; When **Freq Context** is **RF/LO**, you can use *only* this command to set IF stop frequency.

|                |                                                                                                                                                        |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe ] :NFIGure:MODE:MCONverter:IF:FREQuency:STOP &lt;freq&gt;</code><br><code>[ :SENSe ] :NFIGure:MODE:MCONverter:IF:FREQuency:STOP?</code> |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|

|             |                                                                                                                     |
|-------------|---------------------------------------------------------------------------------------------------------------------|
| Example     | <code>:NFIG:MODE:MCON:IF:FREQ:STOP 30MHz</code>                                                                     |
| Couplings   | Disabled and hidden when "Freq Mode" on page 191 is <b>FIXed</b><br>Grayed-out when <b>Freq Mode</b> is <b>LIST</b> |
| Preset      | 3 GHz                                                                                                               |
| State Saved | Yes                                                                                                                 |
| Min         | 2 Hz                                                                                                                |
| Max         | Hardware Dependent                                                                                                  |

## IF Fixed Frequency

Set the fixed IF frequency. For Converter (multi-stage), this parameter is only available when **Freq Mode** is set to **FIXed**.

|                |                                                                                                                                          |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:NFIGure:MODE:MCONverter:IF:FREQuency &lt;freq&gt;</code><br><code>[ :SENSe]:NFIGure:MODE:MCONverter:IF:FREQuency?</code> |
| Example        | <code>:NFIG:MODE:MCON:IF:FREQ 30MHz</code>                                                                                               |
| Couplings      | Available only when "Freq Mode" on page 191 is <b>FIXed</b>                                                                              |
| Preset         | 10 MHz                                                                                                                                   |
| State Saved    | Yes                                                                                                                                      |
| Min            | 1 Hz                                                                                                                                     |
| Max            | Hardware Dependent                                                                                                                       |

## System Downconverter LO Block

Lets you set LO fixed frequency parameters.

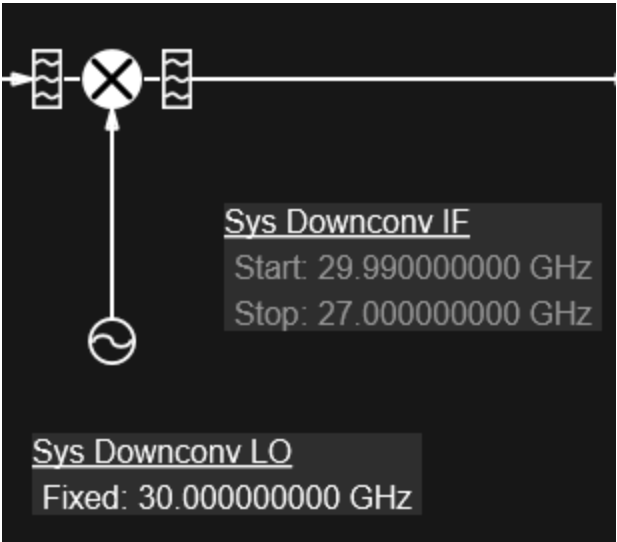
## LO Fixed Frequency

Sets the External LO frequency for system downconverter when the LO Freq Mode of system downconverter is set to **FIXed**.

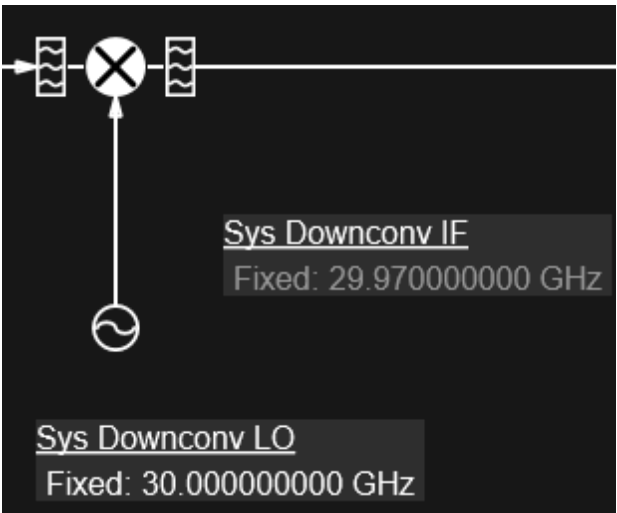
When **Frequency Mode** is **SWEpt** or **LIST**, and System Downconverter is **FIXed**, IF start and stop frequency are displayed. System Downconverter LO start and stop frequency are hidden.



3 Noise Figure Mode  
3.7 Meas Setup



When **Frequency Mode** is **FIXed**, only IF Fixed and LO Fixed frequencies are displayed. LO Fixed frequency is enabled for changing the frequency. IF Fixed frequency is disabled.



|                |                                                                                                                                                    |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:NFIGure:MODE:SYSTem:LOSCillator:FREQuency &lt;freq&gt;</code><br><code>[ :SENSe]:NFIGure:MODE:SYSTem:LOSCillator:FREQuency?</code> |
| Example        | <code>:NFIG:MODE:SYST:LOSC:FREQ 10 MHz</code><br><code>:NFIG:MODE:SYST:LOSC:FREQ?</code>                                                           |
| Couplings      | Disabled (grayed-out) when Sys Downconv is <b>OFF</b><br>Hidden when Sys Downconv LO Freq Mode is <b>SWEPT</b>                                     |
| Preset         | 30 GHz                                                                                                                                             |
| State Saved    | Yes                                                                                                                                                |

|                                    |                                                                                       |
|------------------------------------|---------------------------------------------------------------------------------------|
| Min                                | 1 Hz                                                                                  |
| Max                                | 3.30 THz                                                                              |
| Annunciation                       | LO Freq: <LO Frequency value> when FIXed                                              |
| Backwards<br>Compatibility<br>SCPI | <a href="#">[:SENSe]:CONFigure:MODE:SYSTem:LOSCillator:FREQuency</a><br>(PSA/NFA/FSP) |

### LO Start Frequency

Displays the LO Start frequency of the system downconverter when the LO Freq Mode of system downconverter is [SWEPT](#). This value is not editable.

### LO Stop Frequency

Displays the LO Stop frequency of the system downconverter when the LO Freq Mode of system downconverter is [SWEPT](#). This value is not editable.

### System Downconverter IF Block

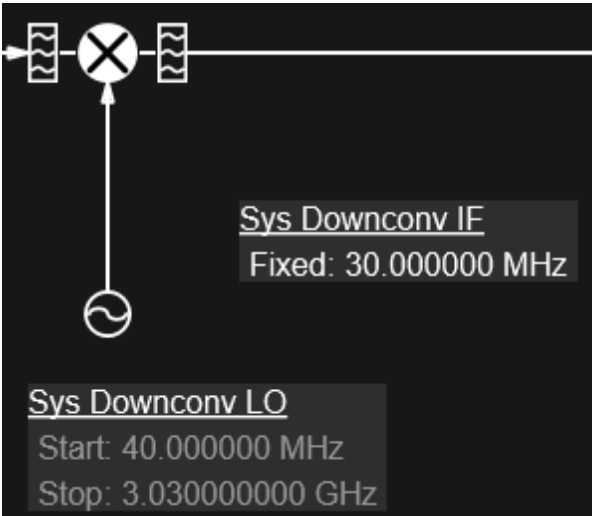
Lets you set IF fixed frequency parameters.

### IF Fixed Frequency

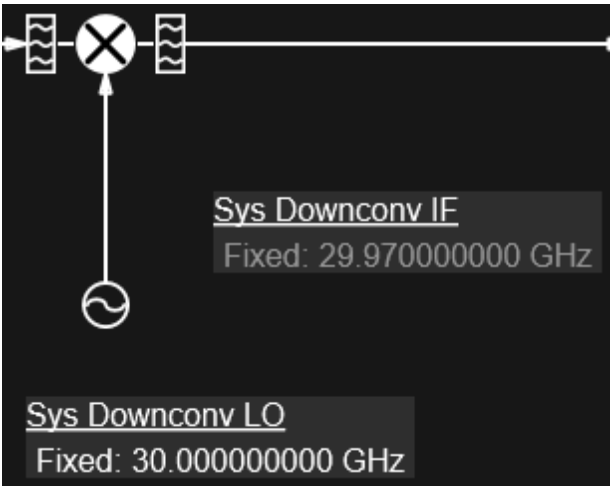
Sets the tuned frequency at the input of the Instrument when system downconverter is turned on. This parameter is only available when External LO Frequency Mode of system downconverter is [SWEPT](#).

When **Frequency Mode** is [SWEPT](#) or [LIST](#), and system downconverter is [SWEPT](#), IF start and stop frequency will be hidden. System downconverter LO start and stop frequency will be displayed.

3 Noise Figure Mode  
3.7 Meas Setup



When "Freq Mode" on page 191 is **FIXed**, only IF Fixed and LO Fixed frequencies are displayed. LO Fixed frequency is enabled for changing the frequency. IF Fixed frequency is disabled.



|                |                                                                                                                                                                                                                                                    |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:NFIGure:MODE:SYSTem:IF:FREQuency &lt;freq&gt;</code><br><code>[ :SENSe]:NFIGure:MODE:SYSTem:IF:FREQuency?</code>                                                                                                                   |
| Example        | <code>:NFIG:MODE:SYST:IF:FREQ 15 GHz</code><br><code>:NFIG:MODE:SYST:IF:FREQ?</code>                                                                                                                                                               |
| Couplings      | Disabled (grayed-out) when Sys Downconv is <b>OFF</b><br>Hidden when Sys Downconv LO Freq Mode is <b>FIXed</b><br>Disabled (grayed-out) and calculated automatically when "Freq Mode" on page 191 is <b>FIXed</b> and System Downconv is <b>ON</b> |
| Preset         | None<br>Only displayed when "DUT" on page 219 is a mixing device. Default <b>DUT</b> is <b>AMPLifier</b>                                                                                                                                           |

|                                 |                                                |
|---------------------------------|------------------------------------------------|
| State Saved                     | Yes                                            |
| Min                             | 1 Hz                                           |
| Max                             | Depends on instrument frequency range          |
| Annunciation                    | IF Freq: <value>                               |
| Backwards Compatibility<br>SCPI | [ :SENSe ] :CONFigure:MODE:SYSTem:IF:FREQuency |

IF Start Frequency

Displays the IF Start frequency of the system downconverter when the LO Freq Mode of system downconverter is **FIXed** and "Freq Mode" on page 191 is **SWEpt** or **LIST**. This value is not editable.

IF Stop Frequency

Displays the IF Stop frequency of the system downconverter when the LO Freq Mode of system downconverter is **FIXed** and "Freq Mode" on page 191 is **SWEpt** or **LIST**. This value is not editable.

Calibration

Displays the block diagram for calibration and lets you change some parameters  
This table is for backwards compatibility only.

|                                 |                                                                                   |
|---------------------------------|-----------------------------------------------------------------------------------|
| Example                         | :NFIG:MODE:DIAG CAL                                                               |
| Backwards Compatibility<br>SCPI | [ :SENSe ] :NFIGure:MODE:DIAGram CALibration<br>[ :SENSe ] :NFIGure:MODE:DIAGram? |

Profile Calibration

Lets you select multiple DUT profiles, perform calibration or delete existing calibration data.

Profile Calibration

☒ DUT 1

☒ DUT 2

☒ DUT 3

☐ DUT 4

☐ DUT 5

☐ DUT 6

☐ DUT 7

☐ DUT 8

☐ DUT 9

☐ DUT 10

☐ DUT 11

☐ DUT 12

Select All

Deselect All

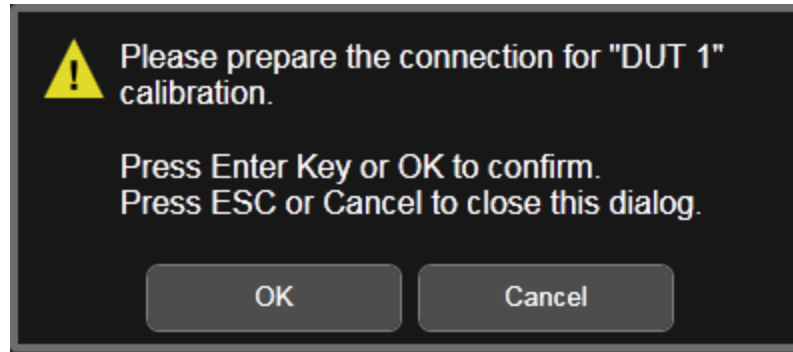
Calibrate Profiles

Clear Cal Data

Pressing **Calibrate Profiles** performs user calibration on the selected profiles in sequence. The measurement loads the settings from each profile and performs

calibration. Once the calibration is performed successfully on the selected profile, the Cal Data is automatically saved in that profile. When you change the DUT profile, the Cal Data saved in that profile is automatically loaded.

You can skip calibration on a selected profile by pressing **Cancel**.



## Signal Path Configuration

This tab is only available in N897xB models. This path can help you improve the uncertainty of your measurement. It lets you input DUT, Noise Source and USB Preamp information and configure the signal path according to the uncertainty estimation.

Input the required DUT information, the Noise Source type and USB Preamp type then press **Optimize**. The **Signal Path Configuration** table will show the optimized attenuation value and estimated uncertainty for four different preamp combinations, and automatically selects the one with the minimum uncertainty. You can also choose other preamp combinations with optimized attenuation in the table, or choose the **User Defined** row to configure both preamp combination and attenuation yourself. The Internal Preamp and Attenuation settings are updated according to the selected configuration. During the calibration and measurement, you will be prompted to plug or unplug the USB Preamp according to the selected configuration in this table.

You can bypass this feature by leaving the Information table blank (or pressing **Clear** if the Information table is not blank), and then exiting this tab. If the Information table is blank, no signal path configuration will be selected in the Signal Path Configuration table, and you will not be prompted to plug or unplug the USB Preamp during the calibration and measurement.

You are recommended to fill the ENR table first to get a more accurate uncertainty estimation.

## DUT Information

Used to input necessary DUT, Noise Source and USB Preamp information for uncertainty estimation, including DUT Noise Figure, DUT Gain, DUT bandwidth, DUT input/output match, Noise Source type and USB Preamp type. The DUT information can be measured or estimated values.

### NF (Front Panel Only)

Lets you enter the noise figure of DUT.

|             |        |
|-------------|--------|
| State Saved | Yes    |
| Min         | 0 dB   |
| Max         | 100 dB |

### Gain (Front Panel Only)

Lets you enter the gain of DUT.

|             |           |
|-------------|-----------|
| State Saved | Yes       |
| Min/Max     | -/+100 dB |

### BW (Front Panel Only)

Lets you enter the bandwidth of DUT.

|             |          |
|-------------|----------|
| State Saved | Yes      |
| Min         | 1 Hz     |
| Max         | 3.30 THz |

### Input Match (Front Panel Only)

Lets you enter the input match of DUT.

|             |        |
|-------------|--------|
| State Saved | Yes    |
| Min/Max     | -/+100 |

### Output Match (Front Panel Only)

Lets you enter the input match of DUT.

### 3 Noise Figure Mode

#### 3.7 Meas Setup

|             |        |
|-------------|--------|
| State Saved | Yes    |
| Min/Max     | -/+100 |

#### Noise Source (Front Panel Only)

Lets you select the Noise Source model.

|             |                                                                                                                                 |
|-------------|---------------------------------------------------------------------------------------------------------------------------------|
| State Saved | Yes                                                                                                                             |
| Range       | 346A   346B   346C   346CK40   N4000A   N4001A   N4002A   U1832A   U1832C   U1832C   U1833A   U1833B   U1833C   U1833D   U1833G |

#### USB Preamp (Front Panel Only)

Lets you select the USB Preamp model.

|             |                          |
|-------------|--------------------------|
| State Saved | Yes                      |
| Range       | U7227A   U7227C   U7227F |

#### Optimize (Front Panel Only)

Used to calculate optimized attenuation value and estimated uncertainty for four different preamp combinations, according to Information table, and select the one with minimum estimated uncertainty to update Internal Preamp and Attenuation.

|           |                                                                                          |
|-----------|------------------------------------------------------------------------------------------|
| Couplings | Enabled only when "DUT" on page 219, Noise Source and USB Preamp information are entered |
|-----------|------------------------------------------------------------------------------------------|

#### Clear (Front Panel Only)

Used to clear the Information table. As a result, the Signal Path Configuration table will also be cleared, and you will not be prompted to plug or unplug USB-Preamp during calibration/measurement process.

|           |                                                                                                  |
|-----------|--------------------------------------------------------------------------------------------------|
| Couplings | Enabled when one of the configurations in the <b>Signal Path Configuration</b> table is selected |
|-----------|--------------------------------------------------------------------------------------------------|

#### Signal Path Configuration

Shows the optimized attenuation value and estimated uncertainty for four different preamp combinations, and automatically selects the one with the minimum uncertainty.

For the first four rows (**Both | USB PA Only | Int PA Only | None**), Int PA and Atten cannot be modified in the table, if they are modified outside through the front panel

or SCPI, the selected signal path configuration changes to **User Defined** automatically.

The **User Defined** row lets you control preamp combinations and fine tune the attenuation settings by observing the estimated uncertainty.

## Signal Path Selection (Front Panel Only)

Lets you select one signal path for current DUT profile. The Internal Preamp and Attenuation settings will be updated according to the selected signal path.

When the **Both** row is selected, the USB-Preamplifier should be plugged in, the Internal Preamp turns on automatically, and the attenuation is adjusted automatically. You will be prompted to plug in the USB-Preamplifier during calibration and measurement, if it was not plugged in.

When the **USB PA Only** row is selected, the USB-Preamplifier should be plugged in, the Internal Preamp is turned off automatically, and the attenuation is adjusted automatically. You will be prompted to plug in the USB-Preamplifier during calibration/measurement process, if it was not plugged in.

When the **Int PA Only** row is selected, the USB-Preamplifier should be unplugged, the Internal Preamp turns on automatically, and the attenuation is adjusted automatically. You will be prompted to unplug the USB-Preamplifier during the calibration/measurement process, if it is plugged in.

When the **None** row is selected, the USB-Preamplifier should be unplugged, the Internal Preamp turns off automatically, and the attenuation is adjusted automatically. You will be prompted to unplug USB-Preamplifier during the calibration/measurement process, if it is plugged in.

The **User Defined** row is the only row in this table where you can modify the USB PA, Int PA and Atten. When you modify these parameters, the uncertainty estimation is updated. You will be prompted to plug or unplug the USB-Preamplifier according to your input here.

---

|           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Couplings | <p>The Internal Preamp and Attenuation settings are updated according to the selected signal path</p> <p>When <b>User Defined</b> is selected, the Internal Preamp and Attenuation settings are updated according to the <b>Int PA</b> and <b>Atten</b> values in the <b>User Defined</b> row</p> <p>If you change the <b>Internal Preamp</b> or <b>Attenuation</b> settings via the front panel or via SCPI commands, <b>User Defined</b> will be selected</p> <p><b>Both</b> and <b>USB PA Only</b> are disabled when your measurement frequency range is not within the USB Preamp frequency range. An advisory message: "RF Input frequency out of USB Preamp frequency range. "Both" and "USB PA Only" options are disabled." is displayed</p> <p>The selection is cleared if you change any of:</p> <ul style="list-style-type: none"> <li>- The Information table</li> <li>- Start, Stop frequency when "Freq Mode" on page 191 is <b>SWEPT</b></li> </ul> |
|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|



|             |                                                                                                                                                                                               |
|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|             | <ul style="list-style-type: none"> <li>- Fixed frequency when <b>Freq Mode</b> is <b>FIXed</b></li> <li>- Frequency list when <b>Freq Mode</b> is <b>LIST</b></li> <li>- ENR table</li> </ul> |
| State Saved | Yes                                                                                                                                                                                           |
| Range       | Both   USB PA Only   Int PAOnly   None   User Defined                                                                                                                                         |

### 3.7.1.5 Ext LO Setup

Lets you maintain a list of available instruments, choose and setup the instrument that you want to use from the list as an External LO. It also shows the currently selected instruments.

#### DUT LO Control (on/off)

Toggles DUT LO control on/off.

|                |                                                                                                                                                              |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:NFIgure:MODE:LOSCillator:DUT:CONTRol[:STATe] ON   OFF   1   0</code><br><code>[ :SENSe]:NFIgure:MODE:LOSCillator:DUT:CONTRol[:STATe]?</code> |
| Example        | <code>:NFIg:MODE:LOSC:DUT:CONT OFF</code><br><code>:NFIg:MODE:LOSC:DUT:CONT?</code>                                                                          |
| Couplings      | When <b>ON</b> and there is no valid external source, error message 153 is displayed                                                                         |
| Preset         | <b>OFF</b>                                                                                                                                                   |
| State Saved    | Yes                                                                                                                                                          |
| Range          | <b>ON OFF</b>                                                                                                                                                |

#### Sys Downconv LO Control (on/off)

Toggles system downconverter LO control on or off.

|                |                                                                                                                                                                    |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:NFIgure:MODE:LOSCillator:SYSTem:CONTRol[:STATe] ON   OFF   1   0</code><br><code>[ :SENSe]:NFIgure:MODE:LOSCillator:SYSTem:CONTRol[:STATe]?</code> |
| Example        | <code>:NFIg:MODE:LOSC:SYST:CONT OFF</code><br><code>:NFIg:MODE:LOSC:SYST:CONT?</code>                                                                              |
| Couplings      | When <b>ON</b> , and there is no valid external source, then error message 153 is displayed                                                                        |
| Preset         | <b>OFF</b>                                                                                                                                                         |
| State Saved    | Yes                                                                                                                                                                |
| Range          | <b>ON OFF</b>                                                                                                                                                      |

## DUT/Sys Downconv LO Control (on/off) (Remote Command Only)

|                              |                                                                                                                                                                                                                                                                                        |
|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Example                      | <code>:NFIG:MODE:LOSC:CONT OFF</code><br><code>:NFIG:MODE:LOSC:CONT?</code>                                                                                                                                                                                                            |
| Couplings                    | When "DUT" on page 219 type is <b>DOWNconv</b> , <b>UPConv</b> or <b>MCONverter</b> , and the System Downconverter is <b>OFF</b> , sets the Ext LO Control for DUT<br>When <b>DUT</b> type is <b>AMPLifier</b> , sets the Ext LO Control for System Downconverter                      |
| Preset                       | <b>OFF</b>                                                                                                                                                                                                                                                                             |
| State Saved                  | Yes                                                                                                                                                                                                                                                                                    |
| Range                        | <b>ON OFF</b>                                                                                                                                                                                                                                                                          |
| Backwards Compatibility SCPI | <code>:SYSTem[:NFIGure]:CONFigure:LOSCillator:CONTRol[:STATe]</code><br><code>:SYSTem:CONFigure:GENerator:CONTRol:STATe</code><br><code>[ :SENSe]:NFIGure:MODE:LOSCillator:CONTRol[:STATe] ON   OFF   1   0</code><br><code>[ :SENSe]:NFIGure:MODE:LOSCillator:CONTRol[:STATe]?</code> |

## DUT LO Setup

Used to set up miscellaneous source functions, including Ext LO power level, settling time, minimum frequency, maximum frequency, etc.

## LO Power

Sets the fixed signal generator LO drive level into the frequency converter device.

|                |                                                                                                                                                                           |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:NFIGure:MODE:LOSCillator:DUT:PARAmeter:POWer[:LEVel] &lt;float&gt;</code><br><code>[ :SENSe]:NFIGure:MODE:LOSCillator:DUT:PARAmeter:POWer[:LEVel]?</code> |
| Example        | <code>:NFIG:MODE:LOSC:DUT:PAR:POW 22.25 dBm</code><br><code>:NFIG:MODE:LOSC:DUT:PAR:POW?</code>                                                                           |
| Preset         | 0.00 dBm                                                                                                                                                                  |
| State Saved    | Yes                                                                                                                                                                       |
| Min/Max        | -/+100                                                                                                                                                                    |

## Backwards Compatibility Command

|           |                                                                                                                                                       |
|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------|
| Example   | <code>:NFIG:MODE:LOSC:PAR:POW 22.25 dBm</code><br><code>:NFIG:MODE:LOSC:PAR:POW?</code>                                                               |
| Couplings | When "DUT" on page 219 type is <b>DOWNconv</b> , <b>UPConv</b> or <b>MCONverter</b> , and System Downconverter is <b>ON</b> , this command is invalid |

### 3 Noise Figure Mode

#### 3.7 Meas Setup

|                              |                                                                                                                                                                                                                                              |
|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                              | When <b>DUT</b> type is <b>DOWNconv</b> , <b>UPConv</b> or <b>MCONverter</b> , and System Downconverter is <b>OFF</b> , sets the Ext LO Power Level for DUT                                                                                  |
|                              | When <b>DUT</b> type is <b>AMPLifier</b> , sets the Ext LO Power Level for System Downconverter                                                                                                                                              |
| Preset                       | 0.00 dBm                                                                                                                                                                                                                                     |
| State Saved                  | Yes                                                                                                                                                                                                                                          |
| Min/Max                      | -/+100                                                                                                                                                                                                                                       |
| Backwards Compatibility SCPI | :SYSTem:CONFigure:LOSCillator:PARAmeter:POWer[:LEVel]<br>(NFA)<br>:SOURce:EXTernal:POWer[:LEVel]<br>(FSP)<br>[:SENSe]:NFIGure:MODE:LOSCillator:PARAmeter:POWer[:LEVel] <float><br>[:SENSe]:NFIGure:MODE:LOSCillator:PARAmeter:POWer[:LEVel]? |

## Settling Time

Controls the grace period allocated for the LO to settle between the issuing of commands.

|                |                                                                                                                                             |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | [:SENSe]:NFIGure:MODE:LOSCillator:DUT:PARAmeter:SETTling[:TIME] <float><br>[:SENSe]:NFIGure:MODE:LOSCillator:DUT:PARAmeter:SETTling[:TIME]? |
| Example        | :NFIG:MODE:LOSC:DUT:PAR:SETT 150 ms<br>:NFIG:MODE:LOSC:DUT:PAR:SETT?                                                                        |
| Preset         | 100 ms                                                                                                                                      |
| State Saved    | Yes                                                                                                                                         |
| Min            | 0                                                                                                                                           |
| Max            | 1000 ms                                                                                                                                     |

### Backwards Compatibility Command

|             |                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Example     | :NFIG:MODE:LOSC:PAR:SETT 150 ms<br>:NFIG:MODE:LOSC:PAR:SETT?                                                                                                                                                                                                                                                                                                                                                                         |
| Couplings   | When " <b>DUT</b> " on page 219 type is <b>DOWNconv</b> , <b>UPConv</b> or <b>MCONverter</b> , and System Downconverter is <b>ON</b> , this command is invalid<br>When <b>DUT</b> type is <b>DOWNconv</b> , <b>UPConv</b> or <b>MCONverter</b> , and System Downconverter is <b>OFF</b> , sets the Ext LO Settling Time for DUT<br>When <b>DUT</b> type is <b>AMPLifier</b> , sets the Ext LO Settling Time for System Downconverter |
| Preset      | 100 ms                                                                                                                                                                                                                                                                                                                                                                                                                               |
| State Saved | Yes                                                                                                                                                                                                                                                                                                                                                                                                                                  |

|                              |                                                                                                                                                                       |
|------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Min                          | 0                                                                                                                                                                     |
| Max                          | 1000 ms                                                                                                                                                               |
| Backwards Compatibility SCPI | <code>[ :SENSe]:NFIGure:MODE:LOSCillator:PARAmeter:SETTling[:TIME] &lt;float&gt;</code><br><code>[ :SENSe]:NFIGure:MODE:LOSCillator:PARAmeter:SETTling[:TIME]?</code> |

## Multiplier Numerator

Sets the External Local Oscillator frequency multiplier. If an external frequency divider is used in conjunction with the External Local Oscillator, then the values of the multiplier denominator should be set to the external frequency divider's dividing factor.

|                |                                                                                                                                                                                       |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:NFIGure:MODE:LOSCillator:DUT:PARAmeter:MULTiplier:NUMerator &lt;int&gt;</code><br><code>[ :SENSe]:NFIGure:MODE:LOSCillator:DUT:PARAmeter:MULTiplier:NUMerator?</code> |
| Example        | <code>:NFIG:MODE:LOSC:DUT:PAR:MULT:NUM 1000</code><br><code>:NFIG:MODE:LOSC:DUT:PAR:MULT:NUMerator?</code>                                                                            |
| Preset         | 1                                                                                                                                                                                     |
| State Saved    | Yes                                                                                                                                                                                   |
| Min            | 1                                                                                                                                                                                     |
| Max            | 20000000000                                                                                                                                                                           |

## Backwards Compatibility Command

|                              |                                                                                                                                                                                                                                                                                                                                                                                                                       |
|------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Example                      | <code>:NFIG:MODE:LOSC:PAR:MULT:NUM 1000</code><br><code>:NFIG:MODE:LOSC:PAR:MULT:NUMerator?</code>                                                                                                                                                                                                                                                                                                                    |
| Couplings                    | When "DUT" on page 219 type is <b>DOWNconv</b> , <b>UPConv</b> or <b>MCONverter</b> , and System Downconverter is <b>ON</b> , this command is invalid<br>When <b>DUT</b> type is <b>DOWNconv</b> , <b>UPConv</b> or <b>MCONverter</b> , and System Downconverter is <b>OFF</b> , sets the Ext LO Multiplier for DUT<br>When <b>DUT</b> type is <b>AMPLifier</b> , sets the Ext LO Multiplier for System Downconverter |
| Preset                       | 1                                                                                                                                                                                                                                                                                                                                                                                                                     |
| State Saved                  | Yes                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Min                          | 1                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Max                          | 20000000000                                                                                                                                                                                                                                                                                                                                                                                                           |
| Backwards Compatibility SCPI | <code>:SYSTem:CONFigure:LOSCillator:PARAmeter:MULTiplier</code><br>(NFA)<br><code>:SOURce:EXTernal:FREQuency[:FACTor]:NUMerator</code><br>(FSP)                                                                                                                                                                                                                                                                       |

---

```
[ :SENSe]:NFIGure:MODE:LOSCillator:PARAmeter:MULTiplier:NUMerator <int>
[ :SENSe]:NFIGure:MODE:LOSCillator:PARAmeter:MULTiplier:NUMerator?
```

---

## Multiplier Denominator

Sets the External Local Oscillator frequency divider value. If an external frequency multiplier is used in conjunction with the External Local Oscillator, then the values of the multiplier should be set to the external frequency multiplier's multiplying factor. Alternatively, this value can be used when custom commands are used to drive the External Local Oscillator and the frequency suffix is not 'Hz'. In this case, enter the power of ten equivalent to the frequency scaling implied by the suffix.

For example: if the suffix is "GHz" then enter 1000000000. The maximum is high in the case where you are using a non-SCPI source whose input is given in GHz. In such a case, enter 1E9 here to convert between Hz (the units of the measurement) and GHz (the units of the source). However, if the source is followed by a doubler for high-frequency measurement, the proper conversion factor is 2E9, which is the value that should be entered.

---

|                |                                                                                                                                                                         |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <pre>[ :SENSe]:NFIGure:MODE:LOSCillator:DUT:PARAmeter:MULTiplier:DENominator &lt;int&gt; [ :SENSe]:NFIGure:MODE:LOSCillator:DUT:PARAmeter:MULTiplier:DENominator?</pre> |
| Example        | <pre>:NFIG:MODE:LOSC:DUT:PAR:MULT:DEN 1000 :NFIG:MODE:LOSC:DUT:PAR:MULT:DEN?</pre>                                                                                      |
| Preset         | 1                                                                                                                                                                       |
| State Saved    | Yes                                                                                                                                                                     |
| Min            | 1                                                                                                                                                                       |
| Max            | 20000000000                                                                                                                                                             |

---

## Backwards Compatibility Command

---

|             |                                                                                                                                                                                                                                                                                                                                                                                                                       |
|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Example     | <pre>:NFIG:MODE:LOSC:PAR:MULT:DEN 1000 :NFIG:MODE:LOSC:PAR:MULT:DEN?</pre>                                                                                                                                                                                                                                                                                                                                            |
| Couplings   | When "DUT" on page 219 type is <b>DOWNconv</b> , <b>UPConv</b> or <b>MCONverter</b> , and System Downconverter is <b>ON</b> , this command is invalid<br>When <b>DUT</b> type is <b>DOWNconv</b> , <b>UPConv</b> or <b>MCONverter</b> , and System Downconverter is <b>OFF</b> , sets the Ext LO Multiplier for DUT<br>When <b>DUT</b> type is <b>AMPLifier</b> , sets the Ext LO Multiplier for System Downconverter |
| Preset      | 1                                                                                                                                                                                                                                                                                                                                                                                                                     |
| State Saved | Yes                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Min         | 1                                                                                                                                                                                                                                                                                                                                                                                                                     |

---

|                              |                                                                                                                                                                                                             |
|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Max                          | 20000000000                                                                                                                                                                                                 |
| Backwards Compatibility SCPI | :SOURCE:EXTERNAL:FREQUENCY[:FACTOR]:DENOMINATOR<br>(FSP)<br>[:SENSe]:NFIGure:MODE:LOSCillator:PARAmeter:MULTIplier:DENOMINATOR <int><br>[:SENSe]:NFIGure:MODE:LOSCillator:PARAmeter:MULTIplier:DENOMINATOR? |

## Min Freq

Used to specify the minimum frequency that the external source is capable of. Attempting to set the external source to a value less than this will result in an error message and clipping to this value.

This value is automatically set when the minimum frequency of the external source is capable of being queried.

|                |                                                                                                                                                                                                                        |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | [:SENSe]:NFIGure:MODE:LOSCillator:DUT:PARAmeter:MINimum[:FREQUENCY] <freq><br>[:SENSe]:NFIGure:MODE:LOSCillator:DUT:PARAmeter:MINimum[:FREQUENCY]?                                                                     |
| Example        | :NFIG:MODE:LOSC:DUT:PAR:MIN 100 kHz<br>:NFIG:MODE:LOSC:DUT:PAR:MIN?                                                                                                                                                    |
| Couplings      | Automatically populates when the address of a SCPI-compliant source is selected and connected by pressing "Select Highlighted Source As DUT LO" on page 289<br>The LO frequency cannot be set to lower than this value |
| Preset         | 10 MHz                                                                                                                                                                                                                 |
| State Saved    | Yes                                                                                                                                                                                                                    |
| Min            | 1 Hz                                                                                                                                                                                                                   |
| Max            | 324.999999999 GHz                                                                                                                                                                                                      |

## Backwards Compatibility Command

|           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|-----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Example   | :NFIG:MODE:LOSC:PAR:MIN 100 kHz<br>:NFIG:MODE:LOSC:PAR:MIN?                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Couplings | Automatically populates when the address of a SCPI-compliant source is selected and connected by pressing <b>Select Highlighted Source</b><br>The LO frequency cannot be set to lower than this value<br>When "DUT" on page 219 type is <b>DOWNconv</b> , <b>UPConv</b> or <b>MCONverter</b> , and System Downconverter is <b>ON</b> , this command is invalid<br>When <b>DUT</b> type is <b>DOWNconv</b> , <b>UPConv</b> or <b>MCONverter</b> , and System Downconverter is <b>OFF</b> , sets the Ext LO Min Frequency for DUT<br>When <b>DUT</b> type is <b>AMPLifier</b> , sets the Ext LO Min Frequency for System Downconverter |
| Preset    | 10 MHz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |

### 3 Noise Figure Mode

#### 3.7 Meas Setup

|                              |                                                                                                                                                                                                                                                          |
|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| State Saved                  | Yes                                                                                                                                                                                                                                                      |
| Min                          | 1 Hz                                                                                                                                                                                                                                                     |
| Max                          | 324.999999999 GHz                                                                                                                                                                                                                                        |
| Backwards Compatibility SCPI | <code>:SYSTem:CONFigure:LOSCillator:PARAmeter:MINimum[:FREQuency]</code><br><code>[ :SENSe]:NFIGure:MODE:LOSCillator:PARAmeter:MINimum[:FREQuency] &lt;freq&gt;</code><br><code>[ :SENSe]:NFIGure:MODE:LOSCillator:PARAmeter:MINimum[:FREQuency]?</code> |

#### Max Freq

Used to specify the maximum frequency that the external source is capable of. Attempting to set the external source to a value greater than this will result in an error message and clipping to this value.

This value is automatically set when the maximum frequency of the external source is capable of being queried.

|                |                                                                                                                                                                                                                                |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:NFIGure:MODE:LOSCillator:DUT:PARAmeter:MAXimum[:FREQuency] &lt;freq&gt;</code><br><code>[ :SENSe]:NFIGure:MODE:LOSCillator:DUT:PARAmeter:MAXimum[:FREQuency]?</code>                                           |
| Example        | <code>:NFIG:MODE:LOSC:DUT:PAR:MAX 100 kHz</code><br><code>:NFIG:MODE:LOSC:DUT:PAR:MAX?</code>                                                                                                                                  |
| Couplings      | Automatically populates when the address of a SCPI-compliant source is selected and connected by pressing <b>"Select Highlighted Source As DUT LO" on page 289</b><br>The LO frequency cannot be set to higher than this value |
| Preset         | 10 MHz                                                                                                                                                                                                                         |
| State Saved    | Yes                                                                                                                                                                                                                            |
| Min            | 2 Hz                                                                                                                                                                                                                           |
| Max            | 3.30 THz                                                                                                                                                                                                                       |

#### Backwards Compatibility Command

|           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|-----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Example   | <code>:NFIG:MODE:LOSC:PAR:MAX 100 kHz</code><br><code>:NFIG:MODE:LOSC:PAR:MAX?</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Couplings | Automatically populates when the address of a SCPI compliant source is selected and connected by pressing <b>"Select Highlighted Source As DUT LO" on page 289</b><br>The LO frequency cannot be set to higher than this value<br>When <b>"DUT" on page 219</b> type is <b>DOWNconv</b> , <b>UPConv</b> or <b>MCONverter</b> , and System Downconverter is <b>ON</b> , this command is invalid<br>When <b>DUT</b> type is <b>DOWNconv</b> , <b>UPConv</b> or <b>MCONverter</b> , and System Downconverter is <b>OFF</b> , sets the Ext LO Max Frequency for DUT<br>When <b>DUT</b> type is <b>AMPLifier</b> , sets the Ext LO Max Frequency for System Downconverter |

|                              |                                                                                                                                                                                                                                                          |
|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Preset                       | 10 MHz                                                                                                                                                                                                                                                   |
| State Saved                  | Yes                                                                                                                                                                                                                                                      |
| Min                          | 2 Hz                                                                                                                                                                                                                                                     |
| Max                          | 3.30 THz                                                                                                                                                                                                                                                 |
| Backwards Compatibility SCPI | <code>:SYSTem:CONFigure:LOSCillator:PARAmeter:MAXimum[:FREQuency]</code><br><code>[ :SENSe]:NFIGure:MODE:LOSCillator:PARAmeter:MAXimum[:FREQuency] &lt;freq&gt;</code><br><code>[ :SENSe]:NFIGure:MODE:LOSCillator:PARAmeter:MAXimum[:FREQuency]?</code> |

## LO Commands

Selects the command set used to control the external LO. Standard SCPI commands are used by default and will work with all Keysight Signal Sources and other SCPI-compliant sources. Non SCPI-compliant sources may be controlled using custom commands defined by the LO Commands parameter. The custom commands are stored with the State, but if you do not store the state prior to **Restore Mode Defaults**, then the custom settings will be lost. If you change from using SCPI commands to using custom commands without saving the state of the instrument, the custom commands will be preserved and will be recalled when you move back to custom commands.

|                |                                                                                                                                     |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:NFIGure:MODE:LOSCillator:DUT:TYPE SCPI   CUSTom</code><br><code>[ :SENSe]:NFIGure:MODE:LOSCillator:DUT:TYPE?</code> |
| Example        | <code>:NFIG:MODE:LOSC:DUT:TYPE CUST</code><br><code>:NFIG:MODE:LOSC:DUT:TYPE?</code>                                                |
| Couplings      | LO Commands parameter is disabled when set to <b>SCPI</b>                                                                           |
| Preset         | <b>SCPI</b>                                                                                                                         |
| State Saved    | Yes                                                                                                                                 |
| Range          | <b>SCPI</b>   <b>CUSTom</b>                                                                                                         |

### Backwards Compatibility Command

|           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|-----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Example   | <code>:NFIG:MODE:LOSC:TYPE CUST</code><br><code>:NFIG:MODE:LOSC:TYPE?</code>                                                                                                                                                                                                                                                                                                                                                                                                      |
| Couplings | <b>LO Commands</b> is disabled when set to <b>SCPI</b><br>When "DUT" on page 219 type is <b>DOWNconv</b> , <b>UPConv</b> or <b>MCONverter</b> , and System Downconverter is <b>ON</b> , this command is invalid<br>When <b>DUT</b> type is <b>DOWNconv</b> , <b>UPConv</b> or <b>MCONverter</b> , and System Downconverter is <b>OFF</b> , sets the Ext LO Command Set for DUT<br>When <b>DUT</b> type is <b>AMPLifier</b> , sets the Ext LO Command Set for System Downconverter |



### 3 Noise Figure Mode

#### 3.7 Meas Setup

|                                 |                                                                                                                                       |
|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|
| Preset                          | SCPI                                                                                                                                  |
| State Saved                     | Yes                                                                                                                                   |
| Range                           | SCPI   CUSTom                                                                                                                         |
| Backwards Compatibility<br>SCPI | :SYSTem:CONFigure:LOSCillator:TYPE<br>[:SENSe]:NFIGure:MODE:LOSCillator:TYPE SCPI   CUSTom<br>[:SENSe]:NFIGure:MODE:LOSCillator:TYPE? |

## Power Prefix

Specifies a custom command to be used for setting external LO power.

|                |                                                                                                                                                                                                                                  |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | [:SENSe]:NFIGure:MODE:LOSCillator:DUT:COMManD:POWer:PREFix <string><br>[:SENSe]:NFIGure:MODE:LOSCillator:DUT:COMManD:POWer:PREFix?                                                                                               |
| Example        | :NFIG:MODE:LOSC:DUT:COMM:POW:PREF "power"<br>:NFIG:MODE:LOSC:DUT:COMM:POW:PREF?                                                                                                                                                  |
| Couplings      | Disabled when "LO Commands" on page 268 is set to SCPI. Attempting to change the value in this case generates an advisory message; Settings conflict; custom LO commands only available when command set is custom." number -221 |
| Preset         | "POW"                                                                                                                                                                                                                            |
| State Saved    | Yes                                                                                                                                                                                                                              |
| Range          | Alphanumeric                                                                                                                                                                                                                     |

## Backwards Compatibility Command

|                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|-------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Example                 | :NFIG:MODE:LOSC:COMM:POW:PREF "power"<br>:NFIG:MODE:LOSC:COMM:POW:PREF?                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Couplings               | Disabled when "LO Commands" on page 268 is set to SCPI. Attempting to change the value in this case generates an advisory message; Settings conflict; custom LO commands only available when command set is custom." number -221<br><br>When "DUT" on page 219 type is DOWNconv, UPConv or MCONverter, and System Downconverter is ON, this command is invalid<br><br>When DUT type is DOWNconv, UPConv or MCONverter, and System Downconverter is OFF, sets the Ext LO Power Prefix for DUT<br><br>When DUT type is AMPLifier, sets the Ext LO Power Prefix for System Downconverter |
| Preset                  | "POW"                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| State Saved             | Yes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Range                   | Alphanumeric                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Backwards Compatibility | :SYSTem:CONFigure:LOSCillator:COMManD:POWer:PREFix<br>[:SENSe]:NFIGure:MODE:LOSCillator:COMManD:POWer:PREFix <string>                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |

|      |                                                                       |
|------|-----------------------------------------------------------------------|
| SCPI | <code>[ :SENSe]:NFIGure:MODE:LOSCillator:COMManD:POWer:PREFix?</code> |
|------|-----------------------------------------------------------------------|

## Power Suffix

Specifies a custom command to be used for setting external LO power units.

|                |                                                                                                                                                                      |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:NFIGure:MODE:LOSCillator:DUT:COMManD:POWer:SUFFix &lt;string&gt;</code><br><code>[ :SENSe]:NFIGure:MODE:LOSCillator:DUT:COMManD:POWer:SUFFix?</code> |
| Example        | <code>:NFIG:MODE:LOSC:DUT:COMM:POW:SUFF "W"</code><br><code>:NFIG:MODE:LOSC:DUT:COMM:POW:SUFF?</code>                                                                |
| Couplings      | Disabled when "LO Commands" on page 268 is set to <b>SCPI</b>                                                                                                        |
| Preset         | "DBM"                                                                                                                                                                |
| State Saved    | Yes                                                                                                                                                                  |
| Range          | Alphanumeric                                                                                                                                                         |

## Backwards Compatibility Command

|                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Couplings                    | Disabled when "LO Commands" on page 268 is set to <b>SCPI</b><br>When "DUT" on page 219 type is <b>DOWNconv</b> , <b>UPConv</b> or <b>MCONverter</b> , and System Downconverter is <b>ON</b> , this command is invalid<br>When <b>DUT</b> type is <b>DOWNconv</b> , <b>UPConv</b> or <b>MCONverter</b> , and System Downconverter is <b>OFF</b> , sets the Ext LO Power Suffix for DUT<br>When <b>DUT</b> type is <b>AMPLifier</b> , sets the Ext LO Power Suffix for System Downconverter |
| Preset                       | "DBM"                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| State Saved                  | Yes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Range                        | Alphanumeric                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Backwards Compatibility SCPI | <code>:SYSTem:CONFigure:LOSCillator:COMManD:POWer:SUFFix</code><br><code>[ :SENSe]:NFIGure:MODE:LOSCillator:COMManD:POWer:SUFFix &lt;string&gt;</code><br><code>[ :SENSe]:NFIGure:MODE:LOSCillator:COMManD:POWer:SUFFix?</code>                                                                                                                                                                                                                                                            |

## Freq Prefix

Specifies a custom command to be used for setting external LO frequency.

|                |                                                                                                                                                                              |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:NFIGure:MODE:LOSCillator:DUT:COMManD:FREQuency:PREFix &lt;string&gt;</code><br><code>[ :SENSe]:NFIGure:MODE:LOSCillator:DUT:COMManD:FREQuency:PREFix?</code> |
| Example        | <code>:NFIG:MODE:LOSC:DUT:COMM:FREQ:PREF "FREQuency"</code><br><code>:NFIG:MODE:LOSC:DUT:COMM:FREQ:PREF?</code>                                                              |
| Couplings      | Disabled when "LO Commands" on page 268 is set to <b>SCPI</b>                                                                                                                |

|             |              |
|-------------|--------------|
| Preset      | "FREQ"       |
| State Saved | Yes          |
| Range       | Alphanumeric |

### Backwards Compatibility Command

The following command is remote only and is for compatibility.

|           |                                                                                                                                                                                                                                                                                                                                                                                                                            |
|-----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Couplings | <p>Disabled when "LO Commands" on page 268 is set to SCPI</p> <p>When "DUT" on page 219 type is DOWNconv, UPConv or MCONverter, and System Downconverter is ON, this command is invalid</p> <p>When DUT type is DOWNconv, UPConv or MCONverter, and System Downconverter is OFF, sets the Ext LO Frequency Prefix for DUT</p> <p>When DUT type is AMPLifier, sets the Ext LO Frequency Prefix for System Downconverter</p> |
|-----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                              |                                                                                                                                                                                                                     |
|------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Preset                       | "FREQ"                                                                                                                                                                                                              |
| State Saved                  | Yes                                                                                                                                                                                                                 |
| Range                        | Alphanumeric                                                                                                                                                                                                        |
| Backwards Compatibility SCPI | <p>:SYSTem:CONFigure:LOSCillator:COMManD:FREQuency:PREFix</p> <p>[ :SENSe]:NFIGure:MODE:LOSCillator:COMManD:FREQuency:PREFix &lt;string&gt;</p> <p>[ :SENSe]:NFIGure:MODE:LOSCillator:COMManD:FREQuency:PREFix?</p> |

## Freq Suffix

Specifies a custom command to be used for setting external LO frequency units.

|                |                                                                                                                                                               |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <p>[ :SENSe]:NFIGure:MODE:LOSCillator:DUT:COMManD:FREQuency:SUFFix &lt;string&gt;</p> <p>[ :SENSe]:NFIGure:MODE:LOSCillator:DUT:COMManD:FREQuency:SUFFix?</p> |
| Example        | <p>:NFIG:MODE:LOSC:DUT:COMM:FREQ:SUFF "MHz"</p> <p>:NFIG:MODE:LOSC:DUT:COMM:FREQ:SUFF?</p>                                                                    |

|             |                                                        |
|-------------|--------------------------------------------------------|
| Couplings   | Disabled when "LO Commands" on page 268 is set to SCPI |
| Preset      | "Hz"                                                   |
| State Saved | Yes                                                    |
| Range       | Alphanumeric                                           |

### Backwards Compatibility Command

|           |                                                                                                                                                                                                                                                                                           |
|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Couplings | <p>Disabled when "LO Commands" on page 268 is set to SCPI</p> <p>When "DUT" on page 219 type is DOWNconv, UPConv or MCONverter, and System Downconverter is ON, this command is invalid</p> <p>When DUT type is DOWNconv, UPConv or MCONverter, and System Downconverter is OFF, sets</p> |
|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                                 |                                                                                                                                                                                              |
|---------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                 | the Ext LO Frequency Suffix for DUT<br>When <b>DUT</b> type is <b>AMPLifier</b> , sets the Ext LO Frequency Suffix for System Downconverter                                                  |
| Preset                          | "Hz"                                                                                                                                                                                         |
| State Saved                     | Yes                                                                                                                                                                                          |
| Range                           | Alphanumeric                                                                                                                                                                                 |
| Backwards Compatibility<br>SCPI | :SYSTem:CONFigure:LOSCillator:COMManD:FREQuency:SUFFix<br>[:SENSe]:NFIGure:MODE:LOSCillator:COMManD:FREQuency:SUFFix <string><br>[:SENSe]:NFIGure:MODE:LOSCillator:COMManD:FREQuency:SUFFix? |

## Auxiliary

Specifies a custom command to be used between setting the power and setting the frequency. By default, it is used to ensure the RF signal is switched **ON**. Several commands can be chained together using the standard semicolon. NFA allows this.

|                |                                                                                                                              |
|----------------|------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | [:SENSe]:NFIGure:MODE:LOSCillator:DUT:COMManD:AUXiliary <string><br>[:SENSe]:NFIGure:MODE:LOSCillator:DUT:COMManD:AUXiliary? |
| Example        | :NFIG:MODE:LOSC:DUT:COMM:AUX "RF ON"<br>:NFIG:MODE:LOSC:DUT:COMM:AUX?                                                        |
| Couplings      | Disabled when "LO Commands" on page 268 is set to <b>SCPI</b>                                                                |
| Preset         | "OUTP:STAT ON"                                                                                                               |
| State Saved    | Yes                                                                                                                          |
| Range          | Alphanumeric                                                                                                                 |

## Backwards Compatibility Command

|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|---------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Couplings                       | Disabled when "LO Commands" on page 268 is set to <b>SCPI</b><br>When "DUT" on page 219 type is <b>DOWNconv</b> , <b>UPConv</b> or <b>MCONverter</b> , and System Downconverter is <b>ON</b> , this command is invalid<br>When <b>DUT</b> type is <b>DOWNconv</b> , <b>UPConv</b> or <b>MCONverter</b> , and System Downconverter is <b>OFF</b> , sets the Ext LO Auxiliary for DUT<br>When <b>DUT</b> type is <b>AMPLifier</b> , sets the Ext LO Auxiliary for System Downconverter |
| Preset                          | "OUTP:STAT ON"                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| State Saved                     | Yes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Range                           | Alphanumeric                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Backwards Compatibility<br>SCPI | :SYSTem:CONFigure:LOSCillator:COMManD:AUXiliary<br>[:SENSe]:NFIGure:MODE:LOSCillator:COMManD:AUXiliary <string><br>[:SENSe]:NFIGure:MODE:LOSCillator:COMManD:AUXiliary?                                                                                                                                                                                                                                                                                                              |

## Sys Downconv LO Setup

Used to set up miscellaneous source functions, including Ext LO power level, settling time, minimum frequency, maximum frequency, etc.

### LO Power

Sets the fixed signal generator LO drive level into the frequency converter device.

|                |                                                                                                                                                                                 |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:NFIGure:MODE:LOSCillator:SYStem:PARameter:POWer[:LEVel] &lt;float&gt;</code><br><code>[ :SENSe]:NFIGure:MODE:LOSCillator:SYStem:PARameter:POWer[:LEVel]?</code> |
| Example        | <code>:NFIG:MODE:LOSC:SYS:PAR:POW 22.25 dBm</code><br><code>:NFIG:MODE:LOSC:SYS:PAR:POW?</code>                                                                                 |
| Preset         | 0.00 dBm                                                                                                                                                                        |
| State Saved    | Yes                                                                                                                                                                             |
| Min/Max        | -/+100                                                                                                                                                                          |

### Backwards Compatibility Command

|                              |                                                                                                                                                                                                                                                                                                                                                                                                                         |
|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Couplings                    | When "DUT" on page 219 type is <b>DOWNconv</b> , <b>UPConv</b> or <b>MCONverter</b> , and System Downconverter is <b>ON</b> , this command is invalid<br>When <b>DUT</b> type is <b>DOWNconv</b> , <b>UPConv</b> or <b>MCONverter</b> , and System Downconverter is <b>OFF</b> , sets the Ext LO Power Level for DUT<br>When <b>DUT</b> type is <b>AMPLifier</b> , sets the Ext LO Power Level for System Downconverter |
| Preset                       | 0.00 dBm                                                                                                                                                                                                                                                                                                                                                                                                                |
| State Saved                  | Yes                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Min/Max                      | -/+100                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Backwards Compatibility SCPI | <code>:SYStem:CONFigure:SYStem:PARameter:POWer[:LEVel]</code><br>(NFA)<br><code>:SOURce:EXTernal:POWer[:LEVel]</code><br>(FSP)<br><code>[ :SENSe]:NFIGure:MODE:LOSCillator:PARameter:POWer[:LEVel] &lt;float&gt;</code><br><code>[ :SENSe]:NFIGure:MODE:LOSCillator:PARameter:POWer[:LEVel]?</code>                                                                                                                     |

### Settling Time

Controls the grace period allocated for the LO to settle between issue of commands.

|        |                                                                                                |
|--------|------------------------------------------------------------------------------------------------|
| Remote | <code>[ :SENSe]:NFIGure:MODE:LOSCillator:SYStem:PARameter:SETTling[:TIME] &lt;float&gt;</code> |
|--------|------------------------------------------------------------------------------------------------|

|             |                                                                                                |
|-------------|------------------------------------------------------------------------------------------------|
| Command     | <code>[ :SENSe]:NFIGure:MODE:LOSCillator:SYSTem:PARameter:SETTling[:TIME]?</code>              |
| Example     | <code>:NFIG:MODE:LOSC:SYS:PAR:SETT 150 ms</code><br><code>:NFIG:MODE:LOSC:SYS:PAR:SETT?</code> |
| Preset      | 100 ms                                                                                         |
| State Saved | Yes                                                                                            |
| Min         | 0                                                                                              |
| Max         | 1000 ms                                                                                        |

### Backwards Compatibility Command

|                              |                                                                                                                                                                                                                                                                                                                                                                                                                             |
|------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Couplings                    | When "DUT" on page 219 type is <b>DOWNconv</b> , <b>UPConv</b> or <b>MCONverter</b> , and System Downconverter is <b>ON</b> , this command is invalid<br>When <b>DUT</b> type is <b>DOWNconv</b> , <b>UPConv</b> or <b>MCONverter</b> , and System Downconverter is <b>OFF</b> , sets the Ext LO Settling Time for DUT<br>When <b>DUT</b> type is <b>AMPLifier</b> , sets the Ext LO Settling Time for System Downconverter |
| Preset                       | 100 ms                                                                                                                                                                                                                                                                                                                                                                                                                      |
| State Saved                  | Yes                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Min                          | 0                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Max                          | 1000 ms                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Backwards Compatibility SCPI | <code>:SYSTem:CONFigure:SYSTem:PARameter:SETTling[:TIME]</code><br><code>[ :SENSe]:NFIGure:MODE:SYSTem:PARameter:SETTling[:TIME] &lt;float&gt;</code><br><code>[ :SENSe]:NFIGure:MODE:SYSTem:PARameter:SETTling[:TIME]?</code>                                                                                                                                                                                              |

### Multiplier Numerator

Sets the External Local Oscillator frequency multiplier. If an external frequency divider is used in conjunction with the External Local Oscillator, then the values of the multiplier denominator should be set to the external frequency divider's dividing factor.

|                |                                                                                                                                                                                             |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:NFIGure:MODE:LOSCillator:SYSTem:PARameter:MULTiplier:NUMerator &lt;int&gt;</code><br><code>[ :SENSe]:NFIGure:MODE:LOSCillator:SYSTem:PARameter:MULTiplier:NUMerator?</code> |
| Example        | <code>:NFIG:MODE:LOSC:SYS:PAR:MULT:NUM 1000</code><br><code>:NFIG:MODE:LOSC:SYS:PAR:MULT:NUMerator?</code>                                                                                  |
| Preset         | 1                                                                                                                                                                                           |
| State Saved    | Yes                                                                                                                                                                                         |
| Min            | 1                                                                                                                                                                                           |
| Max            | 20000000000                                                                                                                                                                                 |

## Backwards Compatibility Command

|                              |                                                                                                                                                                                                                                                                                                                                                                                                                               |
|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Couplings                    | <p>When "DUT" on page 219 type is <b>DOWNconv</b>, <b>UPConv</b> or <b>MCONverter</b>, and System Downconverter is <b>ON</b>, this command is invalid</p> <p>When <b>DUT</b> type is <b>DOWNconv</b>, <b>UPConv</b> or <b>MCONverter</b>, and System Downconverter is <b>OFF</b>, sets the Ext LO Multiplier for DUT</p> <p>When <b>DUT</b> type is <b>AMPLifier</b>, sets the Ext LO Multiplier for System Downconverter</p> |
| Preset                       | 1                                                                                                                                                                                                                                                                                                                                                                                                                             |
| State Saved                  | Yes                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Min                          | 1                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Max                          | 20000000000                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Backwards Compatibility SCPI | <p><b>:SYSTem:CONFigure:LOSCillator:PARAmeter:MULTiplier</b></p> <p>(NFA)</p> <p><b>:SOURce:EXTernal:FREQuency[:FACTor]:NUMerator</b></p> <p>(FSP)</p> <p><b>[ :SENSe]:NFIGure:MODE:LOSCillator:PARAmeter:MULTiplier:NUMerator &lt;int&gt;</b></p> <p><b>[ :SENSe]:NFIGure:MODE:LOSCillator:PARAmeter:MULTiplier:NUMerator?</b></p>                                                                                           |

## Multiplier Denominator

Sets the External Local Oscillator frequency divider value. If an external frequency multiplier is used in conjunction with the External Local Oscillator, then the values of the multiplier should be set to the external frequency multiplier's multiplying factor. Alternatively, this value can be used when custom commands are used to drive the External Local Oscillator, and the frequency suffix is not 'Hz'. In this case enter the power of ten equivalent to the frequency scaling implied by the suffix.

For example: if the suffix is "GHz" then enter 1000000000. The maximum is high in the case where you are using a non-SCPI source whose input is given in GHz. In such a case enter 1E9 here to convert between Hz (the units of the measurement) and GHz (the units of the source). However, if the source is followed by a doubler for high-frequency measurement, the proper conversion factor is 2E9, which is the value that should be entered.

|                |                                                                                                                                                                                                |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <p><b>[ :SENSe]:NFIGure:MODE:LOSCillator:SYSTem:PARAmeter:MULTiplier:DENominator &lt;int&gt;</b></p> <p><b>[ :SENSe]:NFIGure:MODE:LOSCillator:SYSTem:PARAmeter:MULTiplier:DENominator?</b></p> |
| Example        | <p><b>:NFIG:MODE:LOSC:SYS:PAR:MULT:DEN 1000</b></p> <p><b>:NFIG:MODE:LOSC:SYS:PAR:MULT:DEN?</b></p>                                                                                            |
| Preset         | 1                                                                                                                                                                                              |
| State Saved    | Yes                                                                                                                                                                                            |

|     |             |
|-----|-------------|
| Min | 1           |
| Max | 20000000000 |

### Backwards Compatibility Command

|                              |                                                                                                                                                                                                                                                                                                                                                                                                                               |
|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Couplings                    | <p>When "DUT" on page 219 type is <b>DOWNconv</b>, <b>UPConv</b> or <b>MCONverter</b>, and System Downconverter is <b>ON</b>, this command is invalid</p> <p>When <b>DUT</b> type is <b>DOWNconv</b>, <b>UPConv</b> or <b>MCONverter</b>, and System Downconverter is <b>OFF</b>, sets the Ext LO Multiplier for DUT</p> <p>When <b>DUT</b> type is <b>AMPLifier</b>, sets the Ext LO Multiplier for System Downconverter</p> |
| Preset                       | 1                                                                                                                                                                                                                                                                                                                                                                                                                             |
| State Saved                  | Yes                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Min                          | 1                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Max                          | 20000000000                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Backwards Compatibility SCPI | <p><b>:SOURce:EXternal:FREQuency[:FACTor]:DENominator</b></p> <p>(FSP)</p> <p><b>[ :SENSe]:NFIGure:MODE:LOSCillator:PARAmeter:MULTiplier:DENominator &lt;int&gt;</b></p> <p><b>[ :SENSe]:NFIGure:MODE:LOSCillator:PARAmeter:MULTiplier:DENominator?</b></p>                                                                                                                                                                   |

### Min Freq

Used to specify the minimum frequency that the external source is capable of. Attempting to set the external source to a value less than this will result in an error message and clipping to this value.

This value is automatically set when the minimum frequency of the external source is capable of being queried.

|                |                                                                                                                                                                                                                  |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <p><b>[ :SENSe]:NFIGure:MODE:LOSCillator:SYStem:PARAmeter:MINimum[:FREQuency] &lt;freq&gt;</b></p> <p><b>[ :SENSe]:NFIGure:MODE:LOSCillator:SYStem:PARAmeter:MINimum[:FREQuency]?</b></p>                        |
| Example        | <p><b>:NFIG:MODE:LOSC:SYS:PAR:MIN 100 kHz</b></p> <p><b>:NFIG:MODE:LOSC:SYS:PAR:MIN?</b></p>                                                                                                                     |
| Couplings      | <p>Automatically populates when the address of a SCPI-compliant source is selected and connected by pressing <b>Select Highlighted Source</b></p> <p>The LO frequency cannot be set to lower than this value</p> |
| Preset         | 10 MHz                                                                                                                                                                                                           |
| State Saved    | Yes                                                                                                                                                                                                              |
| Min            | 1 Hz                                                                                                                                                                                                             |
| Max            | 324.999999999 GHz                                                                                                                                                                                                |



## Backwards Compatibility Command

|                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Couplings                    | <p>Automatically populates when the address of a SCPI-compliant source is selected and connected by pressing <b>Select Highlighted Source</b></p> <p>The LO frequency cannot be set lower than this value</p> <p>When "DUT" on page 219 type is <b>DOWNconv</b>, <b>UPConv</b> or <b>MCONverter</b>, and System Downconverter is <b>ON</b>, this command is invalid</p> <p>When <b>DUT</b> type is <b>DOWNconv</b>, <b>UPConv</b> or <b>MCONverter</b>, and System Downconverter is <b>OFF</b>, sets the Ext LO Min Frequency for DUT</p> <p>When <b>DUT</b> type is <b>AMPLifier</b>, sets the Ext LO Min Frequency for System Downconverter</p> |
| Preset                       | 10 MHz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| State Saved                  | Yes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Min                          | 1 Hz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Max                          | 324.999999999 GHz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Backwards Compatibility SCPI | <pre>:SYSTem:CONFigure:LOSCillator:PARAmeter:MINimum[:FREQuency] [:SENSe]:NFIGure:MODE:LOSCillator:PARAmeter:MINimum[:FREQuency] &lt;freq&gt; [:SENSe]:NFIGure:MODE:LOSCillator:PARAmeter:MINimum[:FREQuency]?</pre>                                                                                                                                                                                                                                                                                                                                                                                                                              |

## Max Freq

Used to specify the maximum frequency that the external source is capable of. Attempting to set the external source to a value greater than this will result in an error message and clipping to this value.

This value is automatically set when the maximum frequency of the external source is capable of being queried.

|                |                                                                                                                                                                                                                   |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <pre>[:SENSe]:NFIGure:MODE:LOSCillator:SYSTem:PARAmeter:MAXimum[:FREQuency] &lt;freq&gt; [:SENSe]:NFIGure:MODE:LOSCillator:SYSTem:PARAmeter:MAXimum[:FREQuency]?</pre>                                            |
| Example        | <pre>:NFIG:MODE:LOSC:SYS:PAR:MAX 100 kHz :NFIG:MODE:LOSC:SYS:PAR:MAX?</pre>                                                                                                                                       |
| Couplings      | <p>Automatically populates when the address of a SCPI-compliant source is selected and connected by pressing <b>Select Highlighted Source</b></p> <p>The LO frequency cannot be set to higher than this value</p> |
| Preset         | 10 MHz                                                                                                                                                                                                            |
| State Saved    | Yes                                                                                                                                                                                                               |
| Min            | 2 Hz                                                                                                                                                                                                              |
| Max            | 3.30 THz                                                                                                                                                                                                          |

## Backwards Compatibility Command

|                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Couplings                    | <p>Automatically populates when the address of a SCPI-compliant source is selected and connected by pressing <b>Select Highlighted Source</b></p> <p>The LO frequency cannot be set higher than this value</p> <p>When "DUT" on page 219 type is <b>DOWNconv</b>, <b>UPConv</b> or <b>MCONverter</b>, and System Downconverter is <b>ON</b>, this command is invalid</p> <p>When <b>DUT</b> type is <b>DOWNconv</b>, <b>UPConv</b> or <b>MCONverter</b>, and System Downconverter is <b>OFF</b>, sets the Ext LO Max Frequency for DUT</p> <p>When <b>DUT</b> type is <b>AMPLifier</b>, sets the Ext LO Max Frequency for System Downconverter</p> |
| Preset                       | 10 MHz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| State Saved                  | Yes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Min                          | 2 Hz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Max                          | 3.30 THz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Backwards Compatibility SCPI | <pre>:SYSTem:CONFigure:LOSCillator:PARAmeter:MAXimum[:FREQuency]</pre> <pre>[ :SENSe]:NFIGure:MODE:LOSCillator:PARAmeter:MAXimum[:FREQuency] &lt;freq&gt;</pre> <pre>[ :SENSe]:NFIGure:MODE:LOSCillator:PARAmeter:MAXimum[:FREQuency]?</pre>                                                                                                                                                                                                                                                                                                                                                                                                       |

## LO Commands

Selects the command set used to control the external LO. Standard SCPI commands are used by default and will work with all Keysight Signal Sources and other SCPI-compliant sources. Non SCPI-compliant sources may be controlled using custom commands defined by the LO Commands parameter. The custom commands are stored with the State, but if you do not store the state prior to **Restore Mode Defaults**, then the custom settings will be lost. If you change from using SCPI commands to using custom commands without saving the state of the instrument, the custom commands will be preserved and will be recalled when you move back to custom commands.

|                |                                                                                                                                    |
|----------------|------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <pre>[ :SENSe]:NFIGure:MODE:LOSCillator:SYSTem:TYPE SCPI   CUSTom</pre> <pre>[ :SENSe]:NFIGure:MODE:LOSCillator:SYSTem:TYPE?</pre> |
| Example        | <pre>:NFIG:MODE:LOSC:SYS:TYPE CUST</pre> <pre>:NFIG:MODE:LOSC:SYS:TYPE?</pre>                                                      |
| Couplings      | LO Commands parameter is disabled when set to SCPI                                                                                 |
| Preset         | <b>SCPI</b>                                                                                                                        |
| State Saved    | Yes                                                                                                                                |
| Range          | <b>SCPI CUSTom</b>                                                                                                                 |

## Backwards Compatibility Command

|                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Couplings                    | <p><b>LO Commands</b> is disabled when set to <b>SCPI</b></p> <p>When <b>"DUT" on page 219</b> type is <b>DOWNconv</b>, <b>UPConv</b> or <b>MCONverter</b>, and System Downconverter is <b>ON</b>, this command is invalid</p> <p>When <b>DUT</b> type is <b>DOWNconv</b>, <b>UPConv</b> or <b>MCONverter</b>, and System Downconverter is <b>OFF</b>, sets the Ext LO Command Set for DUT</p> <p>When <b>DUT</b> type is <b>AMPLifier</b>, sets the Ext LO Command Set for System Downconverter</p> |
| Preset                       | <b>SCPI</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| State Saved                  | Yes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Range                        | <b>SCPI   CUSTom</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Backwards Compatibility SCPI | <p><b>:SYSTem:CONFigure:LOSCillator:TYPE</b></p> <p><b>[ :SENSe]:NFIGure:MODE:LOSCillator:TYPE SCPI   CUSTom</b></p> <p><b>[ :SENSe]:NFIGure:MODE:LOSCillator:TYPE?</b></p>                                                                                                                                                                                                                                                                                                                          |

## Power Prefix

Specifies a custom command to be used for setting external LO power.

|                |                                                                                                                                                                                                 |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <p><b>[ :SENSe]:NFIGure:MODE:LOSCillator:SYSTem:COMManD:POWer:PREFix &lt;string&gt;</b></p> <p><b>[ :SENSe]:NFIGure:MODE:LOSCillator:SYSTem:COMManD:POWer:PREFix?</b></p>                       |
| Example        | <p><b>:NFIG:MODE:LOSC:SYS:COMM:POW:PREF "power"</b></p> <p><b>:NFIG:MODE:LOSC:SYS:COMM:POW:PREF?</b></p>                                                                                        |
| Couplings      | Disabled when LO commands set to SCPI. If tried to be changed, then an advisory message appears: "Settings conflict; custom LO commands only available when command set is custom." number -221 |
| Preset         | <b>"POW"</b>                                                                                                                                                                                    |
| State Saved    | Yes                                                                                                                                                                                             |
| Range          | Alphanumeric                                                                                                                                                                                    |

## Backwards Compatibility Command

|           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|-----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Couplings | <p>Disabled when <b>"LO Commands" on page 268</b> is set to <b>SCPI</b>. If you attempt to change it, then an advisory message appears: Settings conflict; custom LO commands only available when command set is custom." number -221</p> <p>When <b>"DUT" on page 219</b> type is <b>DOWNconv</b>, <b>UPConv</b> or <b>MCONverter</b>, and System Downconverter is <b>ON</b>, this command is invalid</p> <p>When <b>DUT</b> type is <b>DOWNconv</b>, <b>UPConv</b> or <b>MCONverter</b>, and System Downconverter is <b>OFF</b>, sets the Ext LO Power Prefix for DUT</p> <p>When <b>DUT</b> type is <b>AMPLifier</b>, sets the Ext LO Power Prefix for System Downconverter</p> |
| Preset    | <b>"POW"</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |

|               |                                                                                     |
|---------------|-------------------------------------------------------------------------------------|
| State Saved   | Yes                                                                                 |
| Range         | Alphanumeric                                                                        |
| Backwards     | <code>:SYSTem:CONFIgure:LOSCillator:COMManD:POWer:PREFix</code>                     |
| Compatibility | <code>[ :SENSe]:NFIGure:MODE:LOSCillator:COMManD:POWer:PREFix &lt;string&gt;</code> |
| SCPI          | <code>[ :SENSe]:NFIGure:MODE:LOSCillator:COMManD:POWer:PREFix?</code>               |

## Power Suffix

Specifies a custom command to be used for setting external LO power units.

|                |                                                                                                                                                                            |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:NFIGure:MODE:LOSCillator:SYSTem:COMManD:POWer:SUFFix &lt;string&gt;</code><br><code>[ :SENSe]:NFIGure:MODE:LOSCillator:SYSTem:COMManD:POWer:SUFFix?</code> |
| Example        | <code>:NFIG:MODE:LOSC:SYS:COMM:POW:SUFF "W"</code><br><code>:NFIG:MODE:LOSC:SYS:COMM:POW:SUFF?</code>                                                                      |
| Couplings      | Disabled when LO commands set to SCPI                                                                                                                                      |
| Preset         | "DBM"                                                                                                                                                                      |
| State Saved    | Yes                                                                                                                                                                        |
| Range          | Alphanumeric                                                                                                                                                               |

## Backwards Compatibility Command

|               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Couplings     | Disabled when "LO Commands" on page 268 is set to <b>SCPI</b><br>When "DUT" on page 219 type is <b>DOWNconv</b> , <b>UPConv</b> or <b>MCONverter</b> , and System Downconverter is <b>ON</b> , this command is invalid<br>When <b>DUT</b> type is <b>DOWNconv</b> , <b>UPConv</b> or <b>MCONverter</b> , and System Downconverter is <b>OFF</b> , sets the Ext LO Power Suffix for DUT<br>When <b>DUT</b> type is <b>AMPLifier</b> , sets the Ext LO Power Suffix for System Downconverter |
| Preset        | "DBM"                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| State Saved   | Yes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Range         | Alphanumeric                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Backwards     | <code>:SYSTem:CONFIgure:LOSCillator:COMManD:POWer:SUFFix</code>                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Compatibility | <code>[ :SENSe]:NFIGure:MODE:LOSCillator:COMManD:POWer:SUFFix &lt;string&gt;</code>                                                                                                                                                                                                                                                                                                                                                                                                        |
| SCPI          | <code>[ :SENSe]:NFIGure:MODE:LOSCillator:COMManD:POWer:SUFFix?</code>                                                                                                                                                                                                                                                                                                                                                                                                                      |

## Freq Prefix

Specifies a custom command to be used for setting external LO frequency.

### 3 Noise Figure Mode

#### 3.7 Meas Setup

|                |                                                                                                                                                                                    |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:NFIGure:MODE:LOSCillator:SYStem:COMManD:FREQuency:PREFix &lt;string&gt;</code><br><code>[ :SENSe]:NFIGure:MODE:LOSCillator:SYStem:COMManD:FREQuency:PREFix?</code> |
| Example        | <code>:NFIG:MODE:LOSC:SYS:COMM:FREQ:PREF "FREQuency"</code><br><code>:NFIG:MODE:LOSC:SYS:COMM:FREQ:PREF?</code>                                                                    |
| Couplings      | Disabled when LO commands set to SCPI                                                                                                                                              |
| Preset         | "FREQ"                                                                                                                                                                             |
| State Saved    | Yes                                                                                                                                                                                |
| Range          | Alphanumeric                                                                                                                                                                       |

#### Backwards Compatibility Command

|                              |                                                                                                                                                                                                                                                                                                                                                                                                         |
|------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Couplings                    | Disabled when "LO Commands" on page 268 is set to SCPI<br>When "DUT" on page 219 type is DOWNconv, UPConv or MCONverter, and System Downconverter is ON, this command is invalid<br>When DUT type is DOWNconv, UPConv or MCONverter, and System Downconverter is OFF, sets the Ext LO Frequency Prefix for DUT<br>When DUT type is AMPLifier, sets the Ext LO Frequency Prefix for System Downconverter |
| Preset                       | "FREQ"                                                                                                                                                                                                                                                                                                                                                                                                  |
| State Saved                  | Yes                                                                                                                                                                                                                                                                                                                                                                                                     |
| Range                        | Alphanumeric                                                                                                                                                                                                                                                                                                                                                                                            |
| Backwards Compatibility SCPI | <code>:SYStem:CONFigure:LOSCillator:COMManD:FREQuency:PREFix</code><br><code>[ :SENSe]:NFIGure:MODE:LOSCillator:COMManD:FREQuency:PREFix &lt;string&gt;</code><br><code>[ :SENSe]:NFIGure:MODE:LOSCillator:COMManD:FREQuency:PREFix?</code>                                                                                                                                                             |

#### Freq Suffix

Specifies a custom command to be used for setting external LO frequency units.

|                |                                                                                                                                                                                    |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:NFIGure:MODE:LOSCillator:SYStem:COMManD:FREQuency:SUFFix &lt;string&gt;</code><br><code>[ :SENSe]:NFIGure:MODE:LOSCillator:SYStem:COMManD:FREQuency:SUFFix?</code> |
| Example        | <code>:NFIG:MODE:LOSC:SYS:COMM:FREQ:SUFF "MHz"</code><br><code>:NFIG:MODE:LOSC:SYS:COMM:FREQ:SUFF?</code>                                                                          |
| Couplings      | Disabled when LO commands set to SCPI                                                                                                                                              |
| Preset         | "Hz"                                                                                                                                                                               |
| State Saved    | Yes                                                                                                                                                                                |
| Range          | Alphanumeric                                                                                                                                                                       |

## Backwards Compatibility Command

|                              |                                                                                                                                                                                                                                                                                                                                                                                                                            |
|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Couplings                    | <p>Disabled when "LO Commands" on page 268 is set to SCPI</p> <p>When "DUT" on page 219 type is DOWNconv, UPConv or MCONverter, and System Downconverter is ON, this command is invalid</p> <p>When DUT type is DOWNconv, UPConv or MCONverter, and System Downconverter is OFF, sets the Ext LO Frequency Suffix for DUT</p> <p>When DUT type is AMPLifier, sets the Ext LO Frequency Suffix for System Downconverter</p> |
| Preset                       | "Hz"                                                                                                                                                                                                                                                                                                                                                                                                                       |
| State Saved                  | Yes                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Range                        | Alphanumeric                                                                                                                                                                                                                                                                                                                                                                                                               |
| Backwards Compatibility SCPI | <p>:SYSTEM:CONFigure:LOSCillator:COMManD:FREQuency:SUFFix</p> <p>[ :SENSe]:NFIGure:MODE:LOSCillator:COMManD:FREQuency:SUFFix &lt;string&gt;</p> <p>[ :SENSe]:NFIGure:MODE:LOSCillator:COMManD:FREQuency:SUFFix?</p>                                                                                                                                                                                                        |

## Auxiliary

Specifies a custom command to be used between setting the power and setting the frequency. By default, it is used to ensure the RF signal is switched ON. Several commands can be chained together using the standard semicolon. NFA allows this.

|                |                                                                                                                                                       |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <p>[ :SENSe]:NFIGure:MODE:LOSCillator:SYStem:COMManD:AUXiliary &lt;string&gt;</p> <p>[ :SENSe]:NFIGure:MODE:LOSCillator:SYStem:COMManD:AUXiliary?</p> |
| Example        | <p>:NFIG:MODE:LOSC:SYS:COMM:AUX "RF ON"</p> <p>:NFIG:MODE:LOSC:SYS:COMM:AUX?</p>                                                                      |
| Couplings      | Disabled when LO commands set to SCPI                                                                                                                 |
| Preset         | "OUTP:STAT ON"                                                                                                                                        |
| State Saved    | Yes                                                                                                                                                   |
| Range          | Alphanumeric                                                                                                                                          |

## Backwards Compatibility Command

|             |                                                                                                                                                                                                                                                                                                                                                                                                              |
|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Couplings   | <p>Disabled when "LO Commands" on page 268 is set to SCPI</p> <p>When "DUT" on page 219 type is DOWNconv, UPConv or MCONverter, and System Downconverter is ON, this command is invalid</p> <p>When DUT type is DOWNconv, UPConv or MCONverter, and System Downconverter is OFF, sets the Ext LO Auxiliary for DUT</p> <p>When DUT type is AMPLifier, sets the Ext LO Auxiliary for System Downconverter</p> |
| Preset      | "OUTP:STAT ON"                                                                                                                                                                                                                                                                                                                                                                                               |
| State Saved | Yes                                                                                                                                                                                                                                                                                                                                                                                                          |

|               |                                                               |
|---------------|---------------------------------------------------------------|
| Range         | Alphanumeric                                                  |
| Backwards     | :SYSTem:CONFigure:LOSCillator:COMManD:AUXiliary               |
| Compatibility | [ :SENSe]:NFIGure:MODE:LOSCillator:COMManD:AUXiliary <string> |
| SCPI          | [ :SENSe]:NFIGure:MODE:LOSCillator:COMManD:AUXiliary?         |

## LO Select

Displays the Add Source dialog, which lets you add a new source to list.

## LAN

The LAN cannot be scanned directly from the instrument software, but you can import the list of currently configured devices from Keysight Connection Expert, by pressing **Add From Connection Expert List**. The Connection Expert List depends on which instruments have already been discovered by the Keysight Connection Expert application. Any connected, supported sources in that list will be added.

You can also enter the IP address then press **Add**. If a supported source is found at that address, it will be added.

If you want to discover sources on the LAN, open Connection Expert by pressing “**Run Connection Expert...**”.

## IP Address

Lets you enter the IP address of the desired source. After you enter the address, press **Add** to add the source at that address to the Available Source List.

|             |                                                                                             |
|-------------|---------------------------------------------------------------------------------------------|
| Preset      | Unaffected by <b>Mode Preset</b> but set to 0.0.0.0 by <b>Restore Input/Output Defaults</b> |
| State Saved | No                                                                                          |

## Add Specified IP Address

Adds the source at the entered IP address to the Available Source List. If a supported source is found at that address it will be added to the list.

|       |                                                                                              |
|-------|----------------------------------------------------------------------------------------------|
| Notes | If no supported source is found at the specified address, an error message is generated –310 |
|-------|----------------------------------------------------------------------------------------------|

## Run Connection Expert

Runs the **Keysight Connection Expert** so that you can scan the LAN for sources.

## Add From Connection Expert

You can import the list of currently configured devices from **Keysight Connection Expert** by pressing **Add From Connection Expert**. The Connection Expert list depends on which instruments have already been discovered by **Keysight Connection Expert**. Any connected, supported sources in that list will be added.

---

|       |                                                                                                   |
|-------|---------------------------------------------------------------------------------------------------|
| Notes | If no supported source is found in the Connection Expert list, an error message is generated –310 |
|-------|---------------------------------------------------------------------------------------------------|

## GPIB

Lets you add GPIB sources to the Available Source List. Both GPIB-GPIB and USB-GPIB interfaces are supported.

For the GPIB-GPIB interface to work properly, it must be configured as a Controller. You can find this setting under **System, I/O Config, GPIB**. Set the GPIB Controller function to **Enabled**.

You must also ensure that the GPIB interface is *not* set to **Ignore** in **Keysight Connection Expert**. If it is set to **Ignore**, then even if the GPIB Controller is set to **Enabled**, it is not possible for the instrument to find a GPIB-connected source. See ["Checking Ignore Status" on page 284](#) below.

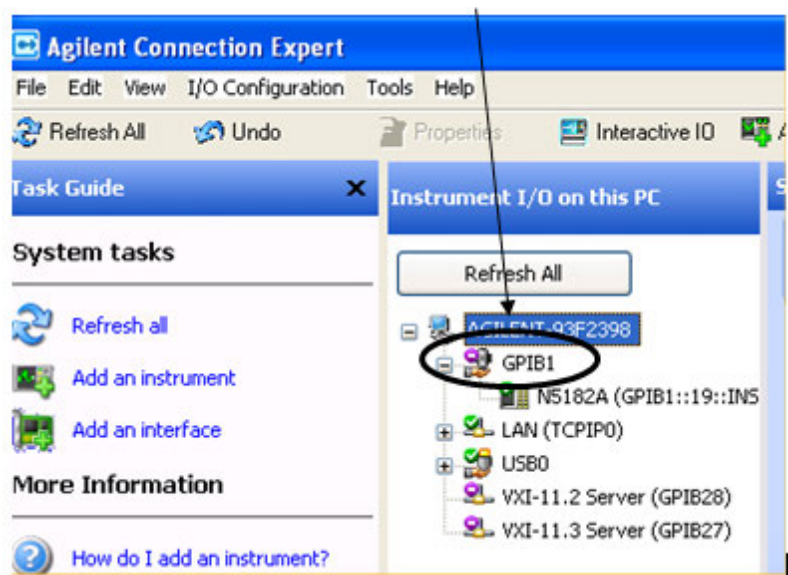
For the USB-GPIB interface, you do *not* need to set the GPIB Controller to **Enabled**.

### Checking Ignore Status

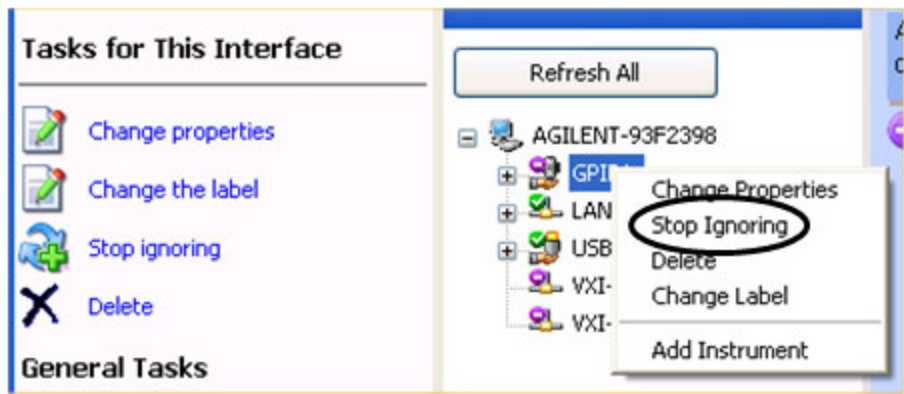
If you suspect that the GPIB interface is set to **Ignore**, run **Keysight Connection Expert**, by pressing **Meas Setup, Ext LO Config, Add Source to List, LAN, "Run Connection Expert" on page 283**. Look for the GPIB branch on the interface tree:



3 Noise Figure Mode  
3.7 Meas Setup



Right click on the GPIB branch. You should see a dialog like the one below. If this dialog shows **Stop Ignoring**, select **Stop Ignoring** and close the Connection Expert.



GPIB Address

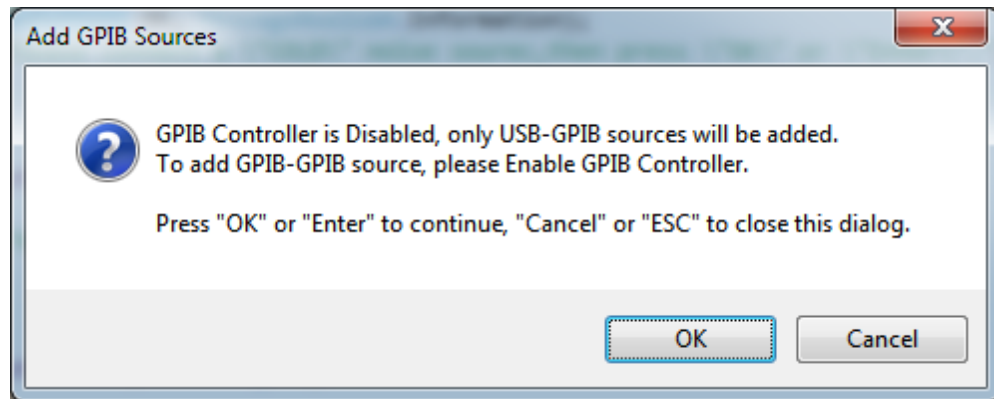
Lets you enter the GPIB address. After entering the address, press **Add** to add the source at that address to the Available Source List.

|             |                                                                                        |
|-------------|----------------------------------------------------------------------------------------|
| Preset      | Unaffected by <b>Mode Preset</b> but set to 19 by <b>Restore Input/Output Defaults</b> |
| State Saved | No                                                                                     |
| Min         | 0                                                                                      |
| Max         | 30                                                                                     |

NOTE

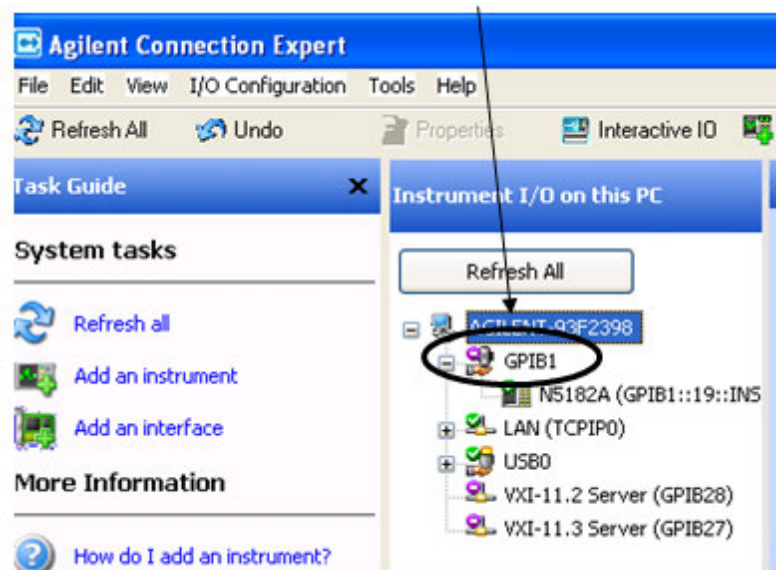
For this to work properly, the GPIB interface must be configured as **GPIB1**. This is the default state and should normally be the case. For the process to verify this, see "[Checking Ignore Status](#)" on page 286 below.

Both GPIB-GPIB and USB-GPIB connection are supported. If GPIB Controller is disabled, the following pop-up message will be displayed to inform you that only USB-GPIB sources will be added.



## Checking Ignore Status

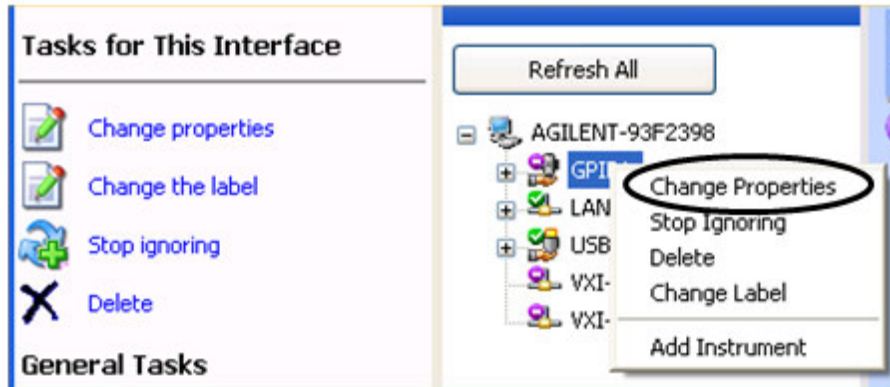
If you suspect that the GPIB interface is set to **Ignore**, run **Keysight Connection Expert**, by pressing **Meas Setup**, **Ext LO Config**, **Add Source to List**, **LAN**, "[Run Connection Expert](#)" on page 283. Look for the GPIB branch on the interface tree:



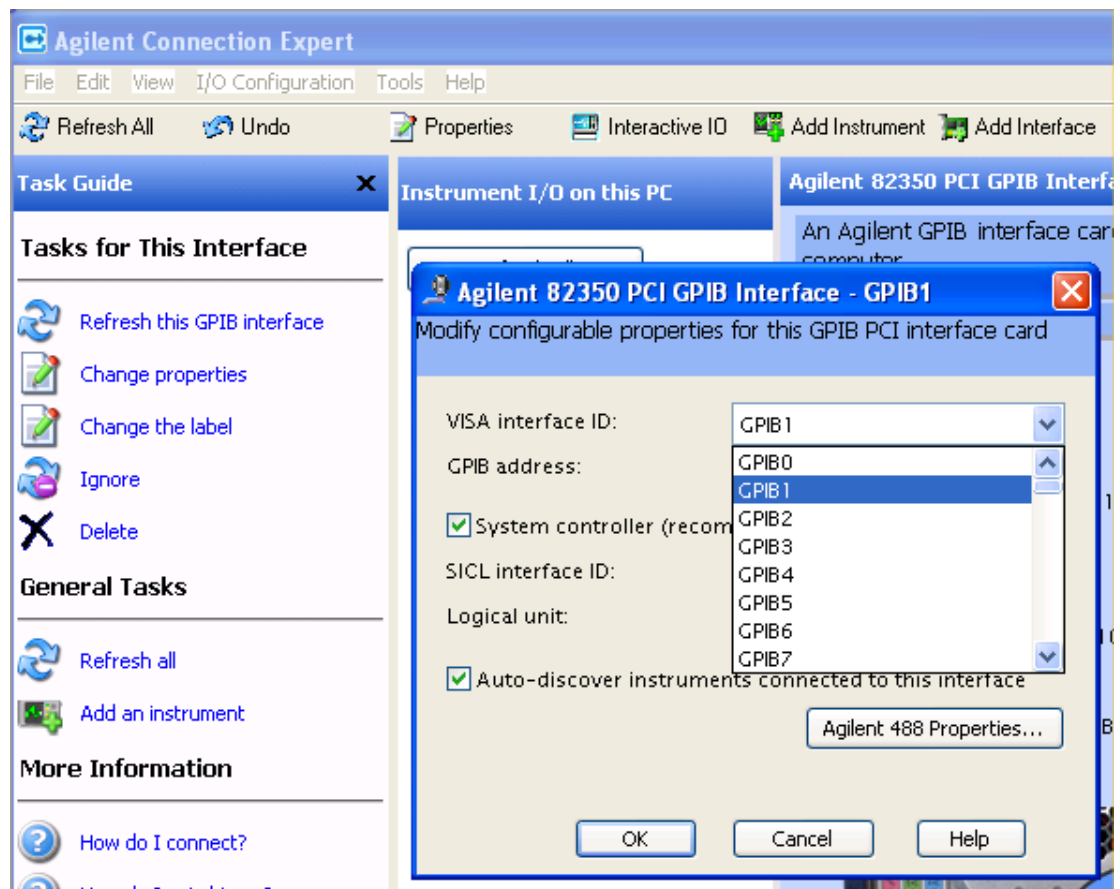
### 3 Noise Figure Mode

#### 3.7 Meas Setup

If this branch is not labeled GPIB1, right click on the GPIB branch, and select **Change Properties**.



You should see a dialog like the one below. Click on the drop-down arrow to the right of **VISA Interface ID**, select **GPIB1** and click **OK**



## Add Specified GPIB Address

Add the source at the entered GPIB address to the Available Source List. If a supported source is found at that address it will be added to the list.

---

|       |                                                                                              |
|-------|----------------------------------------------------------------------------------------------|
| Notes | If no supported source is found at the specified address, an error message is generated –310 |
|-------|----------------------------------------------------------------------------------------------|

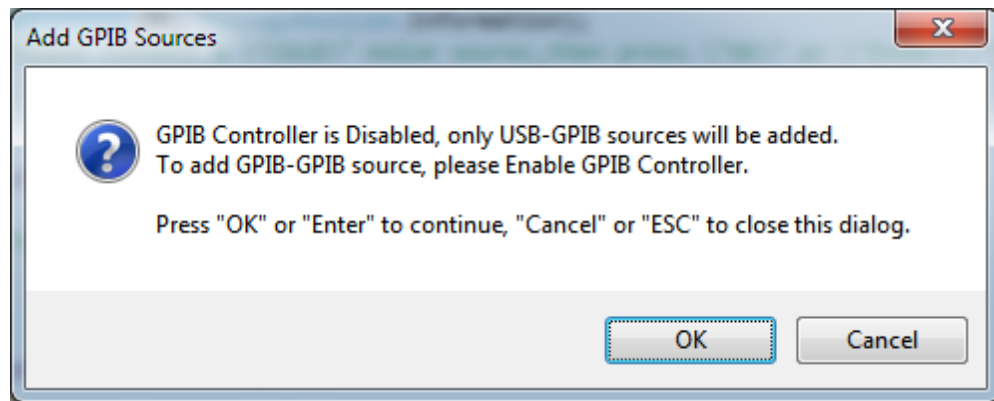
---

## Scan and Add GPIB Sources

Press to add sources on GPIB. Any supported source found will be added to the Available Source List.

### NOTE

Both GPIB-GPIB and USB-GPIB connection are supported. If GPIB Controller is disabled, the following pop-up message will be displayed to inform you that only USB-GPIB sources will be added.



---

|       |                                                                                            |
|-------|--------------------------------------------------------------------------------------------|
| Notes | If no GPIB device is found which is a supported source, an error message is generated –310 |
|-------|--------------------------------------------------------------------------------------------|

---

## USB

Sources on USB (once installed) can be added to the list by pressing **Add Installed USB Sources**. Any supported source found will be added to the list.

## Add Installed USB Sources

Press to add USB sources to the Available Source List. Note that this function will *only* find sources that have previously been installed onto the USB. For information on how to install a USB source, see ["Installing a USB source" on page 289](#).

---

|       |                                                                                                    |
|-------|----------------------------------------------------------------------------------------------------|
| Notes | If no installed USB device is found that is a supported source, an error message is generated –310 |
|-------|----------------------------------------------------------------------------------------------------|

---

Installing a USB source

USB is the only interface that requires no user runtime action in the **Select Source** menu, but does require “installation” when a source is plugged in.

Start by connecting the USB source to the instrument. You will see a series of messages indicating that the instrument is installing required device software.

When the installation is complete, you will see a message to that effect. You can then use **Add Installed USB Sources** to add the source to the list of sources in the Available Source List.

Once a given source is installed, you should not have to repeat this procedure for that source (unless you disconnect the USB source then re-connect it to a *different* port).

Select Highlighted Source As DUT LO

You can navigate up and down in the list with the up and down arrow keys and select any entry by pressing **"Select Highlighted Source As DUT LO"** on page 289.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SYSTem:COMMunicate:SOURce:DUT:ADDRess &lt;address string&gt;</code><br><code>:SYSTem:COMMunicate:SOURce:DUT:ADDRess?</code>                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Example        | Various examples for setting external source address:<br><code>:SYST:COMM:SOUR:DUT:ADDR "TCPIP0::MyHostName::INSTR"</code><br><code>:SYST:COMM:SOUR:DUT:ADDR "TCPIP0::123.121.100.210::INSTR"</code><br><code>:SYST:COMM:SOUR:DUT:ADDR "USB0::12212::32145::US1234567A::INSTR"</code><br><code>:SYST:COMM:SOUR:DUT:ADDR "GPIB1::19::INSTR"</code>                                                                                                                                                                                                                                |
| Notes          | Empty string is allowed and means no source is defined or selected                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Dependencies   | If no supported source, or no source at all is found at the specified address, the command generates an error message -310                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Couplings      | Coupled to the Min Frequency and Max Frequency parameters if the address entered is that of a SCPI-compliant Signal Source. In this case, the Min and Max Frequency parameters are set according to the results of <b>FREQ? MIN</b> and <b>FREQ? MAX</b> queries<br>If the specified address does not respond, error message 167 is displayed<br>If the specified address is valid, but not that of a valid <i>source</i> (for example, the address of another instrument or PC), error message 167 is displayed<br>If the address is not valid, error message -222 is displayed |

Select Highlighted Source As System Downconverter LO

You can navigate up and down in the list with the up and down arrow keys and select any entry by pressing **"Select Highlighted Source As DUT LO"** on page 289.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SYSTem:COMMunicate:SOURce:SYSTem:ADDRess &lt;address string&gt;</code><br><code>:SYSTem:COMMunicate:SOURce:SYSTem:ADDRess?</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Example        | Various examples for setting external source address:<br><code>:SYST:COMM:SOUR:SYST:ADDR "TCPIP0::MyHostName::INSTR"</code><br><code>:SYST:COMM:SOUR:SYST:ADDR "TCPIP0::123.121.100.210::INSTR"</code><br><code>:SYST:COMM:SOUR:SYST:ADDR "USB0::12212::32145::US1234567A::INSTR"</code><br><code>:SYST:COMM:SOUR:SYST:ADDR "GPIB1::19::INSTR"</code>                                                                                                                                                                                                                                          |
| Notes          | Empty string is allowed and means no source is defined or selected                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Dependencies   | If no supported source, or no source at all is found at the specified address, the SCPI command generates an error message –310                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Couplings      | Coupled to the Min Frequency and Max Frequency parameters if the address entered is that of a SCPI-compliant Signal Source. In this case, the Min and Max Frequency parameters are set according to the results of <code>:FREQ? MIN</code> and <code>:FREQ? MAX</code> queries<br>If the specified address does not respond, error message 167 is displayed<br>If the specified address is valid, but not that of a valid <i>source</i> (for example, the address of another instrument or PC), error message 167 is displayed<br>If the address is not valid, error message –222 is displayed |

### Select Highlighted Source (Remote Command only)

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SYSTem:COMMunicate:LAN:SOURce:EXTernal:IP &lt;string&gt;</code><br><code>:SYSTem:COMMunicate:LAN:SOURce:EXTernal:IP?</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Example        | <code>:SYST:COMM:LAN:SOUR:EXT:IP "192.168.0.1"</code><br><code>:SYST:COMM:LAN:SOUR:EXT:IP?</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Notes          | String entered must correspond to a valid IP address , that is, X.X.X.X where $0 \leq X \leq 255$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Couplings      | Coupled to the Min Frequency and Max Frequency parameters if the IP address entered is that of a SCPI-compliant Signal Source. In this case, the Min and Max Frequency parameters are set according to the results of <code>:FREQ? MIN</code> and <code>:FREQ? MAX</code><br>If the specified IP address does not respond, then error message 167 is displayed<br>If the specified IP address is valid but not that of a valid <i>source</i> (for example, the address of another instrument or PC), error message 167 is displayed<br>If the IP address is not valid (that is, not conforming to IP v4 standard, error message –222 is displayed<br>When "DUT" on page 219 type is <b>DOWNconv</b> , <b>UPConv</b> or <b>MCONverter</b> , and System Downconverter is <b>ON</b> , this command is invalid<br>When <b>DUT</b> type is <b>DOWNconv</b> , <b>UPConv</b> or <b>MCONverter</b> , sets the Ext LO address for DUT<br>When <b>DUT</b> type is <b>AMPLifier</b> , sets the Ext LO Address for System Downconverter |
| Range          | Numeric                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |

Delete Highlighted Source

Deletes the highlighted source from the list of available sources. You are first prompted with a dialog box, to confirm that you *really* want to do this: “The highlighted source will be permanently deleted from the list. Are you sure you want to do this? Press Enter to proceed or Cancel (ESC) to cancel.”

3.7.1.6 Uncertainty Calculator

Based largely upon the Java uncertainty calculator, which can be found at:

<http://www.keysight.com/find/nfu>

Automate Settings

Setting this control to **On** in the "Uncertainty Calculator" on page 291 fills in the parameters automatically, unless you set the corresponding field to **MANual** or **NONE**. The parameters are updated once at center frequency (CF) immediately when the control is changed from **Off** to **On**. You can press **Update at CF** or **Update at Selected Freq** to update the parameters at the frequency of interest at any time.

When this control is switched **ON**, the DUT type becomes non-editable and is updated from the DUT setup, that is, if **Amplifier** is selected in DUT setup, the DUT type will be **Amplifier**, otherwise it will be **Converter**. The DUT parameters, including “DUT NF” and “DUT Gain” become non-editable and are filled in using the latest measurement results. Pressing **Update** in the form or from the softpanel updates these two parameters immediately.

When this control is switched **ON**:

- "Noise Source" on page 299 type is set to **AUTO** if an SNS is connected, and “Noise Source Preference” is set to **SNS**
- "Instrument" on page 303 type is set to **AUTO**
- "Ext Preamp" on page 310 type is set to **AUTO** if an U7227x series USB preamplifier is connected

You have the flexibility to change **Noise Source** type, **Instrument** type or **Ext Preamp** type to **MANual** or **NONE** even when **Automate Settings** is **ON**. The related parameters are not updated automatically. See the descriptions of each parameter for details.

|                |                                                                                                  |
|----------------|--------------------------------------------------------------------------------------------------|
| Remote Command | :CALCulate:UNCertainty:PARAmeter:AUTO ON   OFF   1   0<br>:CALCulate:UNCertainty:PARAmeter:AUTO? |
| Example        | :CALC:UNC:PAR:AUTO ON                                                                            |

|             |                                    |
|-------------|------------------------------------|
| Couplings   | See above for detailed information |
| Preset      | OFF                                |
| State Saved | No                                 |
| Range       | ON OFF 1 0                         |

## Update Parameters

When "Automate Settings" on page 291 is enabled, you can press "Update at CF" on page 292 or "Update at Selected Freq" on page 293 to update the calculator parameters at the frequency of interest.

## Update at CF

Enabled only when "Automate Settings" on page 291 is enabled. Note that CF is based on the current "Freq Context" on page 218:

Forces the DUT parameters, including DUT NF and DUT Gain to be updated using the latest measurement results at CF. If CF is not measured, the values are interpolated between the two closest results

When the DUT type on DUT Setup view is **Converter**, and the start and stop frequencies of the current frequency context are equal, the calculator cannot determine the NS Freq and Inst Freq, and the error message "Settings conflict; Unable to interpolate NS and Inst Freq" is displayed

Forces the NS Freq to be updated according to current DUT setup and CF if Noise Source type is **Auto(SNS)/A346A/A346B/A346C**. Related NS parameters are updated automatically

Forces the Inst Freq to be updated if "Instrument" on page 303 type is **AUTO**. Related Inst parameters are updated automatically

Forces the Ext PA parameters to be updated automatically if "Ext Preamp" on page 310 type is **AUTO**

When the latest measurement results are invalid (a dirty marker is displayed), "---" is displayed for DUT NF and DUT Gain

|                |                                                          |
|----------------|----------------------------------------------------------|
| Remote Command | :CALCulate:UNCertainty:PARameter:FREQuency:CENTer:UPDate |
| Example        | :CALC:UNC:PAR:FREQ:CENT:UPD                              |
| Couplings      | See above for detailed information                       |



## Update at Selected Freq

Enabled only when ["Automate Settings" on page 291](#) is enabled. Note that Selected Freq is based on the current ["Freq Context" on page 218](#). When the Selected Freq is outside the measurement frequency range, error message "Settings conflict; Selected frequency is invalid" is displayed.

Forces the DUT parameters, including DUT NF and DUT Gain to be updated using the latest measurement results at Selected Freq. If Selected Freq point is not measured, the values are interpolated between the two closest results

When the DUT type on DUT Setup view is **Converter**, and the start and stop frequencies of the current frequency context are equal, the calculator cannot determine the NS Freq and Inst Freq if the Selected Freq is equal to start (or stop) frequency. Error message "Settings conflict; Unable to interpolate NS and Inst Freq" are displayed

Forces the NS Freq to be updated according to current DUT setup and Selected Freq if ["Noise Source" on page 299](#) type is [Auto\(SNS\)/A346A/A346B/A346C](#). Related NS parameters are updated automatically

Forces the Inst Freq to be updated if ["Instrument" on page 303](#) type is [AUTO](#). Related Inst parameters are updated automatically

Forces the Ext PA parameters to be updated automatically if ["Ext Preamp" on page 310](#) type is [AUTO](#)

When the latest measurement results are invalid (a dirty marker is displayed), "---" is displayed for DUT NF and DUT Gain

|                |                                                                                      |
|----------------|--------------------------------------------------------------------------------------|
| Remote Command | <code>:CALCulate:UNCertainty:PARAmeter:FREQuency:SElected:UPDate &lt;freq&gt;</code> |
| Example        | <code>:CALC:UNC:PAR:FREQ:SEL:UPD</code>                                              |
| Couplings      | See above for detailed information                                                   |

## Selected Freq

Sets the selected frequency to be used when ["Update at Selected Freq" on page 293](#) is pressed. This parameter is based on the current ["Freq Context" on page 218](#). If the context is [RF](#), this frequency is an RF frequency. Also applies to [LO](#) and [IF](#) context.

|                |                                                                                                                                                    |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALCulate:UNCertainty:PARAmeter:FREQuency:SElected &lt;freq&gt;</code><br><code>:CALCulate:UNCertainty:PARAmeter:FREQuency:SElected?</code> |
| Example        | <code>:CALC:UNC:PAR:FREQ:SEL 3GHz</code>                                                                                                           |
| Couplings      | Enabled only when <a href="#">"Automate Settings" on page 291</a> is enabled                                                                       |

|             |           |
|-------------|-----------|
| Preset      | 1.505 GHz |
| State Saved | Yes       |
| Min         | 0 Hz      |
| Max         | 3.30 THz  |

## DUT

Sets DUT type:

- Select **AMPLifier** if the DUT (device under test) has the same input and output frequencies, such as amplifier, attenuator, and filter
- Select **CONVerter** for frequency-converting devices, such as mixers

|                |                                                                                                                               |
|----------------|-------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | :CALCulate:UNCertainty:DUT AMPLifier   CONVerter<br>:CALCulate:UNCertainty:DUT?                                               |
| Example        | :CALC:UNC:DUT AMPL                                                                                                            |
| Couplings      | When "Automate Settings" on page 291 is ON, the DUT type becomes non-editable and is updated automatically from the DUT setup |
| Preset         | AMPL                                                                                                                          |
| State Saved    | No                                                                                                                            |
| Range          | AMPLifier CONVerter                                                                                                           |

## DUT NF, NF1

Includes the DUT noise figure settings.

### DUT NF, NF1

Selects the DUT noise figure to be used in the calculator.

It is best to set this to the best estimate of the NF, such as from the measurement itself, but changes in DUT NF only weakly effect the uncertainty.

When "Automate Settings" on page 291 is enabled, this parameter becomes non-editable and is filled in automatically from the measurement results at the frequency of interest. Pressing **Update** updates this parameter immediately.

|                |                                                                                   |
|----------------|-----------------------------------------------------------------------------------|
| Remote Command | :CALCulate:UNCertainty:DUT:NFIGure <value><br>:CALCulate:UNCertainty:DUT:NFIGure? |
| Example        | :CALC:UNC:DUT:NFIG 25.2dB<br>:CALC:UNC:DUT:NFIG?                                  |

|             |                                                                                                                                                                                                                                                                                                                                                                          |
|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Couplings   | Editable only when <b>Automate Settings</b> is disabled<br>Filled in automatically from the measurement results at center frequency, when <b>Automate Settings</b> changes from <b>Off</b> to <b>On</b><br>When <b>Automate Settings</b> is enabled, pressing <b>Update</b> updates this parameter immediately from the measurement results at the frequency of interest |
| Preset      | 3 dB                                                                                                                                                                                                                                                                                                                                                                     |
| State Saved | No                                                                                                                                                                                                                                                                                                                                                                       |
| Min/Max     | -/+100 dB                                                                                                                                                                                                                                                                                                                                                                |

## DUT NF Specification Style

The specification style of DUT noise figure is “Fixed”. It cannot be changed.

## DUT Gain, G1

Includes the DUT gain settings.

## DUT Gain, G1

Selects the DUT gain to be used in the calculator.

It is best to set this to the best estimate of the gain, such as from the measurement itself, but changes in DUT gain only weakly effect the uncertainty.

When "**Automate Settings**" on page 291 is enabled, this parameter becomes non-editable and is filled in automatically from the measurement results at the frequency of interest. Pressing **Update** updates this parameter immediately.

|                |                                                                                                                                                                                                                                                                                                                                                                          |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <b>:CALCulate:UNCertainty:DUT:GAIN &lt;value&gt;</b><br><b>:CALCulate:UNCertainty:DUT:GAIN?</b>                                                                                                                                                                                                                                                                          |
| Example        | <b>:CALC:UNC:DUT:GAIN 25.2dB</b><br><b>:CALC:UNC:DUT:GAIN?</b>                                                                                                                                                                                                                                                                                                           |
| Couplings      | Editable only when <b>Automate Settings</b> is disabled<br>Filled in automatically from the measurement results at center frequency, when <b>Automate Settings</b> changes from <b>Off</b> to <b>On</b><br>When <b>Automate Settings</b> is enabled, pressing <b>Update</b> updates this parameter immediately from the measurement results at the frequency of interest |
| Preset         | 20 dB                                                                                                                                                                                                                                                                                                                                                                    |
| State Saved    | No                                                                                                                                                                                                                                                                                                                                                                       |
| Min/Max        | -/+100 dB                                                                                                                                                                                                                                                                                                                                                                |

### DUT Gain Specification Style

The specification style of DUT gain is “Fixed”. It cannot be changed.

### DUT Input Match

Includes the DUT input match settings.

### DUT Input Match

Selects the DUT input match to be used in the calculator.

The input match especially can have a significant, though rarely dominant, effect of the uncertainty of the measurement. Therefore, a measured value of the match gives the best estimate of the uncertainty by the calculator.

As noted in the on-calculator footnote, the match can be entered as a return loss (any number that is zero or negative is treated as return loss in decibels), as a reflection coefficient (any number between 0 and 1 is treated as the magnitude of the reflection coefficient), or as a voltage standing-wave ratio, VSWR (any number 1 or larger is treated as a VSWR).

|                                 |                                                                                                                               |
|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------|
| Remote Command                  | <code>:CALCulate:UNCertainty:DUT:MATCH[:INPut] &lt;value&gt;</code><br><code>:CALCulate:UNCertainty:DUT:MATCH[:INPut]?</code> |
| Example                         | <code>:CALC:UNC:DUT:MATC 25.5</code><br><code>:CALC:UNC:DUT:MATC?</code>                                                      |
| Preset                          | 1.5                                                                                                                           |
| State Saved                     | No                                                                                                                            |
| Min/Max                         | -/+100                                                                                                                        |
| Backwards Compatibility<br>SCPI | <code>:CALCulate:UNCertainty:DUT:MATCH:INPut</code>                                                                           |

### DUT Input Match Specification Style

Selects the DUT input match specification style to be used in the calculator.

The values used for the DUT match, whether read from a DUT data sheet or measured, is usually best treated as a value that is not statistically varying., so it is best to set to **FIXed**.

|                   |                                                                                                                  |
|-------------------|------------------------------------------------------------------------------------------------------------------|
| Remote<br>Command | <code>:CALCulate:UNCertainty:DUT:MATCH[:INPut]:SPEC:STYLe MAXimum   PCT95   PCT80   MEDian   MEAN   FIXed</code> |
|-------------------|------------------------------------------------------------------------------------------------------------------|

|             |                                                                                             |
|-------------|---------------------------------------------------------------------------------------------|
|             | <code>:CALCulate:UNCertainty:DUT:MATCH[:INPut]:SPEC:STYLE?</code>                           |
| Example     | <code>:CALC:UNC:DUT:MATC:SPEC:STYL FIX</code><br><code>:CALC:UNC:DUT:MATC:SPEC:STYL?</code> |
| Preset      | <code>FIXed</code>                                                                          |
| State Saved | No                                                                                          |
| Range       | <code>MAXimum   PCT95   PCT80   MEDian   MEAN   FIXed</code>                                |

## DUT Input Match Distribution

Selects the DUT input match distribution to be used in the calculator.

The value used for the DUT match, whether read from a DUT data sheet or measured, is usually best treated as a value that is not statistically varying, so, it is best to set to `FIXed`.

|                |                                                                                                                                                                      |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALCulate:UNCertainty:DUT:MATCH[:INPut]:DISTribution RAYLeigh   FIXed   UNIFORM</code><br><code>:CALCulate:UNCertainty:DUT:MATCH[:INPut]:DISTribution?</code> |
| Example        | <code>:CALC:UNC:DUT:MATC:DIST FIX</code><br><code>:CALC:UNC:DUT:MATC:DIST?</code>                                                                                    |
| Preset         | <code>FIXed</code>                                                                                                                                                   |
| State Saved    | No                                                                                                                                                                   |
| Range          | <code>RAYLeigh   FIXed   UNIFORM</code>                                                                                                                              |

## DUT Output Match

Includes the DUT output match settings.

### DUT Output Match

Selects the DUT output match to be used in the calculator.

As noted in the on-calculator footnote, the match can be entered as a return loss (any number that is zero or negative is treated as return loss in decibels), as a reflection coefficient (any number between 0 and 1 is treated as the magnitude of the reflection coefficient), or as a voltage standing-wave ratio, VSWR (any number 1 or larger is treated as a VSWR).

|                |                                                                                                                             |
|----------------|-----------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALCulate:UNCertainty:DUT:MATCH:OUTPut &lt;value&gt;</code><br><code>:CALCulate:UNCertainty:DUT:MATCH:OUTPut?</code> |
| Example        | <code>:CALC:UNC:DUT:MATC:OUTP 25.5</code>                                                                                   |

|             |                                       |
|-------------|---------------------------------------|
|             | <code>:CALC:UNC:DUT:MATC:OUTP?</code> |
| Preset      | 0.24 dB                               |
| State Saved | No                                    |
| Min/Max     | -/+100                                |

## DUT Output Match Specification Style

Selects the DUT output match specification style to be used in the calculator.

The value used for the DUT match, whether read from a DUT data sheet or measured, is usually best treated as a value that is not statistically varying, so it is best to set to **FIXed**.

|                |                                                                                                                                                                                     |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALCulate:UNCertainty:DUT:MATCH:OUTPut:SPEC:STYLE MAXimum   PCT95   PCT80   MEDian   MEAN   FIXed</code><br><code>:CALCulate:UNCertainty:DUT:MATCH:OUTPut:SPEC:STYLE?</code> |
| Example        | <code>:CALC:UNC:DUT:MATC:OUTP:SPEC:STYL FIX</code><br><code>:CALC:UNC:DUT:MATC:OUTP:SPEC:STYL?</code>                                                                               |
| Preset         | <b>FIXed</b>                                                                                                                                                                        |
| State Saved    | No                                                                                                                                                                                  |
| Range          | <b>MAXimum   PCT95   PCT80   MEDian   MEAN   FIXed</b>                                                                                                                              |

## DUT Output Match Distribution

Selects the DUT output match distribution to be used in the calculator.

The value used for the DUT match, whether read from a DUT data sheet or measured, is usually best treated as a value that is not statistically varying, so it is best to set to **FIXed**.

|                |                                                                                                                                                                    |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALCulate:UNCertainty:DUT:MATCH:OUTPut:DISTribution RAYleigh   FIXed   UNIFORM</code><br><code>:CALCulate:UNCertainty:DUT:MATCH:OUTPut:DISTribution?</code> |
| Example        | <code>:CALC:UNC:DUT:MATC:DIST FIX</code><br><code>:CALC:UNC:DUT:MATC:DIST?</code>                                                                                  |
| Preset         | <b>FIXed</b>                                                                                                                                                       |
| State Saved    | No                                                                                                                                                                 |
| Range          | <b>RAYleigh   FIXed   UNIFORM</b>                                                                                                                                  |

## Noise Source

Set the Noise Source type. The calculator maintains an ENR uncertainty and a VSWR table for each Keysight noise source model. Choosing one of the listed noise sources from the drop-down menu conveniently sets values for NS parameters automatically from the table, based on current NS Freq setting.

For Keysight N4000 Smart Noise Source series, select **AUTO**. When there is no SNS connected, this option is grayed-out. For Keysight 346 series, select the actual model number (**A346A**, **A346B**, **A346C**, **A346CK01**, **A346CK40**).

For other noise sources, especially for the most accurate estimation of uncertainty, select **MANual**. This option can be selected whenever the actual value of the noise source calibration data is available. You must enter values for NS ENR Uncert and NS Match values. There are two ways to estimate the ENR uncertainty: the Calibration Data Report (also known as the Calibration Certificate) for the noise source in use, at the frequency of interest; or from the noise source Operating and Service Manual. The Calibration Data Report provides the more accurate estimation of uncertainty.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | :CALCulate:UNCertainty:SOURce AUTO   MANual   A346A   A346B   A346C   A346CK01   A346CK40<br>:CALCulate:UNCertainty:SOURce?                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Example        | :CALC:UNC:SOUR MAN                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Couplings      | <b>Auto (SNS)</b> is only available when an SNS is connected, and Noise Source Preference is set to SNS. Otherwise, <b>Auto (SNS)</b> is grayed-out<br>Changing <b>Automate Settings</b> from <b>Off</b> to <b>On</b> forces this setting to <b>Auto(SNS)</b> when an SNS is connected, and Noise Source Preference is set to SNS<br>When <b>Auto(SNS)</b> is selected, disconnecting the SNS forces it to <b>MANual</b><br>When <b>MANual</b> is selected, NS Freq is disabled and displayed as ---<br>When any of <b>Auto(SNS)/A346A/A346B/A346C</b> are selected, NS Freq becomes non-editable if <b>Automate Settings</b> is checked, and can be filled in automatically by pressing <b>Update</b> |
| Preset         | <b>MANual</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| State Saved    | Yes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Range          | <b>AUTO</b>   <b>MANual</b>   <b>A346A</b>   <b>A346B</b>   <b>A346C</b>   <b>A346CK01</b>   <b>A346CK40</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |

## NS Freq

Represents the frequency used in the measurement stage. The calculator uses this frequency to fill in NS ENR Uncertainty and Match parameters for standard Keysight Technologies noise sources.

When the "Noise Source" on page 299 type is **MANual**, it will be disabled and displayed as ---.

When the **Noise Source** type is any of **Auto(SNS)/A346A/A346B/A346C**:

- It can be set manually if **"Automate Settings"** on page 291 is **Off**
- It becomes non-editable if **Automate Settings** is switched **On**, and is filled in automatically according to current DUT type, **"Freq Context"** on page 218, and the CF or selected Freq. Pressing **Update** updates **NS Freq** immediately

If **NS Freq** is set manually or updated automatically, the NS ENR Uncertainty and Match parameters update immediately.

|                |                                                                                                                            |
|----------------|----------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALCulate:UNCertainty:SOURce:FREQuency &lt;freq&gt;</code><br><code>:CALCulate:UNCertainty:SOURce:FREQuency?</code> |
| Example        | <code>:CALC:UNC:SOUR:FREQ 3GHz</code>                                                                                      |
| Couplings      | See above                                                                                                                  |
| Preset         | 1.505 GHz                                                                                                                  |
| State Saved    | Yes                                                                                                                        |
| Min            | 0 Hz                                                                                                                       |
| Max            | 3.30 THz                                                                                                                   |

## ENR Uncert

Includes the noise source ENR uncertainty settings.

## ENR Uncert

Selects the ENR Uncertainty used in the uncertainty calculator.

For the most accurate estimation of uncertainty, set the NS ENR Uncertainty manually. This option can be selected whenever the actual value of the noise source calibration data is available. The values are available at each frequency on the Calibration Data Report, also known as the Calibration Certificate. This allows the entry of the actual uncertainty of the ENR and the 50  $\Omega$  match (in dB, VSWR or reflection coefficient).

The calibration data report gives the 95th percentile (two sigma) uncertainty of the ENR, which has a Gaussian probability density function.

### NOTE

**In frequency-converting DUT applications and other two-noise-source applications, the ENR uncertainty and the Noise Source Match can be different for the two locations of usage of the noise source or noise sources. This calculator is not designed to handle that case ideally; we recommend you use the worse of the parameters of the two applications to get a conservative, instead of accurate, estimate of noise figure uncertainty.**



### 3 Noise Figure Mode

#### 3.7 Meas Setup

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | :CALCulate:UNCertainty:SOURce:ENR <value><br>:CALCulate:UNCertainty:SOURce:ENR?                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Example        | :CALC:UNC:SOUR:ENR 1.25dB<br>:CALC:UNC:SOUR:ENR?                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Couplings      | Can be manually set only when "Noise Source" on page 299 type is <b>MANual</b><br>Filled in automatically with the ENR uncertainty at frequency of measurement stage ( <b>NS Freq</b> ) when "DUT" on page 219 type is <b>AMPLifier</b> , and <b>Noise Source</b> type is <b>Auto (SNS)/A346A/A346B/A346C</b><br>Filled in automatically with the ENR uncertainty at frequency of measurement stage ( <b>NS Freq</b> ) when <b>DUT</b> type is <b>MCONverter</b> , "Automate Settings" on page 291 is <b>Off</b> , and <b>Noise Source</b> type is any of <b>Auto (SNS)/A346A/A346B/A346C</b><br>Filled in automatically with the worse value of two ENR uncertainties at frequency of measurement stage ( <b>NS Freq</b> ) and calibration stage when <b>DUT</b> type is <b>MCONverter</b> , <b>Automate Settings</b> is <b>On</b> , and <b>Noise Source</b> type is any of <b>Auto (SNS)/A346A/A346B/A346C</b> |
| Preset         | 0.2 dB                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| State Saved    | No                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Min            | 0 dB                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Max            | 100 dB                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |

#### ENR Uncert Specification Style

The specification style of ENR Uncertainty is "95th percentile". It cannot be changed.

#### ENR Uncert Distribution

The distribution of ENR Uncertainty is Gaussian. It cannot be changed.

#### NS Match

Includes the noise source match settings.

#### NS Match

Selects the **NS Match** value used in the calculator.

The match may come from the calibration report, in which case the specification style and distribution are both "fixed." If the match comes from the data sheet of the noise source, statistical study of the data has shown that for some models and frequency ranges, using "maximum" for the specifications style and "Rayleigh" for the distribution gives a very accurate estimation of the uncertainty. For all other

models and bands, the use of maximum and Rayleigh gives a modestly conservative estimate of uncertainty. (Using the Rayleigh distribution and "Maximum" always results in a more accurate model than previous practice or the other distributions. Therefore, the recommended and default setting of the "Specification Style" column is Maximum and of "Distribution" is Rayleigh for Keysight Noise Sources.)

As noted in the on-calculator footnote, the match can be entered as a return loss (any number that is zero or negative is treated as return loss in decibels), as a reflection coefficient (any number between 0 and 1 is treated as the magnitude of the reflection coefficient), or as a voltage standing-wave ratio, VSWR (any number 1 or larger is treated as a VSWR).

**NOTE**

In frequency-converting DUT applications and other two-noise-source applications, the ENR uncertainty and the Noise Source Match can be different for the two locations of usage of the noise source or noise sources. This calculator is not designed to handle that case ideally; we recommend you use the worse of the parameters of the two applications to get a conservative, instead of accurate, estimate of noise figure uncertainty.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | :CALCulate:UNCertainty:SOURce:MATCH <value><br>:CALCulate:UNCertainty:SOURce:MATCH?                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Example        | :CALC:UNC:SOUR:MATC 5.55<br>:CALC:UNC:SOUR:MATC?                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Couplings      | Editable only when "Noise Source" on page 299 type is <b>MANual</b><br>Filled in automatically with the worse value of two states (On/Off) of NS when <b>Noise Source</b> type is <b>AUTO</b><br>Filled in automatically with the <b>NS Match</b> at frequency of measurement stage (NS Freq) when "DUT" on page 219 type is <b>AMPLifier</b> , and <b>Noise Source</b> type is any of <b>Auto (SNS)/A346A/A346B/A346C</b><br>Filled in automatically with the NS match at frequency of measurement stage (NS Freq) when <b>DUT</b> type is <b>MCONverter</b> , "Automate Settings" on page 291 is <b>Off</b> , and <b>Noise Source</b> type is any of <b>Auto (SNS)/A346A/A346B/A346C</b><br>Filled in automatically with the worse value of two NS matches at frequency of measurement stage (NS Freq) and calibration stage when <b>DUT</b> type is <b>MCONverter</b> , <b>Automate Settings</b> is <b>On</b> , and <b>Noise Source</b> type is any of <b>Auto (SNS)/A346A/A346B/A346C</b> |
| Preset         | 1.15                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| State Saved    | No                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Min/Max        | -/+100                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |

## NS Match Specification Style

Selects the NS match specification style to be used in the calculator.

### 3 Noise Figure Mode

#### 3.7 Meas Setup

|                |                                                                                                                                                                             |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALCulate:UNCertainty:SOURce:MATCH:SPEC:STYLE MAXimum   PCT95   PCT80   MEDian   MEAN   FIXed</code><br><code>:CALCulate:UNCertainty:SOURce:MATCH:SPEC:STYLE?</code> |
| Example        | <code>:CALC:UNC:SOUR:MATC:SPEC:STYL FIX</code><br><code>:CALC:UNC:SOUR:MATC:SPEC:STYL?</code>                                                                               |
| Couplings      | Only enabled when "Noise Source" on page 299 is set to <b>MANual</b>                                                                                                        |
| Preset         | <b>MAX</b>                                                                                                                                                                  |
| State Saved    | No                                                                                                                                                                          |
| Range          | <b>MAXimum</b>   <b>PCT95</b>   <b>PCT80</b>   <b>MEDian</b>   <b>MEAN</b>   <b>FIXed</b>                                                                                   |

## NS Match Distribution

Selects the NS match distribution to be used in the calculator.

|                |                                                                                                                                                            |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALCulate:UNCertainty:SOURce:MATCH:DISTRIBUTion RAYLeigh   FIXed   UNIFORM</code><br><code>:CALCulate:UNCertainty:SOURce:MATCH:DISTRIBUTion?</code> |
| Example        | <code>:CALC:UNC:SOUR:MATC:DIST FIX</code><br><code>:CALC:UNC:SOUR:MATC:DIST?</code>                                                                        |
| Couplings      | Only enabled when "Noise Source" on page 299 is set to <b>MANual</b>                                                                                       |
| Preset         | <b>RAYLeigh</b>                                                                                                                                            |
| State Saved    | No                                                                                                                                                         |
| Range          | <b>RAYLeigh</b>   <b>FIXed</b>   <b>UNIFORM</b>                                                                                                            |

## Instrument

Lets you specify whether the instrument parameters will be filled manually or automatically by the calculator.

The calculator maintains a specification table for each Keysight instrument model. By default, this parameter is set to **AUTO**. The calculator conveniently sets values for instrument parameters automatically from the specification table based on "Inst Freq" on page 304.

For most critical applications, the uncertainty is dominated by the ENR uncertainty of the noise source and only weakly dependent on instrument performance. Therefore, the convenience of using **AUTO** is sufficient for most needs.

For the most accurate estimation of uncertainty, select the **MANual** option and enter actual parameters to the extent known, at the frequency of interest. For example, the NF of the instrument at the exact operating frequency can be found by actual measurement or by reading graphs from the instrument data sheet or Specifications Guide. The instrument match may be measured with a network analyzer, or for X-

Series analyzers it can be estimated from graphs provided in the Specifications Guide, or for convenience in the PXA analyzer, the 95th percentile of the Rayleigh distribution of reflection coefficient can be taken from the Specifications Guide in the Preamplifier chapter. Instrument Uncertainty for NF and Instrument Uncertainty for Gain are both listed in the data sheets and Specifications Guides of Keysight instruments. "NFE Improvement" is listed in the Specifications Guide for X-Series instruments that have NFE available and thus are capable of Internal Cal.

With low gain or lossy devices, the instrument parameters can be significant or dominant contributors to uncertainty. You can change these values by setting this parameter to **MANual** and modifying values for instrument.

|                |                                                                                                                                                                                                                                                                                                                                                                        |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | :CALCulate:UNCertainty:INSTrument <b>AUTO</b>   <b>MANual</b><br>:CALCulate:UNCertainty:INSTrument?                                                                                                                                                                                                                                                                    |
| Example        | :CALC:UNC:INST <b>MAN</b>                                                                                                                                                                                                                                                                                                                                              |
| Couplings      | Forced to <b>AUTO</b> when "Automate Settings" on page 291 is changed from <b>Off</b> to <b>On</b><br>When <b>MANual</b> is selected, <b>Inst Freq</b> is disabled and displayed as ---<br>When <b>AUTO</b> is selected, <b>Inst Freq</b> becomes non-editable if <b>Automate Settings</b> is <b>On</b> , and can be filled in automatically by pressing <b>Update</b> |
| Preset         | <b>AUTO</b>                                                                                                                                                                                                                                                                                                                                                            |
| State Saved    | Yes                                                                                                                                                                                                                                                                                                                                                                    |
| Range          | <b>MANual</b>   <b>AUTO</b>                                                                                                                                                                                                                                                                                                                                            |

## Inst Freq

Represents the frequency used in the measurement stage. The calculator uses this frequency to fill in Inst parameters.

When "Instrument" on page 303 type is **MANual**, it is disabled and displayed as ---.

When **Instrument** type is **AUTO**:

- It can be set manually if "Automate Settings" on page 291 is **Off**
- It becomes non-editable if **Automate Settings** is **On**, and is filled in automatically according to current DUT type, "Freq Context" on page 218, and the CF or selected Freq. Pressing **Update** updates **Inst Freq** immediately

Once **Inst Freq** is set manually or updated automatically, the Inst parameters will be updated immediately, and the Ext PA parameters will be updated immediately when "Ext Preamp" on page 310 is **AUTO**.

|                |                                                                                                    |
|----------------|----------------------------------------------------------------------------------------------------|
| Remote Command | :CALCulate:UNCertainty:INSTrument:FREquency <freq><br>:CALCulate:UNCertainty:INSTrument:FREquency? |
| Example        | :CALC:UNC:INST:FREQ <b>3GHz</b>                                                                    |

### 3 Noise Figure Mode

#### 3.7 Meas Setup

|             |           |
|-------------|-----------|
| Couplings   | See above |
| Preset      | 1.505 GHz |
| State Saved | Yes       |
| Min         | 0 Hz      |
| Max         | 3.30 THz  |

#### Inst NF, NF2

Includes the instrument noise figure settings.

#### Inst NF, NF2

Selects the instrument noise figure to be used in the calculator.

For the most accurate estimation of uncertainty, enter the actual parameter to the extent known. For example, the NF of the instrument at the exact operating frequency can be found by actual measurement or by reading graphs from the instrument data sheet or Specifications Guide.

|                |                                                                                                                                                                    |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALCulate:UNCertainty:INSTrument:NFIGure &lt;value&gt;</code><br><code>:CALCulate:UNCertainty:INSTrument:NFIGure?</code>                                    |
| Example        | <code>:CALC:UNC:INST:NFIG 25.2dB</code><br><code>:CALC:UNC:INST:NFIG?</code>                                                                                       |
| Couplings      | Editable only when "Instrument" on page 303 type is <b>MANua1</b><br>Filled in automatically at "Inst Freq" on page 304 when <b>Instrument</b> type is <b>AUTO</b> |
| Preset         | 10 dB                                                                                                                                                              |
| State Saved    | No                                                                                                                                                                 |
| Min            | 0 dB                                                                                                                                                               |
| Max            | 100 dB                                                                                                                                                             |

#### Inst NF Specification Style

The specification style of instrument noise figure is "Fixed". It cannot be changed.

#### Inst NF Uncert

Includes the instrument input uncertainty settings.

## Inst NF Uncert

Selects the instrument noise figure uncertainty to be used in the calculator.

When "**Instrument**" on page 303 is **AUTO**, the worse value of the Instrument NF Uncertainty at the calibration stage and measurement stage will be used.

For the most accurate estimation of uncertainty, enter the actual parameter to the extent known. Instrument Uncertainty for NF is listed in the data sheets and Specifications Guides of Keysight instruments.

|                |                                                                                                                                                                                                                                                                                                                                                            |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALCulate:UNCertainty:INSTrument:NFIGure:UNCertainty &lt;value&gt;</code><br><code>:CALCulate:UNCertainty:INSTrument:NFIGure:UNCertainty?</code>                                                                                                                                                                                                    |
| Example        | <code>:CALC:UNC:INST:NFIG:UNC 25.2dB</code><br><code>:CALC:UNC:INST:NFIG:UNC?</code>                                                                                                                                                                                                                                                                       |
| Couplings      | Editable only when " <b>Instrument</b> " on page 303 type is <b>MANual</b><br>Filled in automatically with the worst value of two Inst NF Uncertainties at ENR value of measurement stage (Measurement ENR) and calibration stage (Calibration ENR) when " <b>Automate Settings</b> " on page 291 is <b>On</b> , and <b>Instrument</b> type is <b>AUTO</b> |
| Preset         | 0.03 dB                                                                                                                                                                                                                                                                                                                                                    |
| State Saved    | No                                                                                                                                                                                                                                                                                                                                                         |
| Min            | 0 dB                                                                                                                                                                                                                                                                                                                                                       |
| Max            | 100 dB                                                                                                                                                                                                                                                                                                                                                     |

## Inst NF Uncert Specification Style

The specification style of instrument noise figure uncertainty is "Maximum". It cannot be changed.

The specifications style for Instrument Uncertainty for NF, for Keysight Instruments is always "worst case." Statistical study shows that treating these as 3 sigma specifications with Gaussian distribution is on the conservative side of an accurate estimation of uncertainty.

## Inst NF Uncert Distribution

The distribution of instrument noise figure uncertainty is "Gaussian". It cannot be changed.

## Inst Gain Uncert

This section includes the instrument gain uncertainty settings.

## Inst Gain Uncert

Selects the instrument gain uncertainty to be used in the calculator.

For the most accurate estimation of uncertainty, enter the actual parameters to the extent known. Instrument Uncertainty for Gain is listed in the data sheets and Specifications Guides of Keysight instruments.

|                |                                                                                                                                                                    |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALCulate:UNCertainty:INSTrument:GAIN &lt;value&gt;</code><br><code>:CALCulate:UNCertainty:INSTrument:GAIN?</code>                                          |
| Example        | <code>:CALC:UNC:INST:GAIN 25.2dB</code><br><code>:CALC:UNC:INST:GAIN?</code>                                                                                       |
| Couplings      | Editable only when "Instrument" on page 303 type is <b>MANua1</b><br>Filled in automatically at "Inst Freq" on page 304 when <b>Instrument</b> type is <b>AUTO</b> |
| Preset         | Platform Dependent                                                                                                                                                 |
| State Saved    | No                                                                                                                                                                 |
| Min            | 0 dB                                                                                                                                                               |
| Max            | 100 dB                                                                                                                                                             |

## Inst Gain Uncert Specification Style

The specification style of instrument gain uncertainty is "Maximum". It cannot be changed.

The specifications style for Instrument Uncertainty for Gain, for Keysight Instruments is always "worst case." Statistical study shows that treating these as 3 sigma specifications with Gaussian distribution is on the conservative side of an accurate estimation of uncertainty.

## Inst Gain Uncert Distribution

The distribution of instrument gain uncertainty is "Gaussian". It cannot be changed.

## Inst Match

Includes the instrument match settings.

## Inst Match

Selects the instrument input match to be used in the calculator.

For the most accurate estimation of uncertainty, enter the actual parameters to the extent known. The instrument match may be measured with a network analyzer, or with X-Series analyzers it can be estimated from graphs provided in the Specifications Guide, or for convenience in the PXA analyzer, the 95th percentile of the Rayleigh distribution of reflection coefficient can be taken from the Specifications Guide in the Preamplifier chapter.

As noted in the on-calculator footnote, the match can be entered as a return loss (any number that is zero or negative is treated as return loss in decibels), as a reflection coefficient (any number between 0 and 1 is treated as the magnitude of the reflection coefficient), or as a voltage standing-wave ratio, VSWR (any number 1 or larger is treated as a VSWR).

|                              |                                                                                                                                                                                                                                                                                                                                                   |
|------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command               | <code>:CALCulate:UNCertainty:INSTrument:MATCH[:INPut] &lt;value&gt;</code><br><code>:CALCulate:UNCertainty:INSTrument:MATCH[:INPut]?</code>                                                                                                                                                                                                       |
| Example                      | <code>:CALC:UNC:INST:MATC 25.5</code><br><code>:CALC:UNC:INST:MATC?</code>                                                                                                                                                                                                                                                                        |
| Couplings                    | Displayed as --- when "Ext Preamp" on page 310 is selected (AUTO or MANua1), that is, Ext PA Match parameters are used under such conditions<br>Editable only when "Instrument" on page 303 type is MANua1 and "Ext Preamp" on page 310 is not selected (NONE)<br>Filled in automatically at "Inst Freq" on page 304 when Instrument type is AUTO |
| Preset                       | 1.75                                                                                                                                                                                                                                                                                                                                              |
| State Saved                  | No                                                                                                                                                                                                                                                                                                                                                |
| Min/Max                      | -/+100                                                                                                                                                                                                                                                                                                                                            |
| Backwards Compatibility SCPI | <code>:CALCulate:UNCertainty:INSTrument:MATCH</code>                                                                                                                                                                                                                                                                                              |

## Inst Match Specification Style

Selects the instrument match specification style to be used in the calculator.

|                |                                                                                                                                                                                             |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALCulate:UNCertainty:INSTrument:MATCH[:INPut]:SPEC:STYLE MAXimum   PCT95   PCT80   MEDian   MEAN   FIXed</code><br><code>:CALCulate:UNCertainty:INSTrument:MATCH:SPEC:STYLE?</code> |
| Example        | <code>:CALC:UNC:INST:MATC:SPEC:STYL FIX</code><br><code>:CALC:UNC:INST:MATC:SPEC:STYL?</code>                                                                                               |
| Couplings      | Editable only when "Instrument" on page 303 type is MANua1 and "Ext Preamp" on page 310 is NONE                                                                                             |
| Preset         | PCT95                                                                                                                                                                                       |
| State Saved    | No                                                                                                                                                                                          |
| Range          | MAXimum PCT95 PCT80 MEDian MEAN FIXed                                                                                                                                                       |



## Inst Match Distribution

Selects the instrument match specification style to be used in the calculator. For Keysight PXA, MXA and EXA analyzers, the distribution of the reflection coefficient is known to be a Rayleigh probability density function (pdf) with a different value in each band. The Keysight CXA does not have a Rayleigh distribution. Further information on the distribution of mismatch uncertainties is available in “Revisiting Mismatch Uncertainty with the Rayleigh Distribution,” available from the Keysight website at:

<https://www.keysight.com/us/en/assets/7018-03163/white-papers/5990-9185.pdf>

|                |                                                                                                                                                                            |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALCulate:UNCertainty:INSTrument:MATCH[:INPut]:DISTribution RAYleigh   FIXed   UNIFORM</code><br><code>:CALCulate:UNCertainty:INSTrument:MATCH:DISTribution?</code> |
| Example        | <code>:CALC:UNC:INST:MATC:DIST FIX</code><br><code>:CALC:UNC:INST:MATC:DIST?</code>                                                                                        |
| Couplings      | Editable only when "Instrument" on page 303 type is <b>MANual</b> and "Ext Preamp" on page 310 is <b>NONE</b>                                                              |
| Preset         | <b>RAYleigh</b>                                                                                                                                                            |
| State Saved    | No                                                                                                                                                                         |
| Range          | <b>RAYleigh   FIXed   UNIFORM</b>                                                                                                                                          |

## Inst NFE Impr

Includes the instrument NFE improvement settings.

## Inst NFE Impr

Selects the instrument NFE improvement to be used in the calculator.

For the most accurate estimation of uncertainty, enter the actual parameter to the extent known. “NFE Improvement” is listed in the Specifications Guide for X-Series instruments that have NFE available and thus are capable of Internal Cal.

### NOTE

**This parameter does not appear on instruments that do not have an NFE or NF2 license.**

|                |                                                                                                                                                     |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALCulate:UNCertainty:INSTrument:NFE[:IMPRovement] &lt;value&gt;</code><br><code>:CALCulate:UNCertainty:INSTrument:NFE[:IMPRovement]?</code> |
| Example        | <code>:CALC:UNC:INST:NFE 9.0</code>                                                                                                                 |

|             |                                                                                                                                                                                                                                                                  |
|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|             | <b>:CALC:UNC:INST:NFE?</b>                                                                                                                                                                                                                                       |
| Couplings   | Valid only when "Ext Preamp" on page 310 type is <b>NONE</b> , otherwise, displayed as ---<br>Editable only when "Instrument" on page 303 type is <b>MANual</b><br>Filled in automatically at "Inst Freq" on page 304 when <b>Instrument</b> type is <b>AUTO</b> |
| Preset      | 9.0                                                                                                                                                                                                                                                              |
| State Saved | No                                                                                                                                                                                                                                                               |
| Min         | 0                                                                                                                                                                                                                                                                |
| Max         | 100                                                                                                                                                                                                                                                              |

### Inst NFE Impr Specification Style

The specification style of instrument NFE improvement is "95th percentile". It cannot be changed.

**NOTE**

This parameter does not appear on instruments that do not have an NFE or NF2 license.

### Inst NFE Impr Distribution

The distribution of instrument NFE improvement is "Gaussian". It cannot be changed.

**NOTE**

This parameter does not appear on instruments that do not have an NFE or NF2 license.

### Ext Preamp

Lets you specify how to fill in the Ext PA parameters. If no external preamp is in use, select **NONE**.

For other external preamplifiers and the most accurate estimation of uncertainty, choose **MANual** and enter actual parameters to the extent known, at the frequency of interest.

|                |                                                                                                                                                                                                                                     |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <b>:CALCulate:UNCertainty:EXTernal:PREamp</b> <b>AUTO</b>   <b>MANual</b>   <b>NONE</b><br><b>:CALCulate:UNCertainty:EXTernal:PREamp?</b>                                                                                           |
| Example        | <b>:CALC:UNC:EXT:PRE</b> <b>MAN</b>                                                                                                                                                                                                 |
| Couplings      | <b>AUTO</b> is only available when an U7227x-series Keysight USB preamplifier is connected to one of the instrument's USB ports<br>Forced to <b>AUTO</b> when a U7227x series Keysight USB preamplifier is connected, and "Automate |

|             |                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|             | <p><b>Settings" on page 291</b> is changed from <b>Off</b> to <b>On</b></p> <p>When <b>AUTO</b> is selected, disconnecting the USB preamp forces it to <b>NONE</b></p> <p>When <b>AUTO</b> is selected, the Ext PA parameters are updated immediately if "<b>Inst Freq</b>" on page 304 is updated manually or automatically</p> <p>When <b>AUTO</b> or <b>MANual</b> is selected, the "<b>Inst Match</b>" on page 307 parameters are grayed-out</p> |
| State Saved | Yes                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Range       | <b>MANual</b>   <b>AUTO</b>   <b>NONE</b>                                                                                                                                                                                                                                                                                                                                                                                                            |

## Ext Preamp NF

Includes the external preamp noise figure settings.

## Ext Preamp NF

Selects the external preamp noise figure to be used in the calculator.

|                |                                                                                                                                                                                                                                                                            |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <b>:CALCulate:UNCertainty:EXTernal:PREamp:NFIGure&lt;value&gt;</b><br><b>:CALCulate:UNCertainty:EXTernal:PREamp:NFIGure?</b>                                                                                                                                               |
| Example        | <b>:CALC:UNC:EXT:PRE:NFIG 3.5</b><br><b>:CALC:UNC:EXT:PRE:NFIG?</b>                                                                                                                                                                                                        |
| Couplings      | Editable only when " <b>Ext Preamp</b> " on page 310 type is <b>MANual</b><br>Filled in automatically at " <b>Inst Freq</b> " on page 304 when " <b>Ext Preamp</b> " on page 310 type is <b>AUTO</b><br>Invalid when " <b>Ext Preamp</b> " on page 310 type is <b>NONE</b> |
| Preset         | 3.500 dB                                                                                                                                                                                                                                                                   |
| State Saved    | No                                                                                                                                                                                                                                                                         |
| Min            | 0 dB                                                                                                                                                                                                                                                                       |
| Max            | 100 dB                                                                                                                                                                                                                                                                     |

## Ext Preamp NF Specification Style

The specification style of external preamp noise figure is "Fixed". It cannot be changed.

## Ext Preamp Gain

Includes the external preamp gain settings.

## Ext Preamp Gain

Selects the external preamp gain to be used in the calculator.

|                |                                                                                                                                                                                                                                        |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALCulate:UNCertainty:EXTernal:PREamp:GAIN &lt;value&gt;</code><br><code>:CALCulate:UNCertainty:EXTernal:PREamp:GAIN?</code>                                                                                                    |
| Example        | <code>:CALC:UNC:EXT:PRE:GAIN 21</code><br><code>:CALC:UNC:EXT:PRE:GAIN?</code>                                                                                                                                                         |
| Couplings      | Editable only when "Ext Preamp" on page 310 type is <b>MANual</b><br>Filled in automatically at "Inst Freq" on page 304 when "Ext Preamp" on page 310 type is <b>AUTO</b><br>Invalid when "Ext Preamp" on page 310 type is <b>NONE</b> |
| Preset         | 21 dB                                                                                                                                                                                                                                  |
| State Saved    | No                                                                                                                                                                                                                                     |
| Min/Max        | -/+100                                                                                                                                                                                                                                 |

## Ext Preamp Gain Specification Style

The specification style of external preamp gain is "Fixed". It cannot be changed.

## Ext Preamp Match

Includes the external preamp match settings.

## Ext Preamp Match

Selects the external preamp match to be used in the calculator.

As noted in the on-calculator footnote, the match can be entered as a return loss (any number that is zero or negative is treated as return loss in decibels), as a reflection coefficient (any number between 0 and 1 is treated as the magnitude of the reflection coefficient), or as a voltage standing-wave ratio, VSWR (any number 1 or larger is treated as a VSWR).

|                |                                                                                                                                                                                                                                        |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALCulate:UNCertainty:EXTernal:PREamp:MATCH &lt;value&gt;</code><br><code>:CALCulate:UNCertainty:EXTernal:PREamp:MATCH?</code>                                                                                                  |
| Example        | <code>:CALC:UNC:EXT:PRE:MATC 1.3</code><br><code>:CALC:UNC:EXT:PRE:MATC?</code>                                                                                                                                                        |
| Couplings      | Editable only when "Ext Preamp" on page 310 type is <b>MANual</b><br>Filled in automatically at "Inst Freq" on page 304 when "Ext Preamp" on page 310 type is <b>AUTO</b><br>Invalid when "Ext Preamp" on page 310 type is <b>NONE</b> |

### 3 Noise Figure Mode

#### 3.7 Meas Setup

|             |        |
|-------------|--------|
| Preset      | 1.300  |
| State Saved | No     |
| Min/Max     | -/+100 |

#### Ext Preamp Match Specification Style

Selects the external preamp match specification style to be used in the calculator.

|                |                                                                                                                                                                                                                                        |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALCulate:UNCertainty:EXternal:PREamp:MATCH:SPEC:STYLE MAXimum   PCT95   PCT80   MEDian   MEAN   FIXed</code><br><code>:CALCulate:UNCertainty:EXternal:PREamp:MATCH:SPEC:STYLE?</code>                                          |
| Example        | <code>:CALC:UNC:INST:EXT:PRE:SPEC:STYL FIX</code><br><code>:CALC:UNC:INST:EXT:PRE:SPEC:STYL?</code>                                                                                                                                    |
| Couplings      | Editable only when "Ext Preamp" on page 310 type is <b>MANua1</b><br>Filled in automatically at "Inst Freq" on page 304 when "Ext Preamp" on page 310 type is <b>AUTO</b><br>Invalid when "Ext Preamp" on page 310 type is <b>NONE</b> |
| Preset         | <b>FIXed</b>                                                                                                                                                                                                                           |
| State Saved    | No                                                                                                                                                                                                                                     |
| Range          | <b>MAXimum</b>   <b>PCT95</b>   <b>PCT80</b>   <b>MEDian</b>   <b>MEAN</b>   <b>FIXed</b>                                                                                                                                              |

#### Ext Preamp Match Distribution

Selects the external preamp match distribution to be used in the calculator.

|                |                                                                                                                                                                                                                                        |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALCulate:UNCertainty:EXternal:PREamp:MATCH:DISTribution RAYLeigh   FIXed   UNIFORM</code><br><code>:CALCulate:UNCertainty:EXternal:PREamp:MATCH:DISTribution?</code>                                                           |
| Example        | <code>:CALC:UNC:EXT:PRE:MATCH:DIST FIX</code><br><code>:CALC:UNC:EXT:PRE:MATCH:DIST?</code>                                                                                                                                            |
| Couplings      | Editable only when "Ext Preamp" on page 310 type is <b>MANua1</b><br>Filled in automatically at "Inst Freq" on page 304 when "Ext Preamp" on page 310 type is <b>AUTO</b><br>Invalid when "Ext Preamp" on page 310 type is <b>NONE</b> |
| Preset         | <b>FIXed</b>                                                                                                                                                                                                                           |
| State Saved    | No                                                                                                                                                                                                                                     |
| Range          | <b>RAYLeigh</b>   <b>FIXed</b>   <b>UNIFORM</b>                                                                                                                                                                                        |

Specification Style

In combining sources of uncertainty, international standards usually call for using the method named GUM (Guide to the expression of Uncertainty in Measurement). GUM calls for computing the “standard uncertainty” (standard deviation) of each contributor, then combining these using a root-sum-square computation to compute the “combined standard uncertainty,” then multiplying by 2 (the coverage factor, k) to give the “expanded uncertainty.” The expanded uncertainty is also often called the 95th percentile measurement uncertainty.

The documentation of each contributor may be given in different forms, such as median, mean, or 95th percentile, as shown in the drop-down list for those parameters where the user of the calculator might need to vary the style of the specification.

Distribution

The statistical distribution of contributors to the uncertainty depends on the contributor and our knowledge of that parameter. In many cases, the value is known, thus a “Fixed” distribution is appropriate. In other cases, such as Noise Source ENR Uncertainty, the distribution is known to be Gaussian.

Sweep

Allows an input parameter to be selected then swept between lower and upper values so that the variation in uncertainty can be seen on the “Swept Uncertainty” area.

Parameter

Select the parameter to be swept. This calculator only supports DUT parameter sweeping. Use the Java calculator (at <https://www.keysight.com/us/en/lib/resources/training-materials/noise-figure-uncertainty-calculator-96887.html>) to sweep other parameters.

|                |                                                                                                                       |
|----------------|-----------------------------------------------------------------------------------------------------------------------|
| Remote Command | :CALCulate:UNCertainty:SWEEP:PARAMeter NFIGure   GAIN   INMatch   OUTMatch<br>:CALCulate:UNCertainty:SWEEP:PARAMeter? |
| Example        | :CALC:UNC:SWE:PAR NFIG                                                                                                |
| Preset         | NFIGure                                                                                                               |
| State Saved    | Yes                                                                                                                   |
| Range          | NFIGure GAIN INMatch OUTMatch                                                                                         |

## Lower Value

Set the lower value for the swept parameter.

|                |                                                                                                                   |
|----------------|-------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALCulate:UNCertainty:SWEep:STARt &lt;value&gt;</code><br><code>:CALCulate:UNCertainty:SWEep:STARt?</code> |
| Example        | <code>:CALC:UNC:SWE:STAR 1.0</code><br><code>:CALC:UNC:SWE:STAR?</code>                                           |
| Preset         | 1.5                                                                                                               |
| State Saved    | No                                                                                                                |
| Min/Max        | -/+9.9e37                                                                                                         |

## Upper Value

Set the upper value for the swept parameter.

|                |                                                                                                                 |
|----------------|-----------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALCulate:UNCertainty:SWEep:STOP &lt;value&gt;</code><br><code>:CALCulate:UNCertainty:SWEep:STOP?</code> |
| Example        | <code>:CALC:UNC:SWE:STOP 10.0</code><br><code>:CALC:UNC:SWE:STOP?</code>                                        |
| Preset         | 4.5                                                                                                             |
| State Saved    | No                                                                                                              |
| Min/Max        | -/+100                                                                                                          |

## Rules for lower and upper default values

To provide a reasonable sweeping range, the lower and upper values may change when the swept parameter or the value of the swept parameter changes. The lower and upper values follow the following rules. For DUT NF and Gain parameters, the following rules are applied:

- The lower value is set to one-half of the current value of the swept parameter
- The upper value is set to 1.5 times the current value of the swept parameter
- For the Match parameters, the following rules are applied:
  - When the current value is negative, use 0.5 times the value for lower value and 1.5 times for upper value
  - When the current value is between 0 and 0.6, set the upper value to 1.5 times the value, and the lower value to 0.5 times

- When the current value is between 0.6 and 1.0, set the upper value to 0.75 plus 0.25 times the value. Set the lower value to twice the value minus the upper value
- When the current value is 1.0 exactly, set the upper and lower value to 1.0
- When the current value is above 1.0, set the lower value to 0.5 plus half of the value, and the upper value to twice the value minus the lower value

NOTE

When you change the lower or upper value manually for a swept parameter, these rules are turned off for that parameter. They are turned back on by **Mode Preset**.

Points

Sets the number of sweep points. The points are distributed evenly between the lower and upper values.

|                |                                                                                     |
|----------------|-------------------------------------------------------------------------------------|
| Remote Command | :CALCulate:UNCertainty:SWEep:POINts <value><br>:CALCulate:UNCertainty:SWEep:POINts? |
| Example        | :CALC:UNC:SWE:POIN 100<br>:CALC:UNC:SWE:POIN?                                       |
| Preset         | 15                                                                                  |
| State Saved    | No                                                                                  |
| Min            | 2                                                                                   |
| Max            | 1301                                                                                |

Measurement Uncertainty

This section contains information on measurement uncertainty.

Measurement Uncertainty

When Sweep "Parameter" on page 314 is **NONE**, three 95th percentile measurement uncertainties are displayed on the result area, and can be used to determine the overall uncertainty of the noise figure measurement in different calibration types (User Cal, Internal Cal or Uncal). These values update whenever any of the other parameters under the :CALCulate:UNCertainty SCPI node change.

This parameter is never editable from the front panel or via SCPI but is auto calculated from the other parameters in the DUT setup form.



|               |           |
|---------------|-----------|
| User Cal:     | ±0.574 dB |
| Internal Cal: | ±0.576 dB |
| Uncal:        | ±0.726 dB |

User Cal Uncertainty

Returns 95th percentile measurement uncertainty result when calibration type is User Cal.

|                              |                                                                                |
|------------------------------|--------------------------------------------------------------------------------|
| Remote Command               | :CALCulate:UNCertainty:USER?                                                   |
| Example                      | :CALC:UNC:USER?                                                                |
| Notes                        | Automatically calculated from other uncertainty calculator values<br>Read-only |
| Couplings                    | Always read only – calculated from other uncertainty calculator values         |
| Preset                       | 0.2 dB                                                                         |
| State Saved                  | No                                                                             |
| Min                          | 0 dB                                                                           |
| Max                          | 100 dB                                                                         |
| Backwards Compatibility SCPI | :CALCulate:UNCertainty:RSS?                                                    |

Internal Cal Uncertainty

Returns 95th percentile measurement uncertainty result when calibration type is Internal Cal.

|                |                                                                                                                                                                                      |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | :CALCulate:UNCertainty:INTERNAL?                                                                                                                                                     |
| Example        | :CALC:UNC:INT?                                                                                                                                                                       |
| Notes          | Automatically calculated from other uncertainty calculator values<br>Read only                                                                                                       |
| Couplings      | Always read-only – calculated from other uncertainty calculator values<br>Returns NaN if the instrument does not support Internal Cal, in which case, '---' is displayed on the form |
| Preset         | 0.2 dB                                                                                                                                                                               |
| State Saved    | No                                                                                                                                                                                   |

|     |        |
|-----|--------|
| Min | 0 dB   |
| Max | 100 dB |

Uncalibrated Uncertainty

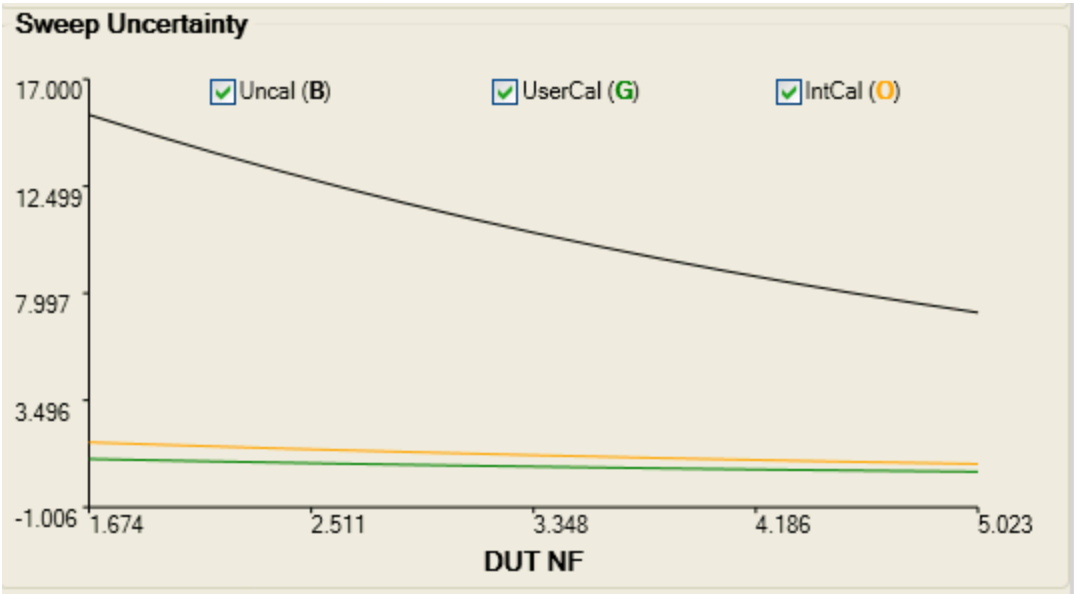
Returns 95th percentile measurement uncertainty result when the measurement is calibrated.

|                |                                                                        |
|----------------|------------------------------------------------------------------------|
| Remote Command | :CALCulate:UNCertainty:UNCal?                                          |
| Example        | :CALC:UNC:UNC?                                                         |
| Notes          | Read only                                                              |
| Couplings      | Always read-only – calculated from other uncertainty calculator values |
| Preset         | 0.2 dB                                                                 |
| State Saved    | No                                                                     |
| Min            | 0 dB                                                                   |
| Max            | 100 dB                                                                 |

Sweep Uncertainty

Three traces are displayed on the result area by default for different calibration types (User Cal, Internal Cal and Uncal). The trace may be hidden if the checkbox for a calibration type is unchecked.

If you move a mouse over the trace, the value of the point will be shown on the upper left corner.



Sweep Result Array (Remote Query only)

Returns an array of the swept uncertainty for each calibration type. One value is returned for each point.

|                |                                                         |
|----------------|---------------------------------------------------------|
| Remote Command | :CALCulate:UNCertainty:SWEep:ARRay:USER INTernal UNCal? |
|----------------|---------------------------------------------------------|

Sweep Trace Display

Selects which trace is displayed. By default, three traces are displayed for three different calibration types. You can uncheck the checkbox to hide the trace.

User Cal Trace

Selects whether displaying sweep results for User Cal.

|             |                  |
|-------------|------------------|
| Notes       | Front Panel Only |
| Preset      | On               |
| State Saved | Yes              |
| Range       | On   Off         |

Internal Cal Trace

Selects whether to display sweep results for Intercal Cal.

|             |                                                                                                             |
|-------------|-------------------------------------------------------------------------------------------------------------|
| Notes       | Front Panel Only                                                                                            |
| Couplings   | Disabled when NFE (and NF2) license is not installed and "Ext Preamp" on page 310 is not set to <b>AUTO</b> |
| Preset      | On                                                                                                          |
| State Saved | Yes                                                                                                         |
| Range       | On   Off                                                                                                    |

Uncal Trace

Selects whether to display sweep results for Uncal.

|             |                  |
|-------------|------------------|
| Notes       | Front Panel Only |
| Preset      | On               |
| State Saved | Yes              |
| Range       | On   Off         |

### 3.7.1.7 Optimize Preselector

This control runs through the current setup's frequency points optimizing the preselector. This may be required if the calibration step was performed some time ago and the preselector drift is impacting the measurement (for example: higher errors than expected).

When selected, the following pop-up box appears, with an estimate of the time expected to complete.

|                |                                                                                    |
|----------------|------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe ]:NFIGure:PRESelector:OPTimize</code>                               |
| Example        | <code>:NFIG:PRES:OPT</code>                                                        |
| Dependencies   | Does not appear in CXA and CXA-m platforms                                         |
| Couplings      | Disabled when instrument tuned frequencies are below 3.6 GHz, that is, in low band |

### 3.7.1.8 Meas Preset

Restores all measurement local parameters to their default values, except for ENR Tables, Limit Line Data, and Loss Comp Table Data. They remain unchanged, but the limit lines and loss comp are turned off.

|                |                                        |
|----------------|----------------------------------------|
| Remote Command | <code>:CONFigure:NFIGure</code>        |
| Example        | <code>:CONF:NFIG</code>                |
| Couplings      | Loads default values of all parameters |

### 3.7.1.9 Calibrate

Performs a User Calibration on the current DUT setup using the ENR data in the Meas Table (if "Use Meas Table Data for Cal" on page 322 is **ON**) or the ENR data in the Cal Table (if Use Meas Table Data for Cal is **OFF**). Cal data is collected for each attenuation setting set in the User Setup parameters. For example, in X-Series Instruments, if Max Atten is set to 8 dB and Min set to 0 dB, then a set of calibration data will be taken for 0 dB, 4 dB and 8 dB. You can then choose any of these attenuation settings when the measurement is performed, and corrected results will be made. If you want attenuation settings outside this range, they need to be set in Max/Min prior to performing a Calibration.

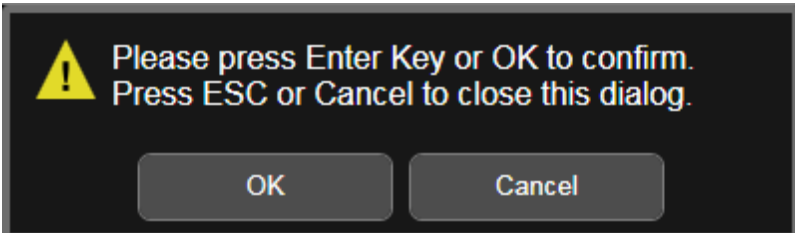
During calibration, the value you select for **Average Count** is translated into a sweep time for each point. So, an **Average Count** of 10 results in a sweep time of 160 ms (160 ms at each measured frequency point if using the default sweep time). There are 2 measurement points per freq point: one for noise source Off and one for On.

Once the calibration step has been performed successfully, the calibration data (including ENR cal data and USB Preamp serial number if in use) is stored in a

'power-on persistent' state. A mode preset or power cycle will not erase the cal data. An advisory message alerts you that cal is valid, and you need to toggle **Apply Calibration** to **On** to restore corrected data. If, after a mode preset, the DUT/measurement setup has changed such that the saved calibration data is invalid, **Apply Calibration** is grayed-out, but can be restored if setup during cal is set again, or the original setup with cal is stored in a state and recalled again.

NOTE

If any input frequencies are in high band, for example: above 3.6 GHz, then the “Calibrate Now” process optimizes the preselector at these frequencies *and stores the preselector offset values*. It uses these *offsets* both in the cal acquisition results and also when acquiring the measurement results. This reduces the error *for* corrected results since the preselector is set at the same place for acquiring the cal and meas results. The ‘Optimize Preselector’ function allows the *offset* values to be collected again without the cal acquisition results.



To abort a Cal while it is running, press **ESC** or **Cancel**. This stops the action and discards any data collected. The previous data is erased, and the **Apply Calibration** parameter is set to **OFF**. If a valid User Cal is still stored, you can then turn **Apply Calibration** back on by setting it to **ON**. Note that aborting the calibration operates in both **Single** and **Continuous** modes of use.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe ] :NFIgure :CALibration :INITiate</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Example        | <code>:NFIg :CAL :INIT</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Notes          | Error -221 displayed when this command is issued, and Cal Type is USER<br>Before sending further SCPI commands, use <code>*OPC?</code> to check if the current calibration is completed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Couplings      | When a calibration has completed, <b>Apply Calibration</b> is set to <b>On</b> , and Cal Type is set to USER<br>If the calibration is canceled before it has completed, <b>Apply Calibration</b> is set to <b>Off</b><br>Attenuation min/max: calibration performed for each attenuation step (with FSA: 4 dB step; without FSA:10 dB step). Default would be 3 stages for instrument with FSA (0, 4, 8) and 2 for instruments without FSA (0, 10)<br>Disabled if no valid ENR data (in Meas table when "Use Meas Table Data for Cal" on page 322 is <b>ON</b> or Cal table when <b>OFF</b> or Spot ENR): error message -221.<br>Disabled when "Noise Source State" is set to On/Off<br><br>Backwards Compatibility Command |
| Notes          | Error -221 is displayed when this command is issued, and Cal Type is <b>USER</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |

|                              |                                                                                                            |
|------------------------------|------------------------------------------------------------------------------------------------------------|
| Backwards Compatibility SCPI | <code>[ :SENSe]:NFIGure:CORRection:COLlect[:ACQuire] STANdard</code><br><code>:CONFigure:CORRection</code> |
|------------------------------|------------------------------------------------------------------------------------------------------------|

Cancel (Front Panel Only)

To abort a Cal while it is running, press **Cancel**. This stops the action and discards any data collected. The previous data is unaffected, and the **Apply Calibration** parameter is set to **Off**. If a valid User Cal is still stored, you can then set **Apply Calibration** to **On**.

3.7.1.10 ENR

Lets you configure parameters related to ENR data.

ENR Mode

Selects between Table and Spot ENR operation.

|                    |                                                  |
|--------------------|--------------------------------------------------|
| <code>TABLE</code> | ENR values are taken from the ENR table(s)       |
| <code>SPOT</code>  | A single ENR value is applied at all frequencies |

Both Table and Spot ENR data can be configured side-by-side, and this function can be used to toggle between them.

|                              |                                                                                                                        |
|------------------------------|------------------------------------------------------------------------------------------------------------------------|
| Remote Command               | <code>[ :SENSe]:NFIGure:CORRection:ENR:MODE TABLE   SPOT</code><br><code>[ :SENSe]:NFIGure:CORRection:ENR:MODE?</code> |
| Example                      | <code>:NFIG:CORR:ENR:MODE TABL</code>                                                                                  |
| Preset                       | <code>TABLE</code>                                                                                                     |
| State Saved                  | Yes                                                                                                                    |
| Range                        | <code>TABLE   SPOT</code>                                                                                              |
| Backwards Compatibility SCPI | <code>[ :SENSe]:NFIGure]:CORRection:ENR:MODE</code>                                                                    |

Use Meas Table Data for Cal

When **ON**, the ENR data for both measurement and calibration is sourced from a combined ENR table. When **OFF**, the measurement and calibration ENR data is sourced from separate tables (See ["Edit Meas Table" on page 323](#) and ["Edit Cal Table" on page 327](#)).

### 3 Noise Figure Mode

#### 3.7 Meas Setup

|                                 |                                                                                                                                                                                                                                                                                                                                          |
|---------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command                  | <code>[ :SENSe]:NFIGure:CORRection:ENR:COMMon[:STATe] ON   OFF   1   0</code><br><code>[ :SENSe]:NFIGure:CORRection:ENR:COMMon[:STATe]?</code>                                                                                                                                                                                           |
| Example                         | <code>:NFIG:CORR:ENR:COMM ON</code>                                                                                                                                                                                                                                                                                                      |
| Couplings                       | Cal table disabled when <b>ON</b><br>Error message 171 is displayed if <b>ON</b> and no data in Meas Table, or <b>OFF</b> and no data in Meas or Cal table<br>If <b>Preference</b> is set to <b>SNS</b> and <b>Auto Load ENR</b> is <b>ON</b> , upon connection of an SNS, <b>Use Meas Table Data for Cal</b> will be switched <b>ON</b> |
| Preset                          | <b>ON</b>                                                                                                                                                                                                                                                                                                                                |
| State Saved                     | Yes                                                                                                                                                                                                                                                                                                                                      |
| Range                           | <code>ON OFF 1 0</code>                                                                                                                                                                                                                                                                                                                  |
| Backwards Compatibility<br>SCPI | <code>[ :SENSe][:NFIGure]:CORRection:ENR:COMMon[:STATe]</code>                                                                                                                                                                                                                                                                           |

## Edit Meas Table

Opens the ENR Table editor for the measurement ENR table, which should contain the ENR data for the noise source that is currently being used.

### NOTE

When each parameter in the table is entered, the table is saved. Once a new ENR Table is entered, the application stores this table in non-volatile memory, to allow for restoration after a power cycle.

Keysight Noise Sources are delivered complete with ENR Data particular to that source. It is possible to read this data directly into the measurement, and even save the data in the same format if changes are required, or if the disk has been lost. The ENR Data can be copied onto a USB flash drive for loading onto the instrument using a PC.

See the section, "Entering Excess Noise Ratio (ENR) Data" in the Measurement Guide.

|           |                                            |
|-----------|--------------------------------------------|
| Couplings | Error 171 is displayed if no data in table |
|-----------|--------------------------------------------|

## Serial #

To obtain the best accuracy, ENR Data is uniquely derived for each noise source. For Keysight Sources, this data can be found printed on the side of the source body. It is a good idea to enter the serial number and model ID of the source into the table – this way you can tell at-a-glance whether the data is valid for a specific source or not.

The Meas and Cal tables both have an independent serial number and model ID parameter.

|                                 |                                                                                                                                                                                        |
|---------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command                  | <code>[ :SENSe]:NFIGure:CORRection:ENR:MEASurement:TABLE:SErIal:DATA &lt;string&gt;</code><br><code>[ :SENSe]:NFIGure:CORRection:ENR:MEASurement:TABLE:SErIal:DATA?</code>             |
| Example                         | <code>:NFIG:CORR:ENR:MEAS:TABL:SER:DATA "4015A05450"</code>                                                                                                                            |
| State Saved                     | Yes                                                                                                                                                                                    |
| Range                           | <code>a-zA-Z0-9</code>                                                                                                                                                                 |
| Backwards Compatibility Command |                                                                                                                                                                                        |
| Notes                           | Same as:<br><code>[ :SENSe]:NFIGure:CORRection:ENR:MEASurement:TABLE:SErIal:DATA</code>                                                                                                |
| Range                           | <code>a-zA-Z0-9</code>                                                                                                                                                                 |
| Backwards Compatibility SCPI    | <code>[ :SENSe][ :NFIGure]:CORRection:ENR[ :MEASurement]:TABLE:SErIal:DATA &lt;string&gt;</code><br><code>[ :SENSe][ :NFIGure]:CORRection:ENR[ :MEASurement]:TABLE:SErIal:DATA?</code> |

## Model ID

To obtain the best accuracy, ENR Data is uniquely derived for each noise source. For Keysight Sources, this data can be found printed on the side of the source body. It is a good idea to enter the serial number and model ID of the source into the table – this way you can tell ‘at-a-glance’ whether the data is valid for a specific source or not.

The Meas and Cal tables both have an independent serial number and model ID parameter.

|                                 |                                                                                                                                                                                |
|---------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command                  | <code>[ :SENSe]:NFIGure:CORRection:ENR:MEASurement:TABLE:ID:DATA &lt;string&gt;</code><br><code>[ :SENSe]:NFIGure:CORRection:ENR:MEASurement:TABLE:ID:DATA?</code>             |
| Example                         | <code>:CORR:ENR:MEAS:TABL:ID:DATA "346A"</code>                                                                                                                                |
| State Saved                     | Yes                                                                                                                                                                            |
| Range                           | <code>a-zA-Z0-9</code>                                                                                                                                                         |
| Backwards Compatibility Command |                                                                                                                                                                                |
| Notes                           | Same as:<br><code>[ :SENSe]:NFIGure:CORRection:ENR:MEASurement:TABLE:ID:DATA</code>                                                                                            |
| Range                           | <code>a-zA-Z0-9</code>                                                                                                                                                         |
| Backwards Compatibility SCPI    | <code>[ :SENSe][ :NFIGure]:CORRection:ENR[ :MEASurement]:TABLE:ID:DATA &lt;string&gt;</code><br><code>[ :SENSe][ :NFIGure]:CORRection:ENR[ :MEASurement]:TABLE:ID:DATA?</code> |



Go to Row

Specify a row and make it the selected row.

Insert Row Below

Inserts a row below the current row. The new row is a copy of the current row, and becomes the current row. The new row is not yet entered into the underlying table, and the data in the row is displayed in light gray.

Delete Row

This is an immediate action control. It immediately deletes the currently-selected row, whether or not that point is being edited, and selects **Navigate**. The point following the currently-selected row (or the row preceding if there is none) will be selected.

Fill From SNS

Invokes population of the Meas Table or Cal Table from an SNS. Only available when an SNS is connected to the instrument.

|                              |                                                                                 |
|------------------------------|---------------------------------------------------------------------------------|
| Remote Command               | <code>[ :SENSe]:NFIGure:CORRection:ENR:MEASurement:TABLE:SNS</code>             |
| Example                      | <code>:NFIG:CORR:ENR:MEAS:TABL:SNS</code>                                       |
|                              | Backwards Compatibility Command                                                 |
| Notes                        | Same as:<br><code>[ :SENSe]:NFIGure:CORRection:ENR:MEASurement:TABLE:SNS</code> |
| Backwards Compatibility SCPI | <code>[ :SENSe][ :NFIGure]:CORRection:ENR[ :MEASurement]:TABLE:SNS</code>       |

Clear Table

Clears all data from the Meas ENR table and removes the table's backup from persistent storage.

|                |                                                                                          |
|----------------|------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:NFIGure:CORRection:ENR[ :MEASurement]:TABLE:DATA:DELeTe</code>           |
| Notes          | Clears all entries in the Meas ENR table. Interrupts the current measurement immediately |

## Frequency Column

Lets you enter the frequency component of a frequency/amplitude pair.

|             |          |
|-------------|----------|
| Preset      | 10 Hz    |
| State Saved | Yes      |
| Min         | 10 kHz   |
| Max         | 3.30 THz |

## ENR Column

Lets you enter the amplitude component of a frequency/amplitude pair.

|             |           |
|-------------|-----------|
| Preset      | 0 dB      |
| State Saved | Yes       |
| Min/Max     | -/+200 dB |

## Setting ENR Table Remotely (Remote Command only)

Data can be entered into the current measurement or calibration ENR table using SCPI. Parameters are provided in frequency/amplitude pairs, the units being Hz and dB respectively. Up to 1301 point-pairs are accepted. See the "[Frequency Column](#)" on page 326 and "[ENR Column](#)" on page 326 definitions for the acceptable parameter ranges.

|                |                                                                                                                                                                                                                               |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:NFIGure:CORRection:ENR:MEASurement:TABLE:DATA &lt;frequency&gt;, &lt;amplitude&gt; ([, &lt;frequency&gt;, &lt;amplitude&gt;])</code><br><code>[ :SENSe]:NFIGure:CORRection:ENR:MEASurement:TABLE:DATA?</code> |
| Example        | <code>:NFIG:CORR:ENR:MEAS:TABL:DATA 1000, -10, 2000,-8, 3000, -6, 10000, 5</code>                                                                                                                                             |

Notes Between 1 and 1301 points must be entered

Backwards Compatibility Command

|                              |                                                                                                                                                                                                                                          |
|------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Notes                        | Between 1 and 1301 points must be entered<br>Same as:<br><code>[ :SENSe]:NFIGure:CORRection:ENR:MEASurement:TABLE:DATA</code>                                                                                                            |
| Backwards Compatibility SCPI | <code>[ :SENSe][ :NFIGure]:CORRection:ENR[:MEASurement]:TABLE:DATA &lt;frequency&gt;, &lt;amplitude&gt; ([, &lt;frequency&gt;, &lt;amplitude&gt;] )</code><br><code>[ :SENSe][ :NFIGure]:CORRection:ENR[:MEASurement]:TABLE:DATA?</code> |

## ENR Table Entry Count (Remote Query only)

Returns the number of frequency/amplitude point-pairs in the current measurement or calibration table. If the table is empty, returns 0.

|                                 |                                                                                   |
|---------------------------------|-----------------------------------------------------------------------------------|
| Remote Command                  | <code>[ :SENSe]:NFIGure:CORRection:ENR:MEASurement:TABLE:COUNT?</code>            |
| Example                         | <code>:NFIG:CORR:ENR:MEAS:TABL:COUNT?</code>                                      |
| Preset                          | 0                                                                                 |
| Min                             | 0                                                                                 |
| Max                             | 1301                                                                              |
| Backwards Compatibility Command |                                                                                   |
| Notes                           | Same as:<br><code>[ :SENSe]:NFIGure:CORRection:ENR:MEASurement:TABLE:COUNT</code> |
| Preset                          | 0                                                                                 |
| Min                             | 0                                                                                 |
| Max                             | 1301                                                                              |
| Backwards Compatibility SCPI    | <code>[ :SENSe][ :NFIGure]:CORRection:ENR[ :MEASurement]:TABLE:COUNT?</code>      |

## Edit Cal Table

Opens the ENR Table editor for the calibration ENR table, which should contain the ENR data for the noise source that is currently being used. If **"Use Meas Table Data for Cal"** on page 322 is **ON**, the ENR data for calibration is taken from the measurement ENR Table.

When an SNS is attached, if **"Noise Source Preference"** on page 343 is **SNS** and **Auto Load ENR** is **ON**, **Use Meas Table Data for Cal** is set to **ON** and the SNS ENR data populates the measurement ENR Table (no alteration to the Cal table). If you want the SNS to be used for the calibration ENR table, then you must **"Fill From SNS"** on page 325 under the ENR Table editor for calibration ENR table.

The **Edit Cal Table** is only available when **Use Meas Table Data for Cal** is **OFF**. Once a new Cal Table is entered, the application stores this table in non-volatile memory, to allow for restoration after a power cycle.

Duplicates are *not* allowed in the frequency field of the Cal Table, but duplicate ENR values at different frequencies are accepted.

**NOTE**

When each parameter in the table is entered, the table is saved. Once a new ENR Table is entered, the application stores this table in non-volatile memory, to allow for restoration after a power cycle.

Keysight Noise Sources are delivered complete with ENR Data particular to that source. It is possible to read this data directly into the measurement, and even save the data in the same format if changes are required, or if the disk has been lost. The ENR Data can be copied onto a USB flash drive for loading onto the instrument using a PC.

See the section, "Entering Excess Noise Ratio (ENR) Data" in the Measurement Guide.

|           |                                            |
|-----------|--------------------------------------------|
| Couplings | Error 171 is displayed if no data in table |
|-----------|--------------------------------------------|

## Serial #

To obtain the best accuracy, ENR Data is uniquely derived for each noise source. For Keysight Sources, this data can be found printed on the side of the source body. It is a good idea to enter the serial number and model ID of the source into the table – this way you can tell ‘at-a-glance’ whether the data is valid for a specific source or not.

The Meas and Cal tables both have an independent serial number and model ID parameter.

|                              |                                                                                                                                                                                  |
|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command               | <code>[ :SENSe]:NFIGure:CORRection:ENR:CALibration:TABLE:SERial:DATA &lt;string&gt;</code><br><code>[ :SENSe]:NFIGure:CORRection:ENR:CALibration:TABLE:SERial:DATA?</code>       |
| Example                      | <code>:NFIG:CORR:ENR:CAL:TABL:SER:DATA "4015A05450"</code>                                                                                                                       |
| State Saved                  | Yes                                                                                                                                                                              |
| Range                        | <code>a-zA-Z0-9</code><br><br>Backwards Compatibility Command                                                                                                                    |
| Notes                        | Same as:<br><code>[ :SENSe]:NFIGure:CORRection:ENR:CALibration:TABLE:SERial:DATA</code>                                                                                          |
| Range                        | <code>a-zA-Z0-9</code>                                                                                                                                                           |
| Backwards Compatibility SCPI | <code>[ :SENSe][ :NFIGure]:CORRection:ENR:CALibration:TABLE:SERial:DATA &lt;string&gt;</code><br><code>[ :SENSe][ :NFIGure]:CORRection:ENR:CALibration:TABLE:SERial:DATA?</code> |

## Model ID

To obtain the best accuracy, ENR Data is uniquely derived for each noise source. For Keysight Sources, this data can be found printed on the side of the source body. It is a good idea to enter the serial number and model ID of the source into the table – this way you can tell ‘at-a-glance’ whether the data is valid for a specific source or not.

The Meas and Cal tables both have an independent serial number and model ID parameter.

|                                 |                                                                                                                                                                          |
|---------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command                  | <code>[ :SENSe]:NFIGure:CORRection:ENR:CALibration:TABLE:ID:DATA &lt;string&gt;</code><br><code>[ :SENSe]:NFIGure:CORRection:ENR:CALibration:TABLE:ID:DATA?</code>       |
| Example                         | <code>:CORR:ENR:CAL:TABL:ID:DATA "346A"</code>                                                                                                                           |
| State Saved                     | Yes                                                                                                                                                                      |
| Range                           | <code>a-zA-Z0-9</code>                                                                                                                                                   |
| Backwards Compatibility Command |                                                                                                                                                                          |
| Notes                           | Same as:<br><code>[ :SENSe]:NFIGure:CORRection:ENR:CALibration:TABLE:ID:DATA</code>                                                                                      |
| Range                           | <code>a-zA-Z0-9</code>                                                                                                                                                   |
| Backwards Compatibility SCPI    | <code>[ :SENSe][ :NFIGure]:CORRection:ENR:CALibration:TABLE:ID:DATA &lt;string&gt;</code><br><code>[ :SENSe][ :NFIGure]:CORRection:ENR:CALibration:TABLE:ID:DATA?</code> |

## Go to Row

Specifies a row and makes it the selected row.

## Insert Row Below

Inserts a row below the current row. The new row is a copy of the current row, and becomes the current row. The new row is not yet entered into the underlying table, and the data in the row is displayed in light gray.

## Delete Row

This is an immediate action control. It immediately deletes the currently-selected row, whether or not that point is being edited, and selects **Navigate**. The point following the currently-selected row (or the row preceding if there is none) will be selected.

### Fill From SNS

Invokes population of the Meas Table or Cal Table from an SNS. Only available when an SNS is connected to the instrument.

|                              |                                                                                 |
|------------------------------|---------------------------------------------------------------------------------|
| Remote Command               | <code>[ :SENSe]:NFIGure:CORRection:ENR:CALibration:TABLE:SNS</code>             |
| Example                      | <code>:NFIG:CORR:ENR:CAL:TABL:SNS</code><br><br>Backwards Compatibility Command |
| Notes                        | Same as:<br><code>[ :SENSe]:NFIGure:CORRection:ENR:CALibration:TABLE:SNS</code> |
| Backwards Compatibility SCPI | <code>[ :SENSe][ :NFIGure]:CORRection:ENR:CALibration:TABLE:SNS</code>          |

### Clear Table

Clears all data from the Cal ENR table and removes the table's backup from persistent storage.

|                |                                                                                                                                                 |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:NFIGure:CORRection:ENR:CALibration:TABLE:DATA:DELeTe</code>                                                                     |
| Notes          | Clears all entries in the Cal ENR table. If the Cal ENR table data is being used in measurement, interrupts the current measurement immediately |

### Frequency Column

Lets you enter the frequency component of a frequency/amplitude pair.

|             |                    |
|-------------|--------------------|
| Preset      | 10 Hz              |
| State Saved | Yes                |
| Range       | 10 kHz to 3.30 THz |
| Min         | 10 kHz             |
| Max         | 3.30 THz           |

### ENR Column

Lets you enter the amplitude component of a frequency/amplitude pair.

### 3 Noise Figure Mode

#### 3.7 Meas Setup

|             |           |
|-------------|-----------|
| Preset      | 0 dB      |
| State Saved | Yes       |
| Min/Max     | -/+200 dB |

#### Setting ENR Table Remotely (Remote Command only)

Data can be entered into the current measurement or calibration ENR table using SCPI. Parameters are provided in frequency/amplitude pairs, the units being Hz and dB respectively. Up to 1301 point-pairs are accepted. See the "[Frequency Column](#)" on page 330 and "[ENR Column](#)" on page 330 definitions for the acceptable parameter ranges.

|                              |                                                                                                                                                                                                                                     |
|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command               | <code>[ :SENSe]:NFIGure:CORRection:ENR:CALibration:TABLE:DATA &lt;frequency&gt;, &lt;amplitude&gt; ([, &lt;frequency&gt;, &lt;amplitude&gt;])</code><br><code>[ :SENSe]:NFIGure:CORRection:ENR:CALibration:TABLE:DATA?</code>       |
| Example                      | <code>:NFIG:CORR:ENR:CAL:TABL:DATA 1000, -10, 2000, -8, 3000, -6, 10000, 5</code>                                                                                                                                                   |
| Notes                        | Between 1 and 1301 points must be entered<br><br>Backwards Compatibility Command                                                                                                                                                    |
| Notes                        | Between 1 and 1301 points must be entered<br>Same as:<br><code>[ :SENSe]:NFIGure:CORRection:ENR:CALibration:TABLE:DATA</code>                                                                                                       |
| Backwards Compatibility SCPI | <code>[ :SENSe][ :NFIGure]:CORRection:ENR:CALibration:TABLE:DATA &lt;frequency&gt;, &lt;amplitude&gt; ([, &lt;frequency&gt;, &lt;amplitude&gt;])</code><br><code>[ :SENSe][ :NFIGure]:CORRection:ENR:CALibration:TABLE:DATA?</code> |

#### ENR Table Entry Count (Remote Query only)

Returns the number of frequency/amplitude point-pairs in the current measurement or calibration table. If the table is empty, returns 0.

|                |                                                                        |
|----------------|------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:NFIGure:CORRection:ENR:CALibration:TABLE:COUNT?</code> |
| Example        | <code>:NFIG:CORR:ENR:MEAS:TABL:COUNT?</code>                           |
| Preset         | 0                                                                      |
| Min            | 0                                                                      |
| Max            | 1301                                                                   |
|                | Backwards Compatibility Command                                        |
| Notes          | Same as:                                                               |

|                                 |                                                                         |
|---------------------------------|-------------------------------------------------------------------------|
|                                 | <code>[ :SENSe]:NFIGure:CORRection:ENR:CALibration:TABLE:COUNT</code>   |
| Preset                          | 0                                                                       |
| Min                             | 0                                                                       |
| Max                             | 1301                                                                    |
| Backwards Compatibility<br>SCPI | <code>[ :SENSe]:NFIGure]:CORRection:ENR:CALibration:TABLE:COUNT?</code> |

## Spot Mode

Toggles the Spot value applied to the measurement between Spot ENR (in dB: [ENR](#)) and Spot Thot (in K: [THOT](#)).

|                                 |                                                                                                                        |
|---------------------------------|------------------------------------------------------------------------------------------------------------------------|
| Remote Command                  | <code>[ :SENSe]:NFIGure:CORRection:SPOT:MODE ENR   THOT</code><br><code>[ :SENSe]:NFIGure:CORRection:SPOT:MODE?</code> |
| Example                         | <code>:NFIG:CORR:SPOT:MODE ENR</code>                                                                                  |
| Preset                          | <a href="#">ENR</a>                                                                                                    |
| State Saved                     | Yes                                                                                                                    |
| Range                           | <a href="#">ENR</a>   <a href="#">THOT</a>                                                                             |
| Backwards Compatibility<br>SCPI | <code>[ :SENSe]:NFIGure]:CORRection:SPOT:MODE</code>                                                                   |

## Spot ENR

Set the ENR value used when "[ENR Mode](#)" on [page 322](#) is [SPOT](#), and "[Spot Mode](#)" on [page 332](#) is ENR. Spot ENR values have units of decibels (dB).

ENR values are the best way to enter the noise of the most common noise sources, solid state noise sources. Solid state noise sources have an output noise that is the sum of the attenuated noise of a noise diode and the noise of the output attenuator. When the ambient temperature experienced by that output attenuator changes, it changes the output noise in both the cold (off) and hot states of the noise source by the same amount of power. ENR is defined in terms of the difference between Thot and Tcold, and thus remains constant as Tcold changes.

|                |                                                                                                                         |
|----------------|-------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:NFIGure:CORRection:ENR:SPOT &lt;value&gt;</code><br><code>[ :SENSe]:NFIGure:CORRection:ENR:SPOT?</code> |
| Example        | <code>:CORR:ENR:SPOT 10 dB</code>                                                                                       |
| Preset         | 15.200 dB                                                                                                               |
| State Saved    | Yes                                                                                                                     |



### 3 Noise Figure Mode

#### 3.7 Meas Setup

|                                 |                                                           |
|---------------------------------|-----------------------------------------------------------|
| Min                             | -7 dB                                                     |
| Max                             | 50 dB                                                     |
| Backwards Compatibility<br>SCPI | <code>[ :SENSe ] [ :NFIgure ] :CORRection:ENR:SPOT</code> |

#### Spot T hot

Set the ENR value used when "Spot Mode" on page 332 is **THOT**.

Setting  $T_{hot}$  is the best way to enter the noise temperature of a noise source that has separate hot and cold loads. Such noise sources are commonly used in national standards laboratories but not by general users.

Unlike the case with solid state noise sources, with hot and cold loads,  $T_{hot}$  does not change due to changes in  $T_{cold}$ . Therefore, when you set  $T_{hot}$ , the instrument does not adjust  $T_{hot}$  according to changes in  $T_{cold}$ .

|                                 |                                                                                                                                   |
|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|
| Remote Command                  | <code>[ :SENSe ] :NFIgure:CORRection:ENR:THOT &lt;temperature&gt;</code><br><code>[ :SENSe ] :NFIgure:CORRection:ENR:THOT?</code> |
| Example                         | <code>:NFIg:CORR:ENR:THOT 200.5 K</code>                                                                                          |
| Preset                          | 9892.80 K                                                                                                                         |
| State Saved                     | Yes                                                                                                                               |
| Min                             | 0 K                                                                                                                               |
| Max                             | 29650000 K                                                                                                                        |
| Backwards Compatibility<br>SCPI | <code>[ :SENSe ] [ :NFIgure ] :CORRection:ENR:THOT</code>                                                                         |

#### T Cold Mode

Determines which Tcold value is used in the measurement:

|                |                                           |
|----------------|-------------------------------------------|
| <b>USER</b>    | Use a user-input custom Tcold value input |
| <b>DEFAult</b> | Use the default Tcold of 301.0 K          |

If an SNS is connected and "SNS T Cold State" on page 335 is **ON**, the Tcold value used for the NF measurement is read from the SNS at the beginning of every sweep and the **T Cold Mode** parameter is disabled. The User Tcold value can also be read once from an SNS (if connected) using "User T cold From SNS" on page 335.

|                |                                                                                                                        |
|----------------|------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe ] :NFIgure:CORRection:TCOLd USER   DEFAult</code><br><code>[ :SENSe ] :NFIgure:CORRection:TCOLd?</code> |
| Example        | <code>:NFIg:CORR:TCOL: DEF</code>                                                                                      |

|                              |                                                                                                                                              |
|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|
| Couplings                    | When <b>SNS T Cold State</b> is <b>ON</b> and SNS is connected, parameter (and selection keys) are disabled                                  |
| Preset                       | <b>DEFAuLt</b>                                                                                                                               |
| State Saved                  | Yes                                                                                                                                          |
| Range                        | <b>USER   DEFAuLt</b><br><br>Backwards Compatibility Command<br><br>To support T cold Mode On/Off:                                           |
| Notes                        | Included for backwards compatibility with ESA/PSA/NFA                                                                                        |
| Couplings                    | Mapped to <b>T Cold Mode</b> :<br>When <b>ON</b> , <b>T Cold Mode</b> = <b>USER</b><br>When <b>OFF</b> , <b>T Cold Mode</b> = <b>DEFAuLt</b> |
| Preset                       | <b>OFF</b>                                                                                                                                   |
| State Saved                  | Yes                                                                                                                                          |
| Range                        | <b>ON OFF 1 0</b>                                                                                                                            |
| Backwards Compatibility SCPI | <b>[ :SENSe]::NFIGure]:CORRection:TCOLd:USER[:STATe] ON   OFF   1   0</b><br><b>[ :SENSe]::NFIGure]:CORRection:TCOLd:USER[:STATe]?</b>       |

## User T cold Value

Sets the ambient temperature, Tcold, of the noise source. This is the temperature of the termination resistance inside the noise source. If this is set incorrectly, the error in temperature leads to a proportional error in the estimated noise power of that resistor. This error appears as an error in the apparent noise power at the input of the DUT. This can be very significant for very low NF devices and negligible for high NF devices.

|                |                                                                                                                                                                                                               |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <b>[ :SENSe]::NFIGure]:CORRection:TCOLd:USER:VALue &lt;value&gt;</b><br><b>[ :SENSe]::NFIGure]:CORRection:TCOLd:USER:VALue?</b>                                                                               |
| Example        | <b>:NFIG:CORR:TCOL:USER:VAL 290K</b>                                                                                                                                                                          |
| Notes          | When setting Tcold with SCPI, three units can be specified: K (Kelvin), CEL (Celsius) and FAR (Fahrenheit). If Celsius or Fahrenheit are specified, the unit is automatically converted to Kelvin for display |
| Couplings      | Disabled when <b>"SNS T Cold State"</b> on page 335 is <b>ON</b> and SNS is attached                                                                                                                          |
| Preset         | 301.0 K                                                                                                                                                                                                       |
| State Saved    | Yes                                                                                                                                                                                                           |
| Min            | 0 K                                                                                                                                                                                                           |
| Max            | 29650000 K                                                                                                                                                                                                    |

|                         |                                                                            |
|-------------------------|----------------------------------------------------------------------------|
| Annunciation            | T cold: <value> -- in Settings Area -- followed by: (SNS)   (Def)   (User) |
| Backwards Compatibility | [ :SENSe]:NFIGure:CORRection:TCOLd:USER:VALue                              |
| SCPI                    | [ :SENSe]:CORRection:TEMPerature                                           |

## User T cold From SNS

Takes a temperature reading from the SNS and sets the User Tcold parameter. Only available when "T Cold Mode" on page 333 is **USER**.

|                         |                                                                                           |
|-------------------------|-------------------------------------------------------------------------------------------|
| Remote Command          | [ :SENSe]:NFIGure:CORRection:TCOLd:USER:SET                                               |
| Example                 | :NFIG:CORR:TCOL:USER:SET                                                                  |
| Couplings               | Only enabled when SNS is connected<br>Only enabled when <b>T Cold Mode</b> is <b>USER</b> |
| Backwards Compatibility | [ :SENSe]:NFIGure:CORRection:TCOLd:USER:SET                                               |
| SCPI                    |                                                                                           |

## SNS T Cold State

When set to **ON** and an SNS is connected, the Tcold values used in the NF measurement are read from the SNS at the beginning of every sweep. User and Default Tcold mode selections are disabled when this is **ON** and SNS is connected.

|                         |                                                                                                                    |
|-------------------------|--------------------------------------------------------------------------------------------------------------------|
| Remote Command          | [ :SENSe]:NFIGure:CORRection:TCOLd:SNS[:STATe] ON   OFF   1   0<br>[ :SENSe]:NFIGure:CORRection:TCOLd:SNS[:STATe]? |
| Example                 | :CORR:TCOL:SNS ON                                                                                                  |
| Couplings               | When <b>ON</b> and SNS is attached, Tcold mode selections ( <b>USER</b> , <b>DEFauLt</b> ) are disabled            |
| Preset                  | <b>ON</b>                                                                                                          |
| State Saved             | Yes                                                                                                                |
| Range                   | ON OFF 1 0                                                                                                         |
| Backwards Compatibility | [ :SENSe]:NFIGure:CORRection:TCOLd:SNS[:STATe]                                                                     |
| SCPI                    |                                                                                                                    |

## 3.7.2 Cal Setup

Lets you configure calibration setup.

### 3.7.2.1 Cal Type

Selects the type of calibration to be used. **USER** cal or **INTernal** cal types are available.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:NFIgure:CALibration:TYPE USER   INTernal</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Example        | <code>:NFIg:CAL:TYPE INT</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Couplings      | <p>If changed from <b>INTernal</b> to <b>USER</b> and no user cal exists, <b>Apply Calibrations</b> is grayed-out and a message is displayed</p> <p>When set to <b>INTernal</b>, Cal State annunciator in meas bar changes to INT CAL</p> <p>When set to <b>USER</b>, Cal State annunciator in meas bar shows CAL when valid cal exists, UNCAL when cal is invalid (error 309) and ~CAL when cal is interpolated (error 311) or adjusted for RBW changes (error 313)</p> <p>Disabled when System Downconverter is used</p> <p>Apply Calibration is grayed-out when selected</p> |
| Preset         | <b>USER</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| State Saved    | Yes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Range          | <b>USER</b>   <b>INTernal</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |

### User Cal

User cal is the "normal" calibration technique, which requires you to connect the noise source directly to the instrument input that is, remove the DUT from the input circuit and perform a calibration.

Once the calibration is complete, the DUT can be inserted back into the input circuit and the measurement can proceed using the acquired calibration data.

When a calibration completes and is valid, **Apply Calibration** is set to "YES", if previously NO

When **User Cal** is selected and valid, the Cal State field in the Meas bar shows "CAL". When cal data is invalid "UNCAL" is shown in the Cal State field. When **User Cal** has been interpolated or adjusted, the Cal State field shows "~CAL"

If cal data changed from valid to invalid (for example, frequency param has changed since last user cal), **Apply Calibration** is grayed-out

### Invalidating User Cal

Should certain measurement parameters change when **User Cal** is selected and valid, the current calibration data will become invalid, and a new user calibration is

required before calibrated measurements can be performed. If **User Cal** is selected and invalid, the results will show uncalibrated data.

In this case, Cal State in Meas bar changes from green "Cal" to red "UnCal".

Changes To Parameters that will Invalidate User Cal

**Frequency:** Setting the frequency outside the current valid user cal set (for example, if the current sweep range is 2 to 3 GHz, then setting the start frequency to 1.9 GHz will invalidate the current user cal. Other frequency changes that will invalidate the user cal are:

- If the cal was performed at a fixed frequency and you change this frequency
- If you are in "Freq List" mode and you change it to extend beyond the current user cal range. In this case you will see an error message

**DUT Type:** If the DUT Type parameter changes, causing the measurement frequencies to be pushed outside the current cal

**Attenuation:** If a setting of attenuator has been selected but not been calibrated

**Preamplifier:** If set to condition different from current cal settings for example: if calibrated with preamp on, turning off will invalidate cal

**Points:** Changing the number of measured frequency points can make the stored preselector offsets become inaccurate and hence invalidate the calibration: This occurs when all the following conditions exist:

- A successful calibration has been performed
- Some measured freq points are > 3.6 GHz

The new points > 3.6 GHz are located more than 50 MHz away from the current calibration points

For freq pts. Measured above 3.6 GHz

**USB Preamplifier:** Changing the USB Preamplifier can invalidate the calibration. This occurs when any one of the following conditions exists:

- The current USB Preamplifier in use is not the one which was used when the current calibration was performed
- Disconnecting an USB Preamplifier after a successful calibration with USB Preamplifier has been performed
- Connecting an USB Preamplifier after a successful calibration without USB Preamplifier has been performed

## Interpolating User Cal

The measurement can interpolate calibration. For example: if the frequency range changes it can 'guess' the correct values; however, this will only work provided the new frequency range is a subset of the calibrated range.

In this case, Cal State in Meas bar will show in yellow as "~Cal" and a warning message will be displayed.

Changes To Parameters that will Interpolate User Cal

**Frequency:** If the frequency changes such that it is inside the current user cal settings. For example, if frequency sweep was from 1 to 2 GHz, and you change the start frequency to 1.1 GHz

**Points:** Changing the number of measured frequency points will interpolate the calibration under the following two conditions:

- All the frequencies are below 3.6 GHz
- Some measured freq points are above 3.6 GHz, the new points above 3.6 GHz are within 50 MHz of the current cal points

## Adjusting User Cal for RBW changes

When you change RBW away from the user cal setting, the cal data is adjusted. Each cal point is normalized to a 1 Hz BW and then multiplied by the new RBW to determine the *new* (interpolated) cal data.

In this case, the Cal State in Meas bar again shows in yellow as "~Cal" and a warning message is displayed.

## Internal Cal

This cal type lets you skip the calibration phase of a noise figure measurement, hence removing the need to mechanically change connection settings. This is only useful if you would normally connect the noise source directly to the instrument RF port. Any test bed fixtures that would normally require calibrating out in the calibrate step cannot use this calibration type. In some cases, you could put the test bed fixture data into the Loss Comp tables, but that would require precise measurement data from the test fixture. Also, for the case when "System Downconverter" is used, the **Internal Cal** option is disabled.

### 3.7.2.2 User Cal Min Atten

To ensure best accuracy in all situations, the calibration process can be performed at multiple attenuation settings. Ideally it should be performed at all available attenuation settings, but in practice this would take far too long and is unnecessary for most applications. For this reason, it is possible to limit the range of calibrated attenuation settings to a sensible range. This command operates in conjunction with **Max RF Atten** to set the range of attenuation used during the calibration process.

This tab is only available when the hardware set includes an input attenuator. For example, this tab does *not* appear in VXT models M9410A, M9411A, M9415A, M9416A, M9410E, M9411E, M9415E, M9416E. For this hardware, **Min Range** is available.

See "[Attenuation](#)" on page 166 under **Amplitude** for more information. The default input attenuation calibration range is:

- With FSA Option: 0 dB to 8 dB, and a step size of 4 dB
- Without FSA Option: 0 dB to 10 dB, and a step size of 10 dB

|                              |                                                                                                                                                             |
|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command               | <code>[ :SENSe]:NFIGure:CALibration:USER:ATTenuation:MINimum &lt;integer&gt;</code><br><code>[ :SENSe]:NFIGure:CALibration:USER:ATTenuation:MINimum?</code> |
| Example                      | <code>:NFIG:CAL:USER:ATT:MIN 20 dB</code>                                                                                                                   |
| Notes                        | Attenuation steps depend on FSA Option: <ul style="list-style-type: none"> <li>– With FSA – 4 dB</li> <li>– Without FSA – 10 dB</li> </ul>                  |
| Couplings                    | If the set value exceeds the MAX attenuation setting, MAX attenuation is set so that MIN is always less than or equal to MAX                                |
| Preset                       | 0 dB                                                                                                                                                        |
| State Saved                  | Yes                                                                                                                                                         |
| Min                          | 0                                                                                                                                                           |
| Max                          | 40 dB                                                                                                                                                       |
| Backwards Compatibility SCPI | <code>:INPut[:NFIGure]:ATTenuation[:RF][:MINimum]</code><br><code>:INPut[:NFIGure]:ATTenuation:MWAVE[:MINimum]</code>                                       |

### 3.7.2.3 User Cal Max Atten

To ensure best accuracy in all situations, the calibration process is performed at multiple attenuation settings. Ideally it should be performed at all available attenuation settings, but in practice this would take far too long; and is excessive for

most applications. For this reason, it is possible to limit the range of calibrated attenuation settings to a sensible range. This command operates in conjunction with **Min RF Atten** to set the range of attenuation used during the calibration process.

This tab is only available when the hardware set includes an input attenuator. For example, this tab does *not* appear in VXT models M9410A, M9411A, M9415A, M9416A, M9410E, M9411E, M9415E, M9416E. For this hardware, **Min Range** is available.

See "[Attenuation](#)" on page 166 under **Amplitude**) for more information. The default input attenuation calibration range is:

|                    |                                         |
|--------------------|-----------------------------------------|
| With FSA Option    | 0 dB to 8 dB, and a step size of 4 dB   |
| Without FSA Option | 0 dB to 10 dB, and a step size of 10 dB |

|                              |                                                                                                                                                             |
|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command               | <code>[ :SENSe]:NFIGure:CALibration:USER:ATTenuation:MAXimum &lt;integer&gt;</code><br><code>[ :SENSe]:NFIGure:CALibration:USER:ATTenuation:MAXimum?</code> |
| Example                      | <code>:NFIG:CAL:USER:ATT:MAX 40dB</code>                                                                                                                    |
| Notes                        | Attenuation steps depend on FSA Option:<br>With FSA: 4 dB<br>Without FSA: 4 dB                                                                              |
| Couplings                    | If the set value is below the MIN attenuation setting, MIN attenuation is set so that MAX is always greater than or equal to MIN                            |
| Preset                       | For instruments without FSA option, the default 10 dB (2 cal stages not 3)                                                                                  |
| State Saved                  | Yes                                                                                                                                                         |
| Min                          | 0                                                                                                                                                           |
| Max                          | 40 dB                                                                                                                                                       |
| Backwards Compatibility SCPI | <code>:INPut[:NFIGure]:ATTenuation[:RF]:MAXimum</code><br><code>:INPut[:NFIGure]:ATTenuation:MwAVE:MAXimum</code>                                           |

### 3.7.2.4 Min Range(Non-attenuator models)

To ensure best accuracy in all situations, the calibration process will be performed at multiple range settings. Ideally it should be performed at all available range settings, but in practice this would take far too long and is unnecessary for most applications. For this reason, it is possible to make a sensible limitation to the range of calibration. This command operates in conjunction with **Max Range** to set the range during the calibration process.

This tab is only available when the hardware does *not* include an input attenuator, such as in VXT models M9410A, M9411A, M9415A, M9416A, M9410E, M9411E, M9415E, M9416E.

|        |                                                                               |
|--------|-------------------------------------------------------------------------------|
| Remote | <code>[ :SENSe]:NFIGure:CALibration:USER:RANGe:MINimum &lt;integer&gt;</code> |
|--------|-------------------------------------------------------------------------------|



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|             |                                                                                       |
|-------------|---------------------------------------------------------------------------------------|
| Command     | <code>[ :SENSe]:NFIgure:CALibration:USER:RANGe:MINimum?</code>                        |
| Example     | <code>:NFIG:CAL:USER:RANG:MIN -22 dBm</code><br><code>:NFIG:CAL:USER:RANG:MIN?</code> |
| Preset      | -28 dBm                                                                               |
| State Saved | Yes                                                                                   |
| Min/Max     | -/+100                                                                                |

##### 3.7.2.5 Max Range(Non-attenuator models)

To ensure best accuracy in all situations, the calibration process will be performed at multiple range settings. Ideally it should be performed at all available range settings, but in practice this would take far too long; and is excessive for most applications. For this reason, it is possible to make a sensible limitation to the range of calibration. This command operates in conjunction with **Min Range** to set the range used during the calibration process.

This tab is only available when the hardware does *not* include an input attenuator, such as in VXT models M9410A, M9411A, M9415A, M9416A, M9410E, M9411E, M9415E, M9416E.

|                |                                                                                                                                                 |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:NFIgure:CALibration:USER:RANGe:MAXimum &lt;integer&gt;</code><br><code>[ :SENSe]:NFIgure:CALibration:USER:RANGe:MAXimum?</code> |
| Example        | <code>:NFIG:CAL:USER:RANG:MAX -18 dBm</code><br><code>:NFIG:CAL:USER:RANG:MAX?</code>                                                           |
| Preset         | -20 dBm                                                                                                                                         |
| State Saved    | Yes                                                                                                                                             |
| Min/Max        | -/+100                                                                                                                                          |

##### 3.7.2.6 Apply Cal

Enables or disables the application of calibration data to the measurement to derive corrected results. If User Cal is selected and no valid calibration data exists (for example: when a calibration has not been performed or when a frequency parameter is changed), this parameter is grayed-out and status message alerts you that **Calibrate Now** is required. This parameter is also grayed-out if you cancel a User Calibration before it is completed.

|                |                                                                                                                        |
|----------------|------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:NFIgure:CALibration:STATe ON   OFF   1   0</code><br><code>[ :SENSe]:NFIgure:CALibration:STATe?</code> |
| Example        | <code>:NFIG:CAL:STAT ON</code>                                                                                         |
| Couplings      | Only enabled when valid calibration data exists                                                                        |

|                                 |                                                                                                                                                                                            |
|---------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                 | <p>Grayed-out if a calibration is canceled before it is completed</p> <p>Set to <b>ON</b> when a calibration is successfully completed</p> <p>Grayed-out when internal cal is selected</p> |
| Preset                          | <b>OFF</b>                                                                                                                                                                                 |
| State Saved                     | Yes                                                                                                                                                                                        |
| Range                           | <b>ON OFF 1 0</b>                                                                                                                                                                          |
| Backwards Compatibility<br>SCPI | <p><b>:DISPlay[:NFIGure]:DATA:CORRections[:STATe]</b></p> <p><b>:DISPlay:DATA:CORRections[:STATe]</b></p> <p><b>[:SENSe]:CORRection[:STATe]</b></p>                                        |

### 3.7.2.7 Clear User Cal Data

Clears any user cal data currently stored both in working memory and on the hard drive of the instrument. The path for the Cal Data file is:

**D:\User\_My\_Documents\Instrument\My Documents\NFIGure\state\Corr.STA**

A confirmation dialog is displayed, as a safety mechanism when this control is pressed.

|                |                                                                                                 |
|----------------|-------------------------------------------------------------------------------------------------|
| Remote Command | <b>[:SENSe]:NFIGure:CALibration:DELeTe</b>                                                      |
| Example        | <b>:NFIG:CAL:DEL</b>                                                                            |
| Couplings      | Grayed-out if no user calibration data exists: status message "No User Calibration data exists" |

### 3.7.2.8 Calibration Status (Remote Query only)

Queries a bit to determine the current status, which will be one of: Cal, Uncal, ~Cal and Internal Cal (if NFE license is available).

|                |                                                                                                               |
|----------------|---------------------------------------------------------------------------------------------------------------|
| Remote Command | <b>[:SENSe]:NFIGure:CALibration:CONDition?</b>                                                                |
| Example        | <b>:NFIG:CAL:COND?</b>                                                                                        |
| Notes          | If the instrument is calibrated but <b>Apply Calibration</b> is set to <b>No</b> , returns "UnCal", not "Cal" |
| Preset         | 0                                                                                                             |
| State Saved    | Yes                                                                                                           |
| Range          | <b>CAL   UNCAL   INTERPCAL   INTCAL</b>                                                                       |

## 3.7.3 Noise Source

Lets you configure how to load ENR data from Noise Source.

3.7.3.1 Noise Source Preference

Selects the noise source preference. This feature lets you select which noise source you would prefer to use (if present). If two noise sources are connected (**SNS** and **NORMa1**), this parameter determines which one is used for measurement and calibration.

If set to **SNS** (Auto), an SNS noise source will be used if one is present. If an SNS is not present or preference is set to **NORMa1**, then a normal noise source will be used.

If set to **NORMa1**, "SNS T Cold State" on page 335 and "User T cold From SNS" on page 335 are disabled.

On connection of an SNS when **Preference** is set to **SNS**, if "Auto Load ENR" on page 343 is **ON**, "Use Meas Table Data for Cal" on page 322 is switched **ON** and the Meas Table will be automatically populated from the Noise Source. If "SNS T Cold State" on page 335 is **ON**, the Tcold parameter is also populated automatically from the SNS before every sweep.

NOTE

This parameter is a preference and is *not* altered automatically when an SNS is connected/disconnected.

|                              |                                                                                                                                                                                                                                                                                                               |
|------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command               | [ :SENSe]:NFIGure:CORRection:ENR:PREFerence NORMa1   SNS<br>[ :SENSe]:NFIGure:CORRection:ENR:PREFerence?                                                                                                                                                                                                      |
| Example                      | :NFIG:CORR:ENR:PREF NORM                                                                                                                                                                                                                                                                                      |
| Couplings                    | When set to <b>SNS</b> and <b>Auto Load ENR</b> is <b>ON</b> , connection of SNS to the instrument sets <b>Use Meas Table Data for Cal</b> to <b>ON</b> , and populates Meas Table from SNS data<br><b>SNS T Cold State</b> and <b>User T cold From SNS</b> parameters are disabled when set to <b>NORMa1</b> |
| Preset                       | <b>SNS</b>                                                                                                                                                                                                                                                                                                    |
| State Saved                  | Yes                                                                                                                                                                                                                                                                                                           |
| Range                        | <b>NORMa1</b>   <b>SNS</b>                                                                                                                                                                                                                                                                                    |
| Backwards Compatibility SCPI | :SOURce[:NFIGure]:NOISe[:PREFerence]                                                                                                                                                                                                                                                                          |

3.7.3.2 Auto Load ENR

If "Noise Source Preference" on page 343 is set to **SNS** and **Auto Load ENR** is **ON**, upon connection of an SNS, "Use Meas Table Data for Cal" on page 322 is switched **ON** and ENR data is automatically loaded into the Meas Table from the SNS, overwriting any existing data.

If set to **OFF**, **Use Meas Table Data for Cal** is not modified and no data is loaded into any ENR table automatically. ENR tables can still be populated from the SNS data using **Fill from SNS** under the appropriate table softpanel.

|                                 |                                                                                                                                            |
|---------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command                  | <code>[ :SENSe]:NFIGure:CORRection:ENR:AUTO[:STATe] OFF   ON   0   1</code><br><code>[ :SENSe]:NFIGure:CORRection:ENR:AUTO[:STATe]?</code> |
| Example                         | <code>:NFIG:CORR:ENR:AUTO OFF</code><br><code>:NFIG:CORR:ENR:AUTO?</code>                                                                  |
| Couplings                       | See above                                                                                                                                  |
| Preset                          | <b>ON</b>                                                                                                                                  |
| State Saved                     | Yes                                                                                                                                        |
| Range                           | <b>ON OFF 1 0</b>                                                                                                                          |
| Backwards Compatibility<br>SCPI | <code>[ :SENSe][:NFIGure]:CORRection:ENR:AUTO[:STATe]</code>                                                                               |

### 3.7.3.3 Noise Source State

Forces the noise source On or Off. When this function is set to **ON** or **OFF**, the application turns on/off the noise source and no valid results are provided. When noise source is set to **NORMa1** (default setting), the application controls the noise source on/off automatically during measurement.

"**Noise Source Preference**" on page 343 determines which noise source is controlled by this function. If **Noise Source Preference** is set to **SNS**, an SNS noise source will be controlled if one is present. If an SNS is not present, or **Noise Source Preference** is set to **NORMa1**, only a normal noise source will be controlled.

|                |                                                                                                         |
|----------------|---------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SOURce:NFIGure:NOISe:STATe NORMa1   ON   OFF</code><br><code>:SOURce:NFIGure:NOISe:STATe?</code> |
| Example        | <code>:SOUR:NFIG:NOIS:STAT ON</code>                                                                    |
| Couplings      | When set to <b>ON</b> or <b>OFF</b> , <b>Calibration Now</b> is disabled and grayed-out                 |
| Preset         | <b>NORMa1</b>                                                                                           |
| State Saved    | Yes                                                                                                     |
| Range          | <b>NORM ON OFF</b>                                                                                      |

### 3.7.3.4 Noise Source Settling Time

Lets you enter a time for the DUT to settle to the transition time of the noise source when measuring each point. The required time for settling of the 346-series or SNS-series noise source is already allocated in the Noise Figure application. Therefore, with these noise sources, the **Noise Source Settling Time** is actually the excess

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settling time required of the DUT. With other, unknown noise sources, this settling time should be set to allow adequate settling time for the noise source as well as the DUT.

The above times are set in the application, so for normal noise sources or DUTs that require longer settling times, the time would be entered via this parameter.

|                                 |                                                                                                |
|---------------------------------|------------------------------------------------------------------------------------------------|
| Remote Command                  | <code>[ :SENSe]:NFIGure:NSSTime &lt;time&gt;</code><br><code>[ :SENSe]:NFIGure:NSSTime?</code> |
| Example                         | <code>:NFIG:SWE:NSST 64 ms</code>                                                              |
| Preset                          | 0 s                                                                                            |
| State Saved                     | Yes                                                                                            |
| Min                             | 0 s                                                                                            |
| Max                             | 5 sec                                                                                          |
| Backwards Compatibility<br>SCPI | <code>:SYST:CONF:DUT:STIM</code>                                                               |

#### 3.7.4 Loss Comp

Controls the amount of loss compensation to be applied both before and after the Device Under Test. The loss compensation can be supplied as a fixed value for all frequencies, or a table of frequency/amplitude pairs that will be interpolated to find the most accurate compensation value for the measurement that is underway.

##### 3.7.4.1 Loss

Specify which loss (Before DUT Loss or After DUT Loss) will be affected by the functions.

##### 3.7.4.2 Loss Comp Mode

Controls the type of Loss Compensation to be applied before or after the Device Under Test.

|                |                                                                                                                                                           |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:NFIGure:CORRection:LOSS:BEFore AFTEr:MODE OFF   FIXed   TABLE</code><br><code>[ :SENSe]:NFIGure:CORRection:LOSS:BEFore AFTEr:MODE?</code> |
| Example        | <code>:NFIG:CORR:LOSS:BEF:MODE FIX</code><br><code>:NFIG:CORR:LOSS:BEF:MODE?</code>                                                                       |
| Preset         | OFF                                                                                                                                                       |
| State Saved    | Yes                                                                                                                                                       |
| Range          | OFF FIXed   TABLE                                                                                                                                         |

|                                 |                                                                                                                                                                    |
|---------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Backwards Compatibility SCPI    | <code>[ :SENSe][ :NFIGure]:CORRection:LOSS:BEFore AFter:MODE</code>                                                                                                |
| Backwards Compatibility Command |                                                                                                                                                                    |
| Notes                           | Supported only for backwards compatibility with PSA/ESA/NFA<br>When set to <b>ON</b> : <code>CORR:LOSS:BEF:MODE</code> (above) set to <b>FIXed</b>                 |
| Preset                          | <b>OFF</b>                                                                                                                                                         |
| Range                           | <b>OFF ON 0 1</b>                                                                                                                                                  |
| Backwards Compatibility SCPI    | <code>[ :SENSe][ :NFIGure]:CORRection:LOSS:BEFore AFter[:STATe] OFF   ON   0   1</code><br><code>[ :SENSe][ :NFIGure]:CORRection:LOSS:BEFore AFter[:STATe]?</code> |

### 3.7.4.3 Loss Table

The loss compensation tables are used as a means of entering correction data that will be used to improve the accuracy of measurements. Where a specific measured frequency does not have an exact match in the table, the loss compensation value will be interpolated linearly on the dB scale between the two closest data points.

The table is displayed on the left side of the current measurement as a series of Frequency and Loss Value pairs. When number of entries in the table cannot all be displayed at once, the table can be scrolled. The table is sorted in ascending order using the frequency as a key. The table disappears from view upon exit from the **Loss Table** menu.

Duplicates are *not* allowed in the frequency fields of the **Loss Table** but duplicate Loss Values at different frequencies are acceptable.

|      |                                                                                                                             |
|------|-----------------------------------------------------------------------------------------------------------------------------|
| NOTE | Data entered into this table will have no effect unless <b>"Loss Comp Mode"</b> on <b>page 345</b> is set to <b>TABLE</b> . |
|------|-----------------------------------------------------------------------------------------------------------------------------|

### Loss

This is the same as **"Loss"** on **page 345** on the **Loss Comp** menu panel.

### Go to Row

Specify a row and make it become selected row.

Insert Row Below

Inserts a row below the current row. The new row is a copy of the current row, and becomes the current row. The new row is not yet entered into the underlying table, and the data in the row is displayed in light gray.

Delete Row

This is an immediate action control. It immediately deletes the currently-selected row, whether or not that point is being edited, and selects **Navigate**. The point following the currently-selected row (or the row preceding if there is none) will be selected.

Clear Table

Clears all data from the Loss table and removes the table’s backup from persistent storage.

|                |                                                                                  |
|----------------|----------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe][ :NFIGure]:CORRection:LOSS:BEFore AFTer:TABLE:DATA:DELeTe</code> |
|----------------|----------------------------------------------------------------------------------|

Freq Column

Lets you enter the frequency component of a frequency/amplitude pair.

|             |                                                            |
|-------------|------------------------------------------------------------|
| Couplings   | Parameter coupled to currently selected frequency in table |
| Preset      | <blank>                                                    |
| State Saved | Yes                                                        |
| Min         | 10 kHz                                                     |
| Max         | 3.30 THz                                                   |

Loss Value Column

Lets you enter the amplitude component of a frequency/amplitude pair.

|             |                                                             |
|-------------|-------------------------------------------------------------|
| Couplings   | Parameter coupled to currently selected Loss Value in table |
| Preset      | 0                                                           |
| State Saved | Yes                                                         |
| Min/Max     | -/+200 dB                                                   |

### Setting Loss Compensation Table Remotely (Remote Command only)

Lets you remotely enter data into the current loss compensation table, by sending a variable number of frequency/amplitude point-pairs, with units Hz and dB respectively. Up to 1301 point-pairs are accepted. For the acceptable parameter ranges, see "[Freq Column](#)" on page 347 and "[Loss Value Column](#)" on page 347.

|                                 |                                                                                                                                                                                                                                    |
|---------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command                  | <code>[ :SENSe]:NFIGure:CORRection:LOSS:BEFore AFter:TABLE:DATA &lt;frequency&gt;, &lt;amplitude&gt; ([, &lt;frequency&gt;, &lt;amplitude&gt;])*</code><br><code>[ :SENSe]:NFIGure:CORRection:LOSS:BEFore AFter:TABLE:DATA?</code> |
| Example                         | <code>:NFIG:CORR:LOSS:BEF:TABL:DATA 1000, -10, 2000, -8, 3000, -6, 10000, 5</code>                                                                                                                                                 |
| Backwards Compatibility<br>SCPI | <code>[ :SENSe]:[ :NFIGure]:CORRection:LOSS:BEFore AFter:TABLE:DATA</code>                                                                                                                                                         |

### Table Entry Count (Remote Query Only)

Returns the number of frequency/amplitude point-pairs in the current measurement or loss compensation table. If the table is empty, returns 0.

|                                 |                                                                              |
|---------------------------------|------------------------------------------------------------------------------|
| Remote Command                  | <code>[ :SENSe]:NFIGure:CORRection:LOSS:BEFore AFter:TABLE:COUNT?</code>     |
| Example                         | <code>:NFIG:CORR:ENR:MEAS:TABL:COUN?</code>                                  |
| Preset                          | 0                                                                            |
| Min                             | 0                                                                            |
| Max                             | 1301                                                                         |
| Backwards Compatibility<br>SCPI | <code>[ :SENSe]:[ :NFIGure]:CORRection:LOSS:BEFore AFter:TABLE:COUNT?</code> |

#### 3.7.4.4 Fixed Loss

Allows entry of a single loss compensation value that will be applied before the device under test at all measured frequencies. Takes effect only if "[Loss Comp Mode](#)" on page 345 before or after DUT is set to **FIXed**.

|                |                                                                                                                                                       |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:NFIGure:CORRection:LOSS:BEFore AFter:VALue &lt;value&gt;</code><br><code>[ :SENSe]:NFIGure:CORRection:LOSS:BEFore AFter:VALue?</code> |
| Example        | <code>:NFIG:CORR:LOSS:BEF:VAL 20 dB</code>                                                                                                            |
| Notes          | Error -221 is displayed if you try to set <b>FIXed</b> value when <b>Before DUT</b> mode is <b>LIST</b> or <b>OFF</b>                                 |
| Couplings      | Only active when <b>Loss Comp Mode</b> is <b>FIXed</b>                                                                                                |



|                              |                                                                                                                                     |
|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|
| Preset                       | 0 dB                                                                                                                                |
| State Saved                  | Yes                                                                                                                                 |
| Min/Max                      | -/+100                                                                                                                              |
| Backwards Compatibility SCPI | <code>[ :SENSe] [ :NFIGure] :CORRection:LOSS:BEFore AFTer:VALue</code><br><code>[ :SENSe] :CORRection:LOSS:INPut OUTPut:SPOT</code> |

### 3.7.4.5 Temperature

Sets the before or after DUT correction temperature in units of Kelvin.

In loss compensation, if you set the gain loss (fixed value in dB), while setting the noise temperature of the attenuator to 0 K, then the noise figure of that loss is not taken into account. It is seen as a "purely reflective (non-dissipative)" loss. In most cases, the loss is a dissipative loss, hence the temperature at that loss is required and normally is set to 290 K.

For example, if a 3 dB attenuator is present before or after the DUT and **Temperature** is set to 0.0 K then only the expected transmission gain to the noise source declines by 3 dB in the results. Any noise added by the attenuator is attributed to the DUT instead of the attenuator. If **Temperature** is set to 290 K, then the NF results are computed assuming a noise contribution from the attenuator. This is then equivalent to adding in a 3 dB loss pad.

|                              |                                                                                                                                                                 |
|------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command               | <code>[ :SENSe] :NFIGure:CORRection:TEMPerature:BEFore AFTer &lt;temperature&gt;</code><br><code>[ :SENSe] :NFIGure:CORRection:TEMPerature:BEFore AFTer?</code> |
| Example                      | <code>:NFIG:CORR:TEMP:BEF 0.15 K</code>                                                                                                                         |
| Notes                        | Only K unit is supported                                                                                                                                        |
| Preset                       | 290.00                                                                                                                                                          |
| State Saved                  | Yes                                                                                                                                                             |
| Min                          | 0 K                                                                                                                                                             |
| Max                          | 29650000 K                                                                                                                                                      |
| Backwards Compatibility SCPI | <code>[ :SENSe] [ :NFIGure] :CORRection:TEMPerature:BEFore AFTer</code>                                                                                         |

### 3.7.5 Limits

Contains controls for the Limit Lines of the Noise Figure measurement. **Limits** arrays can be entered via the front panel, sent over SCPI, or loaded from a file.

|        |                                                                                                                       |
|--------|-----------------------------------------------------------------------------------------------------------------------|
| Preset | Turned off by <b>Preset</b> , but the Limits arrays (data) are only reset (deleted) by <b>Restore Mode Defaults</b> . |
|--------|-----------------------------------------------------------------------------------------------------------------------|

---

They survive shutdown and restarting of the instrument application, which means they will survive a power cycle

### 3.7.5.1 Select Limit

Specifies the selected limit. The term "selected limit" is used throughout this section to specify which limit is affected by the functions. Four limits are available for selection.

### 3.7.5.2 Limit (On/Off)

Selects whether the limit and margin are displayed. If **Test All Limits** is **ON**, also determines whether the test trace will be tested against the limit. If **Limit On/Off** is **ON**, the following occurs:

- The limit trace is displayed
- The trace is tested if "**Test Limits**" on page 353 is **ON**

|                              |                                                                                                                                        |
|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command               | <code>:CALCulate:NFIGure:LLINe[1] 2 ... 4:DISPlay OFF   ON   0   1</code><br><code>:CALCulate:NFIGure:LLINe[1] 2 ... 4:DISPlay?</code> |
| Example                      | <code>:CALC:NFIG:LLIN2:DISP ON</code>                                                                                                  |
| Couplings                    | Limit display <b>ON</b> selects the limit<br>Testing is done on all displayed limits if <b>Test All Limits</b> is <b>ON</b>            |
| Preset                       | Off (all limits)                                                                                                                       |
| State Saved                  | Saved in State                                                                                                                         |
| Backwards Compatibility SCPI | <code>:CALCulate[:NFIGure]:LLINe[1] 2 ... 4[:STATe]</code><br><code>:CALCulate[:NFIGure]:LLINe[1] 2 ... 4:DISPlay[:STATe]</code>       |

### 3.7.5.3 Type

Selects whether the limit you are editing is an **UPPer** or **LOWer** limit. An **UPPer** limit fails if the trace exceeds the limit. A **LOWer** limit fails if the trace falls below the limit.

|                |                                                                                                                                              |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALCulate:LLINe[1] 2 ... 4:TYPE UPPer   LOWer</code><br><code>:CALCulate:LLINe[1] 2 ... 4:TYPE?</code>                                |
| Example        | <code>:CALC:NFIG:LLIN2:TYPE LOW</code><br>sets limit line 2 to act as a <b>LOWer</b> limit                                                   |
| Couplings      | If a margin has already been set for this limit line, and this control is used to change the limit type, then the margin value reverses sign |

### 3 Noise Figure Mode

#### 3.7 Meas Setup

|                                 |                                                                                                                                       |
|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|
| Preset                          | <b>UPPer</b> for Line 1, 3; <b>LOWer</b> for Line 2, 4<br>Not affected by <b>Mode Preset</b> . Preset by <b>Restore Mode Defaults</b> |
| State Saved                     | Saved in State                                                                                                                        |
| Backwards Compatibility<br>SCPI | <b>:CALCulate[:NFIGure]:LLINe[1] 2 ... 4:TYPE</b>                                                                                     |

#### 3.7.5.4 Test Trace

Selects the trace you want the limit to test. A limit is applied to one and only one trace. Each trace can have both an upper and a lower limit. When executing Limit Test, the limit is applied only to the specified trace.

|                |                                                                                                                                         |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <b>:CALCulate:NFIGure:LLINe[1] 2 ... 4:TRACe 1   2</b><br><b>:CALCulate:NFIGure:LLINe[1] 2 ... 4:TRACe?</b>                             |
| Example        | <b>:CALC:NFIG:LLIN3:TRAC 2</b><br>applies limit 3 to trace 2                                                                            |
| Couplings      | Relevant when testing a trace or limit line for failure, via <b>:CALC:NFIG:LLIN3:FAIL?</b> or <b>:CALC:NFIG:TRAC2:FAIL?</b>             |
| Preset         | Limits 1 and 2 default to 1, Limits 3 and 4 default to 2<br>Not affected by <b>Mode Preset</b> . Preset by <b>Restore Mode Defaults</b> |
| State Saved    | Saved in State                                                                                                                          |

#### 3.7.5.5 Edit Limit

Lets you modify limit lines.

#### Select Limit

Specifies the *selected limit*. The term "selected limit" is used throughout this section to specify which limit is affected by the functions. Four limits are available for selection.

#### Go to Row

Specify a row and make it become selected row.

Insert Row Below

Inserts a row below the current row. The new row is a copy of the current row, and becomes the current row. The new row is not yet entered into the underlying table, and the data in the row is displayed in light gray.

Delete Row

This is an immediate action control. It immediately deletes the currently-selected row, whether or not that point is being edited, and selects **Navigate**. The point following the currently-selected row (or the row preceding if there is none) is selected.

Delete Limit

Clears all data from the selected limit.

|                |                                              |
|----------------|----------------------------------------------|
| Remote Command | :CALCulate[:NFIGure]:LLINE[1] 2 ... 4:DElete |
|----------------|----------------------------------------------|

Freq Column

Lets you enter the frequency component of a frequency/amplitude pair.

|             |                                                          |
|-------------|----------------------------------------------------------|
| Couplings   | Parameter coupled to currently selected X value in table |
| Preset      | <blank>                                                  |
| State Saved | Yes                                                      |
| Min         | 10 Hz                                                    |
| Max         | 3.30 THz                                                 |

Amptd Column

Lets you enter the amplitude component of a frequency/amplitude pair.

|             |                                                          |
|-------------|----------------------------------------------------------|
| Couplings   | Parameter coupled to currently selected Y value in table |
| Preset      | 0                                                        |
| State Saved | Yes                                                      |
| Min/Max     | -/+100 dB                                                |

### 3.7.5.6 Test Limits

Selects whether displayed traces are tested against displayed limits (that is, those for which "Limit (On/Off)" on page 350 is ON).

If two amplitude values are entered for the same frequency, a single vertical line is the result. In this case, if an Upper line is chosen, the lesser amplitude is tested. If a Lower line is chosen, the greater amplitude is tested.

|                                 |                                                                                                                |
|---------------------------------|----------------------------------------------------------------------------------------------------------------|
| Remote Command                  | <code>:CALCulate:NFIGure:LLINe:TEST OFF   ON   0   1</code><br><code>:CALCulate:NFIGure:LLINe:TEST?</code>     |
| Example                         | <code>:CALC:NFIG:LLIN:TEST ON</code>                                                                           |
| Notes                           | When the command is used to turn an individual limit line test ON, the test for <i>all</i> limits is turned ON |
| Preset                          | ON<br>Not affected by <b>Mode Preset</b> . Preset by <b>Restore Mode Defaults</b>                              |
| State Saved                     | Saved in State                                                                                                 |
| Annotation                      | If ON, the active limit window displays the information above regarding pass/fail for each displayed limit     |
| Backwards Compatibility<br>SCPI | <code>:CALCulate[:NFIGure]:LLINe[1] 2 ... 4:TEST[:STATE]</code>                                                |

### 3.7.5.7 Delete All Limits

Deletes all limit lines and purges the data from all limit line tables.

All limit data is cleared and returned to factory preset values.

|                |                                                  |
|----------------|--------------------------------------------------|
| Remote Command | <code>:CALCulate:NFIGure:LLINe:ALL:DElete</code> |
| Example        | <code>:CALC:NFIG:LLIN:ALL:DEL</code>             |

### 3.7.5.8 All Limits Fail? (Remote Query Only, Backwards Compatibility)

Tests all limits on all traces for failure. Returns 0 if no limits fail or 1 if any limits fail.

|                                 |                                                                                                                                               |
|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| Notes                           | Performs the same action as sending <code>:CALC:TRACe[1] 2:FAIL?</code> for both traces then performing a logical OR operation on the results |
| Backwards Compatibility<br>SCPI | <code>:CALCulate:CLIMits:FAIL?</code>                                                                                                         |

### 3.7.5.9 Limit Line Data (Remote Command Only, Backwards Compatibility)

Defines the limit line values and destroys all existing data. Up to 200 points may be defined for each limit using the following parameters.

|                        |                                                                                                                                                                                                                                                                                           |
|------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>&lt;x&gt;</b>       | Frequency or time values as specified by<br><b>:CALCulate:LLINE:CONTRol:DOMain</b> . Units default to Hz (for frequency) and seconds (for time)<br>Range: –30 Gs to +30 Gs for time limits, –3 kHz to +350 GHz for frequency limits                                                       |
| <b>&lt;ampl&gt;</b>    | Amplitude values units default to dBm. Up to two amplitude values can be provided for each x-axis value, by repeating <x-axis> in the data list<br>Range: –140 dBm to +100 dBm                                                                                                            |
| <b>&lt;connect&gt;</b> | Connect values are either "0" or "1." "1" means this point will be connected to the previously defined point to define the limit line. "0" means that it is a point of discontinuity and is not connected to the preceding point. The <b>connect</b> value is ignored for the first point |

|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                |
|---------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Preset                          | Limit line data is cleared by <b>Restore Mode Defaults</b>                                                                                                                                                                                                                                                                                                                                                     |
| State Saved                     | Yes                                                                                                                                                                                                                                                                                                                                                                                                            |
| Backwards Compatibility<br>SCPI | <b>:CALCulate[:NFIGure]:LLINE[1] 2 ... 4:DATA</b><br><b>:CALCulate:NFIGure:LLINE[1] 2 ... 4:DATA &lt;freq&gt;,&lt;ampl&gt;,&lt;connect&gt;,...</b><br><b>:CALCulate:NFIGure:LLINE[1] 2 ... 4:DATA?</b><br><br>The following query returns an integer representing the number of frequency/amplitude/connected sets that are currently loaded into the table. Min 0, Max 200. If the table is empty, returns 0. |
| Remote Command                  | <b>:CALCulate[:NFIGure]:LLINE[1] 2 ... 4:COUNT?</b>                                                                                                                                                                                                                                                                                                                                                            |
| Example                         | <b>:CALC:LLIN2:COUN?</b>                                                                                                                                                                                                                                                                                                                                                                                       |
| Preset                          | 0                                                                                                                                                                                                                                                                                                                                                                                                              |

## 3.7.6 Advanced

Allows control of functions that most users will not need to change.

### 3.7.6.1 Pcold/hot Unit

Specifies the Pcold/hot result unit.

| Unit   | SCPI          | Result                                            |
|--------|---------------|---------------------------------------------------|
| dBm/Hz | <b>DBM_HZ</b> | The absolute power density                        |
| dB     | <b>DB</b>     | The power density reference to kTB –173.88 dBm/Hz |

3 Noise Figure Mode  
3.7 Meas Setup

|                |                                                                                                   |
|----------------|---------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:NFIGure:PCHot:UNIT DB   DBM_HZ</code><br><code>[ :SENSe]:NFIGure:PCH:UNIT?</code> |
| Example        | <code>:NFIG:PCH:UNIT DB</code>                                                                    |
| Preset         | <code>DB</code>                                                                                   |
| State Saved    | Yes                                                                                               |
| Range          | <code>DB   DBMHZ</code>                                                                           |

## 3.8 Sweep

Accesses controls to configure and control the acquisition of data, and the X-axis parameters of the instrument.

Depending on the selected mode and measurement, these controls might include: **Sweep Time**, **Continuous/Single**, **Pause/Resume**, **X Scale** and **Number of Points**.

### 3.8.1 Sweep/Control

Accesses controls that let you operate the sweep and control functions of the instrument, such as **Sweep Time** and **Continuous/Single**.

#### 3.8.1.1 Avg Time/Pt

**Avg Time/Pt** is the measurement duration for each of the two states (noise source on and noise source off) that occur at each frequency point. Therefore, for one result trace, the time required will change by 2 times the number of frequency points times the change in **Avg Time/Pt**.

Longer settings of **Avg Time/Pt** reduce the variance of the results but slow the throughput. The **AUTO** setting sets **Avg Time/Pt** according to this formula:

$$\text{Avg Time/Pt} = 64 \text{ ks} / \text{RBW}$$

The default RBW is 4 MHz, so **Avg Time/Pt** default is 16 ms. At this sweep time, the variance of the trace point results under best-case circumstances (high DUT output noise levels) is such that 95% of all results will have an error due to this variance that is similar to the Instrument Uncertainty for Noise Figure. Therefore, the overall uncertainties do not improve much for longer averaging times. Averaging times much shorter than 16 ms will cause the throughput to be dominated by overheads of computation and settling. Thus, the default is often a good tradeoff between speed and variance.

One use of shorter settings of **Avg Time/Pt** is for testing DUTs that operate in a pulsed mode.

**Avg Time/Pt** is one way to reduce variance. Another is setting "**Average/Hold Num**" on page 211 in the **Meas Setup** menu. When averaging traces with **Average/Hold Num** set higher than one, the time to achieve a given variance is longer because the overhead time at each point is experienced during each sweep, thus increasing **Avg Time/Pt** is more efficient. A shorter **Avg Time/Pt** with a higher **Average/Hold Num** gives more interactive results, with an earlier first view of the results.

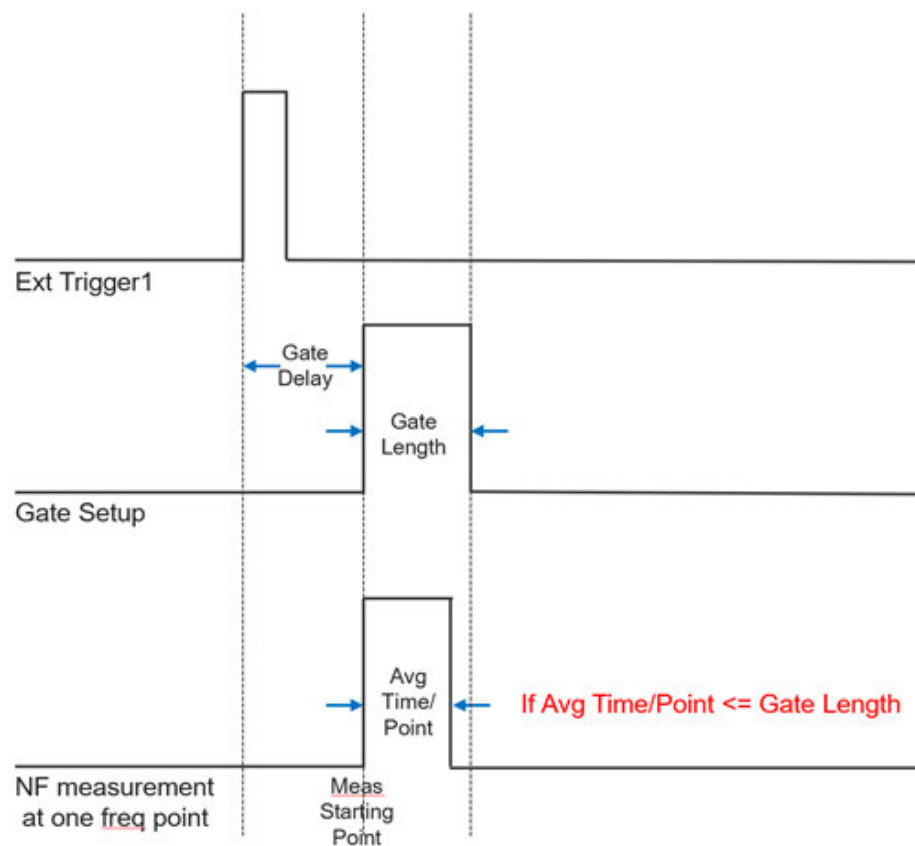
This trade-off between **AvgTime/Pt** and **Average/Hold Num** is analogous to the trade-off between "point" and "sweep" averaging modes in the Keysight NFA.



## Pulsed Noise Figure Measurement

In a Pulsed Noise Figure measurement, the pHot/pCold measurements must be performed only in the active part of the pulse. To accomplish this, in a gated and triggered measurement, **Avg Time/Pt** is further adjusted, according to the following formula, to guarantee that the data acquisition occurs during the active part of the pulse.

$$\text{Avg Time/Pt} \leq \text{Gate Length}$$



Use the controls in **"Gate Settings" on page 987**, under **Trigger**, to adjust the gate parameters. You can then select the appropriate trigger source and gate parameters, such as **Gate Delay** and **Gate Length**, to ensure that the noise figure is measured during the active part of the pulse.

---

Remote Command      [:SENSe]:NFIgure:SWEEP:TIME <time>  
                             [:SENSe]:NFIgure:SWEEP:TIME?

|                                 |                                     |
|---------------------------------|-------------------------------------|
| Example                         | <code>:NFIG:SWE:TIME 64 ms</code>   |
| Preset                          | 16 ms                               |
| State Saved                     | Yes                                 |
| Min                             | 1 us                                |
| Max                             | 6 ks                                |
| Backwards Compatibility<br>SCPI | <code>[ :SENSe ] :SWEep:TIME</code> |

#### Auto Function

|                |                                                                                                                                                                  |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe ] :NFIGure:SWEep:TIME:AUTO ON   OFF   1   0</code><br><code>[ :SENSe ] :NFIGure:SWEep:TIME:AUTO?</code>                                           |
| Example        | <code>:NFIG:SWE:TIME:AUTO OFF</code>                                                                                                                             |
| Couplings      | When set to <b>AUTO</b> , the <b>Avg Time/Pt</b> value is coupled to <b>RBW</b> by this formula:<br>Avg Time/Pt = 64k/RBW<br>This optimizes the results variance |
| Preset         | <b>ON</b>                                                                                                                                                        |
| State Saved    | Yes                                                                                                                                                              |
| Range          | <b>ON OFF 1 0</b>                                                                                                                                                |

### 3.8.1.2 Sweep/Measure

Lets you toggle between **Continuous** and **Single** sweep or measurement operation. The single/continuous state is Meas Global, so the setting affects all measurements.

The front-panel key **Single/Cont** performs exactly the same function

See ["More Information" on page 359](#)

|                |                                                                                                                                                                                                                                                     |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:INITiate:CONTinuous OFF   ON   0   1</code><br><code>:INITiate:CONTinuous?</code>                                                                                                                                                            |
| Example        | Put instrument into <b>Single</b> measurement operation:<br><code>:INIT:CONT 0</code><br><code>:INIT:CONT OFF</code><br><br>Put instrument into <b>Continuous</b> measurement operation:<br><code>:INIT:CONT 1</code><br><code>:INIT:CONT ON</code> |
| Preset         | <b>ON</b><br><br>Note that <code>:SYST:PRES</code> sets <code>:INIT:CONT</code> to <b>ON</b> , but <code>*RST</code> sets <code>:INIT:CONT</code> to <b>OFF</b>                                                                                     |
| State Saved    | Saved in instrument state                                                                                                                                                                                                                           |

|                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|-------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Annunciation                  | <p>The <b>Single/Continuous</b> icon in the Meas Bar changes depending on the setting:</p> <ul style="list-style-type: none"> <li>– A line with an arrow is <b>Single</b></li> <li>– A loop with an arrow is <b>Continuous</b></li> </ul>                                                                                                                                                                                                                                                                                                                                                     |
| Backwards Compatibility Notes | <p>X-Series A-models had <b>Single</b> and <b>Cont</b> hardkeys in place of the <b>SweepSingleCont</b> softkey. In the X-Series A-models, if in single measurement, the <b>Cont</b> hardkey (and <b>INIT:CONT ON</b>) switched to continuous measurement, but never restarted a measurement and never reset a sweep</p> <p>X-Series B-models have a <b>Cont/Single</b> toggle control instead of <b>Single</b> and <b>Cont</b> hardkeys, but it is still true that, if in single measurement, the <b>Cont/Single</b> toggle control never restarts a measurement and never resets a sweep</p> |

### More Information

|                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|-----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Continuous Mode | <p>The instrument takes repetitive sweeps, averages, measurements, etc., when in continuous mode. If in average or Max/Min Hold, and the average/hold count reaches the <b>Average/Hold Num</b>, the count stops incrementing, but the instrument keeps sweeping</p> <p>See the <b>Trace</b> key description under <b>Trace Average</b> for the averaging formula used both before and after the <b>Average/Hold Num</b> is reached. The trigger condition must be met prior to each sweep</p> <p>The type of trace processing for multiple sweeps is set under the <b>Trace</b> key, with choices of <b>Trace Average</b>, <b>Max Hold</b>, or <b>Min Hold</b></p> |
| Single Mode     | <p>The instrument takes a single sweep when in <b>Single</b> mode, or if in average or Max/Min Hold, or if there is a <b>Waterfall</b> window displayed, it takes multiple sweeps until the average/hold count reaches the <b>Average/Hold Num</b>, then the count stops incrementing, and the instrument stops sweeping</p> <p>See the <b>Trace</b> key description under <b>Trace Average</b> for the averaging formula used. The trigger condition must be met prior to the sweep</p> <p>The type of trace processing for multiple sweeps is set under the <b>Trace</b> key, with choices of <b>Trace Average</b>, <b>Max Hold</b>, or <b>Min Hold</b></p>       |

If the instrument is in **Single** measurement mode, pressing the **Cont/Single** toggle control does not zero the count and does not cause the sweep to be reset; the only action is to put the instrument into Continuous measurement operation.

If the instrument is already in **Continuous** sweep:

- **:INIT:CONT 1** has no effect
- **:INIT:CONT 0** places the instrument in Single Sweep but has no effect on the current sequence until  $k = N$ , at which point the current sequence will stop and the instrument will go to the idle state

See "**Restart**" on page 360 for details of **:INIT:IMMediate**.

If the instrument is already in **Single** sweep, **:INIT:CONT OFF** has no effect.

If the instrument is already in **Single** sweep, then pressing **Cont/Single** in the middle of a sweep does not restart the sweep or sequence. Similarly, pressing **Cont/Single** does not restart the sweep or sequence if the sweep is not in the idle state (for example, if you are taking a very slow sweep, or the instrument is waiting for a trigger). Even though pressing **Cont/Single** in the middle of a sweep does not restart the sweep, sending **:INIT:IMM** does reset it.

If the instrument is in **Single** sweep, and *not* Averaging/Holding, and you want to take one more sweep, press **Restart**.

If the instrument is in **Single** sweep, *and* Averaging/Holding, and you want to take one more sweep without resetting the Average trace or count, go to **Meas Setup** and increment the average count by 1 by pressing the **Step-Up** key while **Average/Hold Num** is the active function. You can also do this by sending **:CALC:AVER:TCON UP**.

3.8.1.3 Restart

Restarts the current sweep, or measurement, or set of averaged/held sweeps or measurements. If you are Paused, pressing **Restart** performs a Resume.

The front-panel key **Restart** performs exactly the same function.

The **Restart** function is accessed in several ways:

- Pressing the **Restart** key
- Sending **:INIT:IMM**
- Sending **:INIT:REST**

See "More Information" on page 361

|                              |                                                                                                                                                                                                                                                                                                                                                          |
|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command               | <b>:INITiate[:IMMEDIATE]</b><br><b>:INITiate:REStart</b>                                                                                                                                                                                                                                                                                                 |
| Example                      | <b>:INIT:IMM</b><br><b>:INIT:REST</b>                                                                                                                                                                                                                                                                                                                    |
| Notes                        | <b>:INIT:REST</b> and <b>:INIT:IMM</b> perform exactly the same function                                                                                                                                                                                                                                                                                 |
| Couplings                    | Resets average/hold count k. For the first sweep overwrites all active (update = on) traces with new current data. For application modes, it resets other parameters as required by the measurement                                                                                                                                                      |
| Status Bits/OPC dependencies | This is an Overlapped command<br>The <b>STATus:OPERation</b> register bits 0 through 8 are cleared , <i>except</i> bit 6 (Waiting for Periodic Sync). Initiating a measurement and Waiting for Periodic Sync could be asynchronous<br>The <b>STATus:QUESTionable</b> register bit 9 ( <b>INTegrity</b> sum) is cleared<br>The <b>SWEEPING</b> bit is set |

|                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|-------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                               | The <b>MEASURING</b> bit is set                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Backwards Compatibility Notes | <p>For Spectrum Analysis Mode in ESA and PSA, the <b>Restart</b> hardkey and the <b>:INIT:REST</b> command restarted trace averages (displayed average count reset to 1) for a trace in <b>Clear Write</b>, but did not restart <b>Max Hold</b> and <b>Min Hold</b></p> <p>In X-Series, the <b>Restart</b> hardkey and the <b>:INIT:REST</b> command restart not only <b>Trace Average</b>, but <b>MaxHold</b> and <b>MinHold</b> traces as well</p> |

More Information

The **Restart** function first aborts the current sweep or measurement as quickly as possible. It then resets the sweep and trigger systems, sets up the measurement and initiates a new data measurement sequence with a new data acquisition (sweep) taken once the trigger condition is met.

If the instrument is in the process of aligning when a **Restart** is executed, the alignment finishes before the restart function is performed.

Even when set for **Single** operation, multiple sweeps may be taken when **Restart** is pressed (for example, when averaging/holding is on). Thus, when we say that **Restart** "restarts a measurement", depending on the current settings, we may mean that it:

- Restarts the current sweep
- Restarts the current measurement
- Restarts the current set of sweeps if any trace is in Trace Average, Max Hold or Min Hold
- Restarts the current set of measurements if Averaging, or Max Hold, or Min Hold is on for the measurement

If there is no Average or Max/Min Hold function (no trace in Trace Average or Hold, or **Average/Hold Num** set to 1), and no **Waterfall** window is being displayed, a single sweep is equivalent to a single measurement. A single sweep is taken after the trigger condition is met; and the instrument stops sweeping once that sweep has completed. However, with **Average/Hold Num** >1, and at least one trace set to Trace Average, Max Hold, or Min Hold, or a **Waterfall** window being displayed, multiple sweeps/data acquisitions are taken for a single measurement. The trigger condition must be met prior to each sweep. The sweep is stopped when the average count k equals the number N set for **Average/Hold Num**.

Once the full set of sweeps has been taken, the instrument goes to the idle state. To take one more sweep without resetting the average count, increment the average count by 1, by pressing the **Step-Up** key while **Average/Hold Number** is the active function, or by sending the remote command **:CALC:AVER:TCN UP**.

## Trace Update

The numeric results are not blanked at any time during the restart cycle.

For slow sweeps (see **Trace Update** section in **Trace/Detector**), the traces are updated real-time during the sweep. There may be a special circumstance in application mode measurements where an exception is made and the traces and/or results need to be blanked before displaying the new results.

To summarize, the following list shows what happens to the trace data on various events:

| Event                                                           | Trace Effect                                       |
|-----------------------------------------------------------------|----------------------------------------------------|
| <b>Clear/Write</b> pressed (even if already in Clear/Write)     | Set to mintracevalue                               |
| <b>Max Hold</b> pressed (even if already in Max Hold)           | Set to mintracevalue                               |
| <b>Min Hold</b> pressed (even if already in Min Hold)           | Set to maxtracevalue                               |
| <b>Trace Average</b> pressed (even if already in Trace Average) | Trace data unaffected but start new sweep/avg/hold |
| <b>Restart</b> pressed                                          | Trace data unaffected but start new sweep/avg/hold |
| Parameter requiring restart changed (e.g., RBW)                 | Trace data unaffected but start new sweep/avg/hold |

## Sweep and Trigger Reset

Resetting the sweep system resets the average/hold count  $k$  to 0. It also resets the set point counter to 0. Resetting the trigger system resets the internal auto trig timer to the value set by the **Auto Trig** control.

## Averaging

The weighting factor used for averaging is  $k$ . This  $k$  is also the average/hold count for how many valid sweeps (data acquisitions) have been done. This  $k$  is used for comparisons with  $N$ , as those comparisons always needs to be based on valid completed sweeps.

The displayed average/hold,  $K$ , shows the count for the sweep (data acquisition) in progress.  $K = k + 1$ , with a limit of  $N$ . The displayed value  $K$  changes from its previous value to 1 as soon as the trigger condition for the first data acquisition (sweep) is met.

3.8.1.4 Points

Sets the number of frequency points that are used when "Freq Mode" on page 191 is **SWEpt**. The frequency points are distributed evenly between the start and stop frequencies.

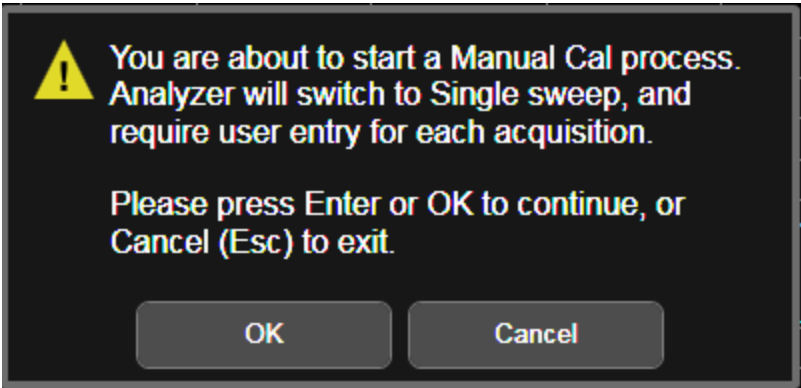
|                                 |                                                                             |
|---------------------------------|-----------------------------------------------------------------------------|
| Remote Command                  | [ :SENSe]:NFIGure:SWEEp:POINts <integer><br>[ :SENSe]:NFIGure:SWEEp:POINts? |
| Example                         | :SWE:POIN 201                                                               |
| Couplings                       | Coupled to max value of "Table Position" on page 183 (under Display)        |
| Preset                          | 11                                                                          |
| State Saved                     | Yes                                                                         |
| Min                             | 2                                                                           |
| Max                             | 1301                                                                        |
| Backwards Compatibility<br>SCPI | [ :SENSe][ :NFIGure]:SWEEp:POINts                                           |

3.8.1.5 Start Manual Cal

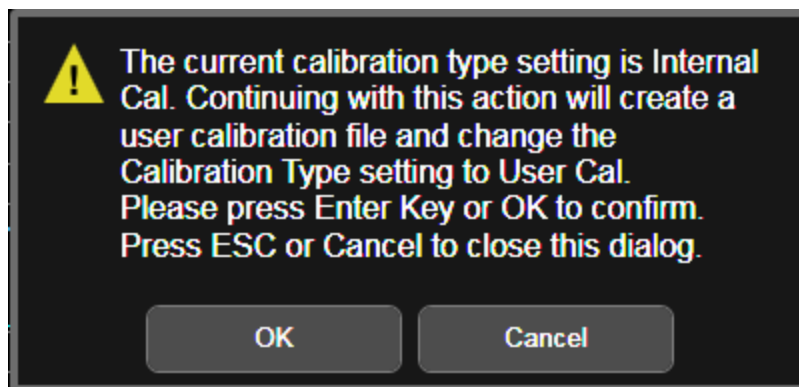
Can be used to perform a manual calibration with a hot/cold noise source. Primarily for situations where a SNS or 346 Series noise source is *not* being used.

This function adds an interrupt state between HOT and COLD power measurement, during which you can switch the noise source.

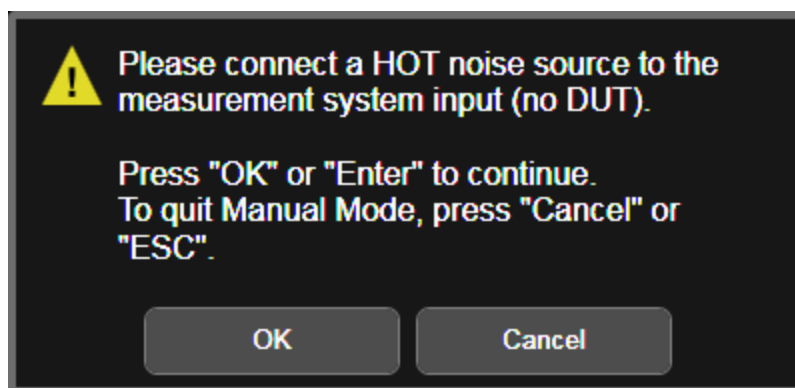
When this control is pressed, the following dialog is displayed:



If **Internal Cal** is selected, the dialog is different, as shown below:

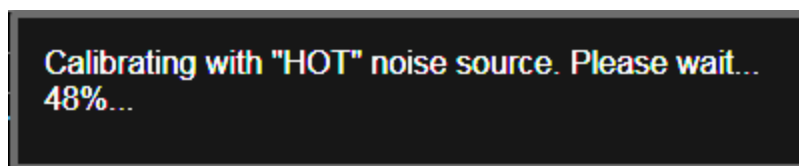


When **OK** is pressed, manual calibration begins. The instrument is forced to **Single** mode, and the following dialog is displayed:



This dialog informs you to connect a “Hot” noise source. After connecting a “Hot” noise source, you can start calibration by pressing **OK** or **Enter**.

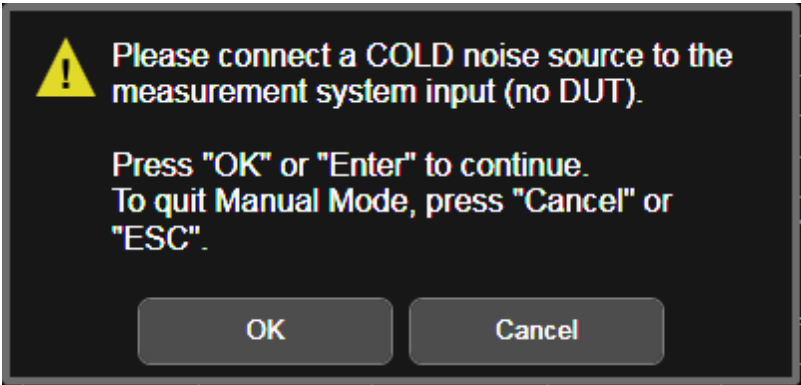
The instrument measures “Hot” power for each frequency points, while displaying the following dialog:



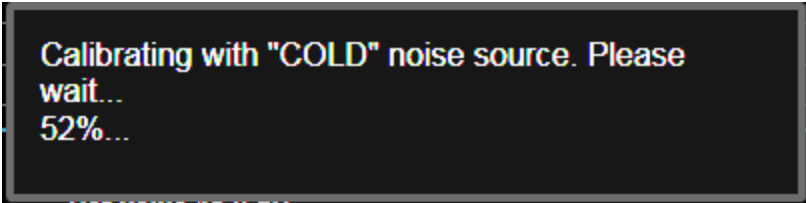
When completed, the measured powers are collected, then the following dialog is displayed.



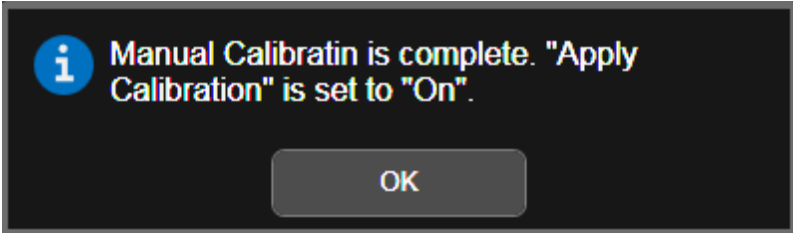
3 Noise Figure Mode  
3.8 Sweep



Connect a “Cold” noise source, the press **OK** or **Enter** to continue. The instrument measures “Cold” powers while displaying the following dialog:



When “Cold” power measurement is complete, the dialog closes. A further message appears: Apply Calibration is set to On.



To abort, press **Cancel** or **ESC**.

To start Manual Measurement, press **Start Manual Meas**. If you press **Restart**, **Single** or **Cont**, an Automatic Measurement will start.

NOTE

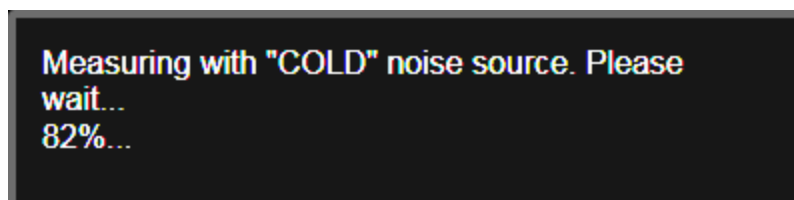
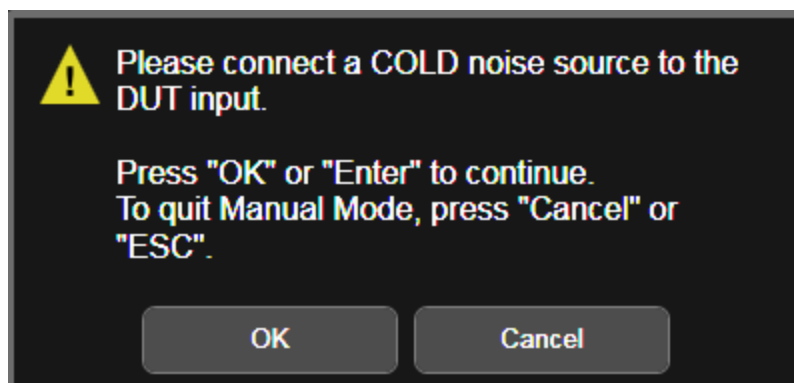
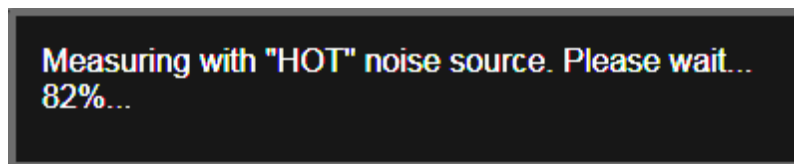
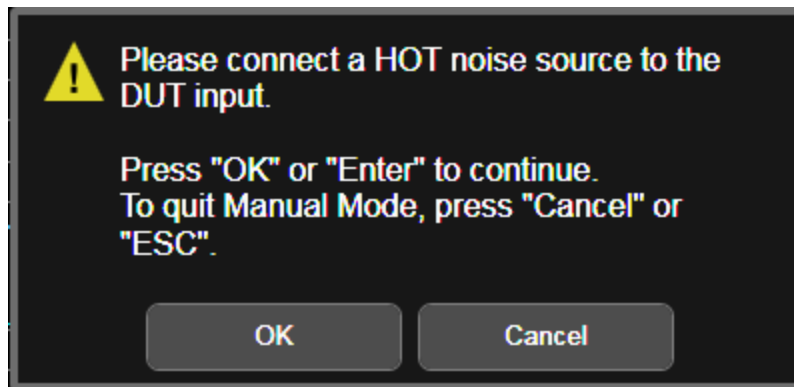
When manual calibration is in progress, "**Start Manual Meas**" on page 366 is disabled.

|                |                                                                |
|----------------|----------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:NFIGure:MANual:CALibration:INITiate</code>     |
| Example        | <code>:NFIG:MAN:CAL:INIT</code>                                |
| Notes          | Immediate action                                               |
| Couplings      | Instrument forced to <b>SINGLE</b> mode when manual cal starts |

### 3.8.1.6 Start Manual Meas

Performs a manual measurement with a hot/cold noise source. Primarily for situations where a SNS or 346 Series noise source is *not* being used.

This procedure is the same as ["Start Manual Cal" on page 363](#), except that the dialogs differ. The following dialogs are displayed during “Cold” and “Hot” power measurement.



When “Cold” power measurement is complete, the dialog closes. A further message “Manual Meas is complete” appears, and the results are displayed.

**NOTE** When manual calibration is in progress, **Start Manual Meas** is disabled.

|                |                                                                |
|----------------|----------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:NFIGure:MANual:MEASurement:INITiate</code>     |
| Example        | <code>:NFIG:MAN:MEAS:INIT</code>                               |
| Notes          | Immediate action                                               |
| Couplings      | Instrument forced to <b>SINGLe</b> mode when manual cal starts |

**3.8.1.7 Manual Continue (Remote Command only)**

Used to trigger manual calibration or manual measurement after you connect a Cold or Hot noise source.

|                |                                                |
|----------------|------------------------------------------------|
| Remote Command | <code>[ :SENSe]:NFIGure:MANual:CONTinue</code> |
| Example        | <code>:NFIG:MAN:CONT</code>                    |

**3.8.1.8 Manual Abort (Remote Command only)**

Used to abort current manual calibration or manual measurement.

|                |                                             |
|----------------|---------------------------------------------|
| Remote Command | <code>[ :SENSe]:NFIGure:MANual:ABORt</code> |
| Example        | <code>:NFIG:MAN:ABORt</code>                |

## 3.9 Trace

Lets you control the display mode of each of the traces in the Noise Figure measurement.

### 3.9.1 Trace Control

Lets you set the **View/Blank** state of each trace, select a trace, and switch on all traces.

#### 3.9.1.1 Select Trace

Specifies the *selected trace*, which is the trace that will be affected when you change trace settings.

**Select Trace** appears above the menu panel, indicating that it applies to *all* controls in the menu panel. **Select Trace** is blanked if you select a tab whose controls do *not* depend on the selected trace (for example, **Trace Function**).

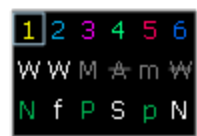
|              |                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|--------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Notes        | The selected trace is remembered even when not in the <b>Trace</b> menu                                                                                                                                                                                                                                                                                                                                                                              |
| Dependencies | <div>For the Swept SA measurement:</div> <div><div><div>– In Image Suppress mode, when you select a trace it becomes the active trace, and the formerly active trace goes into View</div><div>– When you turn on Image Suppress, Update turns off for all traces except the selected trace</div></div><div>For the ACP measurement, when <b>Meas Method</b> is <b>RBW</b>, <b>FAST</b> or <b>FPOwer</b>, <b>Select Trace</b> is disabled</div></div> |
| Preset       | Trace 1                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| State Saved  | Yes                                                                                                                                                                                                                                                                                                                                                                                                                                                  |

#### 3.9.1.2 View/Blank

Lets you set the state of the two trace variables: **Update** and **Display**. The choices available in this dropdown menu are:

|            |                                                                                                                                                                               |
|------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Active     | Update and Display both <b>ON</b>                                                                                                                                             |
| View       | Update <b>OFF</b> ; Display <b>ON</b>                                                                                                                                         |
| Blank      | Update <b>OFF</b> ; Display <b>OFF</b>                                                                                                                                        |
| Background | <div>Update <b>ON</b>, Display <b>OFF</b></div> <div>Allows a trace to be blanked <i>and</i> continue to update “in the background”, which was not possible in the past</div> |

In the Swept SA measurement, a trace with **DisplayOFF** is indicated by a strikethrough of the type letter in the trace annotation panel in the Measurement Bar. A trace with **UpdateOFF** is indicated by dimming the type letter in the trace annotation panel in the Measurement Bar. In the example below, Traces 3, 4, 5 and 6 have **UpdateOFF**, and Traces 4 and 6 have **DisplayOFF**.



See: ["More Information" on page 370](#)

|              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|--------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Notes        | For the commands to control the two variables, Update and Display, see <a href="#">"Trace Update State On/Off" on page 369</a> and <a href="#">"Trace Display State On/Off" on page 369</a> below                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Dependencies | When Signal ID is on, this key is grayed-out                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Couplings    | Selecting a <b>Trace Type</b> for a trace (pressing the key or sending the equivalent command) puts the trace in <b>Active</b> (Update <b>ON</b> and Display <b>ON</b> ), even if that trace type was already selected<br>Selecting a detector for a trace (pressing the key or sending <code>[ :SENS ] :DET :TRAC</code> ) puts the trace in <b>Active</b> (Update <b>ON</b> and Display <b>ON</b> ), even if that detector was already selected<br>Loading a trace from a file puts that trace in <b>View</b> regardless of the state it was in when it was saved; as does being the target of a <b>Copy</b> or a participant in an <b>Exchange</b> |

**Trace Update State On/Off**

|                |                                                                                                                                                                                                                                                                           |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | For Swept SA Measurement (in SA Mode):<br><code>:TRACe[1]   2   3 :&lt;meas&gt;:UPDate[ :STATe] ON   OFF   1   0</code><br><code>:TRACe[1]   2   3 :&lt;meas&gt;:UPDate[ :STATe]?</code><br>where <code>&lt;meas&gt;</code> is the identifier for the current measurement |
| Example        | Make trace 2 inactive (stop updating):<br><code>:TRAC2:UPD 0</code>                                                                                                                                                                                                       |
| Couplings      | Whenever you set <b>Update</b> to <b>ON</b> for any trace, the <b>Display</b> is set to <b>ON</b> for that trace                                                                                                                                                          |
| Preset         | <code>1 0 0</code><br><b>ON</b> for Trace 1; <b>OFF</b> for 2 & 3                                                                                                                                                                                                         |
| State Saved    | Saved in instrument state                                                                                                                                                                                                                                                 |

**Trace Display State On/Off**

|                |                                                                                                                                                                                                                                   |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:TRACe[1]   2   3 :&lt;meas&gt;:DISPlay[ :STATe] ON   OFF   1   0</code><br><code>:TRACe[1]   2   3 :&lt;meas&gt;:DISPlay[ :STATe]?</code><br>where <code>&lt;meas&gt;</code> is the identifier for the current measurement |
| Example        | Make trace 1 visible:<br><code>:TRAC2:DISP 1</code>                                                                                                                                                                               |

|             |                                                                                                                  |
|-------------|------------------------------------------------------------------------------------------------------------------|
|             | Blank trace 3:<br>:TRAC3:DISP 3                                                                                  |
| Couplings   | Whenever you set <b>Update</b> to <b>ON</b> for any trace, the <b>Display</b> is set to <b>ON</b> for that trace |
| Preset      | 1 0 0<br><br><b>ON</b> for Trace 1; <b>OFF</b> for 2 & 3                                                         |
| State Saved | Saved in instrument state                                                                                        |

**More Information**

When a trace becomes inactive, any update from the :SENSe system (detectors) immediately stops, without waiting for the end of the sweep. The trace data remains unchanged, but stops updating. If the trace is blanked, this still does not affect the data in the trace. Traces that are blanked (**Display=OFF**) do not display nor appear on printouts, but their data stays intact, they may be queried, and markers may be placed on them

In most cases, inactive traces are static and unchanging; however, there are cases when an inactive trace will update, specifically:

- if data is written to that trace from remote
- if trace data is loaded from mass storage
- if the trace is the target of a **Copy** or participant in an **Exchange**
- if the trace is cleared using **Clear Trace**

Inactive traces that are also being displayed (traces in **View**) are displayed at half intensity. Traces in **View** display across the entire X-Axis of the instrument. Their horizontal placement does not change, even if X-Axis settings subsequently are changed, although Y-Axis settings do affect the vertical placement of data.

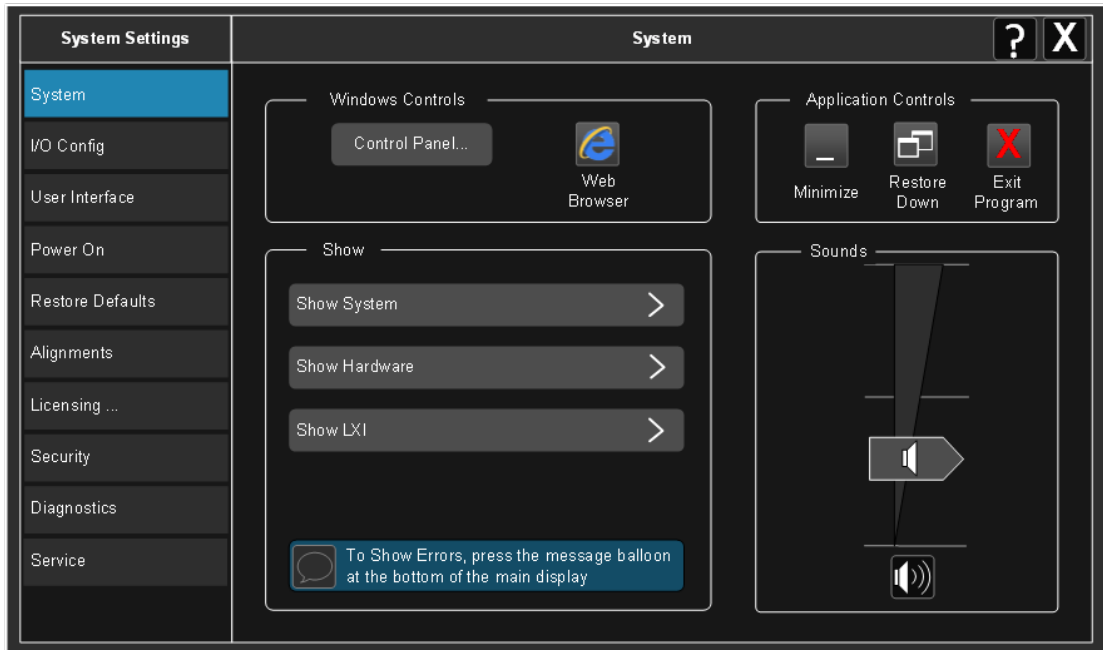
When a trace becomes active (**Update=ON**), the trace is cleared, the average count is reset, and a new sweep is initiated.

Note that putting a trace into **Display=OFF** and/or **Update=OFF** does *not* restart the sweep and does *not* restart Averaging or Hold functions for any traces.

## 4 System



The **System** hardkey and the “gear” icon both open the **System Settings** dialog, which allows you to access various configuration menus and dialogs. The line of tabs down the left side let you choose various pages for configuring your instrument.



|       |                                             |
|-------|---------------------------------------------|
| Notes | No remote command for this key specifically |
|-------|---------------------------------------------|

## 4.1 System

Allows access to several general system functions, including three **Show** screens for viewing system parameters. Several such **Show** screens are available on this and other **System** menu pages. They can also be accessed with the SCPI command described here.

|                |                                                                                                                              |
|----------------|------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | :SYSTem:SHOW OFF   ERRor   SYSTem   HARDware   LXI   HWSTatistics   ALIGNment   SOFTWARE   CAPPlication<br><br>:SYSTem:SHOW? |
| Example        | :SYST:SHOW SYST                                                                                                              |
| Notes          | Displays (or exits) the System information screens                                                                           |
| Preset         | OFF                                                                                                                          |
| State Saved    | No                                                                                                                           |
| Range          | OFF  ERRor   SYSTem   HARDware   LXI   HWSTatistics   ALIGNment   SOFTWARE   CAPPlication                                    |

### 4.1.1 Show System

This screen is divided into three groups: product descriptive information, options tied to the hardware, and software products. Swipe up and down on this screen to scroll the display.

| System Settings  | < System                | Show System                                      | ? X |
|------------------|-------------------------|--------------------------------------------------|-----|
| System           | Keysight Technologies   | Keysight UXa Signal Analyzer                     |     |
| I/O Config       | Product Number          | N9040B                                           |     |
| User Interface   | Serial Number           | US00091133                                       |     |
| Power On         | Instrument S/W Revision | A.15.00_P0053                                    |     |
| Restore Defaults | Revision Date           | 11/17/2014 11:37:12 AM                           |     |
| Alignments       | Computer System         | Windows 7 , Service Pack 1                       |     |
| Licensing ...    | Computer Name           | A-N9040B-91133                                   |     |
| Security         | IP Address              | 141.121.151.83                                   |     |
| Diagnostics      | IPv6 Address            | 2002:8d79:9753::8d79:9753                        |     |
|                  | Link-Local IPv6 Address | fe80::46e:1db5:7286:68ac%3                       |     |
|                  | Host ID                 | N9040B,US00091133                                |     |
|                  | mDNS Enabled            | Yes                                              |     |
|                  | mDNS Host Name          | A-N9040B-91133                                   |     |
|                  | mDNS Service Name       | Keysight N9040B Signal Analyzer - US00091133     |     |
| Service          | Option                  | Name / Description                               |     |
|                  | N9040B-PC6              | Intel(R) Core(TM) i7-3615QE CPU @ 2.30GHz, 16 GB |     |
|                  | N9040B-SSD              | INTEL SSDSC2BB080G4 ATA DEVICE                   |     |
|                  | N9040B-W7X              | Windows Embedded Standard 7, 64 bit OS           |     |



---

|         |                              |
|---------|------------------------------|
| Example | <code>:SYST:SHOW SYST</code> |
|---------|------------------------------|

#### 4.1.1.1 Show System contents (Remote Query Only)

Returns the contents of the **Show System** screen (the entire contents, not just the currently displayed page).

---

|                |                                          |
|----------------|------------------------------------------|
| Remote Command | <code>:SYSTem:CONFigure[:SYSTem]?</code> |
|----------------|------------------------------------------|

---

|         |                          |
|---------|--------------------------|
| Example | <code>:SYST:CONF?</code> |
|---------|--------------------------|

---

|       |                                                                                                                       |
|-------|-----------------------------------------------------------------------------------------------------------------------|
| Notes | The output is an IEEE Block format of the <b>Show System</b> contents. Each line is separated by a new-line character |
|-------|-----------------------------------------------------------------------------------------------------------------------|

#### 4.1.1.2 Computer System description (Remote Query Only)

Returns the **Computer System** description, which consists of the operating system and patch level, as reported by operating system.

---

|                |                               |
|----------------|-------------------------------|
| Remote Command | <code>:SYSTem:CSYStem?</code> |
|----------------|-------------------------------|

---

|         |                          |
|---------|--------------------------|
| Example | <code>:SYST:CSYS?</code> |
|---------|--------------------------|

---

|       |                                                         |
|-------|---------------------------------------------------------|
| Notes | Returns the Computer System name and service pack level |
|-------|---------------------------------------------------------|

### 4.1.2 Show Hardware

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

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

---

|         |                              |
|---------|------------------------------|
| Example | <code>:SYST:SHOW HARD</code> |
|---------|------------------------------|

### 4.1.3 Show LXI

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

---

|         |                             |
|---------|-----------------------------|
| Example | <code>:SYST:SHOW LXI</code> |
|---------|-----------------------------|

4.1.4 Show Support Subscriptions

Displays the software support subscription information for the licenses available on the instrument.

Shows the software license, description, software support expiration date (format is **YYYY.MMDD**), and the software support status. The **Software Version Date** (format is **YYYY.MMDD**) shown in the header indicates the date required to access the latest software enhancements included in this version of the software. If any license has a **Software Support Expiration Date** earlier than the **Software Version Date**, then enhancements may be available that the license does *not* enable.

|                  |                                |                                                        |                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                 |
|------------------|--------------------------------|--------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| System Settings  | < System Support Subscriptions |                                                        |                                                                                                                      |     |
| System           | Keysight PXA                   | Keysight PXA Signal Analyzer                           |                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                 |
|                  | Product Number                 | N9030A                                                 |                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                 |
|                  | Instrument S/W Revision        | A.20.10                                                |                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                 |
|                  | Software Version Date          | 2017.1221                                              |                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                 |
| I/O Config       | Software License               | Description                                            | Software Support Expiration Date  |                                                                                                                                                                                                                                                                                                                                                 |
| User Interface   | N6141EM0E-1FP                  | EMC Software for X-Series                              | 2018.0430                         |                                                                                                                                                                                                                                                                                                                                                 |
|                  | N9030EMCA-1FP                  | Basic Electro-Magnetic Compatibility Functionality     | 2018.0430                         |                                                                                                                                                                                                                                                                                                                                                 |
| Power On         | N9030FP2A-1FP                  | Fast Power Measurements, up to 40 MHz bandwidth        | 2018.0430                         |                                                                                                                                                                                                                                                                                                                                                 |
| Restore Defaults | N9030FT2A-1FP                  | Frequency Mask Trigger >3.6 us signal duration         | 2018.0430                         |                                                                                                                                                                                                                                                                                                                                                 |
|                  | N9030RBEA-1FP                  | RBW Extended, >10 MHz RBW Filter                       | 2018.0430                        |                                                                                                                                                                                                                                                                                                                                                 |
| Alignments       | N9030RT2A-1FP                  | Real-time analysis up to maximum BW, optimum detection | 2018.0430                       |                                                                                                                                                                                                                                                                                                                                                 |
|                  | N9030TDSA-1FP                  | Time Domain Scan, requires N6141A/C, and DP2 or B40    | 2018.0430                       |                                                                                                                                                                                                                                                                                                                                                 |
| Licensing        | N9054EM0E-1FP                  | Flexible Digital Demod App, VMA                        | 2018.0430                       |                                                                                                                                                                                                                                                                                                                                                 |
|                  | N9054EM1E-1FP                  | Custom OFDM App, VMA                                   | 2018.0430                       |                                                                                                                                                                                                                                                                                                                                                 |
| Security         | N9061EM0E-1FP                  | Remote Language Compatibility                          | 2018.0430                       |                                                                                                                                                                                                                                                                                                                                                 |
|                  | N9062EM0E-1FP                  | RS FSP, FSU, FSE, ESU SCPI Language Compatibility      | 2018.0430                       |                                                                                                                                                                                                                                                                                                                                                 |
| Diagnostics      | N9063EM0E-1FP                  | Analog Demod Measurement Application                   | 2018.0430                       |                                                                                                                                                                                                                                                                                                                                                 |
|                  | N9067EM0E-1FP                  | Pulse Application                                      | 2018.0430                       |                                                                                                                                                                                                                                                                                                                                                 |
| Service          | N9068EM0E-1FP                  | Phase Noise Measurement Application                    | 2018.0430                       |                                                                                                                                                                                                                                                                                                                                                 |
|                  | N9069EM0E-1FP                  | Noise Figure Measurement Application                   | 2018.0430                       |                                                                                                                                                                                                                                                                                                                                                 |
| Debug            | N9071EM0E-1FP                  | GSM/EDGE Measurement Application                       | 2018.0430                       |                                                                                                                                                                                                                                                                                                                                                 |
|                  | N9074EM0E-1FP                  | Single App Combined GSM/EDGE Measurements              | 2018.0430                       |                                                                                                                                                                                                                                                                                                                                                 |

Example        `:SYST:SHOW SSInformation`

4.1.5 Show Support ID

Displays the Support ID for each license available in the instrument. Shows the **Software License**, **Description**, software support expiration date, and **Support ID** for that license.

Each license has a copy icon, which copies just the **Support ID** for that license to the Windows clipboard. This is useful to avoid typing mistakes when entering this value into another program or web site.

The **Copy all to clipboard ...** control copies all the data to the Windows clipboard, in comma-separated value (CSV) format.

| System Settings  | System                  |                                             |           |                   | Support ID |
|------------------|-------------------------|---------------------------------------------|-----------|-------------------|------------|
| System           | Keysight PXA            | Keysight PXA Signal Analyzer                |           |                   |            |
|                  | Product Number          | N9030A                                      |           |                   |            |
|                  | Instrument S/W Revision | A.20.10                                     |           |                   |            |
|                  | Software Version Date   | 2017.1221                                   |           |                   |            |
| I/O Config       | Software License        | Description                                 | Version   | Support ID        |            |
| User Interface   | N6141EM0E-1FP           | EMC Software for X-Series                   | 2018.0430 | N9030A,US00071133 |            |
| Power On         | N6141EM0E-1NP           | EMC Software for X-Series (Network)         | 2019.0123 | 705A0F491DBB      |            |
| Restore Defaults | N9030EMCA-1FP           | Basic Electro-Magnetic Compatibility Functi | 2018.0430 | N9030A,US00071133 |            |
| Alignments       | N9030FP2A-1FP           | Fast Power Measurements, up to 40 MHz b     | 2018.0430 | N9030A,US00071133 |            |
| Licensing        | N9030FT2A-1FP           | Frequency Mask Trigger >3.6 us signal dur   | 2018.0430 | N9030A,US00071133 |            |
| Security         | N9030RBEA-1FP           | RBW Extended, >10 MHz RBW Filter            | 2018.0430 | N9030A,US00071133 |            |
| Diagnostics      | N9030RT2A-1FP           | Real-time analysis up to maximum BW, opti   | 2018.0430 | N9030A,US00071133 |            |
| Service          | N9030TDSA-1FP           | Time Domain Scan, requires N6141A/C, an     | 2018.0430 | N9030A,US00071133 |            |
| Debug            | N9054EM0E-1FP           | Flexible Digital Demod App, VMA             | 2018.0430 | N9030A,US00071133 |            |
|                  | N9054FM1F-1FP           | Custom OFDM App, VMA                        | 2018.0430 | N9030A,US00071133 |            |

Example :SYST:SHOW SID

## 4.1.6 Control Panel...

Opens the Windows Control Panel. **Control Panel** is used to configure certain elements of Windows that are not configured via the Multitouch UI System menus.

**NOTE** This feature is *not* available if Option SF1 is installed.

**Control Panel** is a separate Windows application, so to return to the Instrument Application, either:

- Exit by tapping on the red **X** in the upper right-hand corner
- Use **Alt+Tab**. Press and hold the **Alt** key and press and release the **Tab** key until the Instrument logo is showing in the window in the center of the screen, then release the **Alt** key

Notes No remote command for this key

### 4.1.7 Web Browser

Launches the instrument's default **Web Browser**. Usually, the default is Microsoft Edge. A mouse and external keyboard are highly desirable for using the browser. To return focus to the Instrument Application, close the browser (or use **Alt-Tab**).

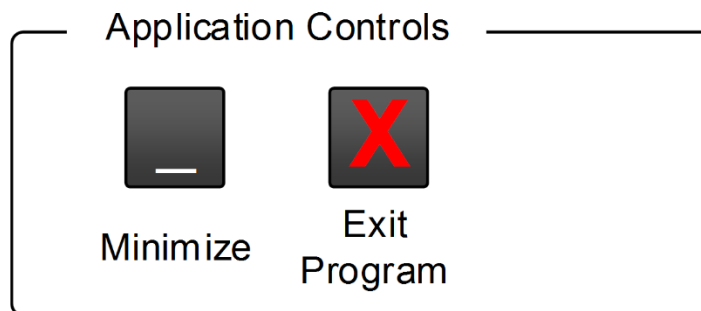
NOTE

This feature is *not* available if Option SF1 is installed.

---

### 4.1.8 Application Controls

Lets you Minimize or Exit the application.



Pressing **Exit Program** displays a prompt asking if you are sure you want to close the program. If you select **OK**, the entire analyzer application will shut down, and you will lose any unsaved trace or measurement data.

---

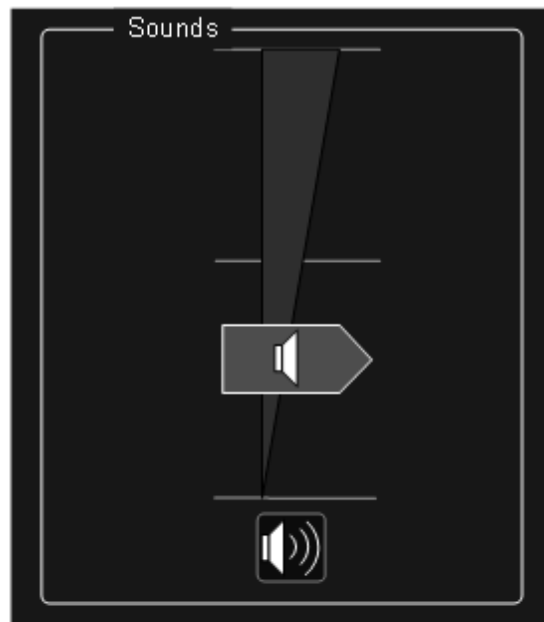
Notes

No equivalent remote command for this key

### 4.1.9 Sounds

Lets you adjust the speaker volume using the slider, or mute/unmute the speaker, by tapping the **Speaker** icon.

Moving the slider up and down changes the speaker volume, and *also* unmutes the speaker if muted.



**Icon when muted**

## 4.2 I/O Config

Lets you specify and change the I/O configuration for remote control. Controls in this menu allow configuration of the I/O ports used for SCPI remote control over GPIB and LAN.

The SCPI LAN parameters are set using controls in this menu, but configuration of LAN settings themselves is performed using the Windows Control Panel (DHCP, Gateway, Subnet Mask, etc.).

The USB port is also available for remote control, but requires no configuration.

### 4.2.1 GPIB

Lets you configure the GPIB I/O port.

|              |                      |
|--------------|----------------------|
| Dependencies | Not available in UXM |
|--------------|----------------------|

#### 4.2.1.1 GPIB Address

Select the GPIB remote address.

|                |                                                                                                                                     |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SYSTem:COMMunicate:GPIB[1][:SELF]:ADDRess &lt;integer&gt;</code><br><code>:SYSTem:COMMunicate:GPIB[1][:SELF]:ADDRess?</code> |
| Example        | <code>:SYST:COMM:GPIB:ADDR 17</code>                                                                                                |
| Notes          | If the GPIB port address is changed, all further communication must use the <i>new</i> address                                      |
| Preset         | Unaffected by <b>Preset</b> , but set to 18 by <b>Restore Defaults</b> > "Misc" on page 426                                         |
| State Saved    | No                                                                                                                                  |
| Min            | 0                                                                                                                                   |
| Max            | 30                                                                                                                                  |

#### 4.2.1.2 GPIB Controller

Sets the GPIB port into Controller (**ON**) or Device (**OFF**) mode. In the normal state, **GPIB Controller** is disabled (**OFF**), which allows the instrument to be controlled by a remote computer. When **GPIB Controller** is enabled (**ON**), the instrument can run software applications that use the instrument's computer as a GPIB controller for devices connected to the GPIB port.

## NOTE

When **GPIO Controller** is enabled, the analyzer application itself cannot be controlled over GPIB. In this case, it can be controlled via LAN or USB. The GPIB port cannot be a Controller and Device at the same time. Only one Controller can be active on the GPIB bus at any given time. If the instrument is the Controller, an external PC cannot also be a Controller.

To control the instrument from the software that is performing GPIB Controller operation, you can use an internal TCP/IP connection to the analyzer application. Use the following IP Address to send commands to the analyzer application:

`TCPIP0:localhost:inst0:INSTR`

|                |                                                                                                                                                                          |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SYSTem:COMMunicate:GPIB[1][:SELF]:CONTroller[:ENABLE] ON   OFF   0   1</code><br><code>:SYSTem:COMMunicate:GPIB[1][:SELF]:CONTroller[:ENABLE]?</code>             |
| Example        | Set GPIB port to Controller:<br><code>:SYST:COMM:GPIB:CONT ON</code><br><br>Set GPIB port to Device:<br><code>:SYST:COMM:GPIB:CONT OFF</code>                            |
| Notes          | When the instrument becomes the Controller, Bit 0 in the Standard Event Status Register is set. When the instrument relinquishes Controller capability, bit 0 is cleared |
| Preset         | Unaffected by Preset, but set to <b>OFF</b> (Disabled) by <b>Restore Defaults &gt; "Misc"</b> on page 426                                                                |
| State Saved    | No                                                                                                                                                                       |
| Range          | Disabled   Enabled                                                                                                                                                       |

## 4.2.2 SCPI LAN

Displays a menu for identifying and changing SCPI over a LAN configuration. There are several ways to send SCPI remote commands to the instrument over LAN.

Having multiple users simultaneously accessing the instrument over the LAN may lead to communication problems. These controls can help to prevent that, by disabling the telnet, socket, and/or SICL capability.

## NOTE

When multiple instances of the application are running, Telnet port 5023, socket port 5025, SICL server inst0 and HiSLIP server Device 0 will be assigned to the first instance; Telnet port 5123, socket port 5125, SICL server inst1 and HiSLIP server Device 1 will be assigned to the second instance; Telnet port 5223, socket port 5225, SICL server inst2 and HiSLIP server Device 2 will be assigned to the third instance; Telnet port 5323, socket port 5325, SICL server inst3 and HiSLIP server Device 3 will be assigned to the fourth instance.

- "SCPI Telnet" on page 380
- "SCPI Socket" on page 380
- "SICL Server" on page 381
- "HiSLIP Server" on page 382
- "Verbose SCPI On/Off" on page 382
- "SCPI Socket Control Port (Remote Query Only)" on page 384

4.2.2.1 SCPI Telnet

Turns SCPI LAN telnet capability On or Off, allowing you to limit SCPI access over LAN through telnet.

|                |                                                                                                                                                                                                            |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | :SYSTem:COMMunicate:LAN:SCPI:TELNet:ENABle OFF   ON   0   1<br>:SYSTem:COMMunicate:LAN:SCPI:TELNet:ENABle?                                                                                                 |
| Example        | :SYST:COMM:LAN:SCPI:TELN:ENAB OFF                                                                                                                                                                          |
| Preset         | Unaffected by <b>Preset</b> , but set to <b>ON</b> by <b>Restore Defaults</b> > "Misc" on page 426<br>If not set up or specified, the Secure Instrument Communications configuration setting: is <b>ON</b> |
| State Saved    | No                                                                                                                                                                                                         |
| Range          | OFF   ON                                                                                                                                                                                                   |

4.2.2.2 SCPI Socket

Turns the capability to establish Socket LAN sessions **ON** or **OFF**, to limit SCPI access over LAN through socket sessions.

Connection String & Copy Button

In "SCPI LAN" on page 379, the full SCPI connection string is displayed to the right of the **SCPI Socket**ON/OFF control. Pressing **Copy**, to the right of the string, copies the connection string to the Windows clipboard.

|                |                                                                                                                                                                                                                                |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | :SYSTem:COMMunicate:LAN:SCPI:SOCKet:ENABle OFF   ON   0   1<br>:SYSTem:COMMunicate:LAN:SCPI:SOCKet:ENABle?                                                                                                                     |
| Example        | :SYST:COMM:LAN:SCPI:SOCK:ENAB OFF                                                                                                                                                                                              |
| Dependencies   | If the Secure Instrument Communications configuration has disabled this connection, local changes are not allowed, and an attempt to do so results in error -221, "Disabled by Secure Instrument Communications configuration" |



|             |                                                                                                                                                                                                            |
|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Preset      | Unaffected by <b>Preset</b> , but set to <b>ON</b> by <b>Restore Defaults</b> > "Misc" on page 426<br>If not set up or specified, the Secure Instrument Communications configuration setting: is <b>ON</b> |
| State Saved | No                                                                                                                                                                                                         |
| Range       | <b>OFF   ON</b>                                                                                                                                                                                            |

#### 4.2.2.3 SICL Server

Turns the **SICL Server** capability **ON** or **OFF**, to limit SCPI access over LAN through the SICL server. (SICL IEEE 488.2 protocol.)

| Parameter                  | Description                                                                                                            | Setting |
|----------------------------|------------------------------------------------------------------------------------------------------------------------|---------|
| Maximum Connections        | The maximum number of connections that can be accessed simultaneously                                                  | 5       |
| Instrument Name            | The name (same as the remote SICL address) of your instrument                                                          | inst0   |
| Instrument Logical Unit    | The unique integer assigned to your instrument when using SICL LAN                                                     | 8       |
| Emulated GPIB Name         | The name (same as the remote SICL address) of the device used when communicating with your instrument                  | gpib7   |
| Emulated GPIB Logical Unit | The unique integer assigned to your device when it is being controlled using SICL LAN                                  | 8       |
| Emulated GPIB Address      | The emulated GPIB address assigned to your transmitter tester when it is a SICL server (the same as your GPIB address) | 18      |

#### Connection String & Copy Button

In "SCPI LAN" on page 379, the full connection string is displayed to the right of the **SICL Server** **ON/OFF** control. Pressing **Copy**, to the right of the string copies the connection string to the Windows clipboard.

|                |                                                                                                                                                                                                                                                        |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <b>:SYSTem:COMMunicate:LAN:SCPI:SICL:ENABle</b> OFF   ON   0   1<br><b>:SYSTem:COMMunicate:LAN:SCPI:SICL:ENABle?</b>                                                                                                                                   |
| Example        | <b>:SYST:COMM:LAN:SCPI:SICL:ENAB</b> OFF                                                                                                                                                                                                               |
| Dependencies   | Not available in UXM<br>If the Secure Instrument Communications configuration has disabled this connection, local changes are not allowed, and an attempt to do so results in error -221, "Disabled by Secure Instrument Communications configuration" |
| Preset         | Unaffected by <b>Preset</b> , but set to <b>ON</b> by <b>Restore Defaults</b> > "Misc" on page 426<br>If not set up or specified, the Secure Instrument Communications configuration setting: is <b>ON</b>                                             |
| State Saved    | No                                                                                                                                                                                                                                                     |
| Range          | <b>OFF   ON</b>                                                                                                                                                                                                                                        |

4.2.2.4 HiSLIP Server

Turns the **HiSLIP Server** capability **ON** or **OFF**, to limit SCPI access over LAN through the HiSLIP server.

HiSLIP stands for High-Speed LAN Instrument Protocol, and is part of the IVI-6.1 specification.

Example of a VISA connection string used to connect to the HiSLIP Server on an X-Series Spectrum Analyzer:

```
TCPIP0::a-n9030a-93016::hislip0::INSTR
```

In the example above, **hislip0** is the HiSLIP device name that VISA users must include in HiSLIP VISA Address strings. Your HiSLIP device name may differ, depending on your VISA settings.

Connection String & Copy Button

In "**SCPI LAN**" on page 379, the full connection string is displayed to the right of the **HiSLIP ServerON/OFF** control. Pressing **Copy**, to the right of the string copies the connection string to the Windows clipboard.

|                |                                                                                                                                                                                                                     |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | :SYSTem:COMMunicate:LAN:SCPI:HISLip:ENABle OFF   ON   0   1                                                                                                                                                         |
| Example        | :SYST:COMM:LAN:SCPI:HISL:ENAB OFF                                                                                                                                                                                   |
| Preset         | Unaffected by <b>Preset</b> , but set to <b>ON</b> by <b>Restore Defaults</b> > " <b>Misc</b> " on page 426<br>If not set up or specified, the Secure Instrument Communications configuration setting: is <b>ON</b> |
| State Saved    | No                                                                                                                                                                                                                  |
| Range          | OFF   ON                                                                                                                                                                                                            |

4.2.2.5 Verbose SCPI On/Off

When you turn **Verbose SCPION**, additional information is returned by **:SYSTem:ERRor?**. The additional information consists of the characters that stimulated the error. This can aid you in debugging your test programs, by indicating where in the parsing of a SCPI command the instrument encountered an invalid command or query.

Specifically, with **Verbose SCPION**, **:SYSTem:ERRor?** is expanded to show the SCPI data received, with the indicator **<Err>** at the point in the stream that the error occurred.

**Verbose SCPI** has no effect on the **Show Errors** screen or front-panel Message Line; and only changes the response to **:SYST:ERR?**.

See the example below, where the invalid command **:SENS:BOGUS** is sent:

Normal response to **:SYST:ERR?** (using the Telnet window):

```
SCPI> SENS:BOGUS
SCPI> SYST:ERR?
-113,"Undefined header"
```

After turning on **Verbose SCPI**:

```
SCPI> SYST:BOGUS
SCPI> SYST:ERR?
-113,"Undefined header;SYST:BOGUS<Err>"
```

|                |                                                                                                     |
|----------------|-----------------------------------------------------------------------------------------------------|
| Remote Command | <b>:SYSTem:ERRor:VERBoSe OFF   ON   0   1</b><br><b>:SYSTem:ERRor:VERBoSe?</b>                      |
| Example        | <b>:SYST:ERR:VERB ON</b>                                                                            |
| Preset         | Unaffected by <b>Preset</b> , but set to <b>OFF</b> by <b>Restore Defaults</b> > "Misc" on page 426 |
| State Saved    | No                                                                                                  |
| Range          | <b>OFF   ON</b>                                                                                     |

#### 4.2.2.6 Device Clear on Disconnect

When using HiSLIP (High Speed LAN Instrument Protocol), Telnet, or Sockets, a communication session with the instrument is opened when you connect, and closed when you disconnect. This differs from other connections such as GPIB, USB and VXI-11 connections, which are never actually closed but stay open as long as the instrument is running.

When a session is closed, a Device Clear function is generated, which affects the entire instrument, not just the current connection. Thus, when using HiSLIP, Telnet, or Sockets, unexpected Device Clears may occur, which can disrupt measurements in ways that GPIB and VXI-11 "sessions" do not.

**Device Clear on Disconnect** enables these auto-generated Device Clears for Telnet, Socket, and HiSLIP sessions. For backwards compatibility, they are *not* generated unless you explicitly enable them.

There is no change in VXI-11, USB, or GPIB session behavior. These sessions do not close when you disconnect, have never generated Device Clear events, and still do not generate Device Clear events, regardless of the setting of this switch.

|                |                                                                                                                                              |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <b>:SYSTem:COMMunicate:LAN:SCPI:EOSession:DCLEar:ENABle 0   1   ON   OFF</b><br><b>:SYSTem:COMMunicate:LAN:SCPI:EOSession:DCLEar:ENABle?</b> |
| Example        | <b>:SYST:COMM:LAN:SCPI:EOS:DCLE:ENAB ON</b>                                                                                                  |
| Preset         | Unaffected by <b>Preset</b> , but set to <b>OFF</b> by <b>Restore Defaults</b> > "Misc" on page 426                                          |

|             |                                          |
|-------------|------------------------------------------|
| State Saved | No                                       |
| Range       | <a href="#">OFF</a>   <a href="#">ON</a> |

#### 4.2.2.7 SCPI Socket Control Port (Remote Query Only)

Returns the TCP/IP port number of the control socket associated with the SCPI socket session. This query lets you obtain the unique port number to open when a device clear is to be sent to the instrument. Every time a connection is made to the SCPI socket, the instrument creates a peer control socket. The port number for this socket is random. You must use this command to obtain the port number of the control socket. To force a device clear on this socket, open the port and send the string [DCL\n](#) to the instrument.

If this query is sent to a non-SCPI Socket interface, then 0 is returned.

|                                 |                                                                                             |
|---------------------------------|---------------------------------------------------------------------------------------------|
| Remote Command                  | <a href="#">:SYSTem:COMMunicate:LAN:SCPI:SOCKet:CONTRol?</a>                                |
| Example                         | <a href="#">:SYST:COMM:LAN:SCPI:SOCK:CONT?</a>                                              |
| Preset                          | Unaffected by <b>Preset</b> or <b>Restore Defaults</b> > <a href="#">"Misc" on page 426</a> |
| State Saved                     | No                                                                                          |
| Range                           | 0 to 65534                                                                                  |
| Min                             | 0                                                                                           |
| Max                             | 65534                                                                                       |
| Backwards Compatibility<br>SCPI | <a href="#">:SYSTem:COMMunicate:TCPIp:CONTRol?</a>                                          |

#### 4.2.2.8 SCPI Instrument Port (Remote Query Only)

Some MIMO applications need to be able to determine the port to use to communicate with the instrument. This query returns the port number to use for communications.

|                   |                                                          |
|-------------------|----------------------------------------------------------|
| Remote<br>Command | <a href="#">:SYSTem:COMMunicate:LAN:INSTrument:PORT?</a> |
|-------------------|----------------------------------------------------------|

### 4.2.3 Web Password Reset

The embedded web server contains certain capabilities that are password-protected; modifying the LAN configuration of the instrument, and access to web pages that can change the settings of the instrument. The default password from the factory is:

[measure4u](#)

This control lets you set the web password as desired, or to reset the password to the factory default.

Selecting **Web Password Reset** displays a control for resetting the password as desired, or to the factory default. The built-in alpha keyboard appears. You may change the password from the factory default of “**measure4u**”.

You can cancel this entry by pressing the **Cancel (ESC)** front-panel key.

---

|              |                      |
|--------------|----------------------|
| Dependencies | Not available in UXM |
|--------------|----------------------|

---

## 4.2.4 System IDN Response

Allows you to specify a response to **\*IDN?**, return the instrument to the **FACTory** response if you have changed it, or, if your test software is expecting the **\*IDN** response to indicate Agilent Technologies, configure the instrument to respond with Agilent as the manufacturer.

The current **\*IDN** response is displayed at the top of the panel, followed by the **System IDN Response** and **User IDN** controls.

### 4.2.4.1 System IDN Response

To select the factory-set response, select **FACTory**. To specify your own response, select **USER**. You can enter your desired response using “**User IDN**” on page 386.

If your test software expects the response to indicate Agilent Technologies as the Manufacturer, you can configure this response by selecting **AGILent**.

---

|                |                                                                                                                                                                                                                                                                                                                                                       |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <b>:SYSTem:IDN:CONFigure</b> <b>FACTory</b>   <b>AGILent</b>   <b>USER</b><br>For option details, see “ <b>More Information</b> ” on page 385<br><b>:SYSTem:IDN:CONFigure?</b>                                                                                                                                                                        |
| Example        | <b>:SYST:IDN:CONF</b> <b>FACT</b>                                                                                                                                                                                                                                                                                                                     |
| Notes          | Affects the response returned by all Modes of the instrument, unless the current Mode has <i>also</i> specified a custom response, in which case the current Mode’s custom IDN response takes precedence over the System’s, but only while that Mode is current<br>Survives shutdown and restart of the software and therefore survives a power cycle |
| Preset         | The <b>*IDN</b> response is reset to <b>FACTory</b> by <b>Restore Defaults &gt; “Misc”</b> on page 426 or <b>Restore Defaults &gt; “All”</b> on page 427 and survives subsequent running of the software                                                                                                                                              |

---

### More Information

Here are details of the options available for the System **\*IDN** response:

## Factory

SCPI example: `:SYST:IDN:CONF FACT`

Selects the factory default configuration of `*IDN?`, which indicates the Manufacturer as Keysight Technologies. For example,

`"Keysight Technologies,N9040B,MY00012345,A.15.00"`

where the fields are Manufacturer, Model Number, Serial Number, Firmware Revision.

### NOTE

In products that run multiple instances of the X-Series Application, all instances use the *same* factory System IDN response.

---

## Agilent

SCPI example: `:SYST:IDN:CONF AGIL`

Starting with software version x.14.50, the `*IDN?` response in the Factory configuration indicates the Manufacturer as Keysight Technologies. If your test software is expecting the response to indicate Agilent Technologies, you can configure the response with this menu selection or SCPI command.

For example:

`"Agilent Technologies,N9020A,MY00012345,A.05.01"`

### NOTE

In products that run multiple instances of the X-Series Application, all instances use the *same* Agilent System IDN response.

---

## User

SCPI example: `:SYST:IDN:CONF USER`

Selects your customized configuration of `*IDN?`

Enter your desired response using "User IDN" on page 386.

### 4.2.4.2 User IDN

Allows you to specify your own response to `*IDN?`. You may enter your desired response with the Alpha Editor or a plugin PC keyboard. Once the value is entered, select **USER** under **System IDN Response**.

When you select this control, the active function becomes the current User string and is highlighted, so typing replaces it. If instead you wish to edit the existing string, press the left or right arrow to go to the beginning or the end.

If you enter a null string (for example, by clearing the User String while editing and then pressing **Done**), the instrument automatically reverts to the **FACTory** setting.

**NOTE**

In products that run multiple instances of the X-Series Application, all instances use the *same* User System IDN response.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SYSTem:IDN &lt;string&gt;</code><br><code>:SYSTem:IDN?</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Notes          | <p>The <code>&lt;string&gt;</code> must consist of four fields, each separated by a comma, example:<br/> <code>:SYST:IDN "XYZ Corp,Model 12,012345,A.01.01"</code></p> <p>The four fields are <code>&lt;manufacturer&gt;</code>, <code>&lt;model number&gt;</code>, <code>&lt;serial number&gt;</code>, <code>&lt;firmware revision&gt;</code>. The fields are comma-delimited, so text within a field cannot contain a comma</p> <p>This affects the response given in all Modes of the instrument, unless the current Mode has <i>also</i> specified a custom response, in which case the current Mode's custom IDN response takes precedence over the System's, but only while that Mode is current</p> <p>Survives shutdown and restart of the software and therefore survives a power cycle</p> <p>Null string as parameter restores the <b>FACTory</b> setting, example:<br/> <code>:SYST:IDN ""</code></p> |
| Preset         | Unaffected by <b>Preset</b> , but set to the original <b>FACTory</b> setting by <b>Restore Defaults &gt; "Misc"</b> on page 426                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |

#### 4.2.4.3 SYSTem:PERSONa (Remote Commands Only)

The `:SYSTem:PERSONa` command set permits setting of individual fields of the `*IDN?` response.

- `"SYSTem:PERSONa:DEFault"` on page 387
- `"SYSTem:PERSONa:MANUFACTurer"` on page 388
- `"SYSTem:PERSONa:MANUFACTurer:DEFault"` on page 388
- `"SYSTem:PERSONa:MODel"` on page 388
- `"SYSTem:PERSONa:MODel:DEFault"` on page 389

#### SYSTem:PERSONa:DEFault

Resets the `*IDN` response to the instrument default.

|                |                                                                                                                                                                                                                 |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SYSTem:PERSONa:DEFault</code><br><code>:SYSTem:PERSONa:DEFault?</code>                                                                                                                                   |
| Notes          | <code>:SYST:PERS:DEF?</code> returns the default value of <code>*IDN?</code> even if the current setting of <code>*IDN?</code> is the non-default value. The query return type is a <code>&lt;string&gt;</code> |

`:SYST:PERS:DEF`  
is equivalent to:  
`:SYSTem:IDN ""`  
`:SYSTem:IDN:CONF DEF`

**SYSTem:PERSONa:MANUFACTURER**

Sets the **MANUFACTURER** field of the **\*IDN?** response. This is the first field of the **\*IDN?** response.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SYSTem:PERSONa:MANUFACTURER &lt;string&gt;</code><br><code>:SYSTem:PERSONa:MANUFACTURER?</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Notes          | When setting the <b>MANUFACTURER</b> field, the current IDN response string is modified to replace the manufacturer field with the string specified by the command. If the resulting IDN response matches one of the predefined responses ( <code>:SYST:IDN:CONF FACT   AGIL</code> ), then the <code>:SYST:IDN:CONF</code> is set to the corresponding value. If the IDN response with the new manufacturer field is not one of the predefined values, then <code>:SYST:IDN:CONF</code> will be set to <b>USER</b> and <code>:SYST:IDN</code> will be set to the new IDN response string<br>The query returns the current value of the <b>*IDN?</b> Manufacturer field |

**SYSTem:PERSONa:MANUFACTURER:DEFAULT**

Resets the **MANUFACTURER** field of the **\*IDN?** response to the default value.

|                |                                                                                                                                                                                                      |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SYSTem:PERSONa:MANUFACTURER:DEFAULT</code><br><code>:SYSTem:PERSONa:MANUFACTURER:DEFAULT?</code>                                                                                              |
| Notes          | The query returns the default <b>MANUFACTURER</b> field value of <b>*IDN?</b> even if the current setting of <b>*IDN?</b> is the non-default value. The return type is a <code>&lt;string&gt;</code> |

**SYSTem:PERSONa:MODEL**

Sets the **MODEL** field of the **\*IDN?** response. This is the second field of the **\*IDN?** response.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SYSTem:PERSONa:MODEL &lt;string&gt;</code><br><code>:SYSTem:PERSONa:MODEL?</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Notes          | When setting the <b>MODEL</b> field, the current IDN response string is modified to replace the model field with the string specified by the command. If the resulting IDN response matches one of the predefined responses ( <code>:SYST:IDN:CONF FACT   AGIL</code> ), then <code>:SYST:IDN:CONF</code> is set to the corresponding value. If the IDN response with the new model field is not one of the predefined values, then <code>:SYST:IDN:CONF</code> will be set to <b>USER</b> and <code>:SYST:IDN</code> will be set to the new IDN response string<br>The query returns the current value of the <b>*IDN?MODEL</b> field |



## SYSTem:PERSon:MODEl:DEFault

Resets the **MODEl** field of the **\*IDN?** response to the default value.

|                |                                                                                                                                                                                         |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <b>:SYSTem:PERSon:MODEl:DEFault</b><br><b>:SYSTem:PERSon:MODEl:DEFault?</b>                                                                                                             |
| Notes          | The query returns the default <b>MODEl</b> field value of <b>*IDN?</b> even if the current setting of <b>*IDN?</b> is the non-default value. The return type is a <b>&lt;string&gt;</b> |

## 4.2.5 LXI

Accesses various **LXI** configuration properties.

|              |                      |
|--------------|----------------------|
| Dependencies | Not available in UXM |
|--------------|----------------------|

### 4.2.5.1 LAN Reset

Resets the LAN connection. This sets parameters as follows, and restarts the LAN operation:

|                               |                 |
|-------------------------------|-----------------|
| DHCP                          | Enabled         |
| Automatic IP Address          | Enabled         |
| ICMP Ping Responder           | Enabled         |
| Web Password                  | <b>keysight</b> |
| Dynamic DNS                   | Enabled         |
| mDNS and DNS-SD               | Enabled         |
| Dynamic Link Local Addressing | Enabled         |
| Auto Negotiation              | Enabled         |

There is no SCPI command for this function.

### 4.2.5.2 Device Identification (Remote Command Only)

Enabling LXI device identification places the LXI Status Indicator in the **Identify** state. Disabling LXI device identification places the LXI Status Indicator in the **No Fault** state. The LXI Status indicator is in the upper left region of the instrument's graphical user interface.

|                |                                                                                |
|----------------|--------------------------------------------------------------------------------|
| Remote Command | <b>:LXI:IDENtify[:STATe] OFF   ON   0   1</b><br><b>:LXI:IDENtify[:STATe]?</b> |
|----------------|--------------------------------------------------------------------------------|

|             |                                                                                                    |
|-------------|----------------------------------------------------------------------------------------------------|
| Example     | :LXI:IDEN ON                                                                                       |
| Preset      | Not part of <b>Preset</b> , but reset to <b>OFF</b> by <b>Restore Defaults</b> > "All" on page 427 |
| State Saved | No                                                                                                 |
| Range       | OFF   ON                                                                                           |

### 4.2.6 Restore I/O Config Defaults

Causes the group of settings associated with the **I/O Config** menu to be reset to their default values. This also happens on **Restore Misc Defaults**, which has a SCPI command.

When **Restore I/O Config Defaults** is selected, a message appears saying:

This will reset all of the I/O Config variables to their default state, including the GPIB address and SCPI LAN settings

It will not affect Alignment data or settings

This action cannot be undone. Do you want to proceed?

The message provides **OK** and **Cancel** buttons so you can affirm or cancel the operation.

### 4.2.7 Query USB Connection (Remote Query Only)

Enables you to determine the speed of the USB connection.

|                |                                     |                                                                                                                                                             |
|----------------|-------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | :SYSTem:COMMunicate:USB:CONNection? |                                                                                                                                                             |
| Example        | :SYST:COMM:USB:CONN?                |                                                                                                                                                             |
| Notes          | NONE                                | Indicates no USB connection has been made                                                                                                                   |
|                | LSpeed                              | Indicates a USB low speed connection (1.5 Mbps)<br>Note that this is reserved for future use, the T+M488 protocol is not supported on low-speed connections |
|                | HSPeed                              | Indicates that a USB high speed connection (480 Mbps) has been negotiated                                                                                   |
|                | FSPeed                              | Indicates that a USB full speed connection (12 Mbps) has been negotiated                                                                                    |
| State Saved    | No                                  |                                                                                                                                                             |
| Range          | NONE   LSPeed   HSPeed   FSPeed     |                                                                                                                                                             |

### 4.2.8 USB Connection Status (Remote Query Only)

Lets you determine the current status of the USB connection.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SYSTem:COMMunicate:USB:STATus?</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Example        | <code>:SYST:COMM:USB:STAT?</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Notes          | <p><b>SUSPended</b> – Indicates that the USB bus is currently in its suspended state. The bus is in the suspended state when:</p> <ul style="list-style-type: none"> <li>– The bus is not connected to any controller</li> <li>– The controller is currently powered off</li> <li>– The controller has explicitly placed the USB device into the suspended state</li> </ul> <p>When in the suspended state, no USB activity, including start of frame packets are received</p> <p><b>ACTive</b> – Indicates that the USB device is in the active state. When the device is in the active state, it receives periodic frame starts, but is not necessarily receiving or transmitting data</p> |
| State Saved    | No                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Range          | <b>SUSPended</b>   <b>ACTive</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |

## 4.2.9 USB Packet Count (Remote Query Only)

Lets you determine the number of packets received and transmitted on the USB bus.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                  |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SYSTem:COMMunicate:USB:PACKets?</code>                                                                                                                                                                                                                                                                                                                                                                    |
| Example        | <code>:SYST:COMM:USB:PACK?</code>                                                                                                                                                                                                                                                                                                                                                                                |
| Notes          | <p>Two integers are returned:</p> <ol style="list-style-type: none"> <li>1. The number of packets received since application invocation</li> <li>2. The number of packets transmitted since application invocation</li> </ol> <p>If no packets have been received or transmitted, the response is <b>0,0</b></p> <p>The packet count is initialized to <b>0,0</b> when the instrument application is started</p> |
| State Saved    | No                                                                                                                                                                                                                                                                                                                                                                                                               |

## 4.2.10 Lock Remote I/O Session (Remote Command only)

An instrument can support multiple remote I/O sessions at the same time. However, you cannot *simultaneously* send remote commands from multiple sessions to the same instrument. The results in such a case are undefined.

Ensure that only *one* session actively controls the instrument at a time. Other sessions must wait until the active session finishes the instrument control.

To help achieve this cooperative instrument sharing, the following remote commands are provided:

- "Lock Remote I/O Request (Remote Query only)" on page 393
- "Unlock Remote I/O Session (Remote Command only)" on page 394
- "Remote I/O Session Lock Name (Remote Query only)" on page 394
- "Remote I/O Session Lock Owner (Remote Query only)" on page 395

Example Procedure for Lock Usage

| Step | Action                                                                                                                                                             |
|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1    | Each session tries to obtain a lock by sending :SYSTem:LOCK:REQuest?<br>This query can be sent simultaneously from multiple sessions                               |
| 2    | Only one session will be granted. The granted session receives 1 in response to its query                                                                          |
| 3    | The granted session actively controls the instrument<br>Meanwhile, other sessions must wait, and must periodically send :SYSTem:LOCK:REQuest?, requesting the lock |
| 4    | When the active session finishes its task, it releases the lock by sending :SYSTem:LOCK:RELease                                                                    |
| 5    | Now the lock has become available, so when one of the waiting sessions sends :SYSTem:LOCK:REQuest?, it receives 1 in response, granting the lock to that session   |

By repeating steps 3, 4, and 5 above, multiple sessions can share the same instrument in a cooperative fashion.

NOTE

A session can query its own unique session name by sending :SYSTem:LOCK:NAME?. This session name is determined by the instrument.

A session also can query the name of the currently granted session by sending :SYSTem:LOCK:OWNer?.

NOTE

Remote I/O interfaces are grouped in two types: single-session interface and multi-session interface. Both types of interfaces can be used for cooperative instrument sharing.

The recommended interface is LAN HiSLIP.

| Interface | Single-session | Multi-Session |
|-----------|----------------|---------------|
| GPIB      | ü              |               |
| USB-488   | ü              |               |

| Interface         | Single-session | Multi-Session |
|-------------------|----------------|---------------|
| LAN VXI-11 (SICL) | ü              |               |
| LAN Socket        |                | ü             |
| LAN HiSLIP        |                | ü             |
| LAN Telnet        |                | ü             |

If using a single-session interface, care must be taken to ensure only one client uses the single-session interface.

In particular, LAN VXI-11 (SICL) interface is a single-session interface, even though multiple clients could simultaneously connect to this interface. Such multiple VXI-11 clients share the same session context; the same status registers and the same error queue. Even a SCPI query response can be received by another client. Furthermore, the lock obtained by `:SYSTem:LOCK:REQuest?` is shared among all VXI-11 clients, allowing all of them to actively control the instrument.

If a LAN VXI-11 (SICL) interface must be used by multiple clients for a cooperative instrument sharing, then VISA locking *must* be used, *in addition to* Remote I/O Session Lock.

#### 4.2.10.1 Lock Remote I/O Request (Remote Query only)

You can lock the SCPI control of the instrument to the I/O Interface and Session by sending `:SYSTem:LOCK:REQuest?`. This permits cooperative sharing of the instrument between multiple computers, or multiple sessions from the same computer.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SYSTem:LOCK:REQuest?</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Example        | <code>:SYST:LOCK:REQ?</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Notes          | <p>Returns 1 if the lock request is granted, or 0 if the request is denied</p> <p>Lock requests on an individual interface and session can be nested and each request will increase an internal lock count by 1. For every granted request, send <code>:SYST:LOCK:REL</code> to decrement the internal lock count to fully relinquish the lock</p> <p>When the instrument is locked, Bit 0 is set in the Operation Instrument status register</p> <p>Disconnecting the individual interface and session releases the lock if the lock is granted to the interface and session</p> <p>A Device Clear over any interface and session releases the lock, regardless of the interface and session which obtained the lock</p> <p>The following queries are permitted over any interface and session, even if an interface has the instrument locked:</p> <ul style="list-style-type: none"> <li>– <code>*IDN?</code></li> </ul> |

---

|             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|             | <ul style="list-style-type: none"><li>- *OPT?</li><li>- *STB?</li><li>- *ESR?</li><li>- :SYSTem:DATE?</li><li>- :SYSTem:TIME?</li><li>- :SYSTem:PON:TIME?</li><li>- Queries in the :STATus subsystem</li><li>- Queries in the :SYSTem:ERRor subsystem</li><li>- Queries in the :SYSTem:LKEY subsystem</li><li>- Queries in the :SYSTem:LOCK subsystem</li><li>- Queries in the :SYSTem:METRics subsystem</li><li>- Queries in the :SYSTem:MODule subsystem</li></ul> <p>All other commands and queries result in error: -203,"Command protected; Instrument locked by another I/O session"</p> |
| State Saved | Not part of Save/Recall                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |

---

4.2.10.2 Unlock Remote I/O Session (Remote Command only)

You can unlock the SCPI control of the current I/O Interface and Session by sending :SYSTem:LOCK:RELease. Lock requests on an individual interface and session can be nested, and each request increases an internal lock count by 1. For every granted request, you will need to perform a release. The lock is not relinquished until the internal lock count reaches 0.

---

|                |                                                                                               |
|----------------|-----------------------------------------------------------------------------------------------|
| Remote Command | :SYSTem:LOCK:RELease                                                                          |
| Example        | :SYST:LOCK:REL                                                                                |
| Notes          | When the instrument is unlocked, Bit 0 is cleared in the Operation Instrument status register |

---

4.2.10.3 Remote I/O Session Lock Name (Remote Query only)

Use this query to obtain the name of the current I/O Interface and Session.

---

|                |                    |
|----------------|--------------------|
| Remote Command | :SYSTem:LOCK:NAME? |
|----------------|--------------------|

---

|         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|---------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Example | <code>:SYST:LOCK:NAME?</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Notes   | <p>The information returned is a string of the format:<br/> <code>&lt;I/O Interface&gt;[/&lt;IP address&gt;/&lt;Session ID&gt;]</code></p> <p>Where <b>IP address</b> and <b>Session ID</b> are only provided for interfaces that provide multiple sessions</p> <p>Single Session interfaces (GPIB, USB-488, and LAN VXI-11) only list interface name</p> <p><b>Session ID</b> is an internally generated identifier. It is not guaranteed to be consistent across instrument software versions (the identifier is subject to change when the software of the instrument is updated). The absolute value of <b>Session ID</b> is not significant, but the identifier will be consistent for a given software version, and can be relied upon for lock owner logic comparisons</p> |

#### 4.2.10.4 Remote I/O Session Lock Owner (Remote Query only)

Use this query to determine which I/O Interface and Session has the SCPI locked.  
If no interface and session has the SCPI locked, then the return value is **NONE**.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SYSTem:LOCK:OWNer?</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Example        | <code>:SYST:LOCK:OWN?</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Notes          | <p>The information returned is a string of the format:<br/> <code>&lt;I/O Interface&gt;[/&lt;IP address&gt;/&lt;Session ID&gt;]</code></p> <p>Where <b>IP address</b> and <b>Session ID</b> are only provided for interfaces that provide multiple sessions</p> <p>Single Session interfaces (GPIB, USB-488, and LAN VXI-11) only list interface name</p> <p><b>Session ID</b> is an internally generated identifier. It is not guaranteed to be consistent across instrument software versions (the identifier is subject to change when the software of the instrument is updated). The absolute value of <b>Session ID</b> is not significant, but the identifier will be consistent for a given software version, and can be relied upon for lock owner logic comparisons</p> <p>If no interface and session has the SCPI locked, then the return value is <b>NONE</b></p> |

### 4.2.11 Multiple Network Interface Card Configuration (Remote Commands Only)

Systems that have multiple Network Interface Cards (NICs) require additional configuration information. The following keys can be added to the XApps configuration file:

- **PrimaryNICIPv4** – IP address value is a string with the exact IP V4 format. Required field in IP v4 networks.
- **PrimaryNICIPv6** – IP address value is a string with the exact IP V6 format. Required field in IP v6 networks.

These commands do not apply to instruments that have only one NIC. The commands apply to all modular deployments that have a controller with multiple NICs.

To configure and query these configuration options, the following remote commands are provided:

- "Multiple Network Adapters Enabled (Remote Query Only)" on page 396
- "Config IPV4 Address (Remote Command Only)" on page 396
- "Config IPV6 Address (Remote Command Only)" on page 397
- "List All Physical Network Adapter IP Addresses (Remote Query Only)" on page 397

#### 4.2.11.1 Multiple Network Adapters Enabled (Remote Query Only)

|                |                                                                                                                                                                                                                                                                                                                                                               |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SYSTem:COMMunicate:LAN:MULTiple:NIC:ENABled?</code>                                                                                                                                                                                                                                                                                                    |
| Example        | <code>:SYSTem:COMMunicate:LAN:MULTiple:NIC:ENABled?</code>                                                                                                                                                                                                                                                                                                    |
| Notes          | <p>Applies to Instruments that have multiple Network Adapters. When more than one network adapter is present in the system, and they are <b>Enabled</b> (that is, they have a valid IP Address), this query returns:</p> <ul style="list-style-type: none"> <li>– 1, if more than one NIC enabled</li> <li>– 0, if only one or No NICs are enabled</li> </ul> |
| State Saved    | No                                                                                                                                                                                                                                                                                                                                                            |

#### 4.2.11.2 Config IPV4 Address (Remote Command Only)

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SYSTem:COMMunicate:LAN:IPV4:CONFig &lt;ipaddress&gt;</code><br><code>:SYSTem:COMMunicate:LAN:IPV4:CONFig?</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Example        | <code>:SYSTem:COMMunicate:LAN:IPV4:CONFig "192.168.1.146"</code><br><code>:SYSTem:COMMunicate:LAN:IPV4:CONFig?</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Notes          | <p>Applies to instruments that have multiple Network Adapters. When more than one network adapter is present in the system, you must specify in the instrument config file the IP address to use to enable Remoting channel bindings. If this is not provided, Remoting connections are likely to fail on systems where multiple NICs are enabled</p> <p>Sets the valid IPV4 address, passed in as string in the config file</p> <p>The query returns IPV4 address, as a string</p> <p>If config file is missing, "" (empty string) is returned</p> <p>Changing the IPV4 value requires a restart of the instrument software, to ensure that servers use the configured IP address</p> |
| State Saved    | No                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |



#### 4.2.11.3 Config IPV6 Address (Remote Command Only)

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SYSTem:COMMunicate:LAN:IPV6:CONFig &lt;ipaddress&gt;</code><br><code>:SYSTem:COMMunicate:LAN:IPV6:CONFig?</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Example        | <code>:SYSTem:COMMunicate:LAN:IPV6:CONFig "2001:0db8:85a3:0000:0000:8a2e:0370:7334"</code><br><code>:SYSTem:COMMunicate:LAN:IPV6:CONFig?</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Notes          | <p>Applies to instruments that have multiple Network Adapters. When more than one network adapter is present in the system, you must specify in the instrument config file the IP address to use to enable Remoting channel bindings. If this is not provided, Remoting connections are likely to fail on systems where multiple NICs are enabled</p> <p>Sets the valid IPV6 address, passed in as string in the config file</p> <p>The query returns IPV6 address, as a string</p> <p>If config file is missing, "" (empty string) is returned</p> <p>Changing the IPV6 value requires a restart of the instrument software, to ensure servers use the configured IP address</p> |
| State Saved    | No                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |

#### 4.2.11.4 List All Physical Network Adapter IP Addresses (Remote Query Only)

|                |                                                                                                                                          |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SYSTem:COMMunicate:LAN:PHYSical:IPADdress:LIST?</code>                                                                            |
| Example        | <code>:SYSTem:COMMunicate:LAN:PHYSical:IPADdress:LIST?</code><br><code>: "192.168.1.146, 2001:0db8:85a3:0000:0000:8a2e:0370:7334"</code> |
| Notes          | Returns the IP Addresses of the physical network adapters found in the PC/Instrument                                                     |
| State Saved    | No                                                                                                                                       |

## 4.3 Preload / Unload Modes

The X-Series platform supports many Modes. Each Mode that is loaded uses a portion of the total available memory. At some point, this may result in insufficient free memory. This can occur during a measurement, or when loading a new Mode. A limited number of Modes can be loaded without impacting performance.

**Preload / Unload Modes** allows you to select and enable Modes to be preloaded at startup, and to specify the default **Power-On Mode**.

The dialog includes the following controls:

- "Power-On Mode" on page 398
- "Table of Modes" on page 399
- "Preload: Select All, Preload: Deselect All" on page 399
- "Move Up, Move Down" on page 399
- "Unload" on page 399

Modes that are not preloaded may be loaded at runtime as needed, resources permitting. However, note that loading more Modes increases memory consumption and may adversely impact performance.

When a memory-full situation occurs, the instrument notifies you with the following message:

Out of memory; Insufficient resources. Please save state if needed. You have following options:

1. Open System Settings > Configure Preload Modes to unload unused Modes
2. Reconfigure preloaded Modes on the above dialog, close and restart the analyzer SW
3. Close and restart the analyzer SW

Option 1 allows you to unload unused Modes and continue running the software, without having to restart it.

The command `:INSTRument:UNLoad <mode>` provides equivalent functionality; see "Unload" on page 399.

### 4.3.1 Power-On Mode

Displays a list of licensed Modes. Use this control to change the factory default Power-On Mode. The instrument will execute the selected Mode after power up. Selecting the Power-On Mode here automatically enables that Mode for preloading.

## 4.3.2 Table of Modes

The table of Modes becomes scrollable when the number of Modes exceeds the dialog's displayable size.

Use the check boxes in the **Preload** column to enable or disable the preloading of the Modes that you want.

Use the check boxes in the **Unload** column to select the Modes that you want to unload.

The Unload check boxes are grayed-out when the Modes are used by other Modes.

Example:

5G NR & V2X Mode cannot be loaded when either Sequence Analyzer Mode or Power Amplifier Mode are already loaded, because these Modes use 5G NR & V2X Mode. To unload 5G NR & V2X Mode, both Sequence Analyzer Mode and Power Amplifier Mode must be unloaded first.

When the active Mode is unloaded, the screen becomes blank except for the message; **"No Mode is active"**. You can then select another desired Mode.

When multiple screens are open, and a Mode is unloaded, inactive screens that have that Mode as their active Modes are closed.

The active screen is never closed.

## 4.3.3 Preload: Select All, Preload: Deselect All

Toggles the **Preload** checkbox state for all Applications listed, except for the Power-On Application, which is always selected.

## 4.3.4 Move Up, Move Down

The default order in which Applications are listed in the table is the order in which they are displayed in the **Mode/Measurement/View** Selector dialog. To change the order in this list, select the desired Application row from the table, then click **Move Up** or **Move Down** to move it to the desired position.

## 4.3.5 Unload

Unloads the specified Mode.

---

Remote `:INSTrument:UNLoad <mode>`

## 4 System

### 4.3 Preload / Unload Modes

|         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|---------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Command |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Example | <code>:INST:UNL NR5G</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Notes   | <p>Error message if the specified Mode is not available,<br/> <code>-224,"Illegal parameter value;&lt;mode&gt; is not a valid choice"</code></p> <p>Error message if the specified Mode is not loaded and therefore cannot be unloaded,<br/> <code>-221,"Settings conflict;&lt;mode&gt; is not loaded"</code></p> <p>Error message if the specified Mode is used by other Modes and therefore cannot be unloaded,<br/> <code>-221,"Settings conflict;&lt;mode&gt; is used by &lt;other modes&gt;"</code></p> <p>Error message if the specified Mode does not support Unload Mode feature and therefore cannot be unloaded,<br/> <code>-221,"Settings conflict;Feature not supported for this Mode"</code></p> |

#### 4.3.6 Loaded Modes (Remote Query Only)

Returns a list of loaded Modes.

|                |                                          |
|----------------|------------------------------------------|
| Remote Command | <code>:SYSTem:APPLication:LOADed?</code> |
| Example        | <code>:SYST:APPL:LOAD?</code>            |
| Preset         | Not affected by Preset                   |

#### 4.3.7 User Interface

Configures functions specific to the User Interface, such as the menu panel orientation and the display color theme.

##### 4.3.7.1 Menu Panel Position

Allows the Menu Panel to be positioned on the **RIGHT** or **LEFT** side of the display.

|                |                                                                                                                                                                         |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SYSTem:DISPlay:MPPosition RIGHT   LEFT</code><br><code>:SYSTem:DISPlay:MPPosition?</code>                                                                        |
| Example        | <code>:SYST:DISP:MPP LEFT</code>                                                                                                                                        |
| Preset         | This is unaffected by <b>Preset</b> but is set to <b>RIGHT</b> by <b>Restore Defaults</b> > "User Interface" on page 425 or <b>Restore Defaults</b> > "All" on page 427 |
| State Saved    | Power On Persistent (survives shutdown and restart)                                                                                                                     |

#### 4.3.7.2 Menu Panel Tabs

Allows the **Menu Panel Tabs** to be positioned on the **RIGHT** or **LEFT** side of the menu panel.

|                |                                                                                                                                                                         |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SYSTem:DISPlay:MPTab RIGHT   LEFT</code><br><code>:SYSTem:DISPlay:MPTab?</code>                                                                                  |
| Example        | <code>:SYST:DISP:MPT LEFT</code>                                                                                                                                        |
| Preset         | This is unaffected by <b>Preset</b> but is set to <b>RIGHT</b> by <b>Restore Defaults</b> > "User Interface" on page 425 or <b>Restore Defaults</b> > "All" on page 427 |
| State Saved    | Power On Persistent (survives shutdown and restart)                                                                                                                     |

#### 4.3.7.3 Annotations Local Settings/All Off

Overrides the annotation settings for all measurement in all modes and turns them all off. This provides the security based "annotation off" function of previous instruments; hence it uses the legacy SCPI command.

When this control is set to **All Off**, the **Screen Annotation**, **Meas Bar**, **Trace Annotation**, and **Control Annotation** controls under the **Display, Annotation** menu are grayed-out and forced to **OFF** for all measurements in all modes. When **Local Settings** is selected, you can set the local annotation settings on a measurement-by-measurement basis.

|                               |                                                                                                                                                                                                                    |
|-------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command                | <code>:DISPlay:WINDow[1]:ANNotation[:ALL] OFF   ON   0   1</code><br><code>:DISPlay:WINDow[1]:ANNotation[:ALL]?</code>                                                                                             |
| Example                       | <code>:DISP:WIND:ANN OFF</code>                                                                                                                                                                                    |
| Preset                        | This is unaffected by <b>Preset</b> but is set to <b>ON</b> by <b>Restore Defaults</b> > "User Interface" on page 425, <b>Restore Defaults</b> > "Misc" on page 426 or <b>Restore Defaults</b> > "All" on page 427 |
| State Saved                   | Power On Persistent (survives shutdown and restart)                                                                                                                                                                |
| Backwards Compatibility Notes | The <b>WINDow</b> parameter and optional subopcode is included for backwards compatibility but ignored – all windows are equally affected                                                                          |

#### 4.3.7.4 Display Theme

Allows you to change the **Display Theme**. This is similar to the Themes selection under Page Setup and Save Screen Image.

The two available themes are:

- **FILLed**: this is the normal theme using filled objects
- **OUTLine**: this theme uses color, but does not use fill for most areas on the display. It is ideal for images that need to be printed on inkjet printers. Although setting **Display Theme** to **OUTLine** does not affect screen image saves or prints, it does show you exactly how screen images will look when using the **OUTLine** theme under **Save Screen Image**, and how prints will look when using the **OUTLine** theme under **Page Setup**.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                            |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| NOTE           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Although the <b>OUTLine</b> theme eliminates most of the filled area, some objects remain filled. In particular, the selected marker remains filled with the green marker color, to distinguish it from the other markers. This is important, as it is the selected marker whose readout appears in the upper right corner of the display. |
| Remote Command | <b>:DISPlay:THEMe</b> <b>TDColor</b>   <b>TDMonochrome</b>   <b>FCOLor</b>   <b>FMONochrome</b>   <b>FILLed</b>   <b>OUTLine</b><br><b>:DISPlay:THEMe?</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                            |
| Example        | <b>:SYST:DISP:THEM OUTL</b><br>sets the display style to <b>OUTLine</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                            |
| Notes          | To permit code compatibility with A-model X-Series Signal Analyzer instruments, the command parameters from the A-models are mapped as follows: <ul style="list-style-type: none"><li>- <b>TDColor</b> and <b>TDMonochrome</b> are both mapped to <b>FILLed</b> (exact full color representation of what is on the screen)</li><li>- <b>FCOLor</b> and <b>FMONochrome</b> are both mapped to <b>OUTLine</b> (uses color for traces and other items, but most filled areas are white)</li></ul> There is no Monochrome theme in the B-model instruments, so the monochrome commands for the A-model instruments yield color themes<br>The query of <b>:DISPlay:THEMe?</b> always returns <b>FILLed</b> or <b>OUTLine</b> . It never returns <b>FCOLor</b> , <b>FMONochrome</b> , <b>TDColor</b> , or <b>TDMonochrome</b> |                                                                                                                                                                                                                                                                                                                                            |
| Preset         | This is unaffected by <b>Preset</b> but is set to <b>FILLed</b> by <b>Restore Defaults &gt; "User Interface" on page 425</b> , <b>Restore Defaults &gt; "Misc" on page 426</b> or <b>Restore Defaults &gt; "All" on page 427</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                            |
| State Saved    | Power On Persistent (survives shutdown and restart)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                            |

4.3.7.5 Backlight

Turns the display **Backlight** on and off. This setting may interact with settings under the Windows **Power** menu.

When the backlight is **OFF**, pressing ESC, TAB, SPACE, ENTER, UP, DOWN, LEFT, RIGHT, DEL, BKSP, CTRL, or ALT turns the backlight **ON** without affecting the

application. Pressing any other key turns backlight **ON**, and could potentially perform the action as well.

|                |                                                                                                                                                                                                                   |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:DISPlay:BACKlight ON   OFF</code><br><code>:DISPlay:BACKlight?</code>                                                                                                                                      |
| Example        | Turn backlight <b>ON</b> :<br><code>:DISP:BACK ON</code><br><br>Turn backlight <b>OFF</b> :<br><code>:DISP:BACK OFF</code>                                                                                        |
| Preset         | Pressing any key turns the backlight back <b>ON</b> , as does <b>Restore Defaults</b> > "User Interface" on page 425, <b>Restore Defaults</b> > "Misc" on page 426 or <b>Restore Defaults</b> > "All" on page 427 |
| State Saved    | Not saved in State                                                                                                                                                                                                |

#### 4.3.7.6 Backlight Intensity

Allows the **Backlight Intensity** to be controlled from the UI settings panel.

|                |                                                                                                                       |
|----------------|-----------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SYSTem:DISPlay:BACKlight:INTensity &lt;integer&gt;</code><br><code>:SYSTem:DISPlay:BACKlight:INTensity?</code> |
| Example        | <code>:SYST:DISP:BACK:INT 67</code>                                                                                   |
| Preset         | 100                                                                                                                   |
| State Saved    | Power On Persistent (survives shutdown and restart)                                                                   |
| Range          | 0-100                                                                                                                 |

#### 4.3.7.7 Hints

**Hints** are descriptions that provide additional information for a control. You can set **Hints** to be enabled or disabled.

|                |                                                                                                                                                                      |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SYSTem:DISPlay:HINTs[:STATe] OFF   ON   0   1</code><br><code>:SYSTem:DISPlay:HINTs?</code>                                                                   |
| Example        | <code>:SYST:DISP:HINT OFF</code>                                                                                                                                     |
| Preset         | This is unaffected by <b>Preset</b> but is set to <b>ON</b> by <b>Restore Defaults</b> > "User Interface" on page 425 or <b>Restore Defaults</b> > "All" on page 427 |
| State Saved    | Power On Persistent (survives shutdown and restart)                                                                                                                  |

#### 4.3.7.8 Numeric Entry Auto Open

Configures whether the **Numeric Entry** Panel will appear immediately when an active function control is activated (Auto Open **ON**), or be deferred until you touch it again or begin to enter a value (Auto Open **OFF**). When configured for Auto Open

**OFF** (the default), adjusting the value with the front panel Up/Down keys or the RPG hides the **Numeric Entry** Panel.

|                |                                                                                                                                                                      |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | :SYSTem:DISPlay:NEPimmediate ON   OFF   1   0<br>:SYSTem:DISPlay:NEPimmediate?                                                                                       |
| Example        | :SYST:DISP:NEP OFF                                                                                                                                                   |
| Preset         | This is unaffected by <b>Preset</b> but is set to <b>ON</b> by <b>Restore Defaults</b> > "User Interface" on page 425 or <b>Restore Defaults</b> > "All" on page 427 |
| State Saved    | Power On Persistent (survives shutdown and restart)                                                                                                                  |

#### 4.3.7.9 Touch On/Off

Turns the touch functionality on and off on the display. If **OFF**, you can turn it back on using the front panel **Touch On/Off** key, or by using a mouse to toggle this control.

|             |                                                                                                                                                                                            |
|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Preset      | Always starts up <b>ON</b><br>Unaffected by <b>Preset</b> but is turned <b>ON</b> by <b>Restore Defaults</b> > "User Interface" on page 425 or <b>Restore Defaults</b> > "All" on page 427 |
| State Saved | Not saved in state, not affected by <b>Preset</b> , not Power On Persistent (does not survive shutdown and restart)                                                                        |

#### 4.3.7.10 Control Size

Configures the size of the controls in the user interface. This can be used to make screen dumps from a large screen instrument match those from a smaller screen instrument, to make the controls more readable on a large-screen instrument, or to display more information on a smaller screen instrument.

|                |                                                                                                                                                                         |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | :DISPlay:UINterface:CSIZe SMALL   LARGE<br>:DISPlay:UINterface:CSIZe?                                                                                                   |
| Example        | :DISP:UINT:CSIZ LARGE                                                                                                                                                   |
| Preset         | This is unaffected by <b>Preset</b> but is set to <b>SMALL</b> by <b>Restore Defaults</b> > "User Interface" on page 425 or <b>Restore Defaults</b> > "All" on page 427 |
| State Saved    | Power On Persistent (survives shutdown and restart)                                                                                                                     |

#### 4.3.7.11 Quick Save Mode

When **Quick Save Mode** is **NORMAL** (the default setting), the instrument does an immediate save of a new file of the same type and to the same directory as the previous **Save** action. When **Quick Save Mode** is in the **PROMPT** state, instead of immediately performing a **Save**, the Alpha Keyboard appears with the proposed

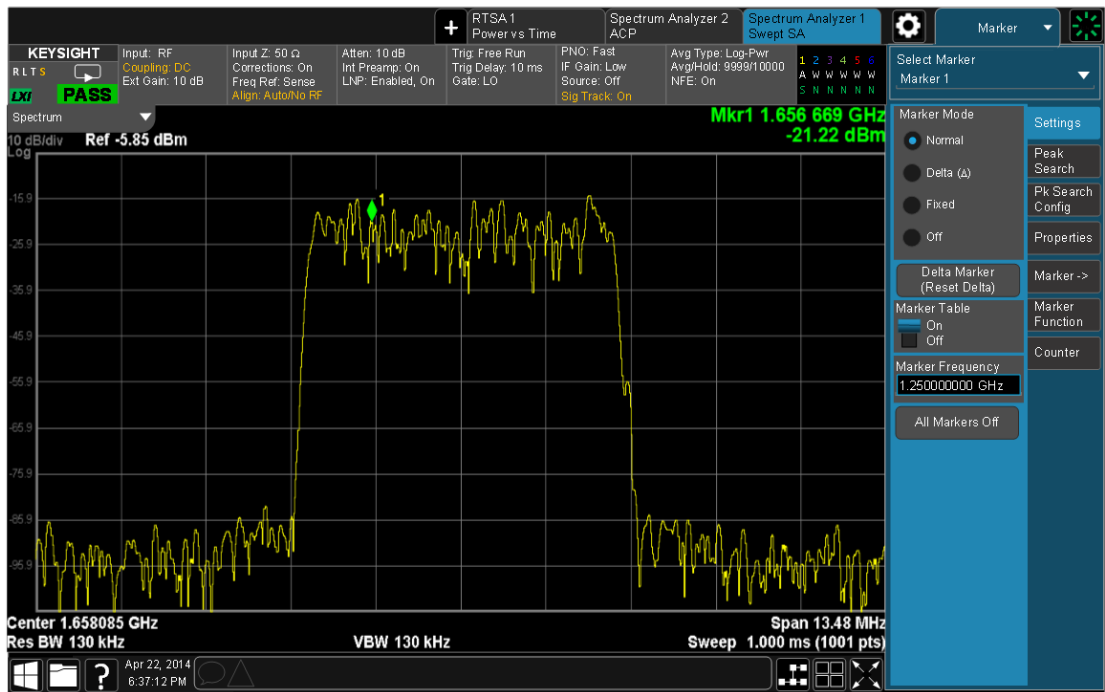


auto-filename in the entry area. You can then press **Enter** to accept the auto filename, or edit the name then press **Enter**. This allows you to easily save a file with a custom file name.

|                |                                                                                                                                                                          |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | :MMEMory:STORe:QSAVe NORMa1   PROMpt<br>:MMEMory:STORe:QSAVe?                                                                                                            |
| Example        | :MMEM:STOR:QSAV PROM                                                                                                                                                     |
| Preset         | This is unaffected by <b>Preset</b> but is set to <b>NORMa1</b> by <b>Restore Defaults</b> > "User Interface" on page 425 or <b>Restore Defaults</b> > "All" on page 427 |
| State Saved    | Power On Persistent (survives shutdown and restart)                                                                                                                      |

4.3.7.12 Screen Tabs Left/Right

This switch, when in the **RIGHT** position, makes the screen tabs start on the right and build across to the left, thus minimizing the finger travel over to the screen tab when there is only one screen. When tabs are added from right to left, they appear as below:



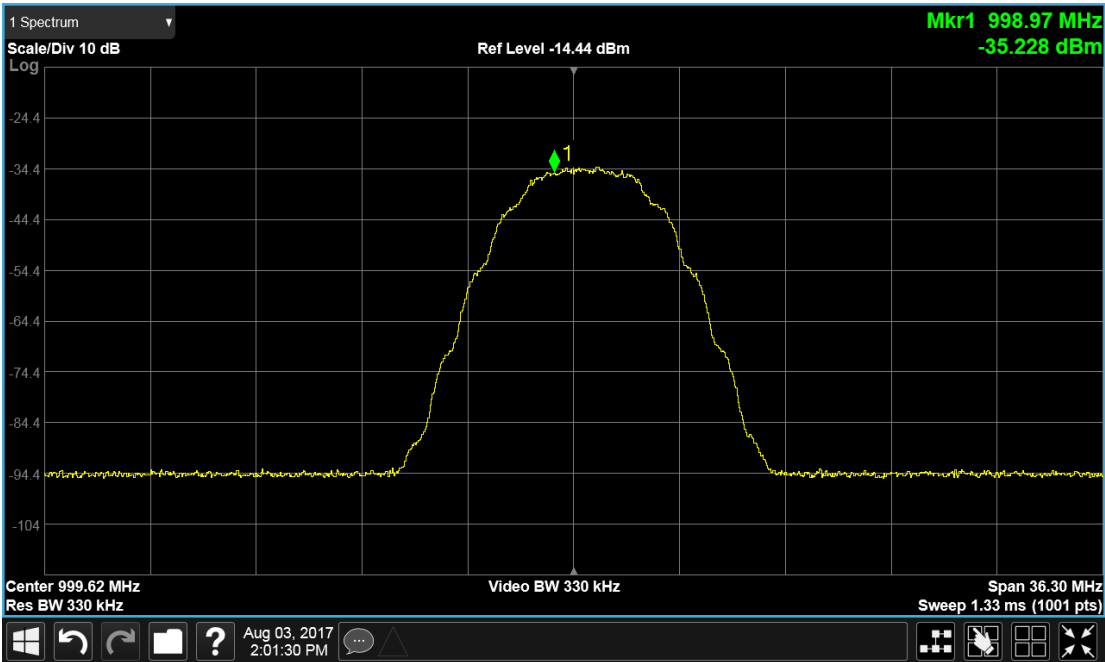
The default is **LEFT**.

|                |                                                                   |
|----------------|-------------------------------------------------------------------|
| Remote Command | :DISPlay:UINTerface:STAB RIGHT   LEFT<br>:INSTrument:SCReen:STAB? |
| Example        | :DISP:UINT:STAB RIGH                                              |

|             |                                                                                                                                                                        |
|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Preset      | This is unaffected by <b>Preset</b> but is set to <b>LEFT</b> by <b>Restore Defaults</b> > "User Interface" on page 425 or <b>Restore Defaults</b> > "All" on page 427 |
| State Saved | Power On Persistent (survives shutdown and restart)                                                                                                                    |

4.3.7.13 Hide Screen Tabs in Full Screen

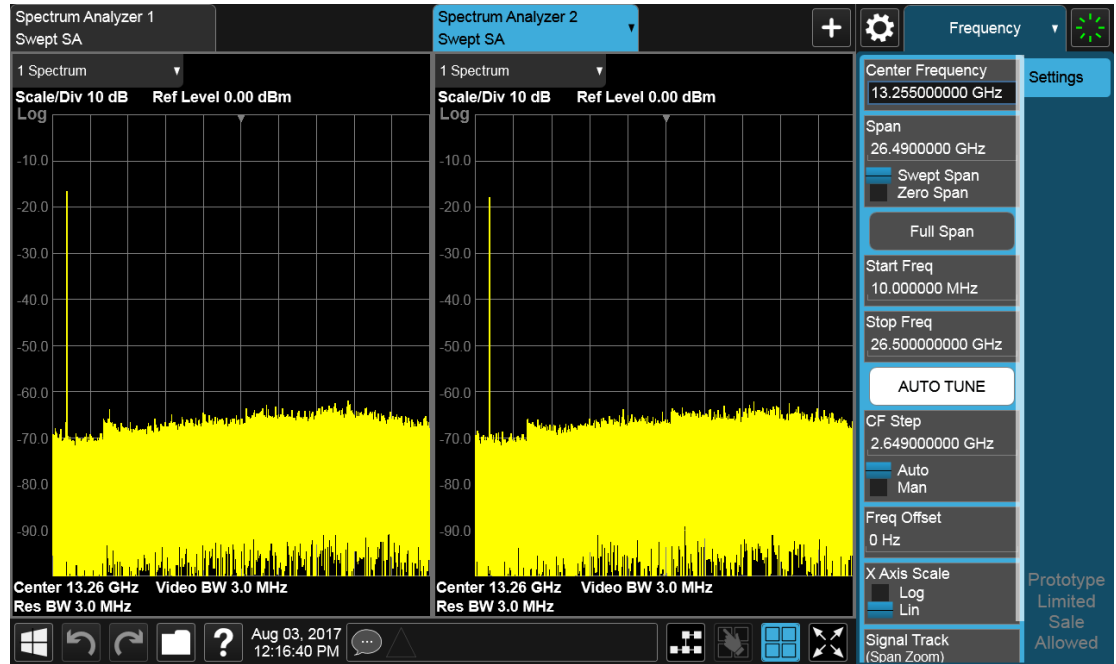
This switch, when in the **ON** position, causes the Screen Tabs to be hidden when in Full Screen view, thus maximizing the display area available for results. By also turning off the Meas Bar (in the **Display, Annotation** menu), you can maximize the available area for results, as shown below:



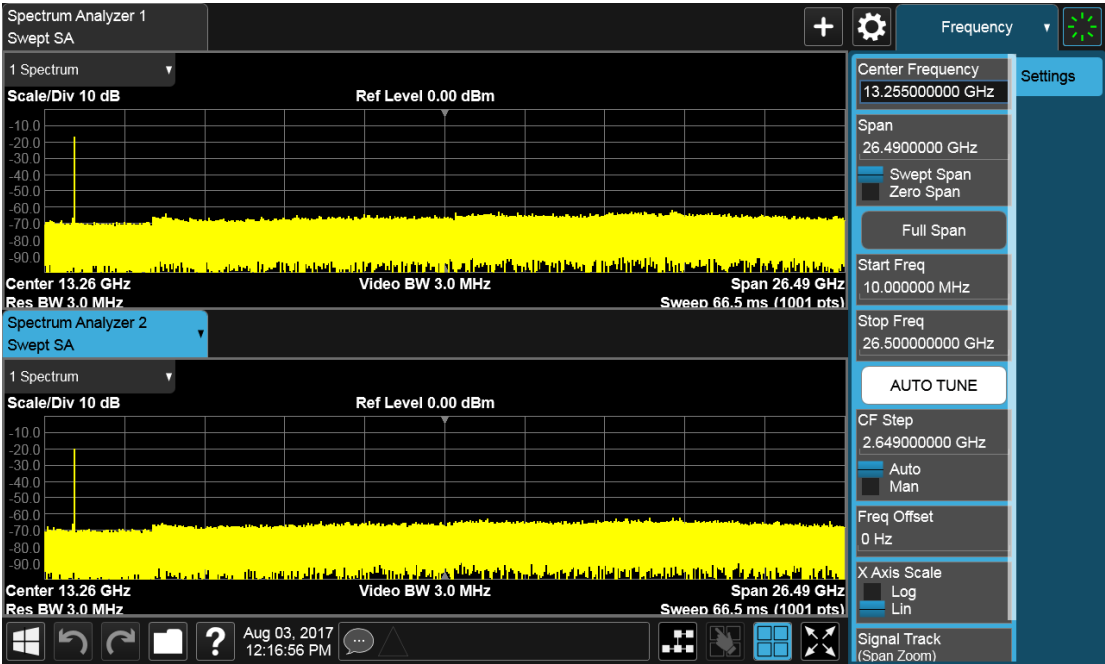
|                |                                                                                                                                                                                                                                                                                |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:DISPlay:UINterface:HTABs ON   OFF   1   0</code><br><code>:DISPlay:UINterface:HTABs?</code><br><code>:DISPlay:UINterface:STFScreen ON   OFF   1   0</code><br>Implemented but with wrong sense; ON turns them off and OFF turns them on; so, don't document to customer |
| Example        | <code>:DISP:UINT:HTAB ON</code><br>Hide the tabs in full screen                                                                                                                                                                                                                |
| Preset         | This is unaffected by <b>Preset</b> but is set to <b>OFF</b> by <b>Restore Defaults</b> > "User Interface" on page 425 or <b>Restore Defaults</b> > "All" on page 427                                                                                                          |
| State Saved    | Power On Persistent (survives shutdown and restart)                                                                                                                                                                                                                            |

#### 4.3.7.14 2-Screen Orientation

When you add a second Screen using the “+” control on the Screen Tabs bar, normally the screen is added to the right of the first screen. However, sometimes it is better to add the new screen below the first screen rather than to the right, as shown below.



New screen added to the right (horizontal orientation)



New screen added below (vertical orientation)

The **2-Screen Orientation** switch allows you to choose between these two orientations for 2-Screen configurations. The default is the **HORizontal** configuration, two Screens side-by-side.

|                |                                                                                                                                                         |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | :INSTrument:SCReen:ORientation VERTical   HORizontal                                                                                                    |
| Example        | :INST:SCR:ORI VERT                                                                                                                                      |
|                | Set the 2 screens to be above/below each other                                                                                                          |
| Preset         | HOR                                                                                                                                                     |
|                | This is unaffected by Preset but is set to <b>HORizontal</b> by Restore Defaults > "User Interface" on page 425 or Restore Defaults > "All" on page 427 |

4.3.7.15 Clock Format

Allows the **Clock Format** to be switched between 12-Hour Format (**HR12**) and 24-Hour Format (**HR24**).

|                |                                                     |
|----------------|-----------------------------------------------------|
| Remote Command | :SYSTem:DISPlay:CFORmat HR12   HR24                 |
|                | :SYSTem:DISPlay:CFORmat?                            |
| Example        | :SYST:DISP:CFOR HR12                                |
| Preset         | HR12                                                |
| State Saved    | Power On Persistent (survives shutdown and restart) |
| Range          | 12-Hour   24-Hour                                   |

### 4.3.7.16 Language

Accesses the selection of **Language** displayed on the menus and controls. **ENGLISH** is the default.

All Measurement Applications that share common controls will display the localized controls.

The description on the control labels is bounded by the control size. Any given language will have labels in that language that are shorter or longer than the equivalent label in English. Any localized text on the controls that does not fit the label size remains in English. Thus, for any given menu, controls may be displayed in English *and* the selected language.

- Labels that are acronyms, engineering, or technology specific terms may remain in English.
- All Application and Measurement names remain in English.
- All data in exported files remain in English.
- The Diagnostic and Service menus in the System Subsystem remain in English.
- The Windows operating system must remain in English. Changing the **Region and Language** settings in the Windows Control Panel is not supported.

External keyboards in English are supported. Localized external keyboards are not supported. When the language selected is not English, a message is displayed to explain that any external keyboard must remain in English.

Other aspects of the Graphical User Interface remain in English. The Remote User Interface (SCPI) remains in English.

|                |                                                                                                                                                                                                                                                    |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SYSTem:DISPlay:LANGuage ENGLISH   RUSSian</code><br><code>:SYSTem:DISPlay:LANGuage?</code>                                                                                                                                                  |
| Example        | <code>:SYST:DISP:LANG ENGL</code><br><code>:SYST:DISP:LANG RUSS</code><br>Requires Option AKT                                                                                                                                                      |
| Preset         | This is unaffected by <b>Preset</b> but is set to <b>ENGLISH</b> by <b>Restore Defaults</b> > " <b>User Interface</b> " on page 425, <b>Restore Defaults</b> > " <b>Misc</b> " on page 426 or <b>Restore Defaults</b> > " <b>All</b> " on page 427 |

### 4.3.7.17 Restore User Interface Defaults

Causes the group of settings associated with the **User Interface** menu to be reset to their default values. This also happens on **Restore Misc Defaults**.

When **User Interface** is selected, a message appears saying:

This will reset all of the User Interface variables to their default state, including the menu panel location, display theme, and language.

It will not affect Alignment data or settings.

This action cannot be undone. Do you want to proceed?

The message provides **OK** and **Cancel** buttons for you to affirm or cancel the operation.

---

|         |                |
|---------|----------------|
| Example | :SYST:DEF UINT |
|---------|----------------|

**4.3.7.18 User Interface Type (Remote Query Only)**

Use this query to determine if the instrument is running the Multi-Touch user interface or Softkey user interface. This is an easy way to distinguish between A-models (Softkey) instruments and Touch UI (Multi-Touch) instruments.

---

|                |                                                                                                                                   |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | :DISPlay:UINterface:TYPE?                                                                                                         |
| Example        | :DISP:UINT:TYPE?                                                                                                                  |
| Notes          | The query returns <b>MULTITOUCH</b> for instruments with the Multi-Touch UI or <b>SOFTKEY</b> for instruments with the Softkey UI |

## 4.4 Power On

Lets you select how the instrument should power on.

NOTE

In products that run multiple instances of the X-Series Application, the same Power On type is shared between all the instances.

### 4.4.1 Power On State

Lets you select whether the instrument powers up in a default state, or some other state. The options are:

- **MODE** and Input/Output Defaults
- **USER** Preset
- **LAST** State

|                              |                                                                                                                                                 |
|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command               | :SYSTem:PON:TYPE <b>MODE</b>   <b>USER</b>   <b>LAST</b><br>:SYSTem:PON:TYPE?                                                                   |
| Example                      | :SYST:PON:TYPE <b>MODE</b><br>:SYST:PON:TYPE <b>USER</b><br>:SYST:PON:TYPE <b>LAST</b>                                                          |
| Preset                       | This is unaffected by <b>Preset</b> but is set to <b>MODE</b> by <b>Restore Defaults</b> > "All" on page 427                                    |
| State Saved                  | No                                                                                                                                              |
| Backwards Compatibility SCPI | :SYSTem:PON:TYPE <b>PRESet</b><br>The <b>PRESet</b> parameter is supported for backward compatibility only, and behaves the same as <b>MODE</b> |

### Mode and Input/Output Defaults

When the instrument is powered-on in **MODE** and Input/Output Defaults, it performs "Restore Mode Defaults" on page 550 for all Modes in the instrument, and performs Restore Input/Output Defaults.

Persistent parameters (such as Amplitude Correction tables or Limit tables) are not affected at power-on, even though they are normally cleared by **Restore Input/Output Defaults** and/or **Restore Mode Defaults**.

## User Preset

Sets **Power On State** to **USER** Preset. When the instrument is powered on in User Preset, it will **User Preset** each mode and switch to the "**Power On Application**" on page 413. **Power On User Preset** does not affect any settings other than those set by a normal **User Preset**.

Backwards Compatibility Note: Power On: **User Preset** causes the instrument to power up in the "**Power On Application**" on page 413, *not* the last Mode the instrument was in prior to shutdown. Also, **Power On: User Preset** will **User Preset** all Modes. This does *not* exactly match legacy behavior.

---

### NOTE

In products that run multiple instances of the X-Series Application, the same **User Preset** is shared between all the instances.

---

### NOTE

An instrument can never power up for the first time in **USER** preset.

---

## Last State

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

**Power On: Last State** only works if you completed a controlled shutdown prior to powering on in **LAST**. If a controlled shutdown is not completed when in **Power On: Last State**, the instrument powers up in the last active Mode, but it may not power up in the active Mode's last state. If an invalid Mode state is detected, a **Mode Preset** occurs. To control the shutdown under remote control, use **:SYSTem:PDOWn**.

Backwards Compatibility Note: It is no longer possible to power-up the instrument in the last Mode the instrument was running with that Mode in the preset state. (ESA/PSA **SYST:PRESET:TYPE MODE** with **SYST:PON:PRESET**) You can power-on the instrument in the last Mode the instrument was running in its last state (**:SYST:PON:TYPE LAST**), or you can specify the Mode to power-up in its preset state (**:SYST:PON:MODE <mode>**).

---

### NOTE

In products that run multiple instances of the X-Series Application, each instance has a unique **Last State**.

---

### NOTE

An instrument can never power up for the first time in **LAST**.

---



If line power to the instrument is interrupted, for example by pulling the line cord plug or by switching off power to a test rack, **Power OnLast State** may not work properly. For proper operation, **Power On Last State** depends on your shutting down the instrument using the **Standby** key or the `:SYSTem:PDOWn` command. This ensures the last state of each Mode is saved and can be recalled during a power-up.

## 4.4.2 Power On Application

Accesses a menu that lists the available Modes, and lets you select which Mode is to be the **Power On Application**. Whichever application is selected runs at power-on when the Power On Type is set to “**MODE** and Input/Output Defaults”.

### NOTE

In products that run multiple instances of the X-Series Application, the same Power On Application is shared between all the instances.

|                                |                                                                                                                                                                                                                                                                                                                                                                     |                                |             |                   |              |                           |              |
|--------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|-------------|-------------------|--------------|---------------------------|--------------|
| Remote Command                 | <code>:SYSTem:PON:MODE &lt;mode&gt;</code><br>where <code>&lt;mode&gt;</code> is an item from the same set that can be sent using the <code>:INSTrument[:SElect]</code> command<br><code>:SYSTem:PON:MODE?</code>                                                                                                                                                   |                                |             |                   |              |                           |              |
| Example                        | <code>:SYST:PON:MODE SA</code>                                                                                                                                                                                                                                                                                                                                      |                                |             |                   |              |                           |              |
| Notes                          | The displayed list of possible Modes (and remote parameters) depends on which Modes are installed in the instrument                                                                                                                                                                                                                                                 |                                |             |                   |              |                           |              |
| Preset                         | Unaffected by <b>Preset</b> but is set by <b>Restore Defaults</b> > “All” on page 427 to <b>SA</b> , except in the cases noted below: <table border="1"> <tr> <td>N8973B, N8974B, N8975B, N8976B</td><td><b>NFIG</b></td></tr> <tr> <td><b>VXT models</b></td><td><b>BASIC</b></td></tr> <tr> <td><b>M9410E/11E/15E/16E</b></td><td><b>BASIC</b></td></tr> </table> | N8973B, N8974B, N8975B, N8976B | <b>NFIG</b> | <b>VXT models</b> | <b>BASIC</b> | <b>M9410E/11E/15E/16E</b> | <b>BASIC</b> |
| N8973B, N8974B, N8975B, N8976B | <b>NFIG</b>                                                                                                                                                                                                                                                                                                                                                         |                                |             |                   |              |                           |              |
| <b>VXT models</b>              | <b>BASIC</b>                                                                                                                                                                                                                                                                                                                                                        |                                |             |                   |              |                           |              |
| <b>M9410E/11E/15E/16E</b>      | <b>BASIC</b>                                                                                                                                                                                                                                                                                                                                                        |                                |             |                   |              |                           |              |
| State Saved                    | No                                                                                                                                                                                                                                                                                                                                                                  |                                |             |                   |              |                           |              |

## 4.4.3 FPGA Configuration

Lets you choose which FPGA image you want loaded into the instrument.

Depending on your hardware configuration, your instrument may contain a Field Programmable Gate Array (FPGA) which handles much of the processing for some of the mathematically intensive features, such as Time Domain Scan (Option TDS) and Enhanced Sweep Speed (Option FS2). The FPGA is not big enough to hold the

functionality for both options, so you must decide which FPGA program you want loaded.

When licenses allow for both FPGA image versions to be available, and you have not explicitly chosen an FPGA image version, then, when the firmware is updated, the Time Domain Scan version will be loaded. In the absence of all licenses, the Enhanced Sweep Speed version will be loaded. Once you have explicitly chosen an FPGA image version, using the FPGA Configuration dialog, any future firmware updates will continue to load the chosen version as long as it is licensed.

Example: loading the Time Domain Scan FPGA image, removing the TDS license, and then updating the firmware will result in the Enhanced Sweep Speed version being loaded.

When multiple capabilities are licensed, the FPGA Configuration presents a dialog that tells you that there is insufficient space to fit all the licensed capabilities, and asks you to choose one of the FPGA programs (images).

If you remove licenses, it is possible to end up with an unlicensed capability loaded in the FPGA while a licensed capability is not loaded. In this case, the dialog does not present the **Preference** group and shows a message about unlicensed/licensed capabilities. You can dismiss the dialog if the licensed capability is not currently needed, and you do not want to take the time to load the licensed FPGA image. However, this dialog will continue to appear each time the instrument is restarted.

### **Behavior when the Enhanced Sweep Speed FPGA Image is Loaded**

When the Enhanced Sweep Speed version of the FPGA image is loaded, sweep behavior still depends on the licenses:

- Option FS2 gives full FPGA enhanced sweep speed
- Option FS1 gives software implemented enhanced sweep speed
- Neither Option FS1 nor FS2 – no enhanced sweep speed
- Both Options FS1 and FS2 – same as Option FS2, the full FPGA enhanced sweep speed

If EMI Receiver Mode and TDS option are licensed, and the Enhanced Sweep Speed FPGA image is loaded, then you will not have the proper FPGA image loaded to fully support EMI Receiver Mode. In particular, the Frequency Scan measurement cannot use Scan Type “Time Domain Scan” (this is the normally the default Scan Type for instruments with the TDS option). Instead, EMI Receiver Mode behaves as if the TDS option is not licensed.

### **Behavior when the Time Domain Scan FPGA Image is loaded**

When the Time Domain Scan version of the FPGA image is loaded, EMI Receiver Mode works as expected with the TDS option licensed, but the Option FS2 capability

silently reverts to FS1 behavior.

### Switching Between Enhanced Sweep Speed and Time Domain Scan FPGA Images

You cannot have both full TDS and FS2 images at the same time, so to switch to the other image, you must go through the process of reloading the FPGA by choosing the desired image with the Selected FPGA control, and pressing **"Load FPGA"** on [page 417](#), or issuing the "Load FPGA" SCPI command below with the proper parameter.

### Incorrect FPGA Configuration

If EMI Receiver Mode, Option TDS, or Option FS2 license is removed while the FPGA image for that license is loaded, the instrument ends up in an incorrect configuration, since the loaded FPGA image version has support for unlicensed functionality that is not accessible and does not support the currently licensed functionality. It will still function, but when the instrument recognizes this situation at startup, it automatically displays the **FPGA Configuration** dialog. The only selections available will be the licensed ones, but you can choose to dismiss the dialog and continue with the current FPGA image version if you do not want to take the time to load the correct FPGA image. The dialog will continue to be presented at each startup until the correct FPGA image is loaded.

### FPGA Updates When Firmware Installs

The FPGA image and X-Series firmware are tightly coupled, so whenever the firmware is updated, the FPGA image is also checked and updated if needed. The rules for choosing between Time Domain Scan and Enhanced Sweep Speed versions of the FPGA image are:

1. Always use Time Domain Scan FPGA image for MXE
2. If neither EMC Mode nor Option TDS nor Option FS2 are licensed, the Enhanced Sweep Speed FPGA image is loaded
3. If EMC Mode and Option TDS are licensed and Option FS2 is not licensed, the Time Domain Scan FPGA image is loaded
4. If EMC Mode and Option TDS are not licensed, and Option FS2 is licensed, the Enhanced Sweep Speed FPGA image is loaded
5. If all are licensed
  - a. If **"FPGA Load Preference"** on [page 416](#) is **Time Domain Scan**, the Time Domain Scan FPGA image is loaded

- b. If **FPGA Load Preference** is **Enhanced Sweep Speed**, the Enhanced Sweep Speed FPGA image is loaded
- c. If **FPGA Load Preference** is **Prompt at Startup**:
  - a. If the last FPGA Configuration Load was Time Domain Scan, the Time Domain Scan FPGA image is loaded
  - b. If the last FPGA Configuration Load was Enhanced Sweep Speed, the Enhanced Sweep Speed FPGA image is loaded
  - c. If no FPGA has been explicitly loaded, the Time Domain Scan FPGA image is loaded

4.4.3.1 FPGA Load Preference

Select either image from the radio buttons at the top of the dialog:

| Option               | SCPI   | Description                                                                                                                                                                   |
|----------------------|--------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Time Domain Scan     | TDS    | Load the Time Domain Scan version of the FPGA image                                                                                                                           |
| Enhanced Sweep Speed | FS2    | Load the Enhanced Sweep Speed version of the FPGA image                                                                                                                       |
| Prompt at Startup    | PROMpt | Prompt at each startup, displaying the <b>FPGA Configuration</b> dialog. You can choose to continue with the currently loaded FPGA image version, or load a different version |

If you select the image that is already loaded, you will not be prompted again. If you select a different one, the Selected FPGA control changes to that one and you must then press **"Load FPGA"** on page 417 to load the other image.

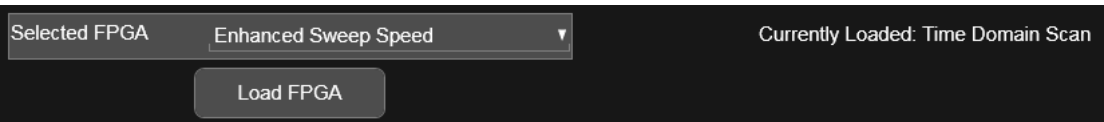
When installing new firmware, the **FPGA Load Preference** setting is used to load the preferred FPGA image version if more than one version is available. Selecting **Prompt at Startup** causes you to be prompted at each startup to select the desired version of the FPGA image.

|                |                                                                                                                                                                                                                                                                                        |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | :SYSTem:PON:FPGA:PREFence TDS   FS2   PROMpt                                                                                                                                                                                                                                           |
| Example        | :SYST:PON:FPGA:PREF TDS<br>:SYST:PON:FPGA:PREF?                                                                                                                                                                                                                                        |
| Notes          | This SCPI is always available, but if the hardware does not support multiple FPGA image choices, the returned value is always:<br>NA = Not available for this hardware<br>Also, when not supported, any attempt to change away from NA generates error -224, "Illegal parameter value" |
| Dependencies   | Dialogs and menus available only when EMC Mode, Option TDS and Option FS2 are all licensed                                                                                                                                                                                             |

|        |                                                                                                                                                   |
|--------|---------------------------------------------------------------------------------------------------------------------------------------------------|
| Preset | <b>PROMpt</b><br>Not affected by <b>Mode Preset</b> but set to <b>PROMpt</b> by <b>Restore Defaults &gt; "All"</b> on page 427 or <b>Power On</b> |
|--------|---------------------------------------------------------------------------------------------------------------------------------------------------|

4.4.3.2 Load FPGA

Depending on the **"FPGA Load Preference"** on page 416 selection, there may be a mismatch between the desired FPGA image, and the one that is currently loaded. In that case the **Load FPGA** control at the bottom of the dialog is not grayed-out, and you must press it to actually load the desired FPGA image. The image that is currently loaded is shown on the right:



If you have a mismatch, but do not actually load the other image, the **FPGA Load Preference** is remembered, but the image you had before remains until you return to this dialog and press **Load FPGA**, or until the next time the instrument firmware is updated.

If you press **Load FPGA**, the X-series software exits, the FPGA update program runs, and the instrument reboots. After rebooting, the new image will be loaded in the FPGA.

**NOTE** This can take 15 minutes or more.

**CAUTION** If power is lost during the FPGA load process, the FPGA can become corrupted, in which case the only solution is to return it to Keysight for servicing.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <b>:SYSTem:PON:FPGA:LOAD TDS   FS2</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Example        | <b>:SYST:PON:FPGA:LOAD TDS</b><br>For options, see Dependencies row below<br><b>:SYST:PON:FPGA:LOAD?</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Notes          | If the specified FPGA image version is the one already loaded, then the command does nothing. If the FPGA image needs to change, the analyzer software exits (terminating the SCPI session), and the FPGA update utility is launched. Once the FPGA has updated, the instrument will reboot<br>This SCPI is always available, but if the hardware does not support multiple FPGA image choices, the value returned is always:<br><b>NA</b> = Not available for this hardware<br>Also, when not supported, any attempt to change away from <b>NA</b> generates error -224, "Illegal parameter value" |
| Dependencies   | Available only when there are multiple versions of the FPGA image that could be loaded                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |

---

|        |                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|--------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|        | <p>Selection limited to licensed features:</p> <ul style="list-style-type: none"><li>- <b>TDS</b> selection requires EMC Mode and Option TDS</li><li>- <b>FS2</b> requires Option FS2</li></ul> <p>The UI is blanked when there is only one licensed selection, and that selection is already loaded. Sending the SCPI for an unlicensed selection results in error:<br/>-224, "Illegal parameter value; &lt;option&gt; is not licensed"</p> |
| Preset | None. Not affected by <b>Mode Preset</b> nor any <b>"Restore Defaults" on page 424</b>                                                                                                                                                                                                                                                                                                                                                       |

---

#### 4.4.4 Restore Power On Defaults

This selection causes the **Power On** settings to be reset to their default values.

When this button is pressed, a message appears saying:

*This will reset Power On State and Power On Application to their default state.*

*It will not affect Alignment data or settings.*

*This action cannot be undone. Do you want to proceed?*

The message provides **OK** and **Cancel** buttons for you to confirm or cancel the operation.

---

|         |                            |
|---------|----------------------------|
| Example | <code>:SYST:DEF PON</code> |
|---------|----------------------------|

---

#### 4.4.5 Configure Applications – Desktop application

The **Configure Applications** utility runs from the instrument's desktop. You must close the Instrument Application before running **Configure Applications**.

This utility can be used to:

- select applications (Modes) for preload
- determine how many Modes can fit in memory at one time
- specify the order of the Modes in the Mode menu.

The utility consists of a window with instructions, a set of **Select Application** checkboxes, a "fuel bar" style memory gauge, and keys that help you set up your configuration.

---

**NOTE**

In products that run multiple instances of the X-Series Application, the same **Configure Applications** utility is shared between all the instances.

---

For more details, see the following topics:

- "Preloading Applications" on page 419
- "Access to Configure Applications utility" on page 419
- "Virtual memory usage" on page 420

---

Example

Display the Config Applications screen:

`:SYST:SHOW CAPP`

### Preloading Applications

During runtime, if a Mode that is not preloaded is selected using the **Mode** menu or by sending SCPI commands, there will be a pause while the Application is loaded. During this pause, a message that says "**Loading application, please wait ...**" is displayed. Once loaded, the application stays loaded, so the next time you select it during a session, there is no delay.

Preloading lets you "preload" at startup, to eliminate the runtime delay. Preloading an application causes it to be loaded into the instrument's memory when the analyzer program starts up. If you do this, the delay will increase the time it takes to start up the analyzer program, but this may be preferable to having to wait the first time you select an application. Note that, once an application is loaded into memory, it cannot be unloaded without exiting and restarting the analyzer program.

Note that there are more applications available for X-Series than can fit into Windows Virtual Memory. By allowing you to choose which licensed applications to load at startup, the **Configure Applications** utility allows you to make optimal use of the instrument memory.

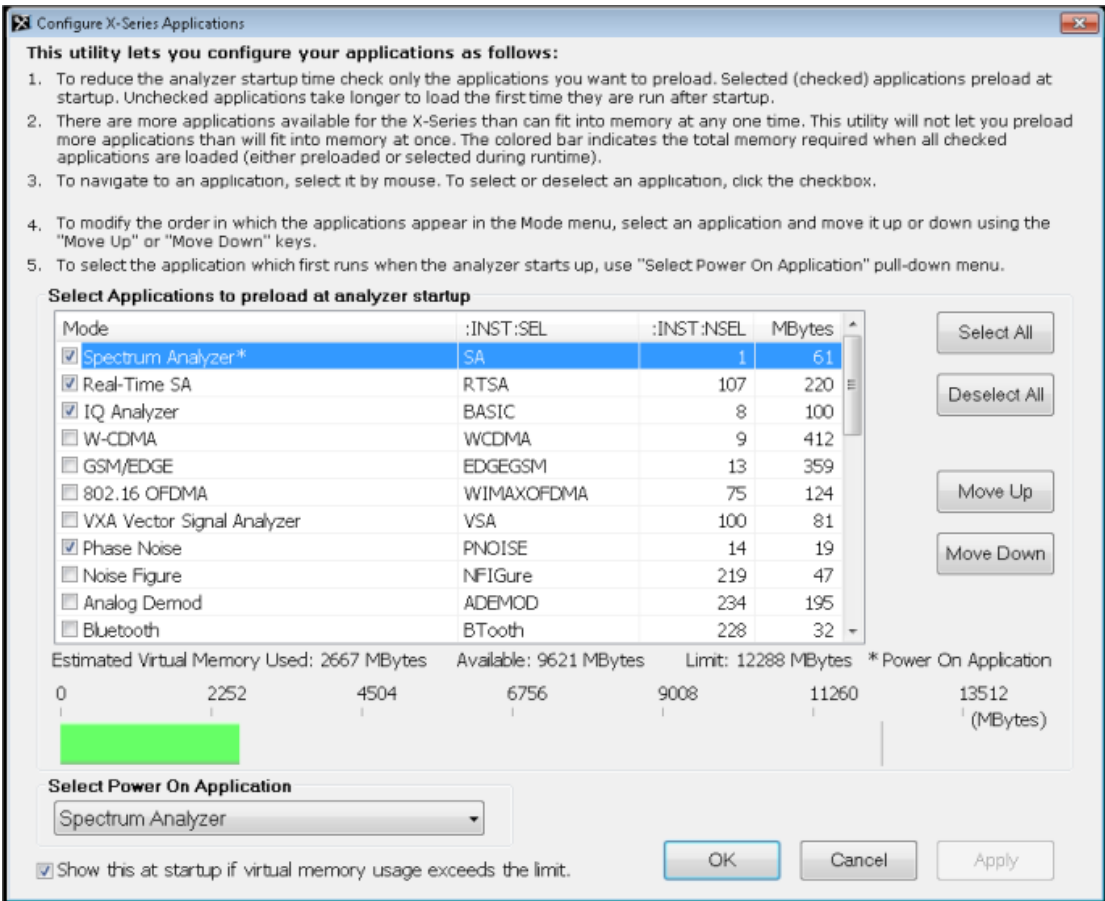
### Access to Configure Applications utility

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

At any time, you can manually start the **Configure Applications** utility by closing the analyzer application and double-tapping the **Configure Applications** icon on the desktop.

The utility's main dialog looks like this:

4 System  
4.4 Power On



Instructions are provided below and in the utility. Use the utility to find a configuration that works best for you, and then restart the analyzer program.

- Select AllMarks all applications in the selection list. This allows you to enable all applications licensed on the instrument for pre-loading, or is a convenience for selecting all applications in one operation and then letting you deselect individual applications
- Deselect AllClears the marks from all applications in the selection list, except the Power On application. The Power On application cannot be eliminated from the pre-load list
- Move UpThe application list is the order that applications appear in the Mode Menu. These keys let you shift the selected application up or down in the list, thus moving the selected application earlier or later in the Mode Menu
- Move Down
- Select Power On ApplicationThis is the same as the "Power On Application" selection on the Power On page of the System Settings dialog

Virtual memory usage

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



two purposes:

1. It will not let you preload more applications than will fit into memory at once
2. You can determine how many of your favorite applications can reside in memory at one time

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

Here is what the fuel bar colors mean:

- RED: the applications you have selected cannot all fit into the instrument's memory. You must deselect applications until the fuel bar turns yellow
- YELLOW: the applications you have selected can all fit into the instrument's memory, but there is less than 10% of the memory left, probably not enough to load any other applications, either via preload or by selecting a Mode while the instrument is running
- GREEN: The indicator is green when <90% of the memory limit is consumed. This means the applications you have selected can all fit into the instrument's memory with room to spare. You will be able to load one or more other applications without running out of memory

If Sequence Analyzer is selected to be preloaded, all apps that are part of the Sequencer Mode (GSM/EDGE, WCDMA, CDMA2K and 1xEVDO) are preloaded (if licensed).

#### 4.4.6 Configure Applications - Instrument boot-up

When the Instrument Application starts, a dialog box similar to the one you see when you run **Configure Applications** is displayed, allowing you to choose which licensed applications are to be loaded. This dialog is only displayed if the memory required to pre-load all the licensed applications exceeds the virtual memory available.

#### 4.4.7 Configure Applications - Remote Commands

The following topics provide details on using remote commands to configure the list of applications you want to load into the instrument memory, or query the virtual

memory utilization for your applications.

- "Configuration list (Remote Command Only)" on page 422
- "Configuration Memory Available (Remote Query Only)" on page 422
- "Configuration Memory Total (Remote Query Only)" on page 422
- "Configuration Memory Used (Remote Query Only)" on page 423
- "Configuration Application Memory (Remote Query Only)" on page 423

#### 4.4.7.1 Configuration list (Remote Command Only)

Used to set or query the list of applications to be loaded in-memory.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SYSTem:PON:APPLication:LLISt &lt;string of INSTRument:SElect names&gt;</code><br><code>:SYSTem:PON:APPLication:LLISt?</code>                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Example        | <code>:SYST:PON:APPL:LLIS "SA,BASIC,WCDMA"</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Notes          | <p><code>&lt;string of INSTRument:SElect names&gt;</code> contains items that are valid options for the <code>:INSTRument:SElect</code> command</p> <p>The order of the <code>&lt;INSTRument:SElect names&gt;</code> specifies the order in which the applications are loaded into memory, and the order that they appear in the <b>Mode</b> menu</p> <p><b>Error message -225 "Out of Memory"</b> is reported when more applications are listed than can reside in virtual memory. When this occurs, the existing applications load list is unchanged</p> |
| Preset         | Not affected by Preset                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| State Saved    | Not saved in instrument state                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |

#### 4.4.7.2 Configuration Memory Available (Remote Query Only)

Returns the amount of Virtual Memory remaining.

|                |                                                           |
|----------------|-----------------------------------------------------------|
| Remote Command | <code>:SYSTem:PON:APPLication:VMEMory[:AVAilable]?</code> |
| Example        | <code>:SYST:PON:APPL:VMEM?</code>                         |
| Preset         | Not affected by Preset                                    |

#### 4.4.7.3 Configuration Memory Total (Remote Query Only)

Returns the limit of Virtual Memory allowed for applications.

|                |                                                     |
|----------------|-----------------------------------------------------|
| Remote Command | <code>:SYSTem:PON:APPLication:VMEMory:TOTal?</code> |
|----------------|-----------------------------------------------------|

|         |                                       |
|---------|---------------------------------------|
| Example | <code>:SYST:PON:APPL:VMEM:TOT?</code> |
| Preset  | Not affected by Preset                |

#### 4.4.7.4 Configuration Memory Used (Remote Query Only)

Returns the amount of Virtual Memory used by all measurement applications.

|                |                                                    |
|----------------|----------------------------------------------------|
| Remote Command | <code>:SYSTem:PON:APPLication:VMEMory:USED?</code> |
| Example        | <code>:SYST:PON:APPL:VMEM:USED?</code>             |
| Preset         | Not affected by Preset                             |

#### 4.4.7.5 Configuration Application Memory (Remote Query Only)

Returns the amount of Virtual Memory a particular application consumes.

|                |                                                                                                                                                                                        |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SYSTem:PON:APPLication:VMEMory:USED:NAME? &lt;INSTRument:SElect name&gt;</code>                                                                                                 |
| Example        | <code>:SYST:PON:APPL:VMEM:USED:NAME? CDMA2K</code>                                                                                                                                     |
| Notes          | <code>&lt;INSTRument:SElect name&gt;</code> is an item from the same set used by the <code>:INSTru-ment:SElect</code> command<br>If the name provided is invalid, 0 (zero) is returned |
| Preset         | Not affected by Preset                                                                                                                                                                 |

## 4.5 Restore Defaults

Provides initialization of system setting groups, including the option to set the entire instrument back to a factory default state.

NOTE

In products that run multiple instances of the X-Series Application, all instances have the same factory default states for **Restore Defaults**.

|                |                                                                                  |
|----------------|----------------------------------------------------------------------------------|
| Remote Command | :SYSTem:DEFault [ALL]   ALIGn   INPut   MISC   MODes   PON   UINTerface   SCReen |
| Example        | :SYST:DEF                                                                        |
| State Saved    | No                                                                               |

### 4.5.1 Input/Output

**Input/Output Preset** resets the group of settings and data associated with the **Input/Output** front-panel key to their default values. These settings are not affected by a **Mode Preset** because they are associated with connections to the instrument, which you will probably not want to reset every time you press **Mode Preset**.

By using **Input/Output Preset** and **"Restore Mode Defaults"** on page 550, a full preset of the current mode will be performed, with the caveat that since **Input/Output Preset** is a global function, it will affect *all* Modes.

This is the same as the **Input/Output Preset** button in the **Preset** dropdown and the **Input/Output** menu.

When **Input/Output** is selected, a message appears saying:

This will reset all of the Input/Output variables to their default state, including which input is selected, all Amplitude Correction settings and data, all External Mixing settings, all Frequency Reference settings and all Output settings

It will not affect Alignment data or settings

This action cannot be undone. Do you want to proceed?

The dialog includes **OK** and **Cancel** controls, for you to confirm or cancel the operation.

|         |               |
|---------|---------------|
| Example | :SYST:DEF INP |
|---------|---------------|

## 4.5.2 I/O Config

Causes the group of settings associated with the **I/O Config** menu to be reset to their default values. This also happens on **Restore Misc Defaults**, which has a SCPI command, although **I/O Config** does not.

When **I/O Config** is selected, a message appears saying:

This will reset all of the I/O Config variables to their default state, including the GPIB address and SCPI LAN settings

It will not affect Alignment data or settings

This action cannot be undone. Do you want to proceed?

The dialog includes **OK** and **Cancel** controls, for you to affirm or cancel the operation.

## 4.5.3 User Interface

Causes the group of settings associated with the **User Interface** menu to be reset to their default values. This also happens on a **Restore Misc Defaults**.

When **User Interface** is selected, a message appears saying:

This will reset all of the User Interface variables to their default state, including the menu panel location, display theme, and language

It will not affect Alignment data or settings

This action cannot be undone. Do you want to proceed?

The dialog includes **OK** and **Cancel** controls, for you to affirm or cancel the operation.

---

|         |                |
|---------|----------------|
| Example | :SYST:DEF UINT |
|---------|----------------|

## 4.5.4 Power On

Causes the **Power On** settings to be reset to their default values.

The Power On settings are **Power On State** and **Power On Application**.

When **Power On** is selected, a message appears saying:

This will reset Power On State and Power On Application to their default state

It will not affect Alignment data or settings

This action cannot be undone. Do you want to proceed?

The dialog includes **OK** and **Cancel** controls, for you to affirm or cancel the operation.

---

Example      `:SYST:DEF PON`

### 4.5.5 Alignments

Causes the **Alignments** system settings to be reset to their default values. This does not affect any Alignment data stored in the system.

After performing this function, it may impact the auto-alignment time of the instrument until a new alignment baseline has been established.

When **Alignments** is selected, a message appears saying:

*This will reset all of the settings for the Alignment system to their default values*

*No alignment data will be erased*

*This action cannot be undone. Do you want to proceed?*

The dialog includes **OK** and **Cancel** controls, for you to affirm or cancel the operation.

---

Example      `:SYST:DEF ALIG`

### 4.5.6 Misc

Causes miscellaneous system settings to be reset to their default values.

**CAUTION** This function resets the GPIB address to 18.

---

When **Misc** is selected, a message appears saying:

*This will reset miscellaneous system settings to their default values. This includes settings for I/O Config (GPIB and SCPI LAN), the User Interface, the Save/Recall system, and the Preset type*

*It will not affect Alignment data or settings*

*This action cannot be undone. Do you want to proceed?*

The dialog includes **OK** and **Cancel** controls, for you to affirm or cancel the operation.

This Miscellaneous group contains settings that are *not* part of the other Restore Defaults groups. These include:

- All settings on the **I/O Config** page of the **System Settings** dialog
- All settings in the following table:

| Miscellaneous Setting | Default Value  |
|-----------------------|----------------|
| The SYST:PRES:TYPE    | MODE           |
| Auto File Name Number | 000            |
| Save Type             | State          |
| State Save To         | Register 1     |
| Screen Save To        | SCREEN000.png  |
| Save/Recall Shortcuts | Deleted        |
| Display Theme         | Filled         |
| Backlight             | ON             |
| System Annotation     | Local Settings |
| Language              | English        |
| DISP:ENABLE           | ON             |
| Full Screen           | Off            |

Example `:SYST:DEF MISC`

## 4.5.7 All

Comprehensively resets **All** instrument settings to their factory default values.

Resets all **System Settings** groups, performs "[Restore Mode Defaults](#)" on page 550 for all Modes in the instrument, and switches back to the power-on mode. Does not affect the User Preset file, or any user saved files.

When **All** is selected, a message appears:

This will reset all of the settings in the instrument to their factory default values, including the state of all Modes and Screens, the GPIB settings, the Alignment settings, and the Power On Mode

It will not affect Alignment data or settings

This action cannot be undone. We recommend canceling this operation and restoring settings individually (I/O Config, User Interface, Alignments, etc.) instead

Do you want to proceed?

The dialog includes **OK** and **Cancel** controls, for you to confirm or cancel the operation.

### NOTE

If you are using a Keysight USB External Mixer, then you will need to perform **Refresh USB Mixer Connection** (SCPI command `:MIX:BAND USB`) after **Restore Defaults > All**.

|                              |                                                                                                                                                                                              |
|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Example                      | :SYST:DEF ALL                                                                                                                                                                                |
| Couplings                    | <b>All</b> causes the currently running measurement to be aborted, and sets all modes to a consistent state, so it is unnecessary to couple any settings<br><br>Backwards Compatibility SCPI |
| Notes                        | :SYST:PRES:PERS is the same as :SYST:DEF ALL                                                                                                                                                 |
| Backwards Compatibility SCPI | :SYSTem:PRESet:PERSiStent                                                                                                                                                                    |



## 4.6 Alignments

Accesses the alignment system of the instrument. You can control the automatic alignments, view alignment statistics and manually perform alignments.

The current setting of the alignment system is displayed in the Meas Bar along the top of the display. For conditions that may cause specifications to be impacted, this annotation will be in amber.

### 4.6.1 Auto Align

Lets you configure the automatic background alignments and the alerts from the automatic alignment system.

|              |                                              |
|--------------|----------------------------------------------|
| Dependencies | Does not appear in VXT or M9410E/11E/15E/16E |
|--------------|----------------------------------------------|

#### 4.6.1.1 Auto Align

Configures the method the automatic background alignment will use when it runs.

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

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

|                |                                                                                                                                                                                                                |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALibration:AUTO ON   LIGHT   PARTial   OFF</code><br>For details of each option, see <a href="#">"Auto Align Options" on page 430</a><br><code>:CALibration:AUTO?</code>                               |
| Example        | <code>:CAL:AUTO ON</code>                                                                                                                                                                                      |
| Notes          | While Auto Align is executing, bit 0 of Status Operation register is set                                                                                                                                       |
| Couplings      | Auto Align is set to Off if Restore Align Data is invoked                                                                                                                                                      |
| Preset         | This is unaffected by <b>Preset</b> but is set to <b>ON</b> by <b>Restore Defaults</b> > <a href="#">"Alignments" on page 426</a>                                                                              |
| State Saved    | No                                                                                                                                                                                                             |
| Annotation     | In the Meas Bar: <ul style="list-style-type: none"> <li>– Normal with "All But RF" off: Auto (white)</li> <li>– Normal with "All But RF" on: Auto/No RF (amber)</li> <li>– Partial: Partial (amber)</li> </ul> |

|                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                              | – Off: Off (amber)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Status Bits/OPC dependencies | When <b>Auto Align</b> is executing, Bit 0 in the Status Operational register is set<br>An interfering signal at the RF Input may prevent automatic alignment of the RF subsystem. If this occurs, the Error Condition message “Align RF skipped” is reported, the Status Questionable Calibration bit 11 is set, and the alignment proceeds. When a subsequent alignment of the RF subsystem succeeds, either by the next cycle of automatic alignment or from an Align Now, RF, the Error Condition and Status Questionable Calibration bit 11 are cleared |
| Backwards Compatibility SCPI | :CALibration:AUTO ALERT<br>Parameter <b>ALERT</b> is for backwards compatibility only, and is mapped to <b>PARTial</b>                                                                                                                                                                                                                                                                                                                                                                                                                                       |

Auto Align Options

The available settings for Auto Align are as follows:

Normal

SCPI example :CAL:AUTO ON

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

If the condition “Align Now All required” is set, transitioning to **Auto Align, Normal** performs the required alignments, clears the “Align Now All required” condition, then continues with further alignments as required to maintain the instrument adequately aligned for warranted operation.

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

When **Auto Align, Normal** is selected, the Meas Bar indicates Align: Auto (in white) or Align: Auto/No RF (in amber). The amber color reminds you that you are responsible for maintaining the RF alignment of the instrument.

Alignment processing because of the transition to **Normal** is executed sequentially. Thus, \*OPC? or \*WAI following :CAL:AUTO ON will return when the alignment processing is complete.

Light

SCPI example :CAL:AUTO LIGH

**Auto Align, Light** turns on the automatic alignment of all measurement systems. The **Auto Align, Light** selection allows more drift in amplitude accuracy to allow much less frequent measurement interruptions to perform alignments. The temperature changes required to trigger each alignment are increased by a factor of three. Alignments also expire from time as well as temperature. In a stable thermal

environment, the alignments occur one-ninth as often as in Normal. With these less frequent alignments, all accuracy specifications (those expressed with  $\pm x$  dB tolerances) change by nominally a factor of 1.4.

If the condition “Align Now, All required” is set, transitioning to **Auto Align, Light** performs the required alignments, clears the “Align Now, All required” condition, and continues with further alignments as required to maintain the instrument adequately aligned for warranted operation.

Alignment processing because of the transition to **Light** is executed sequentially. Thus, **\*OPC?** or **\*WAI** following **:CAL:AUTO LIGHT** will return when the alignment processing is complete.

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

When **Auto Align, Light** is selected, the Settings Panel indicates Align: Light.

### Partial

SCPI example **:CAL:AUTO PART**

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

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

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

When **Auto Align, Partial** is selected, the Settings Panel indicates Align: Partial in an amber color. The amber color reminds you that you are responsible for maintaining the warranted operation of the instrument.

### Off

SCPI example **:CAL:AUTO OFF**

**Auto Align, Off** disables automatic alignment and the maintenance of warranted operation, for the benefit of maximum measurement throughput. With **Auto Align**

set to **Off**, you are now responsible for maintaining warranted operation by updating the alignments when they expire. The Auto Align, Alert mechanism will notify you when alignments have expired. One solution to expired alignments is to perform the **Align All, Now** operation. Another is to return the **Auto Align** selection to **Normal**.

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

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

When **Auto AlignOff** is selected, the Settings Panel indicates Align: Off in an amber color. The amber color reminds you that you are responsible for maintaining the warranted operation of the instrument.

4.6.1.2 All but RF

Configures automatic alignment to include or exclude the RF subsystem. (Eliminating the automatic alignment of the RF subsystem prevents the input impedance from changing. The normal input impedance of 50 ohms can change to an open circuit when alignments are being used. Some devices under test do not behave acceptably under such circumstances, for example by showing instability.)

When **All but RF** is **ON**, the operator is responsible for performing an **Align Now RF** when RF-related alignments expire. The Auto Align, Alert mechanism will notify you to perform an **Align Now All** when the combination of time and temperature variation is exceeded.

When **All But RF** is **ON**, the Settings Panel indicates Align: Auto/No RF (in amber). The amber color reminds you that you are responsible for maintaining the RF alignment of the instrument.

|                |                                                                                                         |
|----------------|---------------------------------------------------------------------------------------------------------|
| Remote Command | :CALibration:AUTO:MODE ALL   NRF<br>:CALibration:AUTO:MODE?                                             |
| Example        | :CAL:AUTO:MODE NRF                                                                                      |
| Preset         | Unaffected by <b>Preset</b> but set to <b>ALL</b> by <b>Restore Defaults</b> > "Alignments" on page 426 |
| State Saved    | No                                                                                                      |

4.6.1.3 Alert

The instrument signals an **Alert** when conditions exist such that you will need to perform a full alignment (for example, **Align Now All**). Alert can be configured in one

of four settings:

| Setting                  | Option                    |
|--------------------------|---------------------------|
| Time & Temperature       | <code>TTEmperature</code> |
| Time & Temperature Light | <code>LIGHT</code>        |
| 7 days                   | <code>WEEK</code>         |
| None                     | <code>NONE</code>         |

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

A confirmation is required when a selection other than `TTEmperature` is chosen. This prevents accidental deactivation of alerts. When setting **Alert** from the front panel to any value but `TTEmperature`, confirmation is required to transition into this setting of Alert. The confirmation dialog is:

*This will suppress alerts from the Alignment system, which would notify you when an Alignment is required to maintain warranted operation. Without the alerts you will be responsible for performing an Align Now All at appropriate intervals to maintain warranted operation*

*Do you want to proceed?*

The dialog includes **OK** and **Cancel** controls, for you to affirm or cancel the operation.

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

For more information see ["Time & Temperature" on page 433](#)

|                              |                                                                                                                                                                         |
|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command               | <code>:CALibration:AUTO:ALERT TTEmperature   LIGHT   DAY   WEEK   NONE</code><br><code>:CALibration:AUTO:ALERT?</code>                                                  |
| Example                      | <code>:CAL:AUTO:ALER TTEM</code>                                                                                                                                        |
| Preset                       | Unaffected by <b>Preset</b> but set to <code>TTEmperature</code> by <b>Restore Alignment Defaults</b>                                                                   |
| State Saved                  | No                                                                                                                                                                      |
| Status Bits/OPC dependencies | When an alert is generated, the condition message "Align Now All required" appears in the Status Bar, and bit 14 is set in the Status Questionable Calibration register |

The settings for **Alert** are detailed below.

## Time & Temperature

SCPI Example `CAL:AUTO:ALER TTEM`

The instrument signals an alert when alignments expire due to the combination of the passage of time and changes in temperature. The alert is the Error Condition message "Align Now All required". If this choice for Alert is selected, the absence of an alert means that the instrument alignment is sufficiently up-to-date to maintain warranted accuracy.

## Time & Temperature Light

SCPI Example

`CAL:AUTO:ALER LIGH`

This is a light version of Time & Temperature which means for this setting the time/temperature changes required to trigger an alert are increased by a factor of three and the time alerts will occur one-ninth as often as for Time and Temperature.

### 24 hours

SCPI Example

`CAL:AUTO:ALER DAY`

The instrument signals an alert after a time span of 24 hours since the last successful full alignment (for example, **Align Now All** or completion of a full **Auto Align**). You may want to select this option in an environment where the temperature is stable on a daily basis, at a small risk of accuracy errors in excess of the warranted specifications. The alert is the Error Condition message “Align Now All required”.

### 7 days

SCPI Example

`CAL:AUTO:ALER WEEK`

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

### None

SCPI Example

`CAL:AUTO:ALER NONE`

The instrument does not signal an alert. This is provided for rare occasions where you are making a long measurement that cannot tolerate **Auto Align** interruptions, and must have the ability to capture a screen image at the end of the measurement without an alert posted to the display. Keysight does not recommend using this selection in any other circumstances, because of the risk of accuracy performance drifting well beyond expected levels without the operator being informed.

## 4.6.2 Align Now

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

Executing immediate alignments from SCPI can be problematic due to the length of time required for the alignments to complete. Alignment commands are by their

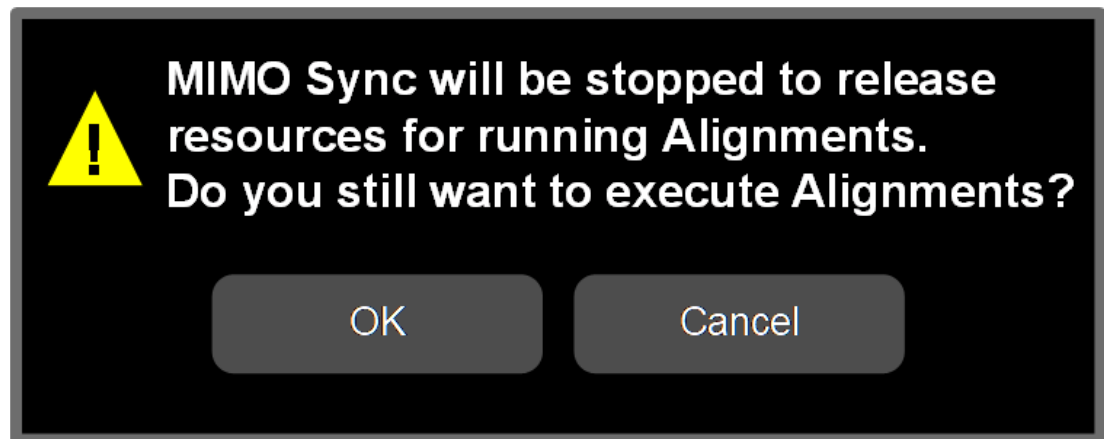
nature sequential, meaning they must complete before any other SCPI commands can be processed. In many cases the alignment itself will take longer than the typical SCPI timeout value. Furthermore, status cannot be easily queried while a sequential command is running.

For this reason, overlapped versions of the **Align Now** commands are provided. When using these No-Operation-Pending (**NPENDING**) commands, the SCPI thread will not be blocked (will be released immediately), so that you can use **:STATus:OPERation:CONDition?** to query the alignment status bit and use **:STATus:QUESTionable:CALibration:CONDition?** to check the alignment results. As an example, **:CALibration[:ALL]:NPENDING** is the overlapped replacement for **:CALibration[:ALL]**.

While the alignment is executing, the coming NOP calibration will be ignored, and **error message “Setting Conflict, Alignment is in process”** will be posted. Also, any other operations to the instrument will be pended and postponed until the alignment is completed. The operations include: Preset, Initiate a new measurement, Device clear and so on. Accordingly, changing parameters will not take effect although the UI is updated immediately. To avoid unexpected timeouts and results, these operations are not recommended during any such alignments.

**NOTE**

The Alignments are not performed if the MIMO Sync is running, because the MIMO and Alignments require the same hardware resource. If the instrument is in MIMO Sync and you press a button to execute Alignments, a pop-up window appears as below. Click **OK** to stop MIMO and execute Alignments.



If the instrument is in MIMO sync, and you send a SCPI command to run Alignments, the align process is not executed, and a warning is generated. To execute Alignments, you must first stop MIMO via SCPI (or manually).

### Controls in this Dialog

The selection and order of controls displayed in this dialog depends on the instrument type and options. Select the control of interest from the following list:

- "Align Now All" on page 436
- "Align Now All but RF" on page 439
- "Align Now RF" on page 440
- "Align Now Expired" on page 441
- "Align Now Preselector" on page 442
- "Align Now All but RF Preselector" on page 443
- "Align Now RF Presel Only (20 Hz to 3.6 GHz)" on page 443
- "Align Now External Mixer" on page 444
- "Align Source" on page 445
- "Align Receiver" on page 446
- "Align Fast" on page 447
- "Align LO Leakage" on page 447
- "Align IF Cable" on page 447
- "Align RRH Amplitude" on page 448
- "Align LO Clock" on page 449
- "Align VXT Transceiver" on page 449
- "Align External Mixer Path" on page 454
- "Align Low Band" on page 455
- "Align High Band" on page 456

#### 4.6.2.1 Align Now All

In PXE, the key label is **Align Now All (plus RF Presel 20 Hz – 3.6 GHz)**



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

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

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

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

If the Align RF subsystem succeeded in aligning (no interfering signal present), the elapsed time counter begins for Last Align Now, RF Time, and the temperature is captured for the Last Align Now, RF Temperature. In addition, the Error Conditions “Align RF skipped” are cleared, the Error Condition “Align Now, RF required” is cleared, and bits 11 and 12 are cleared in the Status Questionable Calibration register.

**Align Now All** can be interrupted, by pressing the **Cancel (ESC)** front-panel key, or remotely with Device Clear followed by the **:ABORT** SCPI command. When this occurs, the Error Condition message “Align Now All required” is generated, and bit 14 is set in the Status Questionable Condition register. This is because new alignment data may be employed for an individual subsystem, but not a cohesive set of data for all subsystems. However, this mechanism does not apply to the M941xA based instruments or solutions. As the new alignment data is independent for all subsystems. “Align Now All required” is generated only when alignments expire due to the combination of the passage of time and changes in temperature. You can refer to the data sheet for more details.

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

|                |                                                                    |
|----------------|--------------------------------------------------------------------|
| Remote Command | <b>:CALibration[:ALL]</b><br><b>:CALibration[:ALL]?</b>            |
| Example        | <b>:CAL</b>                                                        |
| Notes          | <b>:CALibration[:ALL]?</b> returns 0 if successful, or 1 if failed |

|                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                              | <p><b>:CALibration[:ALL]? is the same as *CAL?</b></p> <p>While <b>Align Now All</b> is performing the alignment, the Calibrating bit (Bit 0 in the Status Operation register) is set. Completion, or termination, will clear Bit 0 in the Status Operation register</p> <p>This command is sequential; it must complete before further SCPI commands are processed. Interrupting the alignment from remote is accomplished by invoking Device Clear followed by the <b>:ABORT</b> command</p> <p>Successful completion will clear bit 14 in the Status Questionable Calibration register</p> <p>An interfering user signal is not grounds for failure of <b>Align Now All</b>. However, Bits 11 and 12 are set in the Status Questionable Calibration register to indicate Align Now, RF is required</p> <p>An interfering user-supplied signal will result in the instrument requiring an Align Now, RF with the interfering signal removed</p> |
| Couplings                    | <p>Initializes the time for the Last Align Now All Time</p> <p>Records the temperature for the Last Align Now All Temperature</p> <p>If Align RF component succeeded, initializes the time for the Last Align Now, RF Time</p> <p>If Align RF component succeeded, records the temperature for the Last Align Now, RF Temperature</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Status Bits/OPC dependencies | <p>Bits 11, 12, or 14 may be set in the Status Questionable Calibration register</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| IEEE Command                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Remote Command               | <b>*CAL</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Example                      | <b>*CAL?</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Notes                        | <p>Returns 0 if successful, or 1 if failed</p> <p><b>:CALibration[:ALL]? is exactly the same as *CAL?</b>, including all conditions, status register bits, and couplings</p> <p>See additional remarks described with <b>:CALibration[:ALL]?</b></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Overlapped Command           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Remote Command               | <b>:CALibration[:ALL]:NPENDING</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Example                      | <b>:CAL:NPEN</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Notes                        | <p><b>:CALibration[:ALL]:NPENDING</b> is the same as <b>:CALibration[:ALL]</b>, including all conditions, status register bits, except this SCPI command <i>does not block</i> the SCPI session, so you should use status register bits to query whether the calibration is successfully completed or not</p> <p>Typical usage is:</p> <ol style="list-style-type: none"> <li>1. <b>:CALibration:ALL:NPENDING</b> (Start a calibration)</li> <li>2. <b>:STATus:OPERation:CONDition?</b> (Check if the calibration is completed or not, If bit 0 is set, then the system is doing calibration, you should repeat this SCPI query until the bit is cleared)</li> <li>3. <b>:STATus:QUEStionable:CALibration:CONDition?</b> (Check if there are any errors/-failures in previous calibration procedure)</li> </ol>                                                                                                                                   |

### 4.6.2.2 Align Now All but RF

In PXE, the key label is **Align Now All but RF (not including RF Presel)**

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

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

The query form of the remote commands (**:CALibration:NRF?**) invokes the alignment and returns a success or failure value.

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

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

|                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command               | <b>:CALibration:NRF</b><br><b>:CALibration:NRF?</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Example                      | <b>:CAL:NRF</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Notes                        | <p>Returns 0 if successful, or 1 if failed</p> <p>While <b>Align Now All but RF</b> is performing the alignment, Bit 0 in the Status Operation register is set. Completion, or termination, will clear Bit 0 in the Status Operation register</p> <p>This command is sequential; it must complete before further SCPI commands are processed. Interrupting the alignment from remote is accomplished by invoking Device Clear followed by the <b>:ABORT</b> command</p> <p>Successful completion clears Bit 14 in the Status Questionable Calibration register and sets Bit 12 if invoked with “Align Now All required”</p> |
| Couplings                    | <p>Initializes the time for the Last Align Now All Time</p> <p>Records the temperature for the Last Align Now All Temperature</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Status Bits/OPC dependencies | Bits 12 or 14 may be set in the Status Questionable Calibration register                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |

### Overlapped Command

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALibration:NRF:NPENding</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Example        | <code>:CAL:NRF:NPEN</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Notes          | <p><code>:CALibration:NRF:NPENding</code> is the same as <code>:CALibration:NRF</code>, including all conditions, status register bits, except that this SCPI command <i>does not block</i> the SCPI session, so you should use status register bits to query whether the calibration is successfully completed or not</p> <p>Typical usage is:</p> <ol style="list-style-type: none"> <li>1. <code>:CALibration:NRF:NPENding</code> (start the All but RF calibration)</li> <li>2. <code>:STATus:OPERation:CONDition?</code> (If bit 0 is set, then the system is doing calibration, you should do re-query until this bit is cleared)</li> <li>3. <code>:STATus:QUEStionable:CALibration:CONDition?</code> (to check if there are any errors/-failures in previous calibration procedure)</li> </ol> |

#### 4.6.2.3 Align Now RF

In PXE, the key label is **Align Now RF Only**

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

This operation might be desirable if the alignments had been set to not include RF alignments, or if previous RF alignments could not complete because of interference which has since been removed.

If an interfering user signal is present at the RF Input, the alignment will terminate and generate the Error Condition message “Align RF skipped”, and Error Condition “Align Now, RF required”. In addition, bits 11 and 12 will be set in the Status Questionable Calibration register.

The query form of the remote commands (`:CALibration:RF?`) invokes the alignment of the RF subsystem and returns a success or failure value. An interfering user signal is grounds for failure.

Successful completion of **Align Now RF** begins the elapsed time counter for Last Align Now, RF Time, and capture the Last Align Now, RF Temperature.

**Align Now RF** can be interrupted, by pressing the **Cancel (ESC)** front-panel key, or remotely with Device Clear followed by the `:ABORT` SCPI command. When this occurs, the Error Condition message “Align Now, RF required” is generated, and Bit 12 is set in the Status Questionable Condition register. None of the new alignment data is used.

|        |                              |
|--------|------------------------------|
| Remote | <code>:CALibration:RF</code> |
|--------|------------------------------|

|                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Command                      | <b>:CALibration:RF?</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Example                      | <b>:CAL:RF</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Notes                        | <p>Returns 0 if successful, or 1 if failed (including interfering user signal)</p> <p>While <b>Align Now RF</b> is performing the alignment, Bit 0 in the Status Operation register is set. Completion, or termination, clears Bit 0 in the Status Operation register</p> <p>This command is sequential; it must complete before further SCPI commands are processed. Interrupting the alignment from remote is accomplished by invoking Device Clear followed by the <b>:ABORT</b> command</p> <p>Successful completion clears the Error Conditions “Align RF skipped” and the Error Conditions “Align RF failed” and “Align Now, RF required”, and clears Bits 3, 11, and 12 in the Status Questionable Calibration register</p> <p>A failure encountered during alignment generates the Error Condition message “Align RF failed” and sets Bit 3 in the Status Questionable Calibration register</p> <p>An interfering user signal will result in Bits 11 and 12 being set in the Status Questionable Calibration register, to indicate Align Now, RF is required</p> <p>An interfering user supplied signal results in the instrument requiring <b>Align Now RF</b> with the interfering signal removed</p> |
| Couplings                    | <p>Initializes the time for the Last Align Now, RF Time</p> <p>Records the temperature for the Last Align Now, RF Temperature</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Status Bits/OPC dependencies | <p>Bits 11, 12, or 14 may be set in the Status Questionable Calibration register</p> <p>Overlapped Command</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Remote Command               | <b>:CALibration:RF:NPENDING</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Example                      | <b>:CAL:RF:NPEN</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Notes                        | <p><b>:CALibration:RF:NPENDING</b> is the same as <b>:CALibration:RF</b>, including all conditions, status register bits, except that this SCPI command <i>does not block</i> the SCPI session, so you should use status register bits to query whether the calibration is successfully completed or not</p> <p>Typical usage is:</p> <ol style="list-style-type: none"> <li>1. <b>:CALibration:RF:NPENDING</b> (Start a RF calibration)</li> <li>2. <b>:STATus:OPERation:CONDition?</b> (If Bit 0 is set, then the system is doing calibration, you should do re-query until this bit is cleared)</li> <li>3. <b>:STATus:QUEStionable:CALibration:CONDition?</b> ( to check if there are any errors/-failures in previous calibration procedure)</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                    |

#### 4.6.2.4 Align Now Expired

Alignments can be Expired when **Auto Align** is **PARTial** or **OFF**.

## 4 System

### 4.6 Alignments

This control runs the alignments that have expired. This differs from performing **Align All, Now.**, which performs an alignment of all subsystems regardless of whether they are needed or not, whereas **Execute Expired Alignments** aligns only the individual subsystems that have become due.

|                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command               | <b>:CALibration:EXPIred</b><br><b>:CALibration:EXPIred?</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Example                      | <b>:CAL:EXP?</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Notes                        | <p><b>:CALibration:EXPIred?</b> returns 0 if successful, or 1 if failed</p> <p>While <b>Align Now Expired</b> is performing the alignment, the Calibrating bit (Bit 0 in the Status Operation register) is set. Completion, or termination, clears Bit 0 in the Status Operation register</p> <p>This command is sequential; that is, it must complete before further SCPI commands are processed. Interrupting the alignment from remote is accomplished by invoking Device Clear followed by <b>:ABORT</b></p> <p>Successful completion clears bit 14 in the Status Questionable Calibration register</p> <p>An interfering user signal is not grounds for failure of <b>Align Now Expired</b>. However, if RF Alignment was required, Bits 11 and 12 are set in the Status Questionable Calibration register to indicate Align Now, RF is required</p> |
| Status Bits/OPC dependencies | Bits 11, 12, or 14 may be set in the Status Questionable Calibration register                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |

#### 4.6.2.5 Align Now Preselector

Normally, Preselector Alignment runs during power up, and during the twenty minutes after power up, whenever there is a 1-degree internal temperature change.

This alignment is also run when an **"Align Now All"** on page 436 is performed. This feature is helpful during the 20-minute warm-up time to correct for preselector drift while alignments are being held off. This feature can also be used in lieu of using the Preselector Center functionality, to improve speed throughput for remote testing with minimal impact to amplitude accuracy specs. The algorithm centers the preselector at the upper and lower operating frequencies of the YTF preselector.

The **Align Now Preselector** alignment is *not* a substitute for the Characterizer Preselector Advanced Alignment, which creates the default preselector centering curves for the YTF Preselector and is typically run annually.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <b>:CALibration:PRESelector</b><br><b>:CALibration:PRESelector?</b>                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Example        | <b>:CAL:PRES</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Notes          | <p>Returns 0 if successful, or 1 if failed (including interfering user signal)</p> <p>While <b>Align Now Preselector</b> is performing the alignment, Bit 0 in the Status Operation register is set. Completion, or termination, clears Bit 0 in the Status Operation register</p> <p>This command is sequential; that is, it must complete before further SCPI commands are processed. Interrupting the alignment from remote is accomplished by invoking Device Clear followed by <b>:ABORT</b></p> |

|                              |                                                                                                                                                                                                                                                                                                                                                               |
|------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                              | Successful completion clears the Error Conditions “Align Preselector failed” and clears Bit 3 in the Status Questionable Calibration Failure (Extended) register<br>A failure encountered during alignment generates the Error Condition message “Align Preselector failed” and sets Bit 3 in the Status Questionable Calibration Failure (Extended) register |
| Status Bits/OPC dependencies | Bit 3 may be set in the Status Questionable Calibration Failure (Extended) register                                                                                                                                                                                                                                                                           |

#### 4.6.2.6 Align Now All but RF Preselector

Only available in models with the RF Preselector, such as the N9048B. It is identical to the **"Align Now All" on page 436** (plus RF Presel) function, except that the RF Preselector is only partially aligned. Only the System Gain, Mechanical attenuator and Electronic attenuator alignments on the RF Preselector path are aligned. The purpose of these alignments is to improve the RF Preselector path amplitude variation compared to the bypass path.

|                              |                                                                                              |
|------------------------------|----------------------------------------------------------------------------------------------|
| Remote Command               | <code>:CALibration:NRFPselector</code><br><code>:CALibration:NRFPselector?</code>            |
| Example                      | <code>:CAL:NRFP</code>                                                                       |
| Dependencies                 | Only appears in N9048B. Sending the SCPI command or query in other models generates an error |
| Status Bits/OPC dependencies | Bits 12 or 14 may be set in the Status Questionable Calibration register                     |

#### 4.6.2.7 Align Now RF Presel Only (20 Hz to 3.6 GHz)

Only available in models with the RF Preselector, such as the N9048B. It executes an alignment of the RF Preselector section. The receiver will stop any measurement currently underway, perform the alignment, and then restart the measurement from the beginning (similar to pressing the **Restart** key). *Only* the RF Preselector is aligned; no Align Now All function is performed first.

The query (`:CALibration:RFPSelector:ONLY?`) invokes the alignment of the RF Preselector on both Conducted and Radiated Band, and returns a success or failure value. Successful completion clears the “Align 20 Hz to 3.6 GHz required” Error Condition, and clears Bit 1 and Bit 2 in the Status Questionable Calibration Extended Needed register.

The elapsed time counter will begin for Last Align Now, Conducted Time and Last Align Now Radiated Time and the temperature is captured for Last Align Now, Conducted Temperature and Last Align Now, Radiated Temperature. The alignment can be interrupted by pressing the **Cancel (ESC)** front-panel key or remotely with Device Clear followed by the `:ABORT` SCPI command. When this occurs, the Error Condition “Align 20 Hz to 3.6 GHz required” is set because new alignment data may

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### 4.6 Alignments

be employed for an individual subsystem, but not a cohesive set of data for all subsystems.

The “Align 20 Hz to 3.6 GHz required” Error Condition will appear when this alignment has expired. The user is now responsible to perform the Align Now, 20 Hz to 3.6 GHz in order to keep the receiver in warranted operation. This alignment can only be performed by the user, as it is not part of the Auto Align process.

|                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command               | <code>:CALibration:RFPSelector:ONLY</code><br><code>:CALibration:RFPSelector:ONLY?</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Example                      | <code>:CAL:RFPS:ONLY</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Notes                        | <p>Query returns 0 if successful, or 1 if failed</p> <p>When Align 20 Hz to 3.6 GHz is performing the alignment, bit 0 in the Status Operation register is set. Completion, or termination, will clear bit 0 in the Status Operation register</p> <p>This command is sequential; it must complete before further SCPI commands are processed. Interrupting the alignment from remote is accomplished by invoking Device Clear followed by the <code>:ABORT</code> command. Successful completion clears Bits 1 and 2 in the Status Questionable Calibration Extended Needed register and Bits 0 and 1 in Status Questionable Calibration Extended Failure register</p> <p>A failure encountered during alignment sets the Error Condition “20 Hz to 3.6 GHz Alignment Failure”, sets Bits 1 and 2 in the Status Questionable Calibration Extended Needed register, and Bit 9 in Status Questionable Calibration register</p> |
| Dependencies                 | <p>Only appears in N9048B. Sending the SCPI command or query in other models generates an error</p> <p>This key is grayed-out if the instrument is displaying an “Align Now All required” message. If you press the key while it is grayed-out, you will see the informational message, “Align Now All required first”</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Couplings                    | <p>Initializes the time for the Last Align Conducted Now, Conducted Time</p> <p>Initializes the time for the Last Align Radiated Now, Radiated Time</p> <p>Records the temperature for the Last Align Conducted Now, Conducted Temperature</p> <p>Records the temperature for the Last Align Radiated Now, Radiated Temperature</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Status Bits/OPC dependencies | <p>Bit 8 or 9 may be set in the Status Questionable Calibration register</p> <p>Bit 1 and 2 may be set in the Status Questionable Calibration Extended Needed register</p> <p>Bit 0 and 1 may be set in the Status Questionable Calibration Extended Failure register</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |

#### 4.6.2.8 Align Now External Mixer

Immediately executes an alignment of the External Mixer that is plugged into the USB port. The instrument stops any measurement currently underway, performs the alignment, then restarts the measurement from the beginning (similar to pressing the **Restart** key). As this alignment calibrates the LO power to the mixer, this is considered an LO alignment; and failure is classified as an LO alignment failure.

The query (`:CALibration:EMIXer?`) invokes the alignment of the External Mixer and returns a success or failure value.



|                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command               | <code>:CALibration:EMIXer</code><br><code>:CALibration:EMIXer?</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Example                      | <code>:CAL:EMIX</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Notes                        | <p>Returns 0 if successful, or 1 if failed</p> <p>While <b>Align Now External Mixer</b> is performing the alignment, Bit 0 in the Status Operation register is set. Completion, or termination, clears Bit 0 in the Status Operation register</p> <p>This command is sequential; it must complete before further SCPI commands are processed. Interrupting the alignment from remote is accomplished by invoking Device Clear followed by the <code>:ABORt</code> command</p> <p>A failure encountered during alignment generate the Error Condition message “Align LO failed” and sets Bit 5 in the Status Questionable Calibration register. Successful completion clears the “Align LO failed” message and Bit 5 in the Status Questionable Calibration register</p> |
| Dependencies                 | This control does not appear unless option EXM is present and is grayed-out, unless a USB mixer is plugged in to the USB                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Status Bits/OPC dependencies | Bit3 may be set in the Status Questionable Calibration Extended Failure register                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |

#### 4.6.2.9 Align Source

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

The instrument stops any sequence of the source, performs the alignment, then restarts the sequence from the beginning.

Note: This alignment corrects slow-rate drift, which does not impair specifications for time periods shorter than one week. Thus, it is required to perform this alignment on a weekly basis to maintain specifications. This alignment typically takes >2 minutes to complete.

There is no alert available for the source alignment. Operators are responsible for checking temperature shift since the last **Align Now Source** to determine whether the source alignment needs to be executed.

|                    |                                                                                                                                                   |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command     | <code>:CALibration:INTernal:SOURce[:ALL]</code><br><code>:CALibration:INTernal:SOURce[:ALL]?</code>                                               |
| Example            | <code>:CAL:INT:SOUR</code>                                                                                                                        |
| Notes              | <code>:CAL:INT:SOUR?</code> Initiates an Alignment and returns 0 if successful, or 1 if failed                                                    |
| Dependencies       | Only appears in VXT models M9410A/11A                                                                                                             |
| Couplings          | <p>Initializes the time for the Last Align Source Now, All Time</p> <p>Records the temperature for the Last Align Source Now, All Temperature</p> |
| Overlapped Command |                                                                                                                                                   |

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALibration:INternal:SOURce[:ALL]:NPENding</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Example        | <code>:CAL:INT:SOUR:NPEN</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Notes          | <p><code>:CALibration:INternal:SOURce[:ALL]:NPENding</code> is the same as <code>:CALibration:INternal:SOURce[:ALL]</code>, including all conditions and status register bits, except that this SCPI command <i>does not block</i> the SCPI session, so you should use status register bits to query whether the calibration is successfully completed or not</p> <p>Typical usage is:</p> <ol style="list-style-type: none"> <li>1. <code>:CALibration:INternal:SOURce:NPENding</code> (start an internal source calibration)</li> <li>2. <code>:STATus:OPERation:CONDition?</code> (Check if the calibration is completed or not, If Bit 0 is set, then the system is doing calibration. Repeat this query until the bit is cleared)</li> <li>3. <code>:STATus:QUEStionable:CALibration:EXTEnded:FAILure:CONDition?</code> (Check if Bit 14 is set or not. If this bit is set, that means there are some errors in previous internal source calibration)</li> </ol> |
| Dependencies   | Only appears in VXT models M9410A/11A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |

#### 4.6.2.10 Align Receiver

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

##### NOTE

**This alignment corrects slow-rate drift, which does not impair specifications for time periods shorter than one week. Thus, it is required to perform this alignment on a weekly basis to maintain specifications. This alignment typically takes >2 minutes to complete.**

There is no alert available for the receiver alignment. Operators are responsible for checking temperature shift since the last Align Now, Align Receiver, to determine whether the receiver alignment needs to be executed.

|                |                                                                                                                                                       |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALibration:INternal:RECeiver[:ALL]</code><br><code>:CALibration:INternal:RECeiver[:ALL]?</code>                                               |
| Example        | <code>:CAL:INT:REC</code>                                                                                                                             |
| Notes          | The query initiates an Alignment and returns 0 if successful, or 1 if failed                                                                          |
| Dependencies   | Only appears in VXT models M9410A/11A                                                                                                                 |
| Couplings      | <p>Initializes the time for the Last Align Receiver Now, All Time</p> <p>Records the temperature for the Last Align Receiver Now, All Temperature</p> |

#### 4.6.2.11 Align Fast

Accesses fast alignment processes, which are immediate action operations and perform complete operations, running until they are complete.

Align Fast is a subset of Align All, it aligns the subsystems that are most sensitive to temperature and time and includes:

- compensating the DC offset, gain imbalance and quadrature phase imbalance of IQ Modulator and/or Demodulator
- compensating the gain offset of RF path

It is suggested to perform Fast Alignment every 8 hours or when temperature has changed more than 5°C from the previous Fast Alignment.

|                |                                                                                                 |
|----------------|-------------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALibration:INTernal:FAST[:ALL]</code><br><code>:CALibration:INTernal:FAST[:ALL]?</code> |
| Example        | <code>:CAL:INT:FAST</code>                                                                      |
| Notes          | The query initiates an Alignment and returns 0 if successful, or 1 if failed                    |
| Dependencies   | Only appears in VXT models M9410A/11A/15A/16A and S9110E                                        |

#### 4.6.2.12 Align LO Leakage

Accesses LO Leakage alignment processes, which are immediate action operations and perform complete operations, running until they are complete.

This alignment reduce the LO Leakage of the instrument.

|                |                                                                                               |
|----------------|-----------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALibration:INTernal:LOLeakage</code><br><code>:CALibration:INTernal:LOLeakage?</code> |
| Example        | <code>:CAL:INT:LOL</code>                                                                     |
| Notes          | The query iinitiates an Alignment and returns 0 if successful, or 1 if failed                 |
| Dependencies   | Only appears in VXT models M9410A/11A/15A/16A and S9110E                                      |

#### 4.6.2.13 Align IF Cable

Accesses IF Cable alignment processes, which are immediate action operations and perform complete operations, running until they are complete.

This alignment aligns the IF cabling to the remote heads.

|                |                                                                                                         |
|----------------|---------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALibration:INTernal:RRHead:IFCable</code><br><code>:CALibration:INTernal:RRHead:IFCable?</code> |
|----------------|---------------------------------------------------------------------------------------------------------|

|                    |                                                                              |
|--------------------|------------------------------------------------------------------------------|
| Example            | <code>:CAL:INT:RRH:IFC</code>                                                |
| Notes              | The query initiates an Alignment and returns 0 if successful, or 1 if failed |
| Dependencies       | Only appears in VXT based solutions with M1740A/41A/42A/49A/49B RRH          |
| Backwards          | <code>:CALibration:INTernal:IFCable</code>                                   |
| Compatibility SCPI | <code>:CALibration:INTernal:IFCable?</code>                                  |

#### 4.6.2.14 Align RRH Amplitude

This is an immediate action operation, which runs until complete.

Aligns the Amplitude of Remote Radio Head. This operation could take quite a long time to run.

##### CAUTION

For M1741A/49A/49B RRH, make sure to connect 50-ohm terminations to Head Tx/Rx 1 and 2 ports.

|                    |                                                                                                             |
|--------------------|-------------------------------------------------------------------------------------------------------------|
| Remote Command     | <code>:CALibration:INTernal:RRHead:AMPLitude</code><br><code>:CALibration:INTernal:RRHead:AMPLitude?</code> |
| Example            | <code>:CAL:INT:RRH:AMPL?</code>                                                                             |
| Notes              | The query initiates an Alignment and returns 0 if successful, or 1 if failed                                |
| Dependencies       | Only appears in VXT based solutions with M1741A/42A/49A/49B RRH                                             |
| Backwards          | <code>:CALibration:INTernal:RRHAmp</code>                                                                   |
| Compatibility SCPI | <code>:CALibration:INTernal:RRHAmp?</code>                                                                  |

#### 4.6.2.15 Align Fast RRH Amplitude

This is an immediate action operation, which runs until complete.

Compare to Align RRH Amplitude, it aligns the amplitude of Remote Radio Head with a wider frequency interval. This operation takes about one minute.

|                |                                                                                                                       |
|----------------|-----------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALibration:INTernal:RRHead:AMPLitude:FAST</code><br><code>:CALibration:INTernal:RRHead:AMPLitude:FAST?</code> |
| Example        | <code>:CAL:INT:RRH:AMPL:FAST?</code>                                                                                  |
| Notes          | The query initiates an alignment and returns 0 if successful, or 1 if failed                                          |
| Dependencies   | Only appears in VXT based solutions with M1742A RRH                                                                   |

#### 4.6.2.16 Align RRH LO Power

This is an immediate action operation, which runs until complete.

Aligns the LO Power of Remote Radio Head.

|                |                                                                                                         |
|----------------|---------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALibration:INTernal:RRHead:LOPower</code><br><code>:CALibration:INTernal:RRHead:LOPower?</code> |
| Example        | <code>:CAL:INT:RRH:LOP</code>                                                                           |
| Notes          | The query initiates an alignment and returns 0 if successful, or 1 if failed                            |
| Dependencies   | Only appears in VXT based solutions with M1741A/49A/49B RRH                                             |

#### 4.6.2.17 Align LO Clock

This is an immediate action operation, which runs until complete.  
Synchronizes RRH LO Clocks.

|                    |                                                                                                       |
|--------------------|-------------------------------------------------------------------------------------------------------|
| Remote Command     | <code>:CALibration:INTernal:RRHead:LOSync</code><br><code>:CALibration:INTernal:RRHead:LOSync?</code> |
| Example            | <code>:CAL:INT:RRH:LOS?</code>                                                                        |
| Notes              | The query initiates an Alignment and returns 0 if successful, or 1 if failed                          |
| Dependencies       | Only appears in VXT based solutions with M1741A/42A/49A/49B RRH                                       |
| Backwards          | <code>:CALibration:INTernal:LOSync</code>                                                             |
| Compatibility SCPI | <code>:CALibration:INTernal:LOSync?</code>                                                            |

#### 4.6.2.18 Align VXT Transceiver

In M941xE(M941xA+M9471A) and S9110E system, accesses alignment processes in VXT Transceiver(M9410A/11A/15A/16A), which are immediate action operations and perform complete operations, running until they are complete.

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

There is no alert available for the VXT Transceiver alignment. Operators are responsible for checking temperature shift since the last **Align VXT Transceiver** to determine whether the VXT Transceiver alignment needs to be executed.

|                |                                                                                                           |
|----------------|-----------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALibration:INTernal:VXT:TRANsceiver</code><br><code>:CALibration:INTernal:VXT:TRANsceiver?</code> |
| Example        | <code>:CAL:INT:VXT:TRAN</code>                                                                            |
| Notes          | The query initiates an Alignment and returns 0 if successful, or 1 if failed                              |
| Dependencies   | Only appears on M9410E/11E/15E/16E and S9110E                                                             |

#### 4.6.2.19 Align up down converter

In M941xE(M941xA+M9471A) system, accesses alignment processes in up down converter (M9471A), which are immediate action operations and perform complete operations, running until they are complete.

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

There is no alert available for the up down converter alignment. Operators are responsible for checking temperature shift since the last **Align up down converter** to determine whether the up down converter alignment needs to be executed.

|                |                                                                                           |
|----------------|-------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALibration:UPDown:CONVerter</code><br><code>:CALibration:UPDown:CONVerter?</code> |
| Example        | <code>:CAL:UPD:CONV</code>                                                                |
| Notes          | The query initiates an Alignment and returns 0 if successful, or 1 if failed              |
| Dependencies   | Only appears on M9410E/11E/15E/16E                                                        |

#### 4.6.2.20 Align M9471A up down converter

In S9110E system, accesses alignment processes in up down converter (M9471A), which are immediate action operations and perform complete operations, running until they are complete.

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

There is no alert available for the up down converter alignment. Operators are responsible for checking temperature shift since the last **Align M9471A up down converter** to determine whether the up down converter alignment needs to be executed.

|                |                                                                                           |
|----------------|-------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALibration:UPDown:CONVerter</code><br><code>:CALibration:UPDown:CONVerter?</code> |
| Example        | <code>:CAL:UPD:CONV</code>                                                                |
| Notes          | The query initiates an Alignment and returns 0 if successful, or 1 if failed              |
| Dependencies   | Only appears on S9110E                                                                    |

#### 4.6.2.21 Align Fast Up Down Converter

In M941xE(M941xA+M9471A), accesses alignment processes in up down converter (M9471A), which are immediate action operations and perform complete operations, running until they are complete.

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

There is no alert available for the up down converter alignment. You are responsible for checking temperature shift since the last **Align Fast Up Down Converter**, to determine whether the up down converter alignment needs to be executed.

|                |                                                                                                     |
|----------------|-----------------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALibration:UPDown:CONVerter:FAST</code><br><code>:CALibration:UPDown:CONVerter:FAST?</code> |
| Example        | <code>:CAL:UPD:CONV:FAST</code>                                                                     |
| Notes          | The query initiates an alignment and returns 0 if successful, or 1 if failed                        |
| Dependencies   | Only appears on M9410E/11E/15E/16E                                                                  |

#### 4.6.2.22 Align Specified Freq Ranges

VXT models M9410A/11A provide five alignments: **Align Now All**, **Align Source**, **Align Receiver**, **Align Fast** and **Align LO Leakage**. M9415A/16A provide six alignments: **Align Now All**, **Align Fast**, **Align LO Leakage**, **Align Ext. Mixer Path**, **Align High Band**, **Align Low Band**. Every time you execute one of these alignments, the system performs a full span alignment. To save time, it is possible to limit the range of alignment frequency settings. **Align Specified Freq Ranges** allows you to set the start and stop frequency of an alignment.

The example below shows the steps for processing **Align Receiver** on VXT model M9410A, specifying a frequency range from 1.3 GHz to 1.8 GHz, and 2.5 GHz to 3.9 GHz.

- First row: set the Start and Stop Frequency to 1.3 GHz and 1.8 GHz. Enable the first row
- Second row: set the Start and Stop Frequency to 2.5 GHz and 3.9 GHz. Enable the second row
- Click **Align Receiver**. A message appears: “Aligning 1 of 7”

The equivalent SCPI command sequence is:

```
:CAL:INT:ASFR ON
:CAL:INT:ASFR:FRAN 1.3 GHz, 1.8 GHz, 2.5 GHz, 3.9 GHz
:CAL:INT:REC
```

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### 4.6 Alignments

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALibration:INTernal:ASFRanges[:STATe] ON   OFF   1   0</code><br><code>:CALibration:INTernal:ASFRanges?</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Example        | <code>:CAL:INT:ASFR ON</code><br><code>:CAL:INT:ASFR?</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Notes          | When <b>Align Specified Freq Ranges</b> is <b>ON</b> , the table is displayed for setting up the frequency ranges to be aligned                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Dependencies   | <p>Only available in:</p> <ul style="list-style-type: none"> <li>– VXT models M9410A/11A/15A/16A</li> <li>– VXT models M9410A/11A/15A/16A with RRH and/or CIU</li> <li>– M9410E/11E/15E/16E</li> <li>– S9110E</li> </ul> <p>Only functional for the following alignments:</p> <ul style="list-style-type: none"> <li>– Align Now All of VXT models M9410A/11A/15A/16A and M9410E/11E/15E/16E</li> <li>– Align Source of VXT models M9410A/11A</li> <li>– Align Receiver of VXT models M9410A/11A</li> <li>– Align Fast of VXT models M9410A/11A/15A/16A</li> <li>– Align LO Leakage of VXT models M9410A/11A/15A/16A</li> <li>– Align Ext. Mixer Path of VXT models M9415A/16A</li> <li>– Align High Band of VXT models M9415A/16A</li> <li>– Align Low Band of VXT models M9415A/16A</li> <li>– Align VXT Transceiver of M9410E/11E/15E/16E and S9110E</li> <li>– Align Up Down Converter of M9410E/11E/15E/16E</li> <li>– Align M9471A Up Down Converter of S9110E</li> </ul> <p><b>Align Specified Freq Ranges</b> only guarantees the hardware performance within the frequency range</p> |
| Preset         | <b>OFF</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |

### Enable Extended Freq Range

Allows you to set frequency ranges for VXT models M9410A/11A/15A with Remote Head and/or CIU. When Enable Extended Freq Range is not active, the frequency range is limited by VXT models only.

|                |                                                                              |
|----------------|------------------------------------------------------------------------------|
| Remote Command | <code>:CALibration:INTernal:ASFRanges:EXTend[:STATe] ON   OFF   1   0</code> |
|----------------|------------------------------------------------------------------------------|



|              |                                                                                                                                                    |
|--------------|----------------------------------------------------------------------------------------------------------------------------------------------------|
|              | <code>:CALibration:INTernal:ASFRanges:EXTend[:STATE]?</code>                                                                                       |
| Example      | <code>:CAL:INT:ASFR:EXT ON</code><br><code>:CAL:INT:ASFR:EXT?</code>                                                                               |
| Dependencies | Only available in VXT models M9410A/11A/15A/16A with Remote Head and/or CIU<br>Only available when <b>Align Specified Freq Ranges</b> is <b>ON</b> |
| Preset       | <b>OFF</b>                                                                                                                                         |

## Frequency Range

Allows you to set the alignment frequency range.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALibration:INTernal:ASFRanges:FRANges &lt;startFreq&gt;,&lt;stopFreq&gt;[,&lt;startFreq&gt;,&lt;stopFreq&gt;][,&lt;startFreq&gt;,&lt;stopFreq&gt;][,&lt;startFreq&gt;,&lt;stopFreq&gt;][,&lt;startFreq&gt;,&lt;stopFreq&gt;]</code>                                                                                                                                                                                                                                                                                |
| Example        | <code>:CAL:INT:ASFR:FRAN 1.3 GHz,1.8 GHz,2.5 GHz,3.9 GHz</code><br><code>:CAL:INT:ASFR:FRAN?</code>                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Notes          | <code>&lt;startFreq&gt;</code> : Start frequency of an alignment<br><code>&lt;stopFreq&gt;</code> : Stop frequency of an alignment<br>To process alignment for a single frequency point, set <code>&lt;startFreq&gt; = &lt;stopFreq&gt;</code>                                                                                                                                                                                                                                                                             |
| Dependencies   | Only appears when <b>"Align VXT Transceiver" on page 449</b> is <b>ON</b><br><b>Error message "Invalid alignment frequency range"</b> is reported if start and stop frequencies are invalid, such as: <ol style="list-style-type: none"> <li>1. Stop frequency - Start frequency &lt; 0</li> <li>2. the count of start and stop frequency is not even</li> <li>3. the frequency is out of range. See <b>"More Information" on page 453</b></li> <li>4. more than 5 pairs of start and stop frequency are listed</li> </ol> |
| Preset         | 1.0 GHz, 2.0 GHz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |

## More Information

When **"Enable Extended Freq Range" on page 452** is not active, the frequency range depends on the VXT models. The table below lists the Start and Stop Frequency Ranges for VXT models M9410A/11A/15A:

| Hardware   | Options         | Min Frequency | Max Frequency |
|------------|-----------------|---------------|---------------|
| M9410A/11A | F06             | 330 MHz       | 6.08 GHz      |
| M9410A/11A | F06 & EP6       | 330 MHz       | 6.6 GHz       |
| M9410A/11A | F06 & LFE & EP6 | 6.5 kHz       | 6.6 GHz       |

| Hardware   | Options | Min Frequency | Max Frequency |
|------------|---------|---------------|---------------|
| M9415A/16A | F06     | 330 MHz       | 6.6 GHz       |
| M9415A/16A | F08     | 330 MHz       | 8.6 GHz       |
| M9415A/16A | F12     | 330 MHz       | 12.9 GHz      |

When **Enable Extended Freq Range** is active, the frequency range depends on the extensions connected to VXT models. The table below lists the Start and Stop Frequency Range of VXT models with Remote Radio Heads/CIU:

| Connected with Radio Heads/CIU | Min frequency | Max frequency | IF Frequency range |
|--------------------------------|---------------|---------------|--------------------|
| VXT + CIU                      | 5.9 GHz       | 12 GHz        | 1.4 GHz ~ 4.6 GHz  |
| VXT + CIU + RRH                | 24.25 GHz     | 43.5 GHz      | 2.5 GHz ~ 4.5 GHz  |
| VXT + M1742A                   | 10 GHz        | 32 GHz        | 3.0 GHz ~ 5.5 GHz  |
| VXT + M1749B-F43               | 22.7 GHz      | 43.5 GHz      | 2.5 GHz ~ 4.5 GHz  |
| VXT + M1749B-F49               | 22.7 GHz      | 49.2 GHz      | 2.5 GHz ~ 4.5 GHz  |
| VXT + M9471A + M1749B-F49      | 22.7 GHz      | 49.2 GHz      | 2.5 GHz ~ 4.5 GHz  |

**NOTE**

The Min frequency and Max frequency are also the preset frequencies. It is recommended to keep the preset frequency range for VXT models with extensions. An alignment with the full IF Frequency range will be executed ignoring the specific ranges.

The table below lists the Frequency Range of M941xE(VXT Models with M9471A)

| Options                        | Min Frequency | Max Frequency |
|--------------------------------|---------------|---------------|
| Without LFE                    | 330 MHz       | 26.5 GHz      |
| LFE option in M941xA or M9471A | 750 kHz       | 26.5 GHz      |

## Enable

Enables or disables the selected frequency ranges.

Preset **Row 1: ON**  
**Other rows: OFF**

### 4.6.2.23 Align External Mixer Path

Immediately executes an alignment of the External Mixer Path inside the VXT models M9415A/16A. External Mixer Path is used when the RF Port is connected to an external Remote Radio Head (RRH). It provides a better performance compared to the normal path. External Mixer Path Alignment covers frequencies from 2.4 GHz to 3.4 GHz of the external mixer path.

NOTE

This alignment corrects slow-rate drift, which does not impair specifications for time periods shorter than one week. Thus, you need only perform this alignment on a weekly basis to maintain specifications. This alignment typically takes >2 minutes to complete.

There is no alert for the External Mixer Path alignment. You are responsible for checking the temperature shift since the last **Align Now, External Mixer Path**, to determine whether the external mixer path alignment needs to be executed.

|                |                                                                                                                                                                  |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALibration:INTernal:EMPath</code><br><code>:CALibration:INTernal:EMPath?</code>                                                                          |
| Example        | <code>:CAL:INT:EMP</code>                                                                                                                                        |
| Notes          | The query initiates an alignment and returns 0 if successful, or 1 if failed                                                                                     |
| Dependencies   | Only appears in VXT models M9415A/16A when Option MXP is installed                                                                                               |
| Couplings      | Initializes the time for the Last Align External Mixer Path Now, All Time<br>Records the temperature for the Last Align External Mixer Path Now, All Temperature |

#### 4.6.2.24 Align Low Band

Accesses Low Band alignment processes that are immediate action operations. They perform complete operations and run until they are complete. Low Band Alignment covers frequencies from 380 MHz to 4.3 GHz of the non-external mixer path.

NOTE

This alignment corrects slow-rate drift, which does not impair specifications for time periods shorter than one week. Thus, you need only perform this alignment on a weekly basis to maintain specifications. This alignment typically takes >2 minutes to complete.

There is no alert for the Low Band alignment. You are responsible for checking the temperature shift since the last **Align Now, Align Low Band**, to determine whether the Low Band alignment needs to be executed.

|                |                                                                                                                                            |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALibration:INTernal:LBAnd[:ALL]</code><br><code>:CALibration:INTernal:LBAnd[:ALL]?</code>                                          |
| Example        | <code>:CAL:INT:LBAN</code>                                                                                                                 |
| Notes          | The query initiates an Alignment, and returns 0 if successful, or 1 if failed                                                              |
| Dependencies   | Only appears in VXT models M9415A/16A                                                                                                      |
| Couplings      | Initializes the time for the Last Align Low Band Now, All Time<br>Records the temperature for the Last Align Low Band Now, All Temperature |

4.6.2.25 Align High Band

Accesses High Band alignment processes that are immediate action operations. They perform complete operations and run until they are complete. High Band Alignment covers frequencies from 4.3 GHz to 12 GHz of the non-external mixer path.

NOTE

This alignment corrects slow-rate drift, which does not impair specifications for time periods shorter than one week. Thus, you need only perform this alignment on a weekly basis to maintain specifications. This alignment typically takes >2 minutes to complete.

There is no alert for the High Band alignment. You are responsible for checking the temperature shift since last **Align Now, Align High Band**, to determine whether the High Band alignment needs to be executed.

|                |                                                                                                                                                       |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALibration:INTernal:HBAND[:ALL]</code><br><code>:CALibration:INTernal:HBAND[:ALL]?</code>                                                     |
| Example        | <code>:CAL:INT:HBAN</code>                                                                                                                            |
| Notes          | The query initiates an Alignment, and returns 0 if successful, or 1 if failed                                                                         |
| Dependencies   | Only appears in VXT models M9415A/16A                                                                                                                 |
| Couplings      | Initializes the external time for the Last Align High Band Now, All Time<br>Records the temperature for the Last Align High Band Now, All Temperature |

4.6.3 Path Delay Calibration

Path Delay Calibration is used to remove the time delay differences between multiple power channels of a module.

| Dependencies | Only available in VXT modules M9410A/11A<br>Only for modules with matched Digital board hardware version, which means the modules are in same FPGA version<br>The matched hardware version information is in below table |                |
|--------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
|              | Digital board Hardware version                                                                                                                                                                                           | Matched module |
|              | M9410A 2,3,4,6,10,11                                                                                                                                                                                                     | Yes            |
|              | M9410A 12, 13                                                                                                                                                                                                            | Yes            |
|              | M9411A 18                                                                                                                                                                                                                | Yes            |
|              | M9411A 20,21                                                                                                                                                                                                             | Yes            |
|              | M9411A 12,13                                                                                                                                                                                                             | Yes            |
|              | M9411A 0,1,2,3,4,6,10,11                                                                                                                                                                                                 | Yes            |

### 4.6.3.1 Source Path Delay Calibration

Accesses the Source Path Delay Calibration processes, which are immediate-action operations and perform complete operations, running until they are complete.

**NOTE** Connect the RF In of the primary module to the OUT port (COMMON, PORT 1) of the power splitter (11667B is recommended).

**NOTE** Before performing Path Delay Calibration of Sources, please confirm that:

**NOTE** Each of the RF Out ports is connected to the RF In port of the Primary channel, using a power splitter (11667B is recommended).

**NOTE** The cables between the power splitter (11667B is recommended) and the Source output ports are of the same length.

**NOTE** A pop-up window will appear, press OK to continue the calibration.

**NOTE** If the is in MIMO sync, and you send a SCPI command to run Calibration, the calibration process is not executed and instrument a warning is generated (“-221,Setting Conflict; Calibrations are not available while MIMO Sync is On”). To execute Calibration, you must first stop MIMO, manually or via SCPI.

|                |                                                                                     |
|----------------|-------------------------------------------------------------------------------------|
| Remote Command | <code>:CALibration:PDElay:SOURce</code><br><code>:CALibration:PDElay:SOURce?</code> |
|----------------|-------------------------------------------------------------------------------------|

|         |                             |
|---------|-----------------------------|
| Example | <code>:CAL:PDEL:SOUR</code> |
|---------|-----------------------------|

|       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|-------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Notes | <p>The query initiates an Alignment and returns 0 if successful, or 1 if failed</p> <p>If the calibration process detected a faulty state, an error will be generated: “Misc/System Alignment Failure”. Calibration will be aborted. Please see event log for more information:</p> <ol style="list-style-type: none"> <li>1. Cables are not connected</li> <li>2. Power control failure</li> <li>3. Hardware failure</li> <li>4. M9300A 10MHz reference open failure</li> </ol> |
|-------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|              |                                                                                                                                                                    |
|--------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Dependencies | <p>Only appears in VXT models M9410A/11A</p> <p>Only for modules with matched Digital board hardware version, which means the modules are in same FPGA version</p> |
|--------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|

### 4.6.3.2 Path Delay Correction On/Off(Remote Command only)

On/Off the path delay correction to enable the calibration data on the source of the module.

|                |                                                                                                                                                    |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALibration:PDElay:CORRection ON   OFF</code><br><code>:CALibration:PDElay:CORRection?</code>                                               |
| Example        | <code>:CAL:PDEL:CORR ON</code>                                                                                                                     |
| Notes          | If the <b>Path Delay Calibration</b> has never been performed and there is no calibration correction data in the controller, an alert is generated |
| Preset         | <code>OFF</code>                                                                                                                                   |
| Range          | <code>ON OFF</code>                                                                                                                                |

### 4.6.4 Temperature Drift Correction On/Off (Remote Command Only)

Lets you turn on/off the temperature drift correction at the instrument side.

|                |                                                                                                                          |
|----------------|--------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALibration:RRHead:TDCorrection[:STATe] ON   OFF</code><br><code>:CALibration:RRHead:TDCorrection[:STATe]?</code> |
| Example        | <code>:CAL:RRH:TDC ON</code><br><code>:CAL:RRH:TDC?</code>                                                               |
| Dependencies   | Only supported in S9110A-F32                                                                                             |
| Preset         | <code>OFF</code>                                                                                                         |
| Range          | <code>ON OFF</code>                                                                                                      |

### 4.6.5 Show Alignment Statistics

Shows alignment information you can use to ensure that the instrument is operating in a specific manner. The **Show Alignment Statistics** screen is where you can view time and temperature information.

Values displayed are only updated when the **Show Alignment Statistics** screen is invoked. They are not updated while the **Show Alignment Statistics** screen is being displayed. The remote commands that access this information obtain current values.

Note that some of these statistics only display if your instrument supports them; for example, Last Source Align Now All Time only shows up in instruments which contain a source which supports auto alignments.

An example of the **Show Alignment Statistics** screen would be similar to:

|                           |                                                                                                                                                                                     |                                                                   |
|---------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|
| Std Header                | Product Number: N9020A<br>Serial Number: US46340924<br>Firmware Revision: A.01.01                                                                                                   |                                                                   |
| Instrument Info           | Time since start-up: 300 hrs<br>Current Temperature: +28 degC                                                                                                                       |                                                                   |
| Auto Align Info           | Time while Auto Align off: 90 min                                                                                                                                                   |                                                                   |
| Std Align Now             | Time since last Align Now All: 12.5 hrs<br>Temperature since last Align Now All: -1.3 degC<br>Time since last Align Now RF: 5 min<br>Temperature since last Align Now RF: +0.1 degC | Times & Temperature delta. Shown as "---" if none since start-up. |
| If TG Option (Not Zorro1) | Time since last Align TG: 2.5 hrs<br>Temperature since last Align TG: +0.2 degC                                                                                                     |                                                                   |
| Opts 508,513 526          | Last Characterize Preselector: Jun 1, 2006 15:00:00<br>Last Characterize Preselector Temperature: +32.1 degC                                                                        | Time & Temperature 'stamp'                                        |

"Time while Auto Align off" is not available in VXT models M9410A/11A.

A successful **Align Now, RF** sets the Last Align RF temperature to the current temperature, and resets the Last Align RF time. A successful **Align Now All** or **Align Now All but RF** sets the Last Align Now All temperature to the current temperature, and resets the Last Align Now All time. A successful **Align Now All** also resets the Last Align RF items if the RF portion of the **Align Now** succeeded.

|         |                                                                                                                                   |
|---------|-----------------------------------------------------------------------------------------------------------------------------------|
| Example | <code>:SYST:SHOW ALIGN</code>                                                                                                     |
| Notes   | The values displayed on the screen are only updated upon entry to the screen, and not updated while the screen is being displayed |

The following data-specific queries are available:

### Query Time since Startup

|                |                                                             |
|----------------|-------------------------------------------------------------|
| Remote Command | <code>:SYSTem:PON:TIME?</code>                              |
| Example        | <code>:SYST:PON:TIME?</code>                                |
| Notes          | Value is the time since the most recent start-up in seconds |
| State Saved    | No                                                          |

### Query Current Temperature

|                |                                                |
|----------------|------------------------------------------------|
| Remote Command | <code>:CALibration:TEMPerature:CURRent?</code> |
| Example        | <code>:CAL:TEMP:CURR?</code>                   |
| Notes          | Value is in degrees Centigrade                 |
| State Saved    | No                                             |

### Query Current Temperature at Remote Radio Head

|                |                                                       |
|----------------|-------------------------------------------------------|
| Remote Command | <code>:CALibration:TEMPerature:CURRent:RRHead?</code> |
| Example        | <code>:CAL:TEMP:CURR:RRH?</code>                      |
| Notes          | Value is in degrees Centigrade                        |
| Dependencies   | Only appears when Align RRH Amplitude is available    |
| State Saved    | No                                                    |

### Query Current Temperature at Remote Radio Head LO

|                |                                                          |
|----------------|----------------------------------------------------------|
| Remote Command | <code>:CALibration:TEMPerature:CURRent:RRHead:LO?</code> |
| Example        | <code>:CAL:TEMP:CURR:RRH:LO?</code>                      |
| Notes          | Value is in degrees Centigrade                           |
| Dependencies   | Only appears when Align RRH LO Power is available        |
| State Saved    | No                                                       |

### Query Time since Last Align Now All

|                |                                                                                                                                   |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALibration:TIME:LALL?</code>                                                                                              |
| Example        | <code>:CAL:TIME:LALL?</code>                                                                                                      |
| Notes          | Value is the elapsed time, in seconds, since the last successful <b>Align Now All</b> or <b>Align Now All but RF</b> was executed |
| State Saved    | No                                                                                                                                |

### Query Temperature of Last Align Now All

|                |                                                                                                                              |
|----------------|------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALibration:TEMPerature:LALL?</code>                                                                                  |
| Example        | <code>:CAL:TEMP:LALL?</code>                                                                                                 |
| Notes          | Value is in degrees Centigrade at which the last successful <b>Align Now All</b> or <b>Align Now All but RF</b> was executed |
| State Saved    | No                                                                                                                           |

### Query Time since Last Align Now Receiver

|                |                                                                    |
|----------------|--------------------------------------------------------------------|
| Remote Command | <code>:CALibration:TIME:INTernal:RECeiver?</code>                  |
| Example        | <code>:CAL:TIME:INT:REC?</code>                                    |
| Notes          | Value in hours since the last successful <b>Align Now Receiver</b> |
| Dependencies   | Only appears in VXT models M9410A/11A                              |
| State Saved    | No                                                                 |



### Query Temperature of Last Align Now Receiver

|                |                                                                                             |
|----------------|---------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALibration:TEMPerature:INTernal:RECeiver?</code>                                    |
| Example        | <code>:CAL:TEMP:INT:REC?</code>                                                             |
| Notes          | Value in degrees Centigrade when the last successful <b>Align Now Receiver</b> was executed |
| Dependencies   | Only appears in VXT models M9410A/11A                                                       |
| State Saved    | No                                                                                          |

### Query Time since Last Align Now Source

|                |                                                                  |
|----------------|------------------------------------------------------------------|
| Remote Command | <code>:CALibration:TIME:INTernal:SOURce?</code>                  |
| Example        | <code>:CAL:TIME:INT:SOUR?</code>                                 |
| Notes          | Value in hours since the last successful <b>Align Now Source</b> |
| Dependencies   | Only appears in VXT models M9410A/11A                            |
| State Saved    | No                                                               |

### Query Temperature of Last Align Now Source

|                |                                                                                           |
|----------------|-------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALibration:TEMPerature:INTernal:SOURce?</code>                                    |
| Example        | <code>:CAL:TEMP:INT:SOUR?</code>                                                          |
| Notes          | Value in degrees Centigrade when the last successful <b>Align Now Source</b> was executed |
| Dependencies   | Only appears in VXT models M9410A/11A                                                     |
| State Saved    | No                                                                                        |

### Query Time since Last Align Now Fast

|                |                                                                |
|----------------|----------------------------------------------------------------|
| Remote Command | <code>:CALibration:TIME:INTernal:FAST?</code>                  |
| Example        | <code>:CAL:TIME:INT:FAST?</code>                               |
| Notes          | Value in hours since the last successful <b>Align Now Fast</b> |
| Dependencies   | Only appears in VXT models M9410A/11A/15A/16A                  |
| State Saved    | No                                                             |

### Query Temperature of Last Align Now Fast

|                |                                                                                         |
|----------------|-----------------------------------------------------------------------------------------|
| Remote Command | <code>:CALibration:TEMPerature:INTernal:FAST?</code>                                    |
| Example        | <code>:CAL:TEMP:INT:FAST?</code>                                                        |
| Notes          | Value in degrees Centigrade when the last successful <b>Align Now Fast</b> was executed |
| Dependencies   | Only appears in VXT models M9410A/11A/15A/16A                                           |
| State Saved    | No                                                                                      |

### Query Time since Last Align Now LO Leakage

|                |                                                                      |
|----------------|----------------------------------------------------------------------|
| Remote Command | <code>:CALibration:TIME:INTernal:LOLeakage?</code>                   |
| Example        | <code>:CAL:TIME:INT:LOL?</code>                                      |
| Notes          | Value in hours since the last successful <b>Align Now LO Leakage</b> |
| Dependencies   | Only appears in VXT models M9410A/11A/15A/16A                        |
| State Saved    | No                                                                   |

### Query Temperature of Last Align Now LO Leakage

|                |                                                                                               |
|----------------|-----------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALibration:TEMPerature:INTernal:LOLeakage?</code>                                     |
| Example        | <code>:CAL:TEMP:INT:LOL?</code>                                                               |
| Notes          | Value in degrees Centigrade when the last successful <b>Align Now LO Leakage</b> was executed |
| Dependencies   | Only appears in VXT models M9410A/11A/15A/16A                                                 |
| State Saved    | No                                                                                            |

### Query Time since Last Align Now IF Cable

|                              |                                                                     |
|------------------------------|---------------------------------------------------------------------|
| Remote Command               | <code>:CALibration:TIME:INTernal:RRHead:IFCable?</code>             |
| Example                      | <code>:CAL:TIME:INT:RRH:IFC?</code>                                 |
| Notes                        | Value in hours since the last successful <b>Align Now IF Cable</b>  |
| Dependencies                 | Only appears in VXT based solutions with M1740A/41A/42A/49A/49B RRH |
| State Saved                  | No                                                                  |
| Backwards Compatibility SCPI | <code>:CALibration:TIME:INTernal:IFCable?</code>                    |

### Query Temperature of Last Align Now IF Cable

|                              |                                                                                             |
|------------------------------|---------------------------------------------------------------------------------------------|
| Remote Command               | <code>:CALibration:TEMPerature:INTernal:RRHead:IFCable?</code>                              |
| Example                      | <code>:CAL:TEMP:INT:RRH:IFC?</code>                                                         |
| Notes                        | Value in degrees Centigrade when the last successful <b>Align Now IF Cable</b> was executed |
| Dependencies                 | Only appears in VXT based solutions with M1740A/41A/42A/49A/49B RRH                         |
| State Saved                  | No                                                                                          |
| Backwards Compatibility SCPI | <code>:CALibration:TEMPerature:INTernal:IFCable?</code>                                     |

### Query Time since Last Align LO Clock

|                |                                                        |
|----------------|--------------------------------------------------------|
| Remote Command | <code>:CALibration:TIME:INTernal:RRHead:LOSync?</code> |
|----------------|--------------------------------------------------------|

|                                 |                                                                 |
|---------------------------------|-----------------------------------------------------------------|
| Example                         | <code>:CAL:TIME:INT:RRH:LOS?</code>                             |
| Notes                           | Value in hours since the last successful Align LO Clock         |
| Dependencies                    | Only appears in VXT based solutions with M1741A/42A/49A/49B RRH |
| State Saved                     | No                                                              |
| Backwards<br>Compatibility SCPI | <code>:CALibration:TIME:INTernal:LOSync?</code>                 |

### Query Temperature of Last Align LO Clock

|                                 |                                                                                  |
|---------------------------------|----------------------------------------------------------------------------------|
| Remote Command                  | <code>:CALibration:TEMPerature:INTernal:RRHead:LOSync?</code>                    |
| Example                         | <code>:CAL:TEMP:INT:RRH:LOS?</code>                                              |
| Notes                           | Value in degrees Centigrade when the last successful Align LO Clock was executed |
| Dependencies                    | Only appears in VXT based solutions with M1741A/42A/49A/49B RRH                  |
| State Saved                     | No                                                                               |
| Backwards<br>Compatibility SCPI | <code>:CALibration:TEMPerature:INTernal:LOSync?</code>                           |

### Query Time since Last Align RRH Amplitude

|                                 |                                                                 |
|---------------------------------|-----------------------------------------------------------------|
| Remote Command                  | <code>:CALibration:TIME:INTernal:RRHead:AMPLitude?</code>       |
| Example                         | <code>:CAL:TIME:INT:RRH:AMPL?</code>                            |
| Notes                           | Value in hours since the last successful Align RRH Amplitude    |
| Dependencies                    | Only appears in VXT based solutions with M1741A/42A/49A/49B RRH |
| State Saved                     | No                                                              |
| Backwards<br>Compatibility SCPI | <code>:CALibration:TIME:INTernal:RRHAmp?</code>                 |

### Query Temperature of Last Align RRH Amplitude

|                                 |                                                                                       |
|---------------------------------|---------------------------------------------------------------------------------------|
| Remote Command                  | <code>:CALibration:TEMPerature:INTernal:RRHead:AMPLitude?</code>                      |
| Example                         | <code>:CAL:TEMP:INT:RRH:AMPL?</code>                                                  |
| Notes                           | Value in degrees Centigrade when the last successful Align RRH Amplitude was executed |
| Dependencies                    | Only appears in VXT based solutions with M1741A/42A/49A/49B RRH                       |
| State Saved                     | No                                                                                    |
| Backwards<br>Compatibility SCPI | <code>:CALibration:TEMPerature:INTernal:RRHAmp?</code>                                |

### Query Time since Last Align Fast RRH Amplitude

|                |                                                                   |
|----------------|-------------------------------------------------------------------|
| Remote Command | <code>:CALibration:TIME:INTernal:RRHead:AMPLitude:FAST?</code>    |
| Example        | <code>:CAL:TIME:INT:RRH:AMPL:FAST?</code>                         |
| Notes          | Value in hours since the last successful Align Fast RRH Amplitude |
| Dependencies   | Only appears in VXT based solutions with M1742A RRH               |
| State Saved    | No                                                                |

### Query Temperature of Last Align Fast RRH Amplitude

|                |                                                                                            |
|----------------|--------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALibration:TEMPerature:INTernal:RRHead:AMPLitude:FAST?</code>                      |
| Example        | <code>:CAL:TEMP:INT:RRH:AMPL:FAST?</code>                                                  |
| Notes          | Value in degrees Centigrade when the last successful Align Fast RRH Amplitude was executed |
| Dependencies   | Only appears in VXT based solutions with M1742A RRH                                        |
| State Saved    | No                                                                                         |

### Query Time since Last Align RRH LO Power

|                |                                                             |
|----------------|-------------------------------------------------------------|
| Remote Command | <code>:CALibration:TIME:INTernal:RRHead:LOPower?</code>     |
| Example        | <code>:CAL:TIME:INT:RRH:LOP?</code>                         |
| Notes          | Value in hours since the last successful Align RRH LO Power |
| Dependencies   | Only appears in VXT based solutions with M1741A/49A/49B RRH |
| State Saved    | No                                                          |

### Query Temperature of Last Align RRH LO Power

|                |                                                                                      |
|----------------|--------------------------------------------------------------------------------------|
| Remote Command | <code>:CALibration:TEMPerature:INTernal:RRHead:LOPower?</code>                       |
| Example        | <code>:CAL:TEMP:INT:RRH:LOP?</code>                                                  |
| Notes          | Value in degrees Centigrade when the last successful Align RRH LO Power was executed |
| Dependencies   | Only appears in VXT based solutions with M1741A/49A/49B RRH                          |
| State Saved    | No                                                                                   |

### Query Time since Last Align Now RF

|                |                                                                                                                                                                   |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALibration:TIME:LRF?</code>                                                                                                                               |
| Example        | <code>:CAL:TIME:LRF?</code>                                                                                                                                       |
| Notes          | Value is the elapsed time, in seconds, since the last successful <b>Align Now, RF</b> was executed, either individually or as a component of <b>Align Now All</b> |
| State Saved    | No                                                                                                                                                                |

### Query Temperature of Last Align Now RF

|                |                                                                                                                                                             |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALibration:TEMPerature:LRF?</code>                                                                                                                  |
| Example        | <code>:CAL:TEMP:LRF?</code>                                                                                                                                 |
| Notes          | Value is in degrees Centigrade at which the last successful <b>Align Now RF</b> was executed, either individually or as a component of <b>Align Now All</b> |
| State Saved    | No                                                                                                                                                          |

### Query Time since Last Align IF

|                |                                                                                               |
|----------------|-----------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALibration:TIME:LIF?</code>                                                           |
| Example        | <code>:CAL:TIME:LIF?</code>                                                                   |
| Notes          | Value is the elapsed time, in seconds, since the last successful <b>Align IF</b> was executed |
| State Saved    | No                                                                                            |

### Query Temperature of Last Align IF

|                |                                                                                          |
|----------------|------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALibration:TEMPerature:LIF?</code>                                               |
| Example        | <code>:CAL:TEMP:LIF?</code>                                                              |
| Notes          | Value is in degrees Centigrade at which the last successful <b>Align IF</b> was executed |
| State Saved    | No                                                                                       |

### Query Time since Last Characterize Preselector

|                |                                                                                                                                                                                                                                                     |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALibration:TIME:LPreselector?</code>                                                                                                                                                                                                        |
| Example        | <code>:CAL:TIME:LPR?</code>                                                                                                                                                                                                                         |
| Notes          | Value is the date and time the last successful <b>Characterize Preselector</b> was executed. The date is separated from the time by a space character<br>Returns "" if no <b>Characterize Preselector</b> has ever been performed on the instrument |
| Dependencies   | In models that do not include preselectors, this command is not enabled and any attempt to set or query yields an error                                                                                                                             |
| State Saved    | No                                                                                                                                                                                                                                                  |

### Query Temperature of Last Characterize Preselector

|                |                                                                                                          |
|----------------|----------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALibration:TEMPerature:LPreselector?</code>                                                      |
| Example        | <code>:CAL:TEMP:LPR?</code>                                                                              |
| Notes          | Value is in degrees Centigrade at which the last successful <b>Characterize Preselector</b> was executed |

## 4 System

### 4.6 Alignments

|              |                                                                                                                         |
|--------------|-------------------------------------------------------------------------------------------------------------------------|
| Dependencies | In models that do not include preselectors, this command is not enabled and any attempt to set or query yields an error |
|--------------|-------------------------------------------------------------------------------------------------------------------------|

|             |    |
|-------------|----|
| State Saved | No |
|-------------|----|

#### Query Time since Auto Align Off

|                |                                          |
|----------------|------------------------------------------|
| Remote Command | <code>:CALibration:AUTO:TIME:OFF?</code> |
|----------------|------------------------------------------|

|         |                                  |
|---------|----------------------------------|
| Example | <code>:CAL:AUTO:TIME:OFF?</code> |
|---------|----------------------------------|

|       |                                                                                                                                                                                       |
|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Notes | Value is the elapsed time, in seconds, since <b>Auto Align</b> has been set to <b>Off</b> or <b>Off with Alert</b> . The value is 0 if <b>Auto Align</b> is <b>ALL</b> or <b>NORF</b> |
|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|             |    |
|-------------|----|
| State Saved | No |
|-------------|----|

#### Query Time since Last Align Now 20 Hz – 30 MHz

|                |                                                        |
|----------------|--------------------------------------------------------|
| Remote Command | <code>:CALibration:TIME:RFPSelector:LCONducted?</code> |
|----------------|--------------------------------------------------------|

|         |                                   |
|---------|-----------------------------------|
| Example | <code>:CAL:TIME:RFPS:LCON?</code> |
|---------|-----------------------------------|

|       |                                                                                                                                                               |
|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Notes | Values are the date and time the last successful <b>Align Now, 20 Hz – 30 MHz</b> was executed. The date is separated from the time by a semi-colon character |
|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|

|             |    |
|-------------|----|
| State Saved | No |
|-------------|----|

#### Query Temperature of Last Align Now 20 Hz – 30 MHz

|                |                                                               |
|----------------|---------------------------------------------------------------|
| Remote Command | <code>:CALibration:TEMPerature:RFPSelector:LCONducted?</code> |
|----------------|---------------------------------------------------------------|

|         |                                   |
|---------|-----------------------------------|
| Example | <code>:CAL:TEMP:RFPS:LCON?</code> |
|---------|-----------------------------------|

|       |                                                                                                           |
|-------|-----------------------------------------------------------------------------------------------------------|
| Notes | Value is in degrees Centigrade at which the last successful <b>Align Now, 20 Hz – 30 MHz</b> was executed |
|-------|-----------------------------------------------------------------------------------------------------------|

|             |    |
|-------------|----|
| State Saved | No |
|-------------|----|

#### Query Time since Last Align Now 30 MHz – 3.6 GHz

|                |                                                       |
|----------------|-------------------------------------------------------|
| Remote Command | <code>:CALibration:TIME:RFPSelector:LRADiated?</code> |
|----------------|-------------------------------------------------------|

|         |                                   |
|---------|-----------------------------------|
| Example | <code>:CAL:TIME:RFPS:LRAD?</code> |
|---------|-----------------------------------|

|       |                                                                                                                                                               |
|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Notes | Value is the date and time the last successful <b>Align Now, 30 MHz – 3.6 GHz</b> was executed. The date is separated from the time by a semi-colon character |
|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|

|             |    |
|-------------|----|
| State Saved | No |
|-------------|----|

### Query Temperature of Last Align Now 30 MHz – 3.6 MHz

|                |                                                                                                             |
|----------------|-------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALibration:TEMPerature:RFPSelector:LRADiated?</code>                                                |
| Example        | <code>:CAL:TEMP:RFPS:LRAD?</code>                                                                           |
| Notes          | Value is in degrees Centigrade at which the last successful <b>Align Now, 30 MHz – 3.6 GHz</b> was executed |
| State Saved    | No                                                                                                          |

### Query Next Scheduled Alignment Time

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALibration:RFPSelector:SCHeduler:TIME:NEXT?</code><br>Returns data using the following format:<br>YYYY/MM/DD; HH:MM:SS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Example        | <code>:CAL:RFPS:SCH:TIME:NEXT?</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Notes          | <p>The next run time will be updated based on the start date/time and recurrence set by the user<br/>“date” is representation of the date the task will run in the form:<br/><code>YYYY/MM/DD</code><br/>where:</p> <ul style="list-style-type: none"> <li>– <code>YYYY</code> is the four-digit representation of year. (for example, 2009)</li> <li>– <code>MM</code> is the two-digit representation of month. (for example, 01 to 12)</li> <li>– <code>DD</code> is the two-digit representation of the day. (for example, 01 to 28, 29, 30 or 31 depending on the month and year)</li> </ul> <p>“time” is a representation of the time of day the task will run in the form:<br/><code>HH:MM:SS</code><br/>where:</p> <ul style="list-style-type: none"> <li>– <code>HH</code> is the two-digit representation of the hour in 24-hour format</li> <li>– <code>MM</code> is the two-digit representation of minute</li> <li>– <code>SS</code> is the two-digit representation of seconds</li> </ul> |
| State Saved    | No                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |

### Query Time since Last Align Now External Mixer Path

|                |                                                                               |
|----------------|-------------------------------------------------------------------------------|
| Remote Command | <code>:CALibration:TIME:INTernal:EMPath?</code>                               |
| Example        | <code>:CAL:TIME:INT:EMP?</code>                                               |
| Notes          | Value in hours since the last successful <b>Align Now External Mixer Path</b> |
| Dependencies   | Only appears option MXP is installed                                          |
| State Saved    | No                                                                            |

### Query Temperature of Last Align Now External Mixer Path

|                |                                                                                                        |
|----------------|--------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALibration:TEMPerature:INTernal:EMPath?</code>                                                 |
| Example        | <code>:CAL:TEMP:INT:EMP?</code>                                                                        |
| Notes          | Value in degrees Centigrade when the last successful <b>Align Now External Mixer Path</b> was executed |
| Dependencies   | Only appears option MXP is installed                                                                   |
| State Saved    | No                                                                                                     |

### Query Time since Last Align Now Low Band

|                |                                                                    |
|----------------|--------------------------------------------------------------------|
| Remote Command | <code>:CALibration:TIME:INTernal:LBAND?</code>                     |
| Example        | <code>:CAL:TIME:INT:LBAN?</code>                                   |
| Notes          | Value in hours since the last successful <b>Align Now Low Band</b> |
| Dependencies   | Only appears in VXT models M9415A/16A                              |
| State Saved    | No                                                                 |

### Query Temperature of Last Align Now Low Band

|                |                                                                                             |
|----------------|---------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALibration:TEMPerature:INTernal:LBAND?</code>                                       |
| Example        | <code>:CAL:TEMP:INT:LBAN?</code>                                                            |
| Notes          | Value in degrees Centigrade when the last successful <b>Align Now Low Band</b> was executed |
| Dependencies   | Only appears in VXT models M9415A/16A                                                       |
| State Saved    | No                                                                                          |

### Query Time since Last Align Now High Band

|                |                                                                     |
|----------------|---------------------------------------------------------------------|
| Remote Command | <code>:CALibration:TIME:INTernal:HBAN?</code>                       |
| Example        | <code>:CAL:TIME:INT:HBAN?</code>                                    |
| Notes          | Value in hours since the last successful <b>Align Now High Band</b> |
| Dependencies   | Only appears in VXT models M9415A/16A                               |
| State Saved    | No                                                                  |

### Query Temperature of Last Align Now High Band

|                |                                                                                              |
|----------------|----------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALibration:TEMPerature:INTernal:HBAND?</code>                                        |
| Example        | <code>:CAL:TEMP:INT:HBAN?</code>                                                             |
| Notes          | Value in degrees Centigrade when the last successful <b>Align Now High Band</b> was executed |
| Dependencies   | Only appears in VXT models M9415A/16A                                                        |
| State Saved    | No                                                                                           |



### Query Time since Last Align VXT Transceiver

|                |                                                                                                                                                                 |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALibration:TIME:INTernal:VXT:TRANsceiver?</code>                                                                                                        |
| Example        | <code>:CAL:TIME:INT:VXT:TRAN?</code>                                                                                                                            |
| Notes          | Value in hours since the last successful <b>Align VXT Transceiver</b><br>Returns <b>NaN</b> if Align VXT Transceiver has never been performed on the instrument |
| Dependencies   | Only appears in M9410E/11E/15E/16E                                                                                                                              |
| State Saved    | No                                                                                                                                                              |

### Query Temperature of Last Align VXT Transceiver

|                |                                                                                                                                                                                                      |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALibration:TEMPerature:INTernal:VXT:TRANsceiver?</code>                                                                                                                                      |
| Example        | <code>:CAL:TEMP:INT:VXT:TRAN?</code>                                                                                                                                                                 |
| Notes          | Value in degrees Centigrade when the last successful <b>Align VXT Transceiver</b> was executed<br>Returns 9.91E+37( <b>NaN</b> ) if Align VXT Transceiver has never been performed on the instrument |
| Dependencies   | Only appears in M9410E/11E/15E/16E                                                                                                                                                                   |
| State Saved    | No                                                                                                                                                                                                   |

### Query Time since Last Align Up Down Converter

|                |                                                                                                                                                                     |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALibration:TIME:UPDown:CONVerter?</code>                                                                                                                    |
| Example        | <code>:CAL:TIME:UPD:CONV?</code>                                                                                                                                    |
| Notes          | Value in hours since the last successful <b>Align Up Down Converter</b><br>Returns <b>NaN</b> if Align Up Down Converter has never been performed on the instrument |
| Dependencies   | Only appears in M9410E/11E/15E/16E                                                                                                                                  |
| State Saved    | No                                                                                                                                                                  |

### Query Temperature of Last Align Up Down Converter

|                |                                                                                                                                                                                                          |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALibration:TEMPerature:UPDown:CONVerter?</code>                                                                                                                                                  |
| Example        | <code>:CAL:TEMP:UPD:CONV?</code>                                                                                                                                                                         |
| Notes          | Value in degrees Centigrade when the last successful <b>Align Up Down Converter</b> was executed<br>Returns 9.91E+37( <b>NaN</b> ) if Align Up Down Converter has never been performed on the instrument |
| Dependencies   | Only appears in VXT models M9410A/11A and M9410E/11E                                                                                                                                                     |
| State Saved    | No                                                                                                                                                                                                       |

### Query Time since Last Align Fast Up Down Converter

|                |                                                       |
|----------------|-------------------------------------------------------|
| Remote Command | <code>:CALibration:TIME:UPDown:CONVerter:FAST?</code> |
| Example        | <code>:CAL:TIME:UPD:CONV:FAST?</code>                 |

## 4 System

### 4.6 Alignments

|              |                                                                                                                                                                               |
|--------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Notes        | Value in hours since the last successful <b>Align Fast Up Down Converter</b><br>Returns <b>NaN</b> if Align Fast Up Down Converter has never been performed on the instrument |
| Dependencies | Only appears in M9410E/11E/15E/16E                                                                                                                                            |
| State Saved  | No                                                                                                                                                                            |

#### Query Temperature of Last Align Fast Up Down Converter

|                |                                                                                                                                                                                                                    |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <b>:CALibration:TEMPerature:UPDown:CONVerter:FAST?</b>                                                                                                                                                             |
| Example        | <b>:CAL:TEMP:UPD:CONV:FAST?</b>                                                                                                                                                                                    |
| Notes          | Value in degrees Centigrade when the last successful <b>Align Fast Up Down Converter</b> was executed<br>Returns 9.91E+37( <b>NaN</b> ) if Align Fast Up Down Converter has never been performed on the instrument |
| Dependencies   | Only appears in M9410E/11E/15E/16E                                                                                                                                                                                 |
| State Saved    | No                                                                                                                                                                                                                 |

#### Query Time since Last Path Delay Calibration

|                |                                                                                                                                                                                                       |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <b>:CALibration:TIME:PDElay:SOURce?</b>                                                                                                                                                               |
| Example        | <b>:CAL:TIME:PDEL:SOUR?</b>                                                                                                                                                                           |
| Notes          | The value is the elapsed time in hours since the last successful <b>Path Delay Calibration</b> has been performed<br>Returns <b>NaN</b> if the <b>Path Delay Calibration</b> has never been performed |
| State Saved    | No                                                                                                                                                                                                    |

#### Query Temperature of Last Path Delay Calibration

|                |                                                                                                                                                                                                                  |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <b>:CALibration:TEMPerature:PDElay:SOURce?</b>                                                                                                                                                                   |
| Example        | <b>:CAL:TEMP:PDEL:SOUR?</b>                                                                                                                                                                                      |
| Notes          | The value is in degrees Centigrade at which the last successful <b>Path Delay Calibration</b> has been performed<br>Returns 9.91E+37( <b>NaN</b> ) if the <b>Path Delay Calibration</b> has never been performed |
| State Saved    | No                                                                                                                                                                                                               |

### 4.6.6 Timebase DAC

Lets you change the setting of the **Timebase DAC** from a factory calibrated setting to your own desired setting.

The display shows the current **Timebase DAC** setting at the top, and gives you a choice of **CALibrated** or **USER** setting. There is also a field for you to enter your desired setting.

|              |                                   |
|--------------|-----------------------------------|
| Dependencies | Does not appear in VXT and M941xE |
|--------------|-----------------------------------|

#### 4.6.6.1 Timebase DAC

Allows control of the internal 10 MHz reference oscillator timebase. This may be used to adjust for minor frequency alignment between your signal's reference and the internal frequency reference. This adjustment has no effect if the instrument is operating with an External Frequency Reference.

If the value of the **Timebase DAC** changes (by switching to **CALibrated** from **USER** with **User Value** set to a different value, or in **USER** with a new value entered) an alignment may be necessary. The alignment system will take appropriate action; which will either invoke an alignment or cause an **Alert**.

The **CALibrated** setting sets the **Timebase DAC** to the value established during factory or field calibration. In this case the value displayed at the top of the screen is the calibrated value.

The **USER** setting sets the **Timebase DAC** to the value set on the **User Value** control. In this case the value displayed at the top of the screen is the user value.

|                |                                                                                                                                     |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALibration:FREQuency:REFeRence:MODE CALibrated   USER</code><br><code>:CALibration:FREQuency:REFeRence:MODE?</code>         |
| Example        | <code>:CAL:FREQ:REF:MODE CAL</code>                                                                                                 |
| Notes          | If the value of the timebase is changed the alignment system automatically performs an alignment or alerts that an alignment is due |
| Dependencies   | Not available in UXM                                                                                                                |
| Preset         | Unaffected by <b>Preset</b> , but set to <b>CALibrated</b> by <b>Restore Defaults</b> > <b>"Alignments"</b> on page 426             |
| State Saved    | No                                                                                                                                  |

#### 4.6.6.2 User Value

Lets you set the **Timebase DAC** to a value other than the value established during the factory or field calibration. The current value of the DAC is displayed at the top of the screen. This will be the Calibrated value if **Timebase DAC** is set to **CALibrated**.

|                |                                                                                                                           |
|----------------|---------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALibration:FREQuency:REFeRence:FINE &lt;integer&gt;</code><br><code>:CALibration:FREQuency:REFeRence:FINE?</code> |
| Example        | <code>:CAL:FREQ:REF:FINE 8191</code>                                                                                      |

## 4 System

### 4.6 Alignments

|                              |                                                                                                                                                                                                                                                                                                                                                                      |
|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Notes                        | If the value of the timebase is changed the alignment system automatically performs an alignment or alerts that an alignment is due                                                                                                                                                                                                                                  |
| Couplings                    | Setting <code>:CAL:FREQ:REF:FINE</code> sets <code>:CAL:FREQ:REF:MODE USER</code>                                                                                                                                                                                                                                                                                    |
| Preset                       | Unaffected by <b>Preset</b> , but set to the factory setting by <b>Restore Defaults</b> > "Alignments" on page 426                                                                                                                                                                                                                                                   |
| State Saved                  | No                                                                                                                                                                                                                                                                                                                                                                   |
| Min                          | 0                                                                                                                                                                                                                                                                                                                                                                    |
| Max                          | 16383                                                                                                                                                                                                                                                                                                                                                                |
| Backwards Compatibility SCPI | <p><code>:CALibration:FREQuency:REFeRence:COARse</code></p> <p>ESA hardware contained two DAC controls for the Timebase. In X-Series the command <code>:CALibration:FREQuency:REFeRence:FINE</code> is the method for adjusting the timebase. The <code>COARse</code> option is provided as an alias to <code>FINE</code></p> <p>Backwards Compatibility Command</p> |
| Remote Command               | <p><code>:CALibration:FREQuency:REFeRence:COARse &lt;integer&gt;</code></p> <p><code>:CALibration:FREQuency:REFeRence:COARse?</code></p>                                                                                                                                                                                                                             |
| Example                      | <code>:CAL:FREQ:REF:COAR 8191</code>                                                                                                                                                                                                                                                                                                                                 |
| Notes                        | This is an alias for <code>:CAL:FREQ:REF:FINE</code> . Any change to <code>COARse</code> is reflected in <code>FINE</code> and vice-versa. See <code>:CAL:FREQ:REF:FINE</code> for description of functionality                                                                                                                                                      |
| Couplings                    | Setting <code>:CAL:FREQ:REF:COAR</code> sets <code>:CAL:FREQ:REF:MODE USER</code>                                                                                                                                                                                                                                                                                    |

## 4.6.7 Advanced

Accesses alignment processes that are immediate action operations that perform operations that run until complete. **Advanced** alignments are performed on an irregular basis, or require additional operator interaction.

|              |                      |
|--------------|----------------------|
| Dependencies | Not available in UXM |
|--------------|----------------------|

### 4.6.7.1 Characterize Preselector

The Preselector tuning curve drifts over temperature and time. Recognize that the Amplitude, Presel Center function adjusts the preselector for accurate amplitude measurements at an individual frequency. Characterize Preselector improves the amplitude accuracy by ensuring the Preselector is approximately centered at all frequencies without the use of the Amplitude, Presel Center function. Characterize Preselector can be useful in situations where absolute amplitude accuracy is not of utmost importance, and the throughput savings or convenience of not performing a Presel Center is desired. Presel Center is required prior to any measurement for best (and warranted) amplitude accuracy.

Keysight recommends that the Characterize Preselector operation be performed yearly as part of any calibration, but performing this operation every three months can be worthwhile.

**Characterize Preselector** immediately executes a characterization of the Preselector, which is a YIG-tuned filter (YTF). The instrument stops any measurement currently underway, performs the characterization, then restarts the measurement from the beginning (similar to pressing the **Restart** key).

The query (**:CALibration:YTF?**) invokes the alignment of the YTF subsystem, and returns a success or failure value.

A failure encountered during alignment generates the Error Condition message “Characterize Preselector failure” and sets Bit 3 in the **STATus:QUESTionable:CALibration:EXTended:FAILure** status register. Successful completion of **Characterize Preselector** clears this Condition. It also begins the elapsed time counter for Last Characterize Preselector Time, and captures the Last Characterize Preselector Temperature.

The last Characterize Preselector Time and Temperature survives across the power cycle, as this operation is performed infrequently.

## NOTE

The **Characterize Preselector** function can be interrupted, by pressing the **Cancel (ESC)** front-panel key, or remotely with Device Clear followed by the **:ABORt SCPI** command. None of the new characterization data is then used. However, since the old characterization data is purged at the beginning of the characterization, you now have an uncharacterized preselector. You should re-execute this function and allow it to finish before making any further preselected measurements.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <b>:CALibration:YTF</b><br><b>:CALibration:YTF?</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Example        | <b>:CAL:YTF</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Notes          | <p><b>:CALibration:YTF?</b> returns 0 if successful, or 1 if failed (including interfering user signal)</p> <p>While <b>Advanced, Characterize Preselector</b> is performing the alignment, Bit 0 in the Status Operation register is set. Completion, or termination, clears Bit 0 in the Status Operation register</p> <p>This command is sequential; it must complete before further SCPI commands are processed. Interrupting the alignment from remote is accomplished by invoking Device Clear followed by the <b>:ABORt</b> command</p> <p>Successful completion clears Bit 9 in the Status Questionable Calibration register</p> <p>A failure encountered during alignment generates the Error Condition message “Characterize Preselector failed” and sets Bit 9 in the Status Questionable Calibration register</p> <p>For Options that support frequencies &gt; 3.6 GHz only</p> |
| Dependencies   | This control does not appear in models that do not contain preselectors. In these models the SCPI command is accepted without error, but no action is taken                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Couplings      | Initializes the time for the Last Characterize Preselector Time                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                | Records the temperature for the Last Characterize Preselector Temperature                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|                | Overlapped Command                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Remote Command | <code>:CALibration:YTF:NPENding</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Example        | <code>:CAL:YTF:NPEN</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Notes          | <p><code>:CALibration:YTF:NPENding</code> is the same as <code>:CALibration:YTF</code>, including all conditions, status register bits, except that this SCPI command <i>does not block</i> the SCPI session, so you should use status register bits to query if the calibration is successfully completed or not</p> <p>Typical usage is:</p> <ol style="list-style-type: none"> <li>1. <code>:CALibration:YTF:NPENding</code> (Start a YTF calibration)</li> <li>2. <code>:STATus:OPERation:CONDition?</code> (Check if the calibration is completed or not, If Bit 0 is set, then the system is doing calibration, and you should repeat this query until the bit is cleared)</li> <li>3. <code>:STATus:QUESTionable:CALibration:EXTended:FAILure:CONDition?</code> (Check whether Bit 2 is set. If this bit is set, that means there are some errors in previous internal source calibration)</li> </ol> |

#### 4.6.7.2 Characterize Reference Clock

Calibrates the Reference Input Phase with the External Reference Output. This feature is only available when either option DP2 or B40 is present. It requires connecting the 10 MHz OUT to the EXT REF IN port with a BNC cable before running the characterization.

See ["Front panel guided calibration sequence" on page 475](#)

|                |                                                                                                                                                                                                                                                                      |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALibration:REFerence:CLOCk?</code>                                                                                                                                                                                                                           |
| Example        | <p><code>:CAL:REF:CLOC:INIT?</code></p> <p>connect cable</p> <p><code>:CAL:REF:CLOC?</code></p> <p>disconnect cable</p> <p><code>:CAL:REF:CLOC:END?</code></p>                                                                                                       |
| Notes          | <p><code>:CALibration:REFerence:CLOCk?</code></p> <p>returns 0 if successful, or 1 if failed</p>                                                                                                                                                                     |
| Dependencies   | Option DP2 or B40                                                                                                                                                                                                                                                    |
| Couplings      | <p>Initializes the time for the Last Characterize Reference Clock Time</p> <p>Records the temperature for the Last Characterize Reference Clock Temperature. Expected to be run after <code>:CAL:REF:CLOC:INIT</code>, and before <code>:CAL:REF:CLOC:END</code></p> |
| Remote Command | <code>:CALibration:REFerence:CLOCK:INITialize?</code>                                                                                                                                                                                                                |

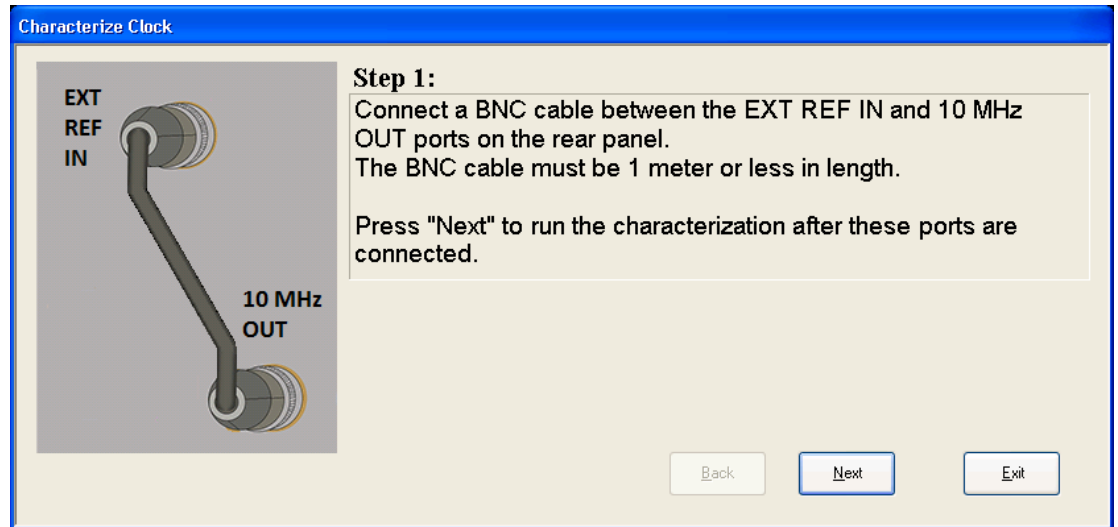
|                |                                                                                                                                                                                                                                           |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Example        | <code>:CAL:REF:CLOC:INIT?</code>                                                                                                                                                                                                          |
| Notes          | Returns 0 if successful, or 1 if failed                                                                                                                                                                                                   |
| Dependencies   | Option DP2 or B40                                                                                                                                                                                                                         |
| Couplings      | Expected to be run before sending <code>:CAL:REF:CLOC?</code> . This will stop the current measurement when it has completed (does not abort the current data acquisition), and prepare the instrument for the expected cabling           |
| Remote Command | <code>:CALibration:REference:CLOCk:END?</code>                                                                                                                                                                                            |
| Example        | <code>:CAL:REF:CLOC:END?</code>                                                                                                                                                                                                           |
| Notes          | Returns 0 if successful, or 1 if failed                                                                                                                                                                                                   |
| Dependencies   | Option DP2 or B40                                                                                                                                                                                                                         |
| Couplings      | Expected to be run after sending <code>:CAL:REF:CLOC?</code> , and after removing the cable used in that Characterize Reference Clock step. This will resume any queued measurements, and concludes the reference clock characterization  |
| Remote Command | <code>:CALibration:TIME:REference:CLOCk?</code>                                                                                                                                                                                           |
| Example        | <code>:CAL:TIME:REference:CLOCk?</code>                                                                                                                                                                                                   |
| Notes          | Value is the date and time the last successful Characterize Reference Clock was executed. The date is separated from the time by a space character. Returns "" if Characterize Reference Clock has never been performed on the instrument |
| Dependencies   | Option DP2 or B40                                                                                                                                                                                                                         |
| State Saved    | No                                                                                                                                                                                                                                        |

## Front panel guided calibration sequence

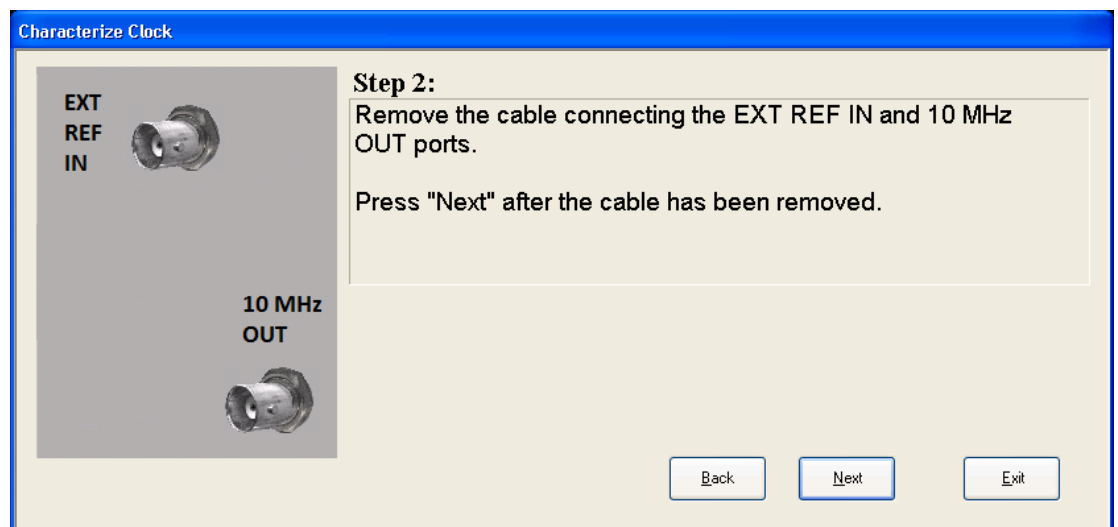
When selecting **Characterize Reference Clock** via the front panel, the following form is displayed.

Step 1 of the guided calibration sequence:

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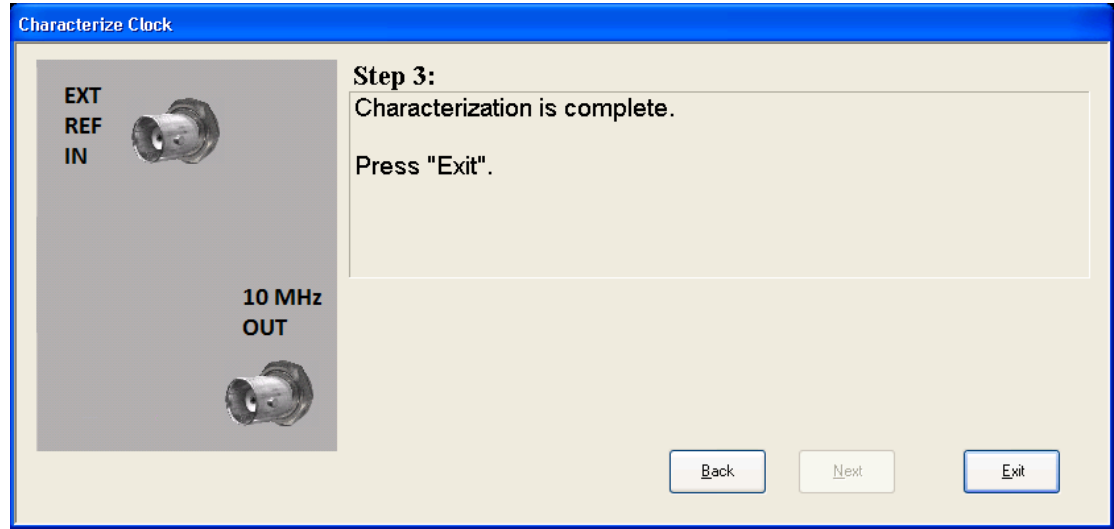


Step 2 of the guided calibration sequence:



Step 3 of the guided calibration sequence:





#### 4.6.7.3 Characterize Noise Floor

On instruments with the NF2 license installed, the calibrated Noise Floor used by Noise Floor Extensions should be refreshed periodically. To do this, press **Characterize Noise Floor**. When you press this control, the instrument stops any measurement currently underway, and a dialog appears with an **OK** and **Cancel** button that says:

*This action will take several minutes to perform. Please disconnect all cables from the RF input and press Enter to proceed. Press ESC to cancel*

When you press **Enter** or **OK**, the characterization proceeds. After the characterization, the instrument restarts the measurement from the beginning (similar to pressing the **Restart** key). The characterization takes many minutes to run.

The noise floor model used by Noise Floor Extensions includes an estimation of the temperature behavior of the noise floor, but this is only an estimation. The noise floor changes little with the age of the components. However, even small changes in the estimated level of the noise floor can make large changes in the effective noise floor, because the effective noise floor is the error in the estimation of the noise floor. Keysight recommends that the **Characterize Noise Floor** operation be performed when the instrument is operating at an ambient temperature that is significantly different than the ambient temperature at which this alignment was last run. In addition, Keysight recommends that the **Characterize Noise Floor** operation be performed after the first 500 hours of operation, and once every calendar year.

The noise floor model from the last operation of **Characterize Noise Floor** survives across the power cycle.

NOTE

The **Characterize Noise Floor** function can be interrupted, by pressing the **Cancel (ESC)** front-panel key, or remotely with Device Clear followed by the **:ABORT SCPI** command. None of the new characterization data is then used. However, since the old characterization data is purged at the beginning of the characterization, you now have an uncharacterized noise floor. You should re-execute this function and allow it to finish before making any further measurements with NFE. Until you do, the instrument will display a “Characterize Noise Floor required” message and set bit 12 in the Status Questionable Calibration register (**STATus:QUEStionable:CALibration:EXTended:NEEDed**).

|                |                                                                                                                                                                                                                                                                                                                      |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <b>:CALibration:NFLoor</b><br><b>:CALibration:NFLoor?</b>                                                                                                                                                                                                                                                            |
| Example        | <b>:CAL:NFL</b>                                                                                                                                                                                                                                                                                                      |
| Notes          | <b>:CALibration:NFLoor?</b> returns 0 if successful, or 1 if failed (including interfering user signal)<br>This command is sequential; it must complete before further commands are processed. Interrupting the alignment from remote is accomplished by invoking Device Clear followed by the <b>:ABORT</b> command |
| Dependencies   | This control does not appear in models that do not contain NF2. In these models the command is accepted without error, but no action is taken                                                                                                                                                                        |
| Couplings      | Successful completion of <b>Characterize Noise Floor</b> begin the elapsed time counter or the Last Characterize Noise Floor Time                                                                                                                                                                                    |
| Remote Command | <b>:CALibration:TIME:NFLoor?</b>                                                                                                                                                                                                                                                                                     |
| Example        | <b>:CAL:TIME:NFL?</b>                                                                                                                                                                                                                                                                                                |
| Notes          | Value is the date and time the last successful <b>Characterize Noise Floor</b> was executed. The date is separated from the time by a space character<br>Returns “” if no <b>Characterize Noise Floor</b> has ever been performed on the instrument                                                                  |
| Dependencies   | In models that do not include NF2, this command is not enabled and any attempt to set or query yields an error                                                                                                                                                                                                       |
| State Saved    | No                                                                                                                                                                                                                                                                                                                   |
| Remote Command | <b>:CALibration:TEMPerature:NFLoor?</b>                                                                                                                                                                                                                                                                              |
| Example        | <b>:CAL:TEMP:NFL?</b>                                                                                                                                                                                                                                                                                                |
| Notes          | Value is the temperature of the last successful <b>Characterize Noise Floor</b> was executed<br>Returns “” if no <b>Characterize Noise Floor</b> has ever been performed on the instrument                                                                                                                           |
| Dependencies   | In models that do not include NF2, this command is not enabled and any attempt to set or query yields an error                                                                                                                                                                                                       |
| State Saved    | No                                                                                                                                                                                                                                                                                                                   |
| Remote Command | <b>:CALibration:TIME:ELAPsed:NFLoor?</b>                                                                                                                                                                                                                                                                             |

|              |                                                                                                                                                                                                                              |
|--------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Example      | <code>:CAL:TIME:ELAP:NFL?</code>                                                                                                                                                                                             |
| Notes        | Value is the elapsed time the instrument was powered-on since the last successful <b>Characterize Noise Floor</b> was executed<br>Returns "" if no <b>Characterize Noise Floor</b> has ever been performed on the instrument |
| Dependencies | In models that do not include NF2, this command is not enabled and any attempt to set or query yields an error                                                                                                               |
| State Saved  | No                                                                                                                                                                                                                           |

#### 4.6.7.4 Characterize Noise Floor for IQ Measurement

Available in N9042B and N9032B instruments only.

The calibrated noise floor used by IQ-based measurements should be refreshed periodically. To do this, select the **IF Path**, select the **Frequency Range** from the table in this dialog, then press **Characterize Noise Floor for IQ Measurement**. The instrument stops any measurement currently underway, and a dialog appears with an **OK** and **Cancel** button that states:

The NF2 license requires characterization of the analyzer's noise floor.

Characterizing the analyzer's noise floor for IQ measurement is an alignment that can take 30 minutes to several hours to complete depending on the IF Path and frequency range you selected. If all IF Path and all frequency ranges are selected, it will take about 18 hours. This alignment is only needed once every calendar year.

Ensure the instrument has been warmed up for at least an hour before running this alignment.

Please disconnect all cables from the RF input(s) and press Enter to proceed. Press ESC to cancel.

When you press **Enter** or **OK**, the characterization proceeds. After the characterization, the instrument restarts the measurement from the beginning (similar to pressing the **Restart** key). The characterization takes about 30 minutes if 1 or 2 frequency ranges are selected for one **IF Path**. If *all* frequency ranges and **IF Paths** are selected, it will take about 18 hours.

The noise floor model used by IQ based measurements includes an estimation of the temperature behavior of the noise floor, but this is *only* an estimation. The noise floor changes little with the age of the components. However, even small changes in the estimated level of the noise floor can make large changes in the effective noise floor, because the effective noise floor is the error in the estimation of the noise floor. Keysight recommends that the **Characterize Noise Floor for IQ Measurement** operation be performed whenever the instrument is operating at an ambient temperature that is significantly different than the ambient temperature at which this alignment was last run. In addition, Keysight recommends that **Characterize Noise Floor for IQ Measurement** be performed after the first 500 hours of operation, and once every calendar year.

The noise floor model from the last operation of **Characterize Noise Floor for IQ Measurement** survives a power cycle.

NOTE

The **Characterize Noise Floor for IQ Measurement** function can be interrupted, by pressing the **Cancel (ESC)** front-panel key, or remotely with Device Clear followed by **:ABORT**. None of the new characterization data is then used. However, since the old characterization data is purged at the beginning of the characterization, you now have an *uncharacterized* noise floor. You should re-execute this function and allow it to finish before making any further measurements that use the calibrated noise floor.

To perform this alignment, you must first select **"IF Path"** on page 480 and **"Frequency Range Table"** on page 480. If multiple frequency ranges are selected, it will take several hours to complete this alignment. To save time, it is recommended that you only perform this alignment *only* for **IF Path** and **Frequency Ranges** that are used in your measurement.

NOTE

The calibrated noise floor is currently used in IQ-NC in the Modulation Analysis measurement in WLAN, 5G NR, and V2X Modes.

IF Path

Select which **IF Path** on which to perform the alignment in **"Characterize Noise Floor for IQ Measurement"** on page 479

The following options are supported in **Characterize Noise Floor for IQ Measurement**:

| Option  | Path      |
|---------|-----------|
| 1 GHz   | 1 GHz     |
| 1.5 GHz | 1.5 GHz   |
| 2 GHz   | 2 GHz     |
| 4 GHz   | 4 GHz     |
| ALL     | All above |

|             |                                       |
|-------------|---------------------------------------|
| Preset      | 1 GHz                                 |
| State Saved | Yes                                   |
| Range       | 1 GHz   1.5 GHz   2 GHz   4 GHz   All |

Frequency Range Table

Select from this table the frequency range to perform the alignment in **"Characterize Noise Floor for IQ Measurement"** on page 479. The frequency ranges for each IF

Path differ. You can select multiple frequency ranges in this table to do the alignment, but the alignment will take more time if multiple frequency ranges are selected. When the alignment is completed, the **Status** column updates accordingly.

#### 4.6.7.5 Calibration Temperature History

The following queries let you retrieve various statistics regarding the Calibration Temperature history.

##### Minimum Temperature Within Last Number of Seconds

Lets you query the minimum temperature within the last number of seconds. If no data exists for the requested time, the returned value is 9.91e+37.

|                |                                                                |
|----------------|----------------------------------------------------------------|
| Remote Command | <code>:CALibration:TEMPerature:MINimum? &lt;seconds&gt;</code> |
| Example        | <code>:CAL:TEMP:MIN? 60</code>                                 |

##### Maximum Temperature Within Last Number of Seconds

Lets you query the maximum temperature within the last number of seconds. If no data exists for the requested time, the returned value is 9.91e+37.

|                |                                                                |
|----------------|----------------------------------------------------------------|
| Remote Command | <code>:CALibration:TEMPerature:MAXimum? &lt;seconds&gt;</code> |
| Example        | <code>:CAL:TEMP:MAX? 60</code>                                 |

##### Temperature Seconds Ago

Lets you query temperature X seconds ago. If no data exists for the requested time, the returned value is 9.91e+37.

|                |                                                            |
|----------------|------------------------------------------------------------|
| Remote Command | <code>:CALibration:TEMPerature:AGO? &lt;seconds&gt;</code> |
| Example        | <code>:CAL:TEMP:AGO? 75</code>                             |

##### Oldest Temperature Value

Lets you query the oldest recorded temperature value.

|                |                                                             |
|----------------|-------------------------------------------------------------|
| Remote Command | <code>:CALibration:TEMPerature:OLDest[:TEMPerature]?</code> |
| Example        | <code>:CAL:TEMP:OLD?</code>                                 |

##### Oldest Temperature Time

Lets you query how long ago the oldest temperature value was recorded.

|                |                                          |
|----------------|------------------------------------------|
| Remote Command | :CALibration:TEMPerature:OLDest:SEConds? |
| Example        | :CAL:TEMP:OLD:SEC?                       |

4.6.7.6 TDS Alignment

Only appears in N9038B (MXE-B) when Option TDS is installed and licensed.

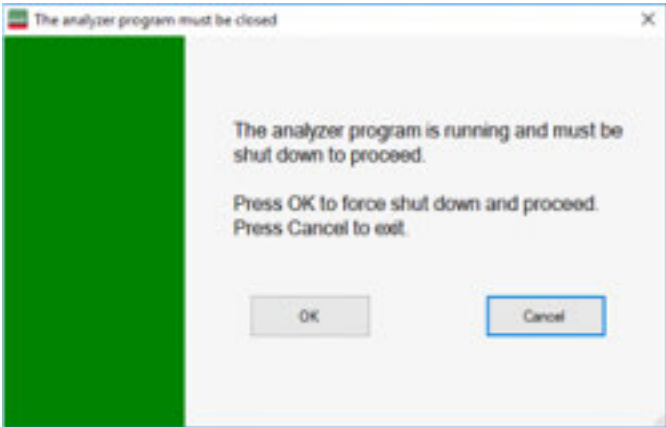
The TDS alignment includes **AlignNowAll** and **RFPresel** alignment. Immediately executes an alignment of the TDS subsystem. The instrument stops any measurement currently underway, performs the alignment, and then restarts the measurement from the beginning (similar to pressing the **Restart** key).

Align TDS can be interrupted by pressing the **Cancel (ESC)** front-panel key or from remote with Device Clear followed by **:ABORt**. When this occurs, no new TDS alignment data will be employed.

|                |                                                                                                                                                                                                           |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | :CALibration:TDS<br><br>Params missing? What does the query return?<br>:CALibration:TDS?                                                                                                                  |
| Example        | :CAL:TDS                                                                                                                                                                                                  |
| Notes          | This command is sequential; it must complete before further commands are processed. Interrupting the alignment from remote is accomplished by invoking Device Clear followed by the <b>:ABORt</b> command |
| Dependencies   | Only appears in N9038B (MXE-B) models with Option TDS installed and licensed                                                                                                                              |

4.6.7.7 Backup or Restore Align Data...

Opens the utility for backing-up or restoring alignment data. Since this utility cannot be run while the instrument software is running, a prompt tells you to shut down the instrument first:



Press **OK** and the instrument will shut down and open the backup utility.

Alignment data for the instrument resides on the hard drive in a database. Keysight uses high quality hard drives; however, it is highly recommended the alignment data be backed-up to storage outside of the instrument. Additionally, for customers who use multiple CPU Assemblies or multiple disk drives, the alignment that pertains to the instrument must be transferred to the resident hard drive after a CPU or hard drive is replaced. This utility facilitates backing-up and restoring the alignment data.

**NOTE**

**This utility allows you to navigate to any location of the Windows file system. If you are backing up alignment data to storage outside of the instrument, then it is assumed that you will use a USB memory device, or Mapped Network Drive.**

Processor Assembly types PC6 and PC7 contain a removable SD memory card. When one of these CPUs is installed, the Backup and Restore Alignment Data wizard defaults to the SD card as the backup location. At every power-on, the software will check to determine if the calibration data on the SD memory card (the backup) is newer than the data in use on the disk. In such situations, before the application is loaded, you are given the opportunity to restore the data from the backup. If you respond **Yes**, the Backup and Restore Alignment Data wizard (see "[Alignment Data Wizard \(without Flash\)](#)" on page 484) will be invoked to perform the restore.

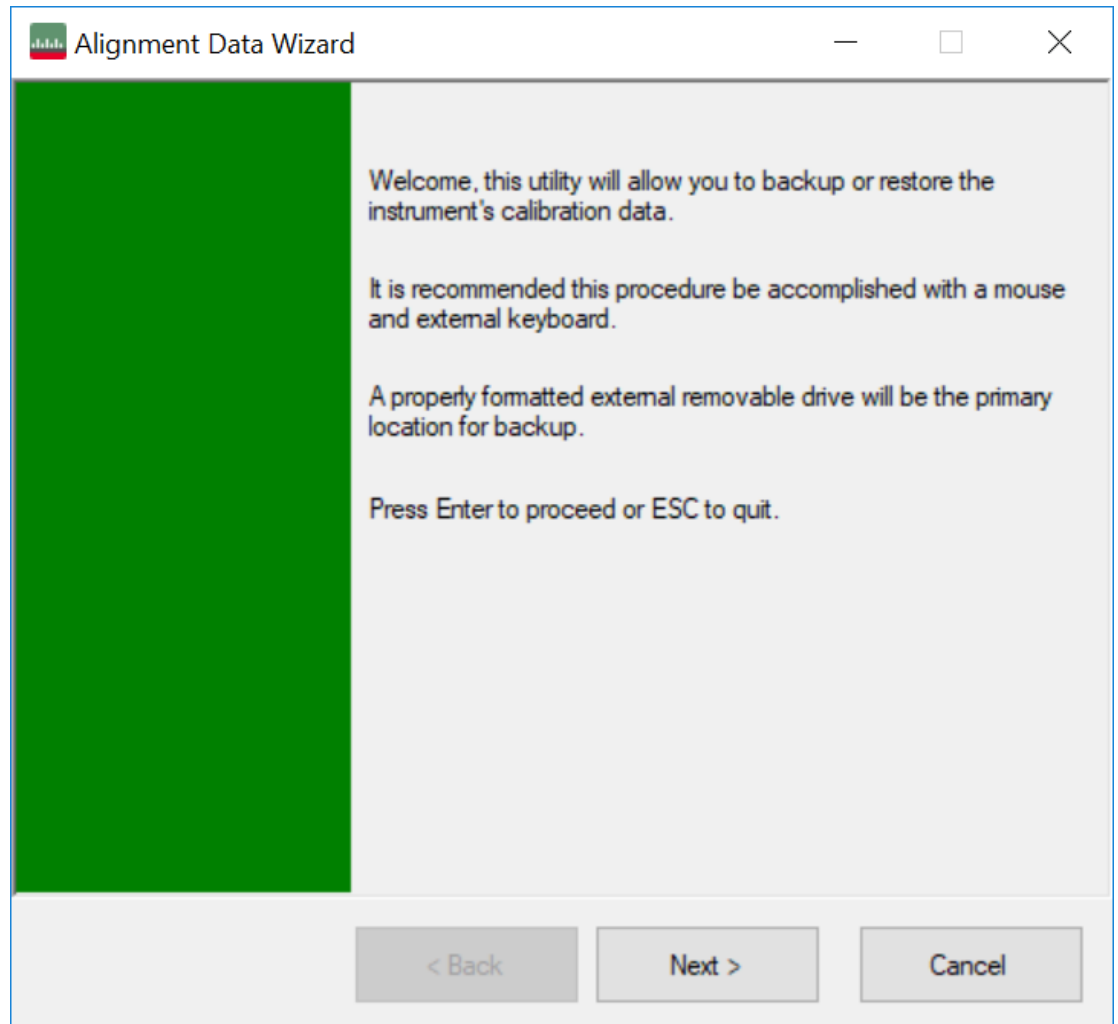
Processor Assembly types PC6S and PC7S contain an internal flash EEPROM, as well as a removable SD card. When one of these CPUs is installed, the Backup and Restore Alignment Data wizard defaults to the internal flash as the backup location. As with the PC6 and PC7, at every power-on, the software compares the timestamp of the backup on the flash and the timestamp of the alignment data in use on the disk. If the backup on the flash has newer data, you are given the opportunity to restore the data from the backup before the application is loaded. If you respond **Yes**, the Backup and Restore Alignment Data wizard (see "[Alignment Data Wizard \(with Flash\)](#)" on page 494) will be invoked and will prompt you to restore that backup.

For purposes of these instructions, "alignment data" and "calibration data" are used interchangeably.

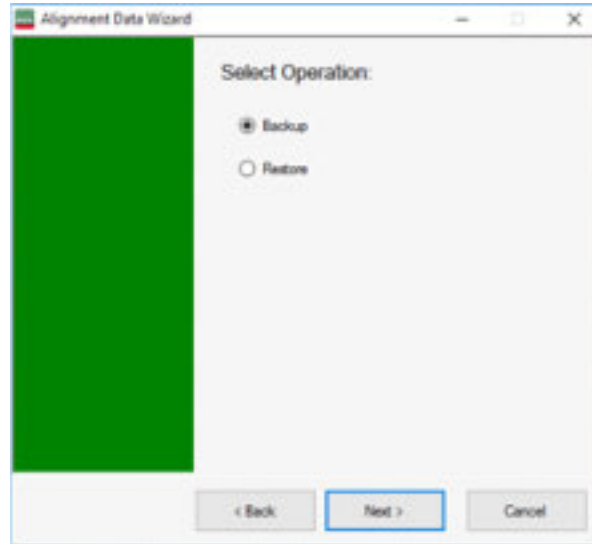
|                |                                                                                                                                                                       |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Dependencies   | Not available in UXM                                                                                                                                                  |
| Remote Command | <code>:CALibration:DATA:DEFault</code>                                                                                                                                |
| Example        | <code>:CAL:DATA:DEF</code>                                                                                                                                            |
| Notes          | Restores the alignment data files to their default state                                                                                                              |
| Couplings      | Sets <b>Auto Align</b> to <b>OFF</b> . Sets Bit 14 in the Status Questionable Calibration register. The Error Condition message "Align Now All required" is generated |

### Alignment Data Wizard (without Flash)

Guides you through the operation of backing-up or restoring the alignment data.



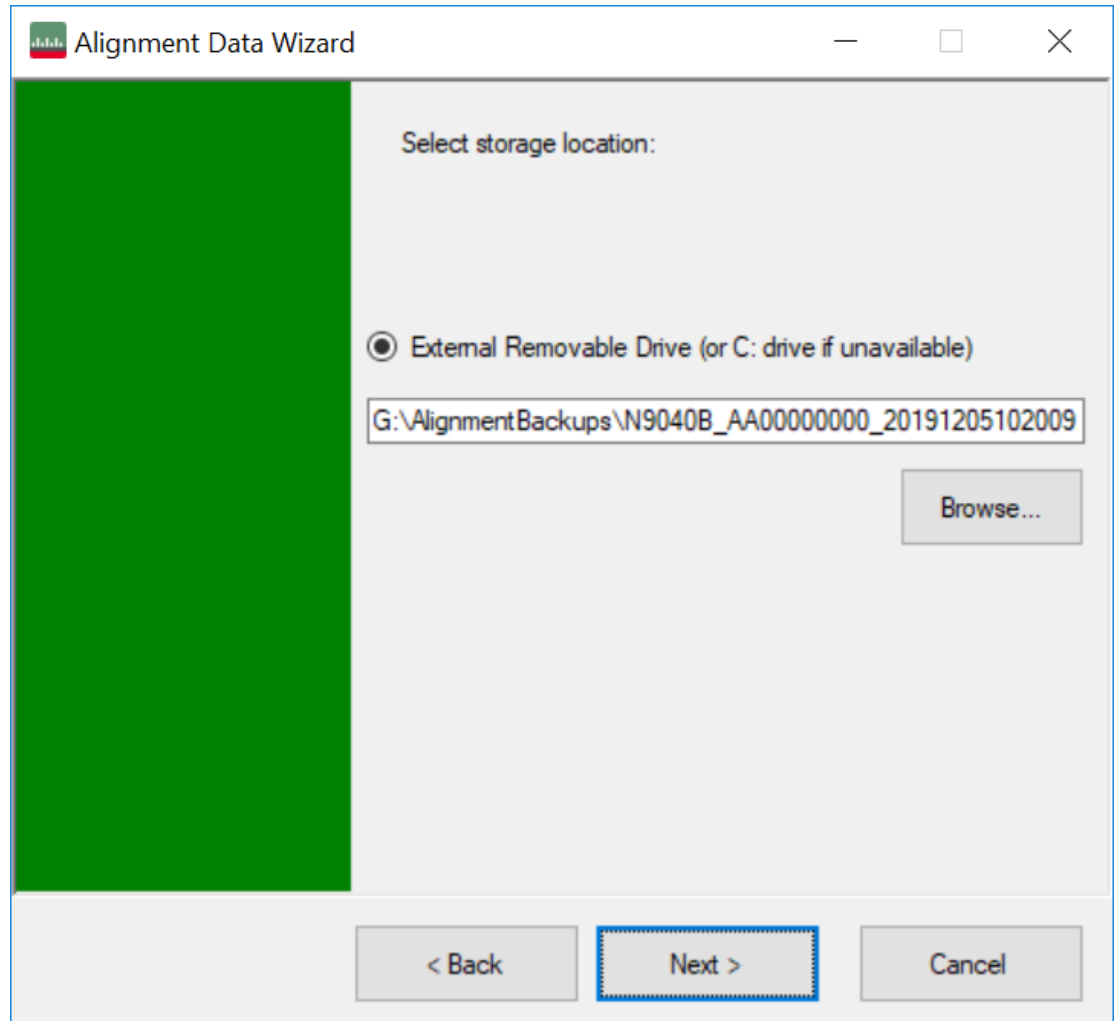




The default backup location for instruments *without* internal flash will be the first drive identified as an external drive (USB or LAN) if such is available; or, if not, the internal D: partition.

The default file name is `<model number>_<serial number>_<date in YYYYMMDDHHMMSS>.bkz`.

The default file extension for legacy backup files was `.bak`. The Backup and Restore operations support both the `.bak` (legacy format) and `.bkz` formats.

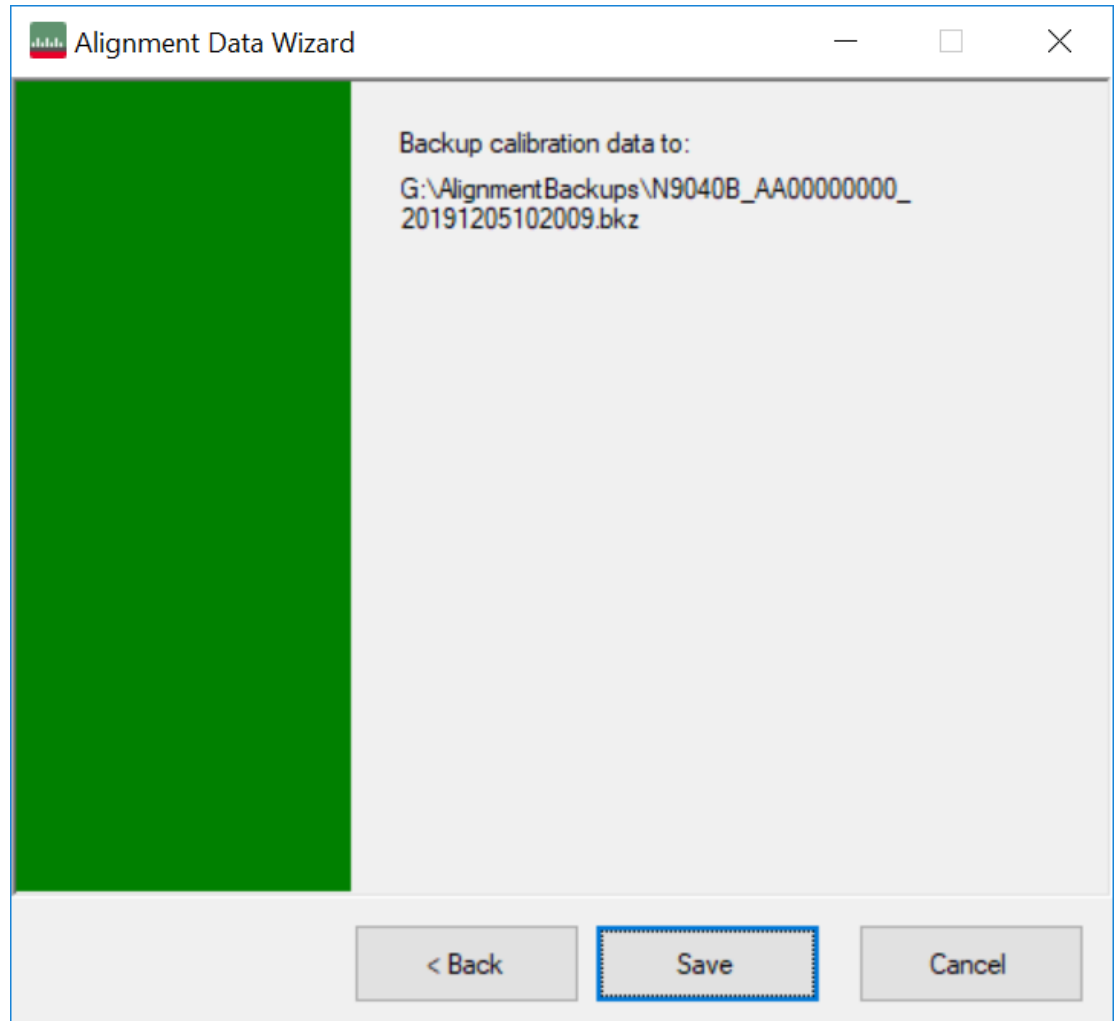


If a USB drive is present, it will be selected by default. The path defaults to the **AlignmentBackups** folder, and a filename is automatically created, in the form: `<model>_<serial number>_<date><time>.bkz`

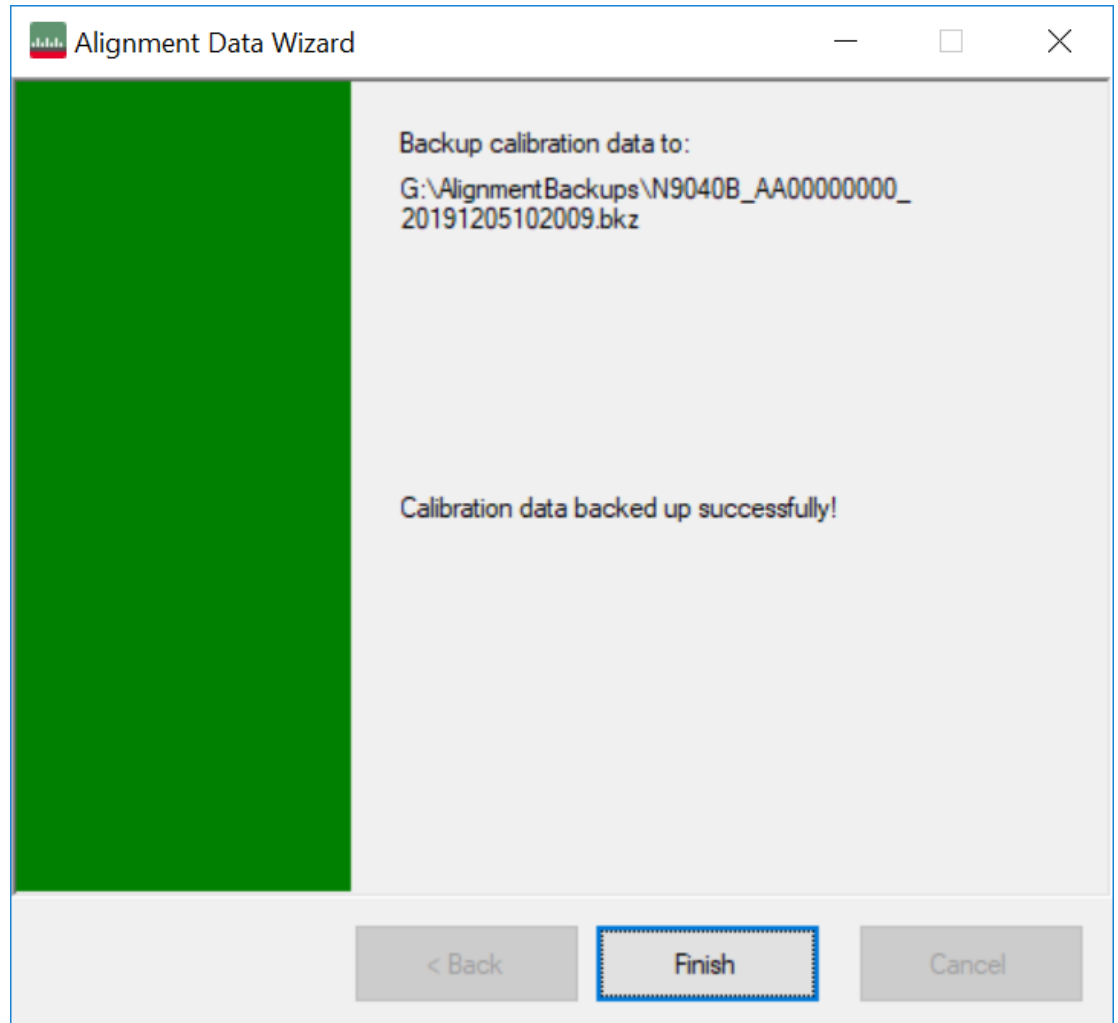
If you wish to enter a customer filename, you can do so with an external keyboard, or by opening the onscreen Alpha keyboard, by pressing the **Keyboard** hardkey on the front panel:



When the **Next >** button is pressed, you will be prompted to create a new folder if the chosen path does not yet exist.

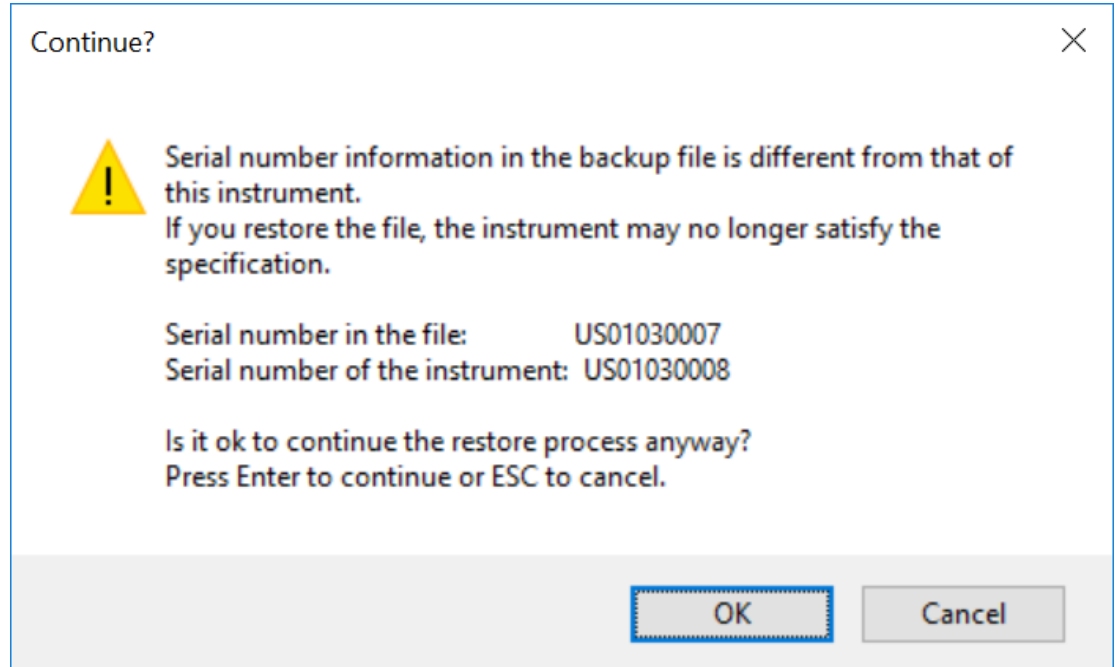


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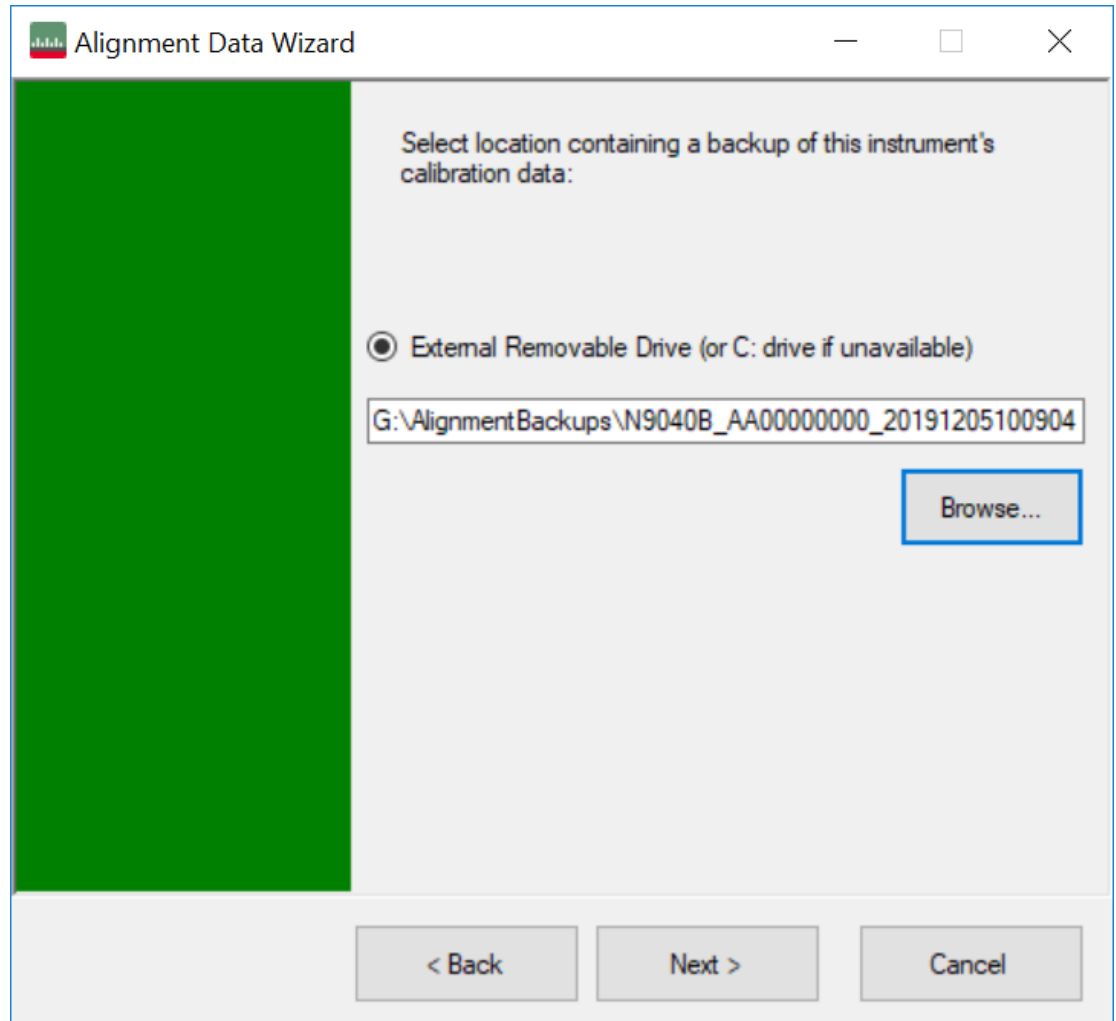
The restore operation checks the validity of the restore file using the database's built-in file validation. If the restore file is corrupt, the existing alignment data will remain in use.

If the serial number information in the backup file being restored is different from that of the instrument, the following message appears (the serial numbers shown are examples):



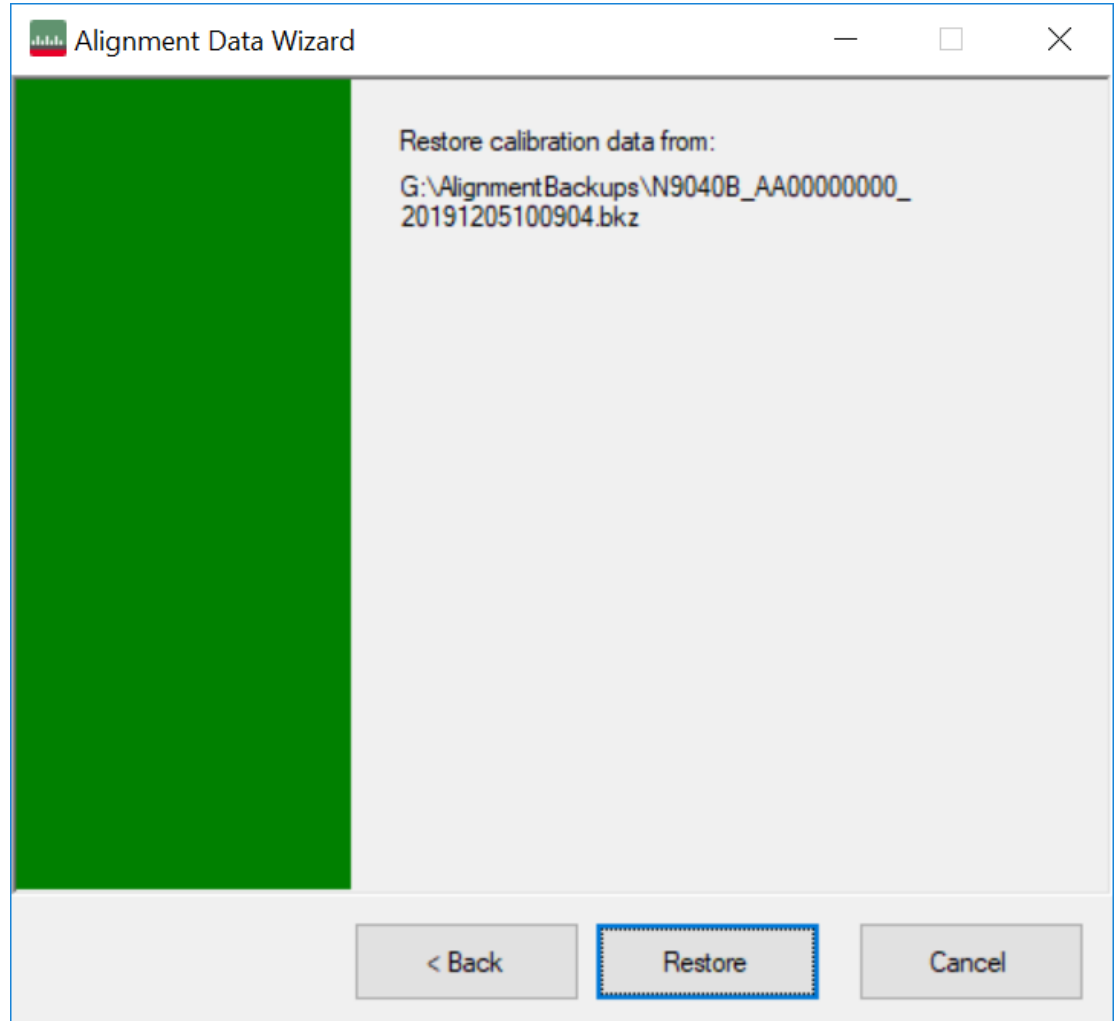
The default restore location for instruments *without* internal flash will be the first drive identified as an external drive (USB or LAN) if such is available; or, if not, the internal D: partition. The default restore file will be the most recent file that matches the default backup file name format: `<model number>_<serial number>_<date>.bkz`

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4.6 Alignments

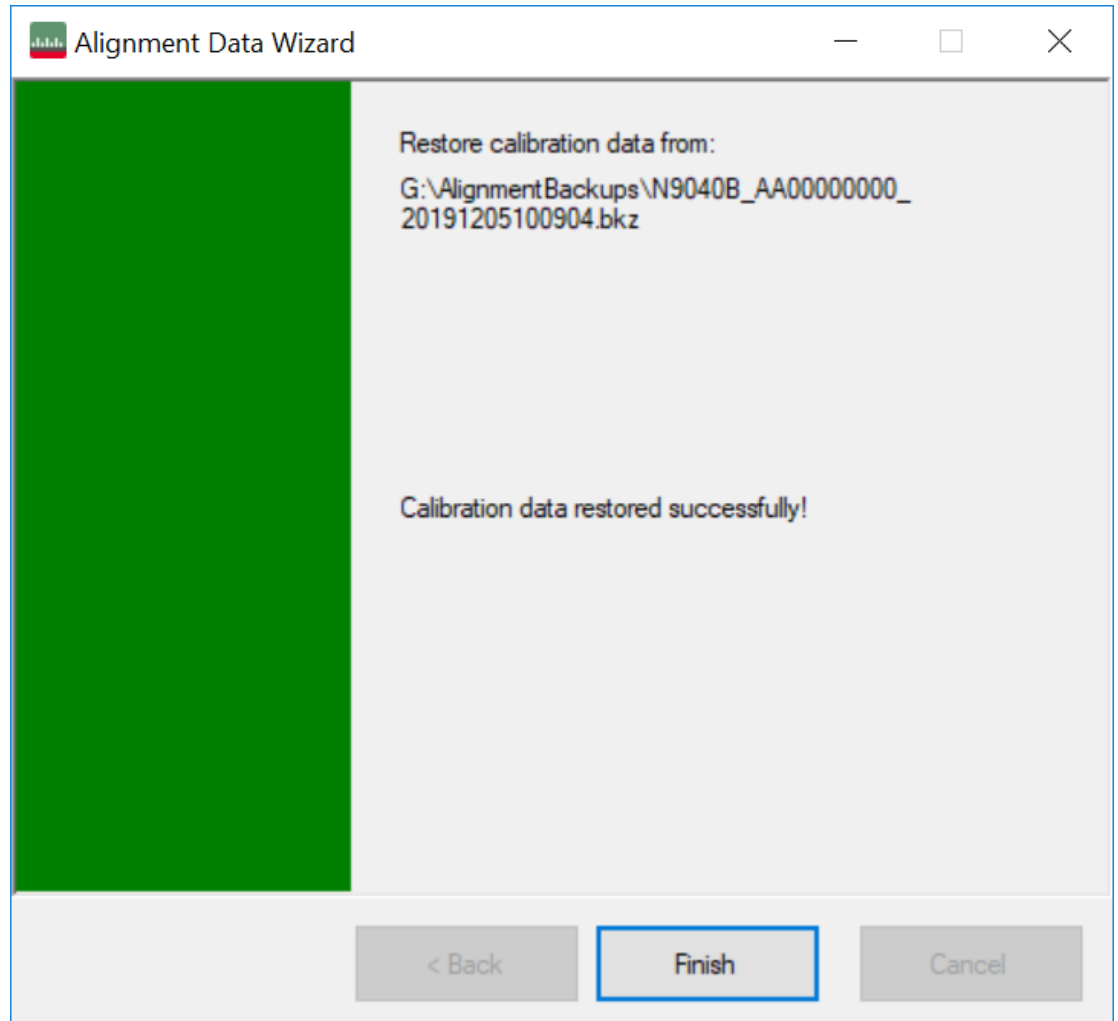


Changing the drive letter also modifies the path displayed in the box below. When this step is first loaded, the drive drop-down menu is populated with connected drives, which provide you with read access.

The path defaults to the **AlignBackups** folder. The most recent backup (\*.bkz or \*.bak) file in the folder will also be selected by default.

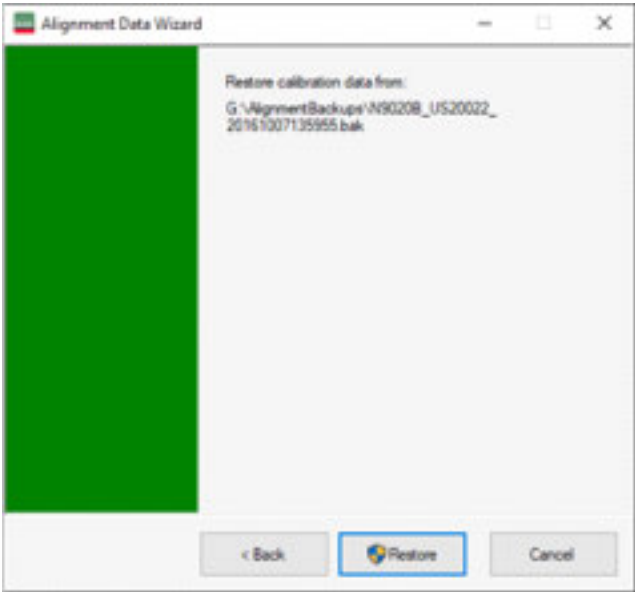


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When restoring data in the legacy **.bak** format, Administrator privileges are required. You will be prompted when you attempt a restore (indicated by the UAC Shield on the **Restore** button below).





**Perform Backup (without Flash) (Remote Command Only)**

Invokes an alignment data backup operation to the provided location.

**NOTE** Keysight recommends that the specified location should be external to the instrument (USB or Mapped Network Drive).

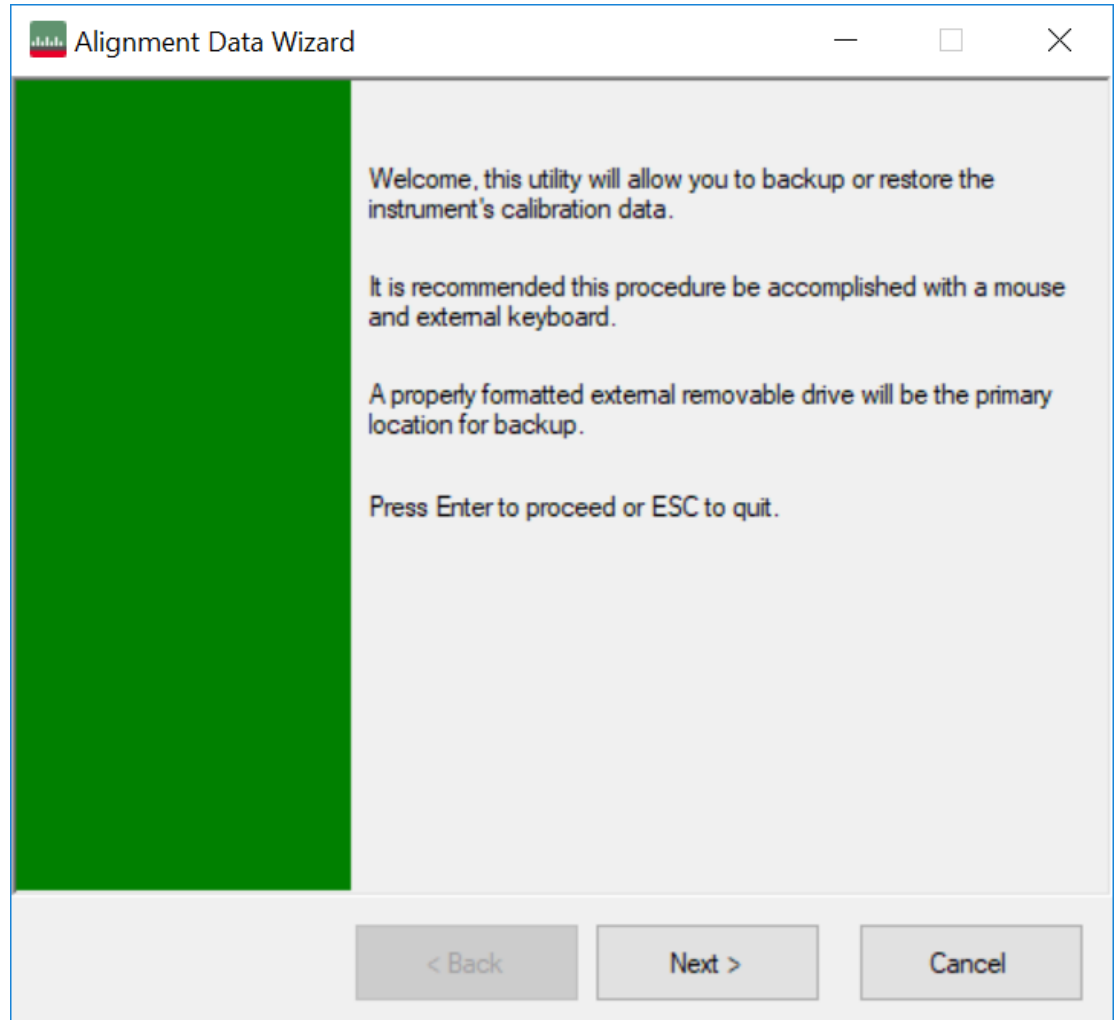
|                |                                                                      |
|----------------|----------------------------------------------------------------------|
| Remote Command | :CALibration:DATA:BACKup <filename>                                  |
| Example        | :CAL:DATA:BACK "F:\AlignDataBackup_N9020A_US00000001_2008140100.bkz" |

**Perform Restore (without Flash) (Remote Command Only)**

Invokes an alignment data restore operation from the provided filename.

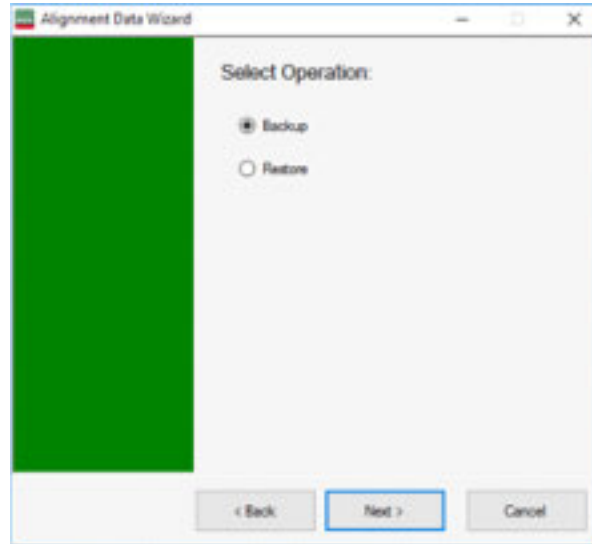
|                |                                                                       |
|----------------|-----------------------------------------------------------------------|
| Remote Command | :CALibration:DATA:REStore <filename>                                  |
| Example        | :CAL:DATA:REST "F:\ AlignDataBackup_N9020A_US00000001_2008140100.bkz" |

## Alignment Data Wizard (with Flash)



If your instrument has Processor Assembly type PC6S or PC7S (see ["Show System" on page 372](#)) the instrument has an internal flash EEPROM that can store a backup of the alignment data. In this case, the interface to the Alignment Data Wizard is enhanced to accommodate this internal storage. This section details the use of this internal flash. For details on using external storage, see the previous section (["Alignment Data Wizard \(without Flash\)" on page 484](#)).

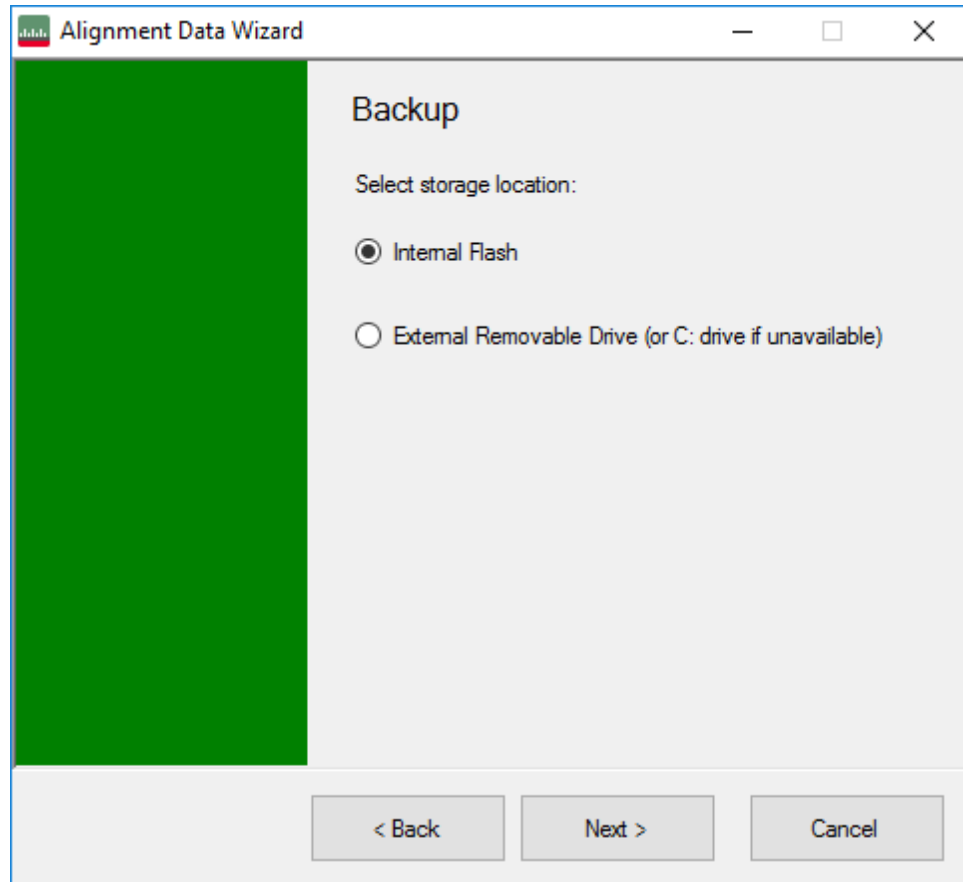
The Alignment Data Wizard guides you through the operations of backing up or restoring alignment data.

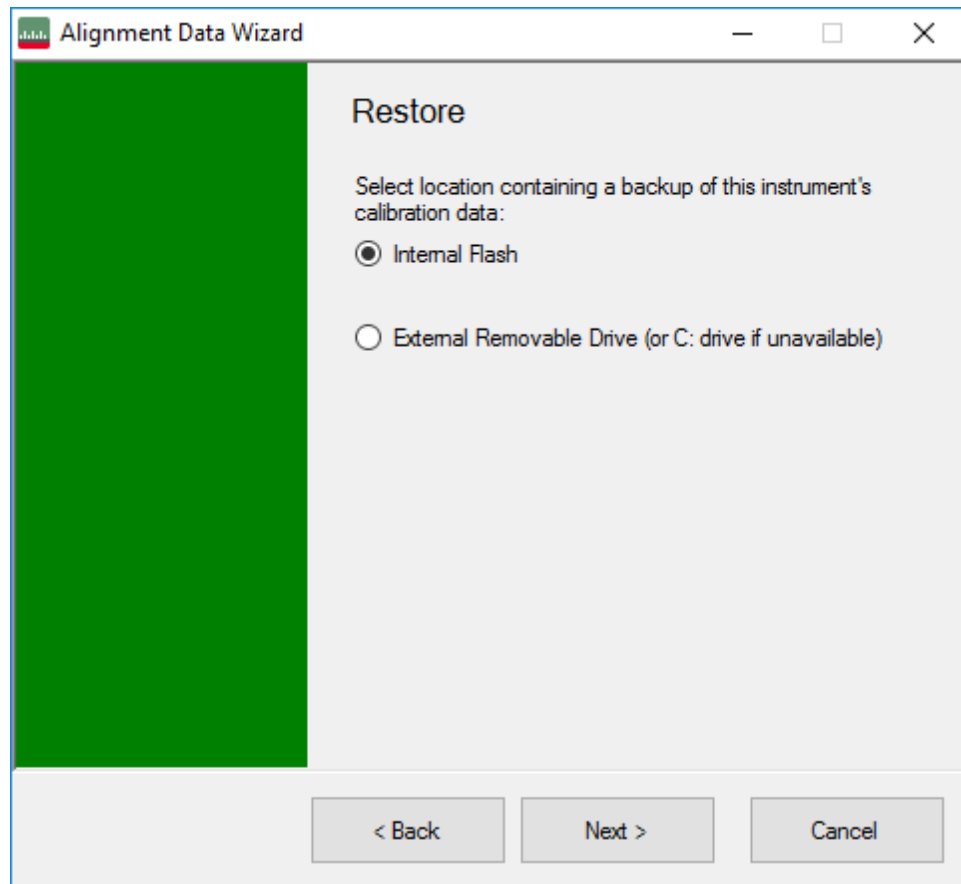


Having selected **Backup** or **Restore**, you then select the source or destination for the alignment data. As shown below, you can select either:

- Internal flash EEPROM, or,
- External Removable Drive (which includes the SD card described in "[Backup or Restore Align Data...](#)" on page 482)

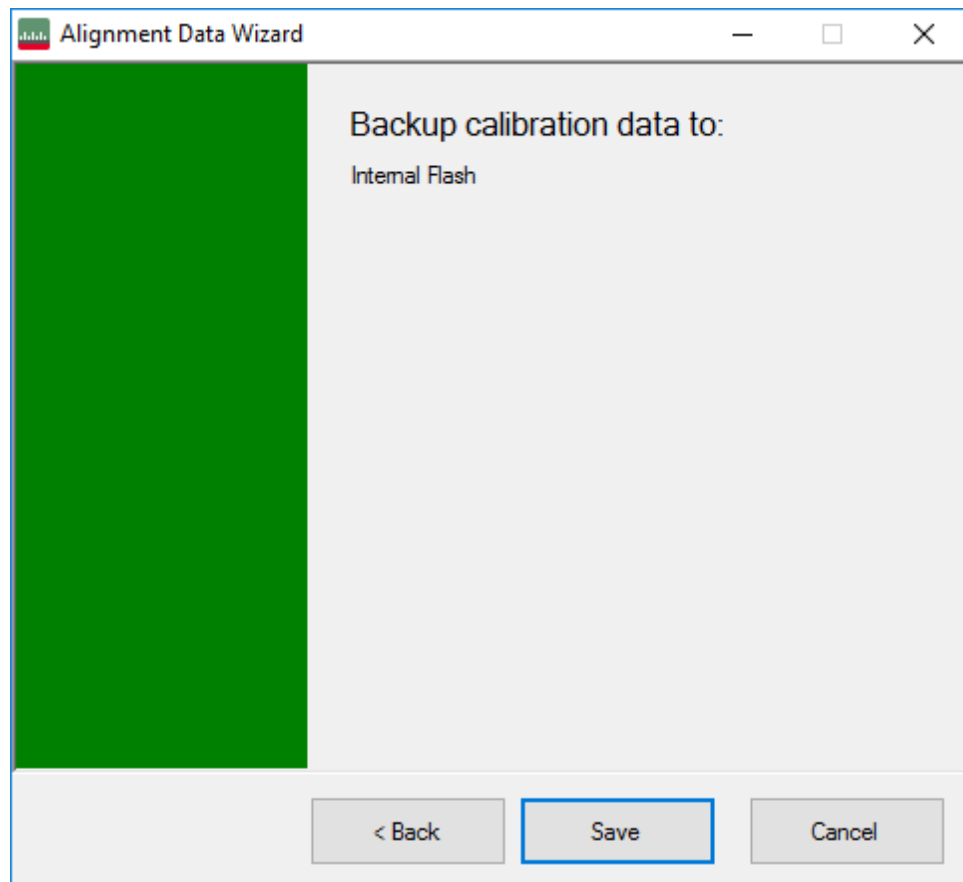
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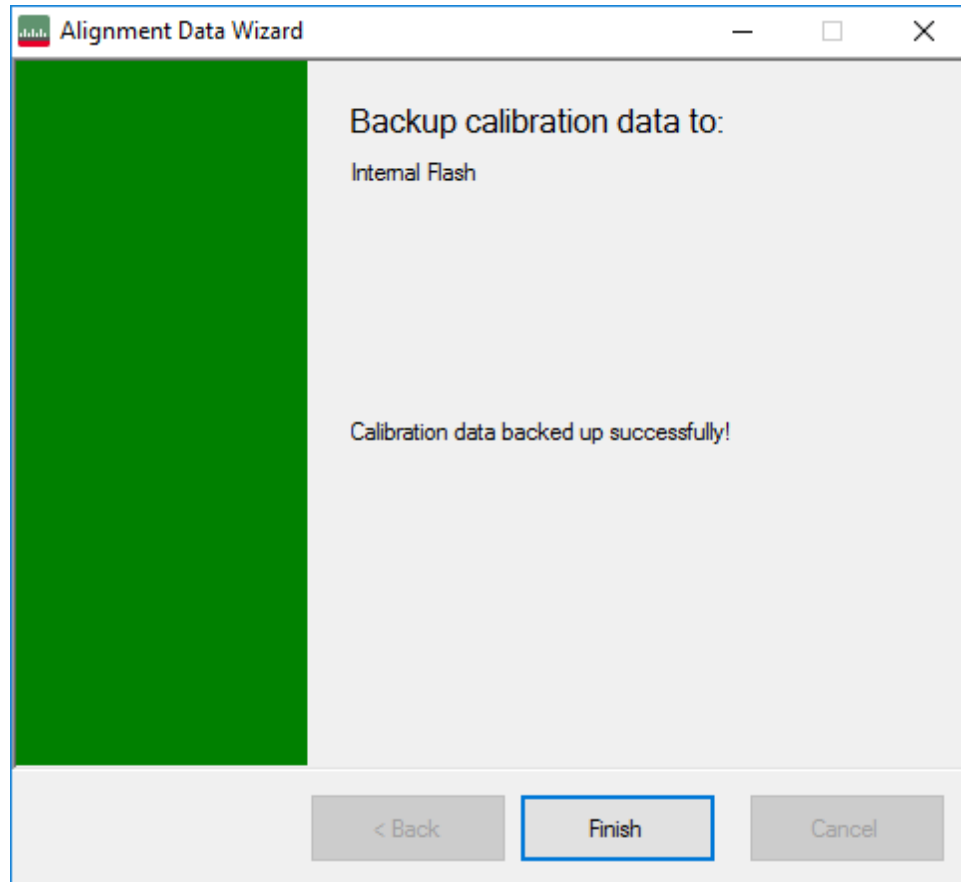




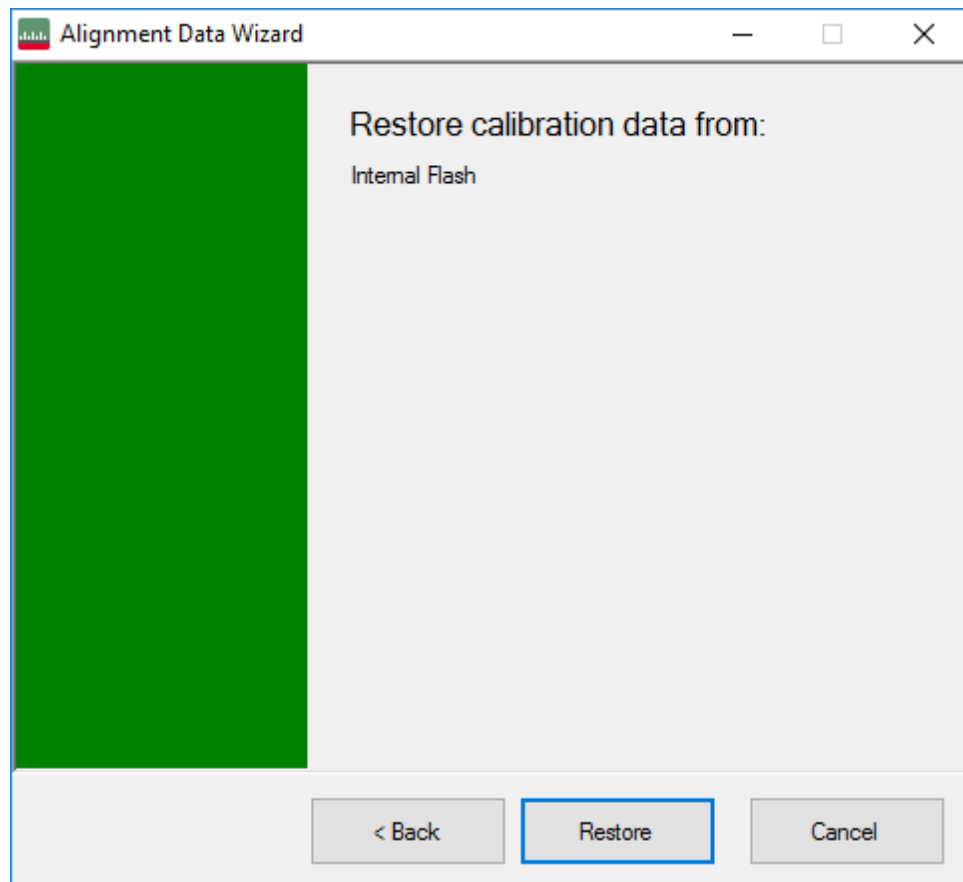
The final page of the wizard asks you to confirm the choices made in the previous pages. When the operation is complete, an indication is displayed on the same page, as below.

## Backup

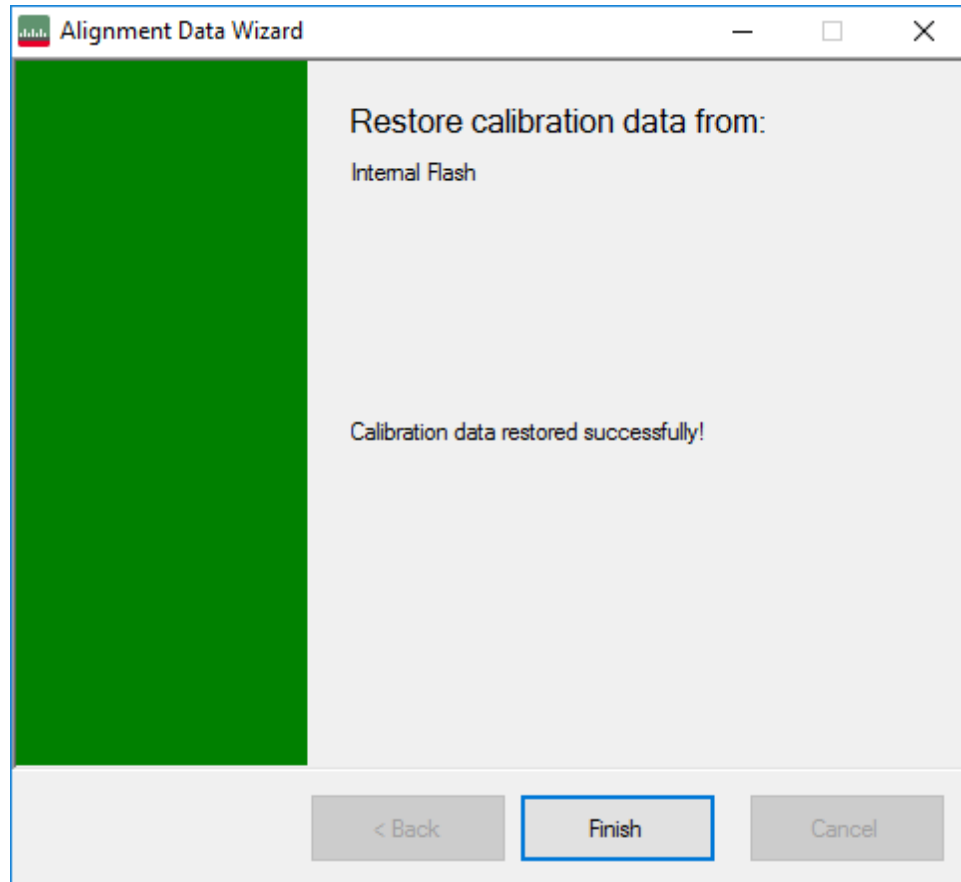




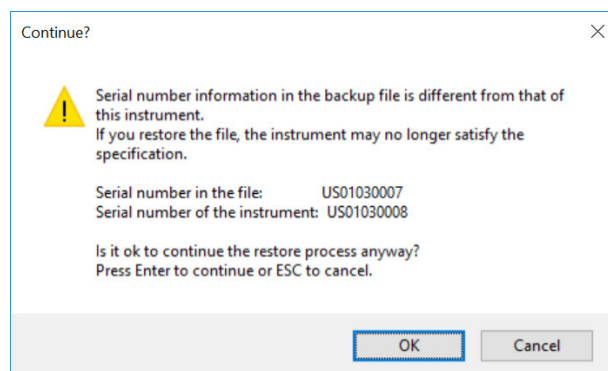
## Restore



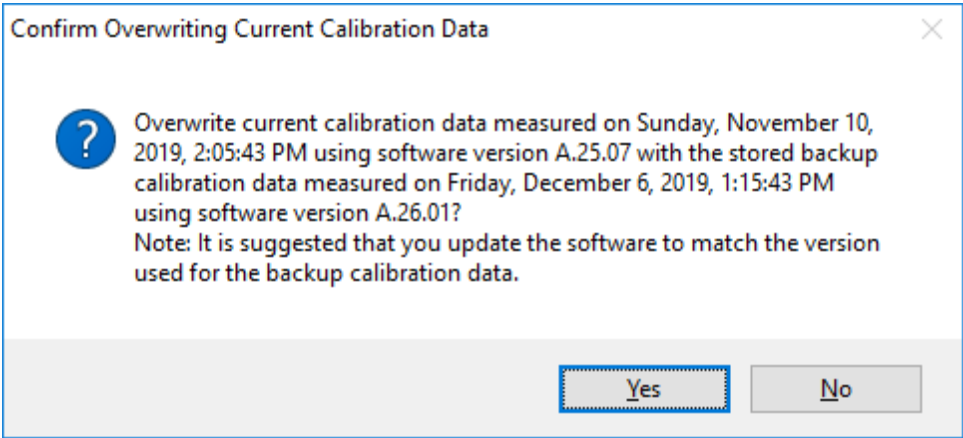




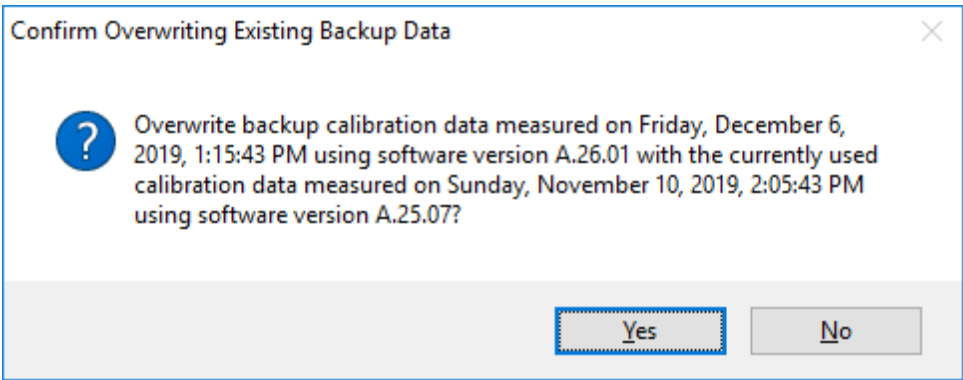
When restoring alignment data, if the serial number information in the backup file being restored is different from that of the instrument, the following message appears (the serial numbers shown are examples):



Immediately before the actual restoration, a final confirmation message is displayed detailing what is being restored and the current database that will be overwritten on the disk (the dates and versions are examples):



When backing up alignment data to the flash, if there is already an existing backup on the flash, a final confirmation message is displayed detailing what is being backed up and what will be overwritten on the flash (again, the dates and versions are examples):



**Perform Backup (with Flash) (Remote Command Only)**

Invokes an alignment data backup operation to the internal flash EEPROM.

|                |                                   |
|----------------|-----------------------------------|
| Remote Command | :CALibration:DATA:INTernal:BACKup |
| Example        | :CAL:DATA:INT:BACK                |

**Perform Restore (With Flash) (Remote Command Only)**

Invokes an alignment data restore operation from the internal flash EEPROM.

|                |                                    |
|----------------|------------------------------------|
| Remote Command | :CALibration:DATA:INTernal:REStore |
| Example        | :CAL:DATA:INT:REST                 |

## Restore Alignment Defaults

Causes the Alignment system settings to be reset to their default values. This does not affect any Alignment data stored in the system.

After performing this function, it may impact the auto-alignment time of the instrument until a new alignment baseline has been established.

When **Alignments** is selected, a message appears saying:

*This will reset all of the settings for the Alignment system to their default values*

*No alignment data will be erased*

*This action cannot be undone. Do you want to proceed?*

The dialog includes **OK** and **Cancel** controls, for you to affirm or cancel the operation.

**Align Now All** must be executed if the value of the Timebase DAC results in a change.

| Example               | :SYST:DEF ALIG                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |           |         |              |            |                      |                  |                  |                                                                                        |                       |     |                  |                    |
|-----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|---------|--------------|------------|----------------------|------------------|------------------|----------------------------------------------------------------------------------------|-----------------------|-----|------------------|--------------------|
| Notes                 | <p>Alignment processing that results as the transition to <b>Auto Align Normal</b> will be executed sequentially; thus <b>*OPC?</b> or <b>*WAI</b> will wait until the alignment processing is complete</p> <p>The parameters affected are:</p> <table> <tr> <th>Parameter</th><th>Setting</th></tr> <tr> <td>Timebase DAC</td><td>Calibrated</td></tr> <tr> <td>Timebase DAC setting</td><td>Calibrated value</td></tr> <tr> <td>Auto Align State</td><td>Normal (if the instrument is not operating with default alignment data, Off otherwise)</td></tr> <tr> <td>Auto Align All but RF</td><td>Off</td></tr> <tr> <td>Auto Align Alert</td><td>Time &amp; Temperature</td></tr> </table> | Parameter | Setting | Timebase DAC | Calibrated | Timebase DAC setting | Calibrated value | Auto Align State | Normal (if the instrument is not operating with default alignment data, Off otherwise) | Auto Align All but RF | Off | Auto Align Alert | Time & Temperature |
| Parameter             | Setting                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |           |         |              |            |                      |                  |                  |                                                                                        |                       |     |                  |                    |
| Timebase DAC          | Calibrated                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |           |         |              |            |                      |                  |                  |                                                                                        |                       |     |                  |                    |
| Timebase DAC setting  | Calibrated value                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |           |         |              |            |                      |                  |                  |                                                                                        |                       |     |                  |                    |
| Auto Align State      | Normal (if the instrument is not operating with default alignment data, Off otherwise)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |           |         |              |            |                      |                  |                  |                                                                                        |                       |     |                  |                    |
| Auto Align All but RF | Off                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |           |         |              |            |                      |                  |                  |                                                                                        |                       |     |                  |                    |
| Auto Align Alert      | Time & Temperature                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |           |         |              |            |                      |                  |                  |                                                                                        |                       |     |                  |                    |

### 4.6.7.8 RF Preselector

This menu and all its submenus are only available in models with the RF Preselector, such as N9038B, or N9048B.

|              |                                         |
|--------------|-----------------------------------------|
| Dependencies | Only available in RF Preselector models |
|--------------|-----------------------------------------|

## Align Now, 20 Hz to 30 MHz

Immediately executes an alignment of the receiver subsystem. The receiver will stop any measurement currently underway, perform an Align Now All, then perform the RF Preselector alignment, and then restart the measurement from the beginning (similar to pressing the Restart key).

The query `:CALibration:RFPSelector:CONDUCTed?` invokes the alignment of the RF Preselector on Conducted Band and returns a success or failure value. Successful completion clears the “Align 20 Hz to 30 MHz required” Error Condition, and clears bit 1 in the Status Questionable Calibration Extended Needed register. The elapsed time counter will begin for Last Align Now, Conducted Time, and the temperature is captured for the Last Align Now, Conducted Temperature. The alignment can be interrupted by pressing the Cancel (ESC) front-panel key or remotely with Device Clear followed by the `:ABORt` SCPI command. When this occurs, the Error Condition “Align 20 Hz to 30 MHz required” is set because new alignment data may be employed for an individual subsystem, but not a cohesive set of data for all subsystems.

The “Align 20 Hz to 30 MHz required” Error Condition will appear when this alignment has expired. User is now responsible to perform the Align Now, 20 Hz to 30 MHz to keep the receiver in warranted operation. This alignment can only be performed by user as it is not part of the Auto Align process.

|                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command               | <code>:CALibration:RFPSelector:CONDUCTed</code><br><code>:CALibration:RFPSelector:CONDUCTed?</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Example                      | <code>:CAL:RFP:COND</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Notes                        | <p>The query returns 0 if successful, or 1 if failed</p> <p>When Align 20 Hz to 30 MHz is performing the alignment, bit 0 in the Status Operation register is set. Completion, or termination, will clear bit 0 in the Status Operation register</p> <p>This command is sequential; it must complete before further SCPI commands are processed. Interrupting the alignment from remote is accomplished by invoking Device Clear followed by the <code>:ABORt</code> command. Successful completion will clear bit 1 in the Status Questionable Calibration Extended Needed register and bit 0 in Status Questionable Calibration Extended Failure register</p> <p>A failure encountered during alignment will set the Error Condition “20 Hz to 30 MHz Alignment Failure” and set both bit 1 in the Status Questionable Calibration Extended Needed register and bit 9 in Status Questionable Calibration register</p> |
| Dependencies                 | Does not appear in non-RF Preselector models, setting or querying the SCPI will generate an error                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Couplings                    | <p>Initializes the time for the Last Align Conducted Now, Conducted Time</p> <p>Records the temperature for the Last Align Conducted Now, Conducted Temperature</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| State Saved                  | No                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Status Bits/OPC dependencies | <p>Bit 8 or 9 may be set in the Status Questionable Calibration register</p> <p>Bit 1 may be set in the Status Questionable Calibration Extended Needed register</p> <p>Bit 0 may be set in the Status Questionable Calibration Extended Failure register</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |

## Align Now, 30 MHz to 3.6 GHz

Immediately executes an alignment of the receiver subsystem. The receiver will stop any measurement currently underway, perform an Align Now All, then perform the RF Preselector alignment, and then restart the measurement from the beginning (similar to pressing the **Restart** key).

The query (`:CALibration:RFPSelector:RADiated?`) invokes the alignment of the RF Preselector on Radiated Band and returns a success or failure value. Successful completion clears the “Align 30 MHz to 3.6 GHz required” Error Condition, and clears bit 2 in the Status Questionable Calibration Extended Needed register. The elapsed time counter begins for Last Align Now, Radiated Time, and the temperature is captured for the Last Align Now, Radiated Temperature. The alignment can be interrupted by pressing the **Cancel (ESC)** front-panel key, or remotely with Device Clear followed by `:ABORT`. When this occurs, the Error Condition “Align 30 MHz to 3.6 GHz required” is set, because new alignment data may be employed for an individual subsystem, but not a cohesive set of data for all subsystems.

The “Align 30 MHz to 3.6 GHz required” Error Condition appears when this alignment has expired. You must now perform **Align Now, 30 MHz to 3.6 GHz** to keep the receiver in warranted operation.

|                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command               | <code>:CALibration:RFPSelector:RADiated</code><br><code>:CALibration:RFPSelector:RADiated?</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Example                      | <code>:CAL:RFPS:RAD</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Notes                        | <p>The query returns 0 if successful, or 1 if failed</p> <p>When <b>Align 30 MHz to 3.6 GHz</b> is performed, alignment, bit 0 in the Status Operation register is set. Completion, or termination, clears bit 0 in the Status Operation register</p> <p>This command is sequential; it must complete before further SCPI commands are processed. Interrupting the alignment from remote is accomplished by invoking Device Clear followed by <code>:ABORT</code>. Successful completion clears bit 2 in the Status Questionable Calibration Extended Needed register and bit 1 in Status Questionable Calibration Extended Failure register</p> <p>A failure encountered during alignment sets the Error Condition “30 MHz to 3.6 GHz Alignment Failure” and sets both bit 2 in the Status Questionable Calibration Extended Needed register and bit 9 in Status Questionable Calibration register</p> |
| Dependencies                 | Does not appear in non-RF Preselector models, setting or querying the SCPI will generate an error                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Couplings                    | <p>Initializes the time for the Last Align Radiated Now, Radiated Time</p> <p>Records the temperature for the Last Align Radiated Now, Radiated Temperature</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| State Saved                  | No                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Status Bits/OPC dependencies | <p>May set Bit 8 or 9 in the Status Questionable Calibration register</p> <p>May set Bit 2 in the Status Questionable Calibration Extended Needed register</p> <p>May set Bit 1 in the Status Questionable Calibration Extended Failure register</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |

## Align Now, 20 Hz to 3.6 GHz

Immediately executes an alignment of the receiver subsystem. The receiver will stop any measurement currently underway, perform an Align Now All, then perform the RF Preselector alignment, and then restart the measurement from the beginning (similar to pressing the **Restart** key).

The query (`:CALibration:RFPSelector:FULL?`) invokes the alignment of the RF Preselector on both Conducted and Radiated Band and return a success or failure value. Successful completion clears the “Align 20 Hz to 3.6 GHz required” Error Condition, and clears bit 1 and bit 2 in the Status Questionable Calibration Extended Needed register. The elapsed time counter begins for Last Align Now, Conducted Time and Last Align Now Radiated Time and the temperature is captured for Last Align Now, Conducted Temperature and Last Align Now, Radiated Temperature. The alignment can be interrupted by pressing the **Cancel (ESC)** front-panel key or remotely with Device Clear, followed by `:ABORT`. When this occurs, the Error Condition “Align 20 Hz to 3.6 GHz required” is set, because new alignment data may be employed for an individual subsystem, but not a cohesive set of data for all subsystems.

The “Align 20 Hz to 3.6 GHz required” Error Condition appears when this alignment has expired. You must now perform the Align Now, 20 Hz to 3.6 GHz to keep the receiver in warranted operation.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALibration:RFPSelector:FULL</code><br><code>:CALibration:RFPSelector:FULL?</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Example        | <code>:CAL:RFPS:FULL</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Notes          | <p>The query returns 0 if successful, or 1 if failed</p> <p>When Align 20 Hz to 3.6 GHz is performed, alignment, bit 0 in the Status Operation register is set. Completion, or termination, clears bit 0 in the Status Operation register</p> <p>This command is sequential; it must complete before further SCPI commands are processed. Interrupting the alignment from remote is accomplished by invoking Device Clear, followed by <code>:ABORT</code>. Successful completion clears bit 1, bit 2 in the Status Questionable Calibration Extended Needed register and bit 0, bit 1 in Status Questionable Calibration Extended Failure register</p> <p>A failure encountered during alignment sets the Error Condition “20 Hz to 3.6 GHz Alignment Failure” and sets bit1, bit 2 in the Status Questionable Calibration Extended Needed register and bit 9 in Status Questionable Calibration register</p> |
| Dependencies   | Does not appear in non-RF Preselector models, setting or querying the SCPI generates an error                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Couplings      | <p>Initializes the time for the Last Align Conducted Now, Conducted Time</p> <p>Initializes the time for the Last Align Radiated Now, Radiated Time</p> <p>Records the temperature for the Last Align Conducted Now, Conducted Temperature</p> <p>Records the temperature for the Last Align Radiated Now, Radiated Temperature</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| State Saved    | No                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |

|                              |                                                                                                                                                                                                                                                   |
|------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Status Bits/OPC dependencies | May set Bit 8 or 9 in the Status Questionable Calibration register<br>May set Bit 1 and 2 in the Status Questionable Calibration Extended Needed register<br>May set Bit 0 and 1 in the Status Questionable Calibration Extended Failure register |
|------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

## Alert

Enables or disables the display of RF Preselector alignment required message on the status line. The instrument powers up with Alert **ON**.

|                |                                                                                                              |
|----------------|--------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALibration:RFPSelector:ALERT ON   OFF   0   1</code><br><code>:CALibration:RFPSelector:ALERT?</code> |
| Example        | <code>:CAL:RFPS:ALER OFF</code>                                                                              |
| Notes          | Error Condition is generated when alert is <b>ON</b> and any of the RF Preselector alignments has expired    |
| Preset         | Unaffected by Preset, but set to <b>ON</b> by <b>Restore Defaults</b> > "Alignments" on page 426             |
| State Saved    | No                                                                                                           |
| Range          | <b>OFF</b>   <b>ON</b>                                                                                       |

### 4.6.7.9 Scheduler

Setting the Scheduler to **ON** triggers execution of the scheduled task based on the recurrence and time set in the scheduler since the last successful of the specific alignment. A warning condition of "RF Preselector alignment scheduler is ON" appears when the scheduler is set to **ON**. **OFF** prevents the Scheduler from running any scheduled task.

|                |                                                                                                                                |
|----------------|--------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALibration:RFPSelector:SCHeuler:STATe ON   OFF   0   1</code><br><code>:CALibration:RFPSelector:SCHeuler:STATe?</code> |
| Example        | <code>:CAL:RFPS:SCH:STAT OFF</code>                                                                                            |
| Preset         | Unaffected by Preset, but set to <b>ON</b> by <b>Restore Defaults</b> > "Alignments" on page 426                               |
| State Saved    | No                                                                                                                             |
| Range          | <b>OFF</b>   <b>ON</b>                                                                                                         |

## Schedule Setup

Lets you schedule a task to run automatically at the background based on the recurrence and time set in the scheduler. Make sure that the instrument's local time is accurate, because the Scheduler relies on this information to execute the task.

This dialog contains the following controls:

- "Task" on page 508
- "Date/Time" on page 508
- "Hour" on page 509
- "Minute" on page 509
- "Recurrence" on page 509
- "Number of Weeks" on page 510
- "Day" on page 510

Task

There are 3 tasks that can be selected for the scheduler to run.

- Task 1 is the 20 Hz to 30 MHz alignment
- Task 2 is the 30 MHz to 3.6 GHz alignment
- Task 3 is the 20 Hz to 3.6 GHz alignment

|                |                                                                                                                                 |
|----------------|---------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | :CALibration:RFPSelector:SCHeduler:TASK T1   T2   T3<br>:CALibration:RFPSelector:SCHeduler:TASK?                                |
| Example        | :CAL:RFPS:SCH:TASK T1                                                                                                           |
| Notes          | Changing the task does not reset the Scheduler time, and the alignment is based on the current scheduled configuration to occur |
| Preset         | Unaffected by <b>Preset</b> but set to <b>T3</b> by <b>Restore Defaults</b> > "Alignments" on page 426                          |
| State Saved    | No                                                                                                                              |
| Range          | Task 1   Task 2   Task 3                                                                                                        |

Date/Time

Lets you configure the scheduler to run a task starting from this date and time. The date and time rely on the instrument's local time to execute a scheduled task. The date format is "YYYY/MM/DD", and the time is 24-hour clock.

|                |                                                                                                                                                                                  |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | :CALibration:RFPSelector:SCHeduler:TIME:START "date","time"<br>:CALibration:RFPSelector:SCHeduler:TIME:START?<br>This query returns data using the format "YYYY/MM/DD; HH:MM:SS" |
| Example        | :CAL:RFPS:SCH:TIME:STAR "2009/8/20","12:00:00"                                                                                                                                   |



|             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Notes       | <p>“<b>date</b>” is the date the task will run, in the form <b>YYYY/MM/DD</b> where:</p> <ul style="list-style-type: none"> <li>– <b>YYYY</b> is the four-digit representation of year (for example, 2009)</li> <li>– <b>MM</b> is the two-digit representation of month (for example, 01 to 12)</li> <li>– <b>DD</b> is the two-digit representation of the day (for example, 01 to 28, 29, 30 or 31 depending on the month and year)</li> </ul> <p>“<b>time</b>” is the time of day the task will run, in the form <b>HH:MM:SS</b> where:</p> <ul style="list-style-type: none"> <li>– <b>HH</b> is the two-digit representation of the hour in 24-hour format</li> <li>– <b>MM</b> is the two-digit representation of minute</li> <li>– <b>SS</b> is the two-digit representation of seconds</li> </ul> |
| Preset      | Unaffected by <b>Preset</b> but set to Current date and 00:00:00 by <b>Restore Defaults</b> > “Alignments” on page 426                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| State Saved | No                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |

## Hour

Lets you configure the hour for the scheduled task. The command to configure the date and time parameters of the scheduler is the same; but they each have their own front panel-control.

|             |                                                                                                                  |
|-------------|------------------------------------------------------------------------------------------------------------------|
| Notes       | See “Date/Time” on page 508                                                                                      |
| Preset      | Unaffected by <b>Preset</b> but set to Current hour and 00 by <b>Restore Defaults</b> > “Alignments” on page 426 |
| State Saved | No                                                                                                               |

## Minute

Lets you configure the minute for the scheduled task. The command to configure the date and time parameters of the scheduler is the same; but they each have their own front panel-control.

|             |                                                                                                                    |
|-------------|--------------------------------------------------------------------------------------------------------------------|
| Notes       | See “Date/Time” on page 508                                                                                        |
| Preset      | Unaffected by <b>Preset</b> but set to Current minute and 00 by <b>Restore Defaults</b> > “Alignments” on page 426 |
| State Saved | No                                                                                                                 |

## Recurrence

Lets you configure the scheduler to run the task recurrently on a scheduled date and time. You can schedule it to run daily, weekly, or alternate weeks.

## 4 System

### 4.6 Alignments

|                |                                                                                                                                            |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALibration:RFPSelector:Scheduler:REcurrence DAY   WEEK   OFF</code><br><code>:CALibration:RFPSelector:Scheduler:REcurrence?</code> |
| Example        | <code>:CAL:RFPS:SCH:REC DAY</code>                                                                                                         |
| Preset         | Unaffected by <b>Preset</b> but set to <b>OFF</b> by <b>Restore Defaults</b> > <b>"Alignments"</b> on page 426                             |
| State Saved    | No                                                                                                                                         |
| Range          | <code>DAY   WEEK   OFF</code>                                                                                                              |

### *Number of Weeks*

Lets you set the number of weeks that the scheduler will wait to trigger a task.

|                |                                                                                                                                                     |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALibration:RFPSelector:Scheduler:REcurrence:WEEK &lt;integer&gt;</code><br><code>:CALibration:RFPSelector:Scheduler:REcurrence:WEEK?</code> |
| Example        | <code>:CAL:RFPS:SCH:REC:WEEK 2</code>                                                                                                               |
| Notes          | New scheduled date to run the alignment task is updated when this parameter is changed                                                              |
| State Saved    | No                                                                                                                                                  |
| Range          | 1-52                                                                                                                                                |
| Min            | 1                                                                                                                                                   |
| Max            | 52                                                                                                                                                  |

### *Day*

Lets you set the Day of the Week the scheduler will run a scheduled task.

|                |                                                                                                                                                                                           |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALibration:RFPSelector:Scheduler:REcurrence:DAY SUN   MON   TUE   WED   THU</code><br><code>  FRI   SAT</code><br><code>:CALibration:RFPSelector:Scheduler:REcurrence:DAY?</code> |
| Example        | <code>:CAL:RFPS:SCH:REC:DAY SUN</code>                                                                                                                                                    |
| State Saved    | No                                                                                                                                                                                        |
| Range          | Sunday   Monday   Tuesday   Wednesday   Thursday   Friday   Saturday                                                                                                                      |

## 4.7 Licensing

Accesses capabilities for configuring the licenses in your instrument.

### 4.7.1 License Manager

Opens the License Explorer for Fixed and Transportable licenses.

NOTE

**This feature is not available if Option SF1 is installed.**

---

For help on licensing, select **Help** in the menu bar at the top of the License Explorer window.

There are also several remote commands available for licensing. See:

- "Install License (Remote Command Only)" on page 519
- "Remove License (Remote Command Only)" on page 519
- "List Licenses (Remote Query Only)" on page 520
- "Validate License (Remote Query Only)" on page 521
- "Host ID Query (Remote Query Only)" on page 521
- "List Borrowed Licenses (Remote Query Only)" on page 516
- "Return a Borrowed License (Remote Command Only)" on page 517

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Notes

No equivalent remote command for this control

### 4.7.2 System Software Version Date

The date of the newest features introduced in this release of the firmware. This is *not* necessarily the same as the build date of the firmware, because the version date only changes when new features are added. For example, if A.18.06 has only defect fixes and no new features compared to A.18.05, then both A.18.05 and A.18.06 would have the same software version date.

For any feature to be enabled, the SW Support Expiration Date of the enabling license must be greater than or equal to the software version date when that feature was first introduced. See the Keysight web site for features related to a specific software application and their required support date.

The SCPI response is 3 integer values: `<year>`, `<month>`, `<day>`.

---

|                |                                |
|----------------|--------------------------------|
| Remote Command | :SYSTem:SOFTware:VERSion:DATE? |
|----------------|--------------------------------|

---

|         |                       |
|---------|-----------------------|
| Example | :SYST:SOFT:VERS:DATE? |
|---------|-----------------------|

---

### 4.7.3 Software Support Expiration Date

This date is encoded in each software license's Version field in the **YYYY.MMDD** format. It specifies the end date of the support contract associated with this license. When a support contract is renewed, a new license is issued with an updated Version corresponding to the new contract's end date. The functionality available for a license is determined by the features available before the expiration date. For example, if feature X is introduced in a release with System Software Version Date of **2017.0831**, then a license with a Software Support Expiration Date of **2017.0831** or greater would enable feature X, but **2017.0830** or earlier would not enable feature X.

The SCPI response is 3 integer values: **<year>**, **<month>**, **<day>**.

---

|                |                                                          |
|----------------|----------------------------------------------------------|
| Remote Command | :SYSTem:LKEY:SOFTware:SUPPort:EXPIration:DATE? <feature> |
|----------------|----------------------------------------------------------|

---

|         |                                                |
|---------|------------------------------------------------|
| Example | :SYST:LKEY:SOFT:SUPP:EXP:DATE? "N9084EM0E-1FP" |
|---------|------------------------------------------------|

---

|              |                                                                                                 |
|--------------|-------------------------------------------------------------------------------------------------|
| Dependencies | When <b>&lt;feature&gt;</b> is not a valid license, one of the following errors will be issued: |
|--------------|-------------------------------------------------------------------------------------------------|

- -224, "IllegalParameterValue;License is not installed"
- -224, "IllegalParameterValue;Unknown license feature"
- -224, "IllegalParameterValue;Support contract not offered for this license"

### 4.7.4 Network Licenses

**Network Licenses** are available over the customer's network from a server the customer configures. The server has a count for each license and will only allow instruments to "check-out" a license up to that count. Once the count is reached for a specific license, further check-outs fail until one of the licenses is checked back in to the server. What this means is that it is possible for an instrument to have different features available to it based on what licenses are still available on the server when it tries to get licenses.

Setting up network licenses is done via the **Keysight Floating License Manager** (available on external Keysight web) and it has an Installation Guide that can be downloaded from that web page.

#### 4.7.4.1 Application Licenses

**Application Licenses** (like N9077EM0E-1NP) are automatically checked out when entering the Mode that uses them, and they are automatically checked-in when leaving that Mode. Because the server may have already checked out the last license for the application to another instrument, there is now the possibility that a mode switch will fail because a required license could not be checked out from the server. If the server has a limited number of licenses compared to the number of users desiring to use that license, this may mean that switching from Mode A to Mode B then back to Mode A may fail when returning to Mode A because another instrument checked out the last available license while the user was in Mode B. Also, for Modes with multiple licenses for different features (like Multi-Standard Radio), the features available may also change when switching out of the Mode and back into it.

So, when using network licenses, it is necessary to check `:SYST:ERR?` after every Mode switch, to verify that it successfully switched. If the Mode's required licenses were not successfully checked out, the instrument posts the error:

-310,"System error; feature not licensed"

There is also a potential performance issue when using network licenses, because the instrument must communicate with the server on each license check-out and check-in. This operation is usually fast (a few milliseconds), but it depends on the network communication lag between the instrument and server. For remote servers on slow or congested networks, this could be significantly slower than that.

#### 4.7.4.2 Instrument Software Options

Instrument software licenses are those that are reported via `*OPT?` the same as HW options. For example, N9040RT1B-1NP is an instrument software option, and is reported via `*OPT?` as `RT1`. Note that the license is composed of the model number (in this case `N9040B`) combined with the option code (`RT1`).

When instrument software options are available from a network server, the instrument automatically checks them out at start-up, and only checks them in when shutting down.

#### 4.7.4.3 License Checked Out Query (Remote Query Only)

Shows whether the specified license is checked out from a server. Since network served licenses may not always be available when there are limited licenses available compared to the desired number of users, the features available on an instrument can vary. Use this query to see whether the feature is currently checked-out to the instrument. The return value is boolean (0 or 1), returning 1 if the feature

exists and is checked out from a server. Note that querying a license that is local to the instrument (-xFP or -xTP) also returns 0, even though the license exists and is valid, because it does not require a check-out. Also, querying a license that does not exist returns 0.

|                |                                                                                                                                                                                                                                         |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | :SYSTem:LKEY:COUT? <feature>                                                                                                                                                                                                            |
| Example        | :SYST:LKEY:COUT? "N9080EM0E"<br>:1                                                                                                                                                                                                      |
| Notes          | <"OptionInfo"> contains the feature and the version. You must specify the feature but can omit the version. If you omit the version, the system regards it as the latest one<br>Return Value:<br>0 if not checked out, 1 if checked out |

4.7.4.4 List Licenses Checked Out (Remote Query Only)

Lists the licenses checked out from a server. Since network served licenses may not always be available when there are limited licenses available compared to the desired number of users, the features available on an instrument can vary. Use this query to see which features are currently checked-out to the instrument.

|                |                                                                                                                                |
|----------------|--------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | :SYSTem:LKEY:COUT:LIST?                                                                                                        |
| Example        | :SYST:LKEY:COUT:LIST?<br>:#284<br>:N9073EM0E,2018.0831<br>:N9077EM0E,2018.0831<br>:N9080EM0E,2018.0831<br>:N9081EM0E,2018.0831 |

4.7.4.5 Borrowed Network Licenses

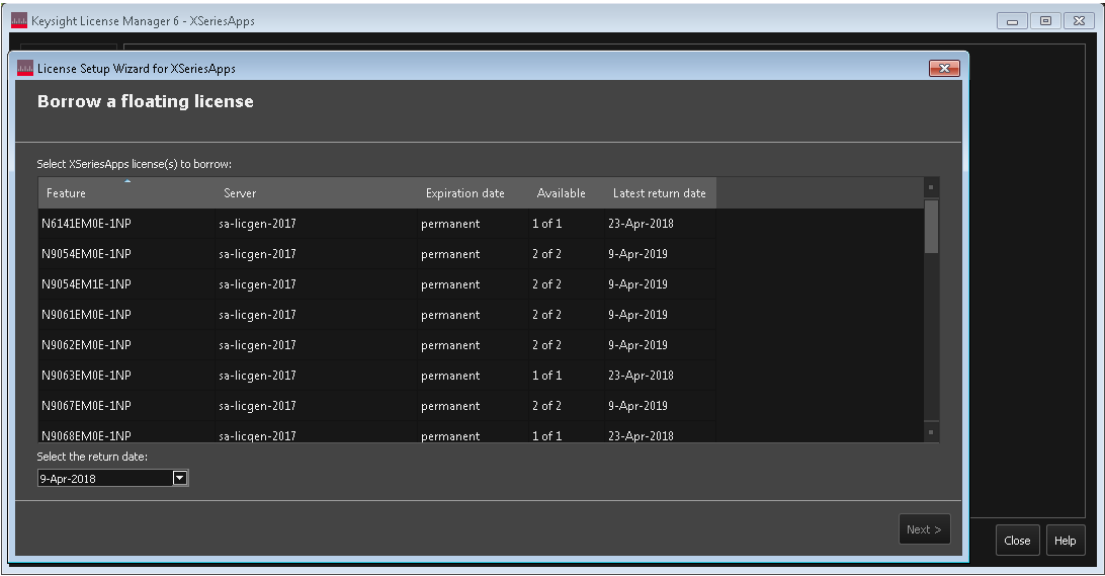
Network licenses can be borrowed from the network license server for a time. The maximum amount of time a license can be borrowed is specified in the license installed on the server and is set at the time the license is generated by Keysight. As part of the borrow operation, you specify how long to borrow the license. This borrow period is in hours and can be any time up to the maximum allowed by the license. Once borrowed, the license appears as a local license and can be used even when not connected to the network, and the instrument software treats them the same as other time-based licenses that are installed on the instrument. This means the licenses are validated when the instrument is started and then are used without the overhead of checking them out and back in when switching Modes. At the time of the borrow, a time is specified for how long the license will be borrowed. When that time expires, the license is automatically returned to the network license server

even if the instrument is not connected to the network. If you are done with the license before it automatically returns to the network server, the license can be explicitly returned earlier.

4.7.4.6 Borrow a License

Licenses are borrowed by using the Keysight License Manager 6 application. This can be launched from the **System Licensing** screen.

Graphic



The corresponding remote command is:

|                |                                                                                                                                                                                                                                                                                                                                                      |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SYSTem:LKEY:BORRow "&lt;feature&gt;[,&lt;version&gt;]",&lt;return date&gt;</code><br><code>:SYSTem:LKEY:BORRow? "&lt;feature&gt;[,&lt;version&gt;]"</code>                                                                                                                                                                                    |
| Example        | <code>:SYST:LKEY:BORR "N9080EM0E", "20-Aug-2018"</code><br><code>:SYST:LKEY:BORR? "N9080EM0E"</code><br><code>: "20-Aug-2018"</code>                                                                                                                                                                                                                 |
| Notes          | If <code>&lt;version&gt;</code> is not specified, the highest available version will be borrowed<br>The <code>&lt;return date&gt;</code> is the day when the borrow will automatically be returned to the server                                                                                                                                     |
| Dependencies   | For the command, when <code>&lt;feature&gt;</code> is not a valid license, or when a license is not currently available for borrowing, one of the following errors is issued: <ul style="list-style-type: none"><li>- -224,"IllegalParameterValue;License is not installed"</li><li>- -224,"IllegalParameterValue;Unknown license feature"</li></ul> |

- -224, "IllegalParameterValue;License not available for borrowing"

Additionally, the return date is evaluated. If it is not a valid date, the following error is issued:

- -224, "IllegalParameterValue;Invalid return date"
- -200, "Execution error; No Available Borrow Licenses For Feature: <feature>"

The return date may be clipped to the maximum borrow allowed by the license. When this happens, the following warning is issued:

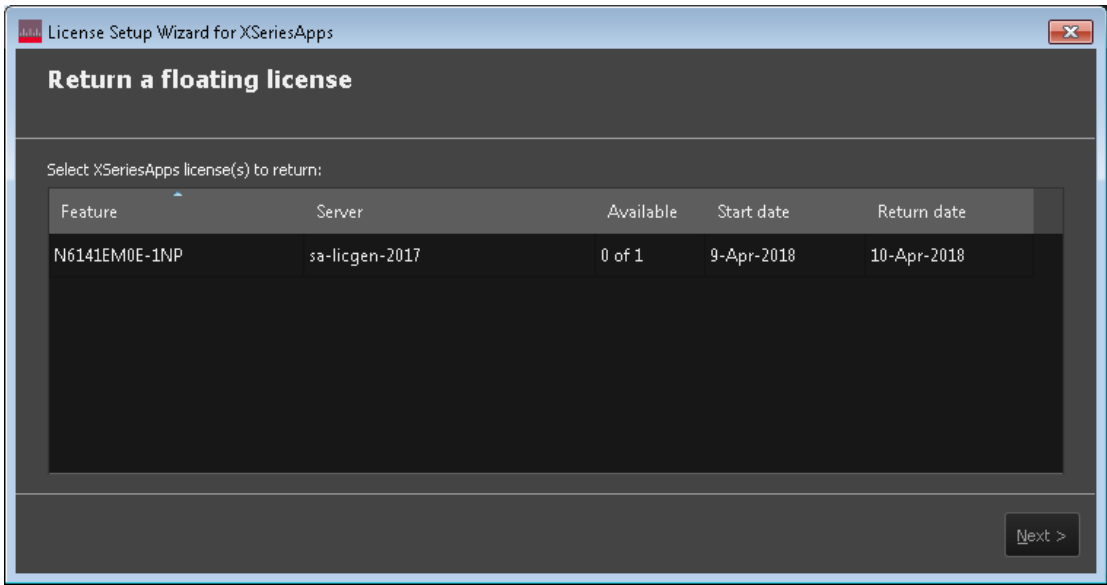
- -221, "Return date clipped to maximum of <max date>"

For the query, the return is the borrow return date (as a string in **dd-mmm-yyyy** format) if the license is borrowed. In all other cases, (not borrowed, not installed, etc.) the return is an empty string

4.7.4.7 Listing Borrowed Licenses and Return a Borrowed License

The Keysight License Manager 6 can also be used to see the currently borrowed licenses or return a license before the automatic return time.

Graphic



List Borrowed Licenses (Remote Query Only)

Remote Command :SYSTem:LKEY:BORRow:LIST?



---

|         |                                               |
|---------|-----------------------------------------------|
| Example | <code>:SYST:LKEY:BORR:LIST?</code>            |
|         | <code>:#266</code>                            |
|         | <code>:N9073EM0E,2018.0831,20-Aug-2018</code> |
|         | <code>:N9077EM0E,2018.0831,20-Aug-2018</code> |

---

### Return a Borrowed License (Remote Command Only)

---

|                |                                                                                                                                                                                                                                                                                                                                                                                  |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SYSTem:LKEY:BORRow:RETurn "&lt;feature&gt;"</code>                                                                                                                                                                                                                                                                                                                        |
| Example        | <code>:SYST:LKEY:BORR:RET "N9080EM0E"</code>                                                                                                                                                                                                                                                                                                                                     |
| Dependencies   | <p>When <code>&lt;feature&gt;</code> is not a valid license or when a license is not borrowed, one of the following errors is issued:</p> <ul style="list-style-type: none"> <li>- -224,"IllegalParameterValue;License is not installed"</li> <li>- -224,"IllegalParameterValue;Unknown license feature"</li> <li>- -224,"IllegalParameterValue;License not borrowed"</li> </ul> |

---

#### 4.7.4.8 Enabling Network Checkouts While Borrowed

The default for borrowed license use is that you will be explicitly borrowing all desired network licenses, and that all other available network licenses should be ignored. This allows you to intentionally limit the functionality available to the instrument to what is explicitly borrowed.

For example, the RT1/RT2 options that enable the RTSA Mode are automatically checked out when the instrument is started, because the hardware must be configured for them at startup time. If you do not intend to use RTSA, then by borrowing only the licenses you want to use and disabling other network checkouts, the RT1/RT2 licenses will not be checked out at startup. This leave more RTSA licenses available for others to use. Note that the instrument must be restarted after the borrowing has been done to ensure the release of any network licenses already acquired.

If your intent in borrowing is to ensure access to a particular feature or application, but you still want to opportunistically use other features or applications, the default behavior can be changed to enable network license checkouts even when licenses have been borrowed.

---

|                |                                                                                                                             |
|----------------|-----------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SYSTem:LKEY:BORRow:NETWork:COUT:ENABle</code>                                                                        |
| Example        | <code>:SYST:LKEY:BORR:NETW:COUT:ENAB 0</code><br><code>:SYST:LKEY:BORR:NETW:COUT:ENAB?</code>                               |
| Dependencies   | Only visible when licensing is configured to use a network server. SCPI is always available                                 |
| Preset         | Unaffected by <b>Preset</b> but set to 0 by <b>Restore Defaults</b> > "Misc" on page 426 or <b>Restore Defaults</b> > "All" |

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on page 427

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|             |                                                     |
|-------------|-----------------------------------------------------|
| State Saved | Power On Persistent (survives shutdown and restart) |
|-------------|-----------------------------------------------------|

### 4.7.5 USB Portable Licenses

The USB Portable license is implemented with a physical dongle that is a USB device, like a USB thumb drive. It has a Host ID fixed in the dongle HW. It does not contain any writable data and so is acceptable to high security A/D customers. Transporting licenses from one instrument to another just requires moving the dongle and license files to the desired instrument. The license files can be installed on many instruments, but they will only be valid the one instrument that has the dongle. The use of USB portable licenses requires that the Keysight Floating License Manager is installed on the instrument. The licenses can then be added to the instrument's server.

USB Portable licenses are checked out and in like Network licenses. Because the licenses are local, there will be no network latency involved in the check-out/check-in, but there can still be a slight performance degradation compared to Fixed and Transportable licenses. If the instrument allows multiple concurrent instances of the X-Series software (as is the case for modular products), there may also be availability issues if all licenses are already checked out to other X-Series instances. Plugging/un-plugging the dongle is equivalent to transporting a license to/from the instrument, however, the software must be restarted whenever the dongle is plugged in.

### 4.7.6 Configuring Network and USB Portable Licenses

The Keysight Floating License Manager must be used to configure the Network or USB Portable licenses before the licenses can be used. Currently, an instrument can only be configured for Network or USB Portable licenses or both.

- To set up USB Portable licenses, in the Keysight Floating License Manager select “Start a floating license server with a license file” and add files containing the USB Portable licenses desired
- To set up Network licenses, in the Keysight Floating License Manager select “Connect to a floating license server” and enter the network server's name preceded by the “@” character (example: “@myserver”)
- To set up both Network and USB Portable license, first configure the USB Portable license, then configure the Network licenses, but append “;@localhost” to the server name (example: “@myserver;@localhost”). Whenever the configuration is changed, the X-Series software must be restarted

## 4.7.7 Floating License Manager

Opens the License Explorer for Network and USB Portable licenses.

NOTE

This feature is not available if Option SF1 is installed.

For help on licensing, select **Help** in the menu bar at the top of the License Explorer window.

## 4.7.8 Install License (Remote Command Only)

Used to add a license to the instrument.

An example of such a command would be as below. The parameter is a unique 120-character code for each license.

```
SYST:LKEY "N9073A-  
1FP", "027253AD27F83CDA5673A9BA5F427FDA5E4F25AEB1017638211AC9F60D9C639FE53973590  
9C551DE0A91"
```

Another example using one of the optional clauses.

```
SYST:LKEY "N9063EM0E-  
1FP, 2019.0330", "02220210867E187713C9AFD4C90EA0DE2B674615DD0255798EE5B237A146A0D  
4E411E0ABFE04D3CAFDFA", "ISSUED=30-Mar-2018"
```

NOTE

This command does not work for Transportable, Network or USB Portable licenses.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | :SYSTem:LKEY <"OptionInfo">, <"LicenseInfo">, <"Optional1">, <"Optional2">, <"Optional3">, <"Optional4">, <"Optional5">                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Notes          | <p>&lt;"OptionInfo"&gt; contains the feature and the version. You must specify the feature but can omit the version. If you omit the version, the system regards it as the latest one, since the system knows which version is supported for each feature</p> <p>&lt;"LicenseInfo"&gt; contains the signature, the expiration date, and serial number for transport if transportable. You must specify the signature, but you can omit the other information. If you omit the expiration date, the system regards it as permanent. If you omit the serial number, the system regards it as non-transportable. As a result, this supports reverse compatibility</p> <p>&lt;"Optional#"&gt; are optional parameters that may be needed to match the information in the original license</p> |

## 4.7.9 Remove License (Remote Command Only)

Removes a particular license.

An example of such a command would be as below. The parameter is a unique 120-character code for each license.

```
SYST:LKEY:DEL "N9073A-1FP", "027253AD27F83CDA5673A9BA5F427FDA5E4F25AEB1017638211AC9F60D9C639FE539735909C551DE0A91"
```

**NOTE** This command does not work for Transportable, Network or USB Portable licenses.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | :SYSTem:LKEY:DELeTe <"OptionInfo">,<"LicenseInfo">                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Notes          | <p>&lt;"OptionInfo"&gt; contains the feature and the version. You must specify the feature but can omit the version. If you omit the version, the system regards it as the latest one, if more than one version is installed</p> <p>&lt;"LicenseInfo"&gt; contains the signature, the expiration date, and whether be transportable. You must specify the signature, but you can omit the other information. If you omit the expiration date, the system regards it as permanent. If you omit the transportability, the system regards it as non-transportable. As a result, this supports reverse compatibility</p> |

### 4.7.10 List Licenses (Remote Query Only)

Returns a list of installed licenses.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | :SYSTem:LKEY:LIST?                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Notes          | <p>Return Value:</p> <p>An &lt;arbitrary block data&gt; of all the installed instrument licenses</p> <p>The format of each license is as follows</p> <p>&lt;Feature&gt;,&lt;Version&gt;,&lt;Signature&gt;,&lt;Expiration Date&gt;,&lt;Serial Number for Transport&gt;,...</p> <p>Return Value Example:</p> <pre>#3136 N9073A-1FP,1.000,B043920A51CA N9060A-2FP,1.000,4D1D1164BE64 N9020A-508,1.000,389BC042F920 N9073A-1F1,1.000,5D71E9BA814C,13-aug-2005</pre> <p>&lt;arbitrary block data&gt; is:</p> <pre>#NMMM&lt;data&gt;</pre> <p>Where:</p> <p>N is the number of digits that describes the number of MMM characters. For example, if the data was 55 bytes, N would be 2</p> |

---

`MMM` would be the ASCII representation of the number of bytes. In the previous example, N would be 55  
`<data>` ASCII contents of the data  
Additional fields may appear depending on the type of license (Fixed, Transportable, Network, USB Portable)

### 4.7.11 Validate License (Remote Query Only)

Lets you query whether a particular license is currently valid.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SYSTem:LKEY? &lt;"OptionInfo"&gt;</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Example        | <code>:SYST:LKEY? "N9073A-1FP"</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Notes          | <p><code>&lt;"OptionInfo"&gt;</code> contains the feature and the version. You must specify the feature but can omit the version. If you omit the version, the system regards it as the latest one</p> <p>Return Value:</p> <p><code>&lt;"LicenseInfo"&gt;</code> if the license is valid, null otherwise</p> <p><code>&lt;"LicenseInfo"&gt;</code> contains the signature, the expiration date, and serial number if transportable</p> <p>Return Value Example:</p> <p><code>"B043920A51CA"</code></p> |

### 4.7.12 Host ID Query (Remote Query Only)

Returns the Host ID as a string.

|                |                           |
|----------------|---------------------------|
| Remote Command | <code>:SYSTem:HID?</code> |
|----------------|---------------------------|

## 4.8 Security

Accesses capabilities for operating the instrument in a security-controlled environment.

The **Security** page of the **System** menu has two controls: **USB Read/Write** and **Restore Security Defaults**.

|              |                      |
|--------------|----------------------|
| Dependencies | Not available in UXM |
|--------------|----------------------|

### 4.8.1 USB Write Protect

The Windows operating system can be configured to disable write access to the USB ports for users who are in a secure environment where transferring data from the instrument is prohibited. The **USB Write Protect** control is a convenient way for you to disable write access to USB.

NOTE

This control is only available to users with Administrator privileges.

|                |                                                                                                                                                                     |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SYSTem:SECurity:USB:WPRotect[:ENABle] ON   OFF   0   1</code><br><code>:SYSTem:SECurity:USB:WPRotect[:ENABle]?</code>                                        |
| Example        | Set USB ports to Read-only:<br><code>:SYST:SEC:USB:WPR ON</code><br><br>Set USB ports to Read-Write:<br><code>:SYST:SEC:USB:WPR OFF</code>                          |
| Notes          | When the USB ports are in Read-only mode, then no data can be stored to USB, including the internal USB memory used for a back-up location for the calibration data |
| Dependencies   | Grayed-out unless the current user has Administrator privileges                                                                                                     |
| Preset         | Unaffected by <b>Preset</b> or any <b>"Restore Defaults"</b> on page 424. A Keysight Recovery sets the USB to write protect <b>OFF</b>                              |
| State Saved    | No                                                                                                                                                                  |
| Range          | Read-Write   Read only                                                                                                                                              |

### 4.8.2 Restore Security Defaults

Sets USB Read/Write to Enable.

NOTE

This control is only available to users with Administrator privileges.

## 4.9 Diagnostics

Displays a slider that allows you to view Hardware Statistics.

|              |                      |
|--------------|----------------------|
| Dependencies | Not available in UXM |
|--------------|----------------------|

### 4.9.1 Show Hardware Statistics

Provides a display of various hardware statistics. The statistics include the following:

- Mechanical relay cycles (on models with mechanical relays)
- High and Low temperature extremes
- Elapsed time that the instrument has been powered-on (odometer)

Modular instruments display only time and temperature information.

|         |                              |
|---------|------------------------------|
| Example | <code>:SYST:SHOW HWST</code> |
|---------|------------------------------|

|       |                                                                                                                                  |
|-------|----------------------------------------------------------------------------------------------------------------------------------|
| Notes | The values displayed on the screen are only updated upon entry to the screen and not updated while the screen is being displayed |
|-------|----------------------------------------------------------------------------------------------------------------------------------|

### 4.9.2 Pathwave Calibration Advisor...

This is a separate application that helps maintain your instrument at peak performance. You can set the cal interval, configure cal due reminders, check the cal status, view cal certificates and test reports, and contact Keysight for a cal service.

The embedded help documentation can be accessed in the instrument at: <C:\Program Files\Keysight\Calibration Advisor\PCA.chm>, or via the ? button at the top right of the **PathWave Calibration Advisor** window.

### 4.9.3 Query the Mechanical Relay Cycle Count (Remote Query Only)

Returns the count of mechanical relay cycles.

|                |                                    |
|----------------|------------------------------------|
| Remote Command | <code>:SYSTem:MRELay:COUNT?</code> |
|----------------|------------------------------------|

|         |                               |
|---------|-------------------------------|
| Example | <code>:SYST:MREL:COUN?</code> |
|---------|-------------------------------|

|       |                                                                                                                                                           |
|-------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|
| Notes | Query Only<br>The return value is a comma-separated list of the individual counts for each mechanical relay<br>The position of the relays in the list is: |
|-------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|

|              |                                                                                                                                                                                                                                                                                                                                              |
|--------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|              | <p>“&lt;Cal Signal&gt;,&lt;AC/DC&gt;,&lt;2dB #1 Atten&gt;,&lt;2dB #2 Atten&gt;,&lt;6dB Atten&gt;,&lt;10dB Atten&gt;,&lt;20dB Atten&gt;,&lt;30dB Atten&gt;,&lt;Fixed Atten&gt;,&lt;Low Noise Path Switch&gt;,&lt;Presel Bypass&gt;”</p> <p>Items in the list not pertaining to your hardware configuration return as -999 for those items</p> |
| Dependencies | Not supported by E6607C                                                                                                                                                                                                                                                                                                                      |

#### 4.9.4 Query the Operating Temperature Extremes (Remote Query Only)

Returns the low operating temperature extreme value. The value survives a power-cycle and is the temperature extreme encountered since the value was reset by the factory or service center.

|                |                                                                                                                                                                                               |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | :SYSTem:TEMPerature:LEXTreme?                                                                                                                                                                 |
| Example        | :SYST:TEMP:LEXT?                                                                                                                                                                              |
| Notes          | Value is in degrees Celsius at which the lowest operating temperature has been recorded since 1st power-up                                                                                    |
| State Saved    | No                                                                                                                                                                                            |
|                | Returns the high operating temperature extreme value. The value survives a power-cycle and is the temperature extreme encountered since the value was reset by the factory or service center. |

|                |                                                                                                             |
|----------------|-------------------------------------------------------------------------------------------------------------|
| Remote Command | :SYSTem:TEMPerature:HEXTreme?                                                                               |
| Example        | :SYST:TEMP:HEXT?                                                                                            |
| Notes          | Value is in degrees Celsius at which the highest operating temperature has been recorded since 1st power-up |
| State Saved    | No                                                                                                          |

#### 4.9.5 Query the Elapsed Time since 1<sup>st</sup> power on (Remote Query Only)

Returns the elapsed on-time in minutes since 1<sup>st</sup> power-on.

|                |                    |
|----------------|--------------------|
| Remote Command | :SYSTem:PON:ETIME? |
| Example        | :SYST:PON:ETIM?    |
| Notes          | Query Only         |



## 4.10 Service

Accesses capabilities performed in the factory or under instructions from repair procedures. This key is only visible when the logged-in user is “[advanceduser](#)” or “[saservice](#)”. The first access to the **Service** menu after invoking the instrument application will require an authentication Service Code.

---

|              |                      |
|--------------|----------------------|
| Dependencies | Not available in UXM |
|--------------|----------------------|

## 4.11 SCPI Recorder

Lets you view active recording content, and edit the content. Right-click or touch and hold on any UI control to display a menu allowing you to record the SCPI associated with the control.

Selecting this tab displays the **Recorder** dialog on the right. The dialog displays the recorder table with the data in chronological order of recording. The **Function Label** column shows the feature name, for example, **Center Frequency**, and the **SCPI** column shows the full mnemonic corresponding to the feature.

This section describes the following controls:

- "Continuous SCPI Recording" on page 526
- "Recording Limit" on page 527
- "Play All" on page 528
- "Play Selected" on page 528
- "Copy" on page 528
- "Insert \*OPC? Below" on page 528
- "Move Up" on page 528
- "Move Down" on page 529
- "Delete Row" on page 529
- "Delete All" on page 529

You can also **Save** and **Recall** SCPI Recorder lists to and from on-disk files. For details, see:

- Recall "SCPI Recorder" on page 886
- Save "SCPI Recorder" on page 920

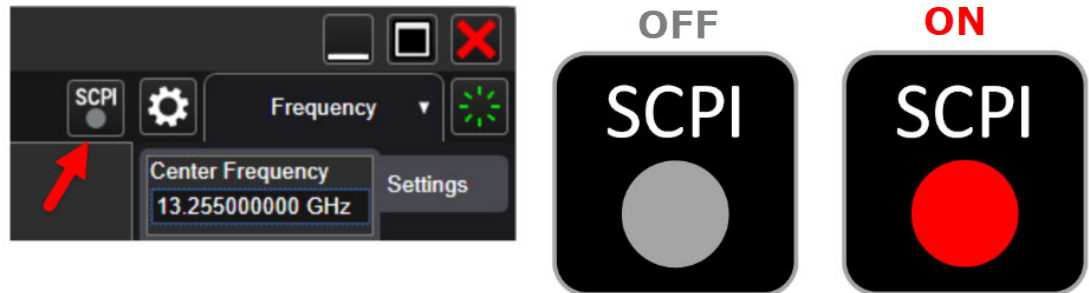
### 4.11.1 Continuous SCPI Recording

Toggles the state of continuous recording.

When enabled (**ON**), *all* user interaction with settings that are Immediate Actions, and that have associated SCPI commands or queries, are added as recording entries in chronological order. Not every User Interface action has a corresponding SCPI

command/query, for example, navigation actions between dialogs and menus in the User Interface do not have corresponding SCPI commands. All settings or a measurement that are accessible via menus have SCPI commands, so modifying those settings will create entries in the Recorder.

As a convenience, this feature can also be toggled (without visiting the SCPI Recording menu) by clicking the SCPI icon which has been added to the left of the “gear” icon (as illustrated below):



NOTE

When recording is turned on, some entries are automatically created and added to the recording. These are: `:INST:CONF:<mode>:<meas>` (see ["Mode" on page 56](#)) and `*OPC?` (see ["\\*OPC? - Operation Complete" on page 1034](#)). These commands set the current Mode and Measurement, perform a **Mode Preset**, then cause the instrument to wait for the completion of any previous commands. When **Continuous SCPI Recording** fills the recording container to the limit, a warning message is displayed to notify you that the recording container is full and recording will be stopped, unless the recording limit is increased.

NOTE

To maintain the integrity of recording, stop recording *before* sending remote commands to the instrument. Changes made to the instrument via remote SCPI are *not* recorded.

## 4.11.2 Recording Limit

When ["Continuous SCPI Recording" on page 526](#) is enabled, every change you make is recorded into the recording system, which can lead to extremely large recordings.

This value limits how much content can be saved into the recording table. You may change this number to suit your needs, but the value cannot be less than 0 or greater than 500. When the recording length reaches the limit, a warning is displayed to indicate that the recording size has reached the limit and recording will be stopped.

The default limit is 250. If the limit is reduced after recording entries are added, the reduced count cannot be less than the current number of entries in the recording. If the newly-entered limit is smaller than the existing number of entries, then the actual new limit is set to the current number of entries. Increasing the limit will increase memory consumption.

### 4.11.3 Play All

Clicking this control causes each of the entries in the SCPI Recorder table to be executed.

If execution results in any errors, then a message box showing the SCPI command, and its corresponding error are displayed after play has completed.

### 4.11.4 Play Selected

You can select a row in the SCPI recording table, then click **Play Selected** to play that entry. **Play Selected** is disabled if the recording table is empty, or when no row is selected. You can then select another row and play the selection, but, if you want to play back in a particular order, you must execute the plays in the desired sequence.

After playing the selected entry, the selected row is moved down by one entry.

### 4.11.5 Copy

Copies the SCPI column data to the system clipboard, to make it available for Paste operations.

### 4.11.6 Insert \*OPC? Below

Certain queries and commands must be sent during instrument programming, but there is no corresponding user-interface control for these commands. This control allows you to insert one such query: **\*OPC?** below the selected row.

### 4.11.7 Move Up

Moves the selected / highlighted row up by 1 slot. Note that moving a mode or measurement switch entry in the table may impact context for subsequent entries in the table.

### 4.11.8 Move Down

Moves the selected / highlighted row down by 1 slot. Note that moving a mode or measurement switch entry in the table may impact context for subsequent entries in the table.

### 4.11.9 Delete Row

Deletes the selected entry from the recording table. Note that some entries may have subsequent entries related to the row that you delete, for example, **\*OPC?**, which may be added automatically after a mode or measurement switch.

### 4.11.10 Delete All

Deletes all entries from the recording table. A warning message is displayed: "All recording data will be deleted".

To confirm that you want to delete the entire recording content, click **OK**, or click **Cancel** to avoid deleting it.

## 4.12 Wake on LAN

This feature lets you remotely turn on an instrument that has been in power-off state, by sending a special LAN packet, called Magic Packet. **Wake-On-LAN** is also called **WOL** or **Remote Wake up**. It is part of the **Advanced Configuration and Power Interface (ACPI)**.

This feature is available only when *all* the following conditions are satisfied.

|   |                                                      |                                                                                        |
|---|------------------------------------------------------|----------------------------------------------------------------------------------------|
| 1 | Product Model                                        | Must be one of: N904x, N903x, N902x, N901x, or N900x                                   |
| 2 | CPU Option                                           | Must be one of: PC8, PC9, PCA, or PCB                                                  |
| 3 | BIOS/UEFI and Windows Operating System Configuration | See <a href="#">"BIOS/UEFI and Windows Operating System Configuration" on page 530</a> |
| 4 | Network Configuration                                | See <a href="#">"Network Configuration" on page 530</a>                                |

### 4.12.1 BIOS/UEFI and Windows Operating System Configuration

The procedure varies according to CPU type:

- For [PC8/PC9](#) CPUs, see ["BIOS/UEFI and Windows Operating System Configuration Procedure for PC8 and PC9 CPUs" on page 531](#)
- For [PCA/PCB](#) CPUs, see ["LAN Port, BIOS/UEFI, and Windows Operating System Configuration Procedure for PCA and PCB CPUs" on page 533](#)

### 4.12.2 Network Configuration

Configure the LAN so that the external PC that sends the Magic Packet and the instrument that receives the Magic Packet share all the following:

- Gateway
- Subnet Mask
- DNS Server

### 4.12.3 Procedures to Configure Wake-On-LAN

The following sections explain how to configure:

1. LAN Port connection (PCA/PCB CPUs only)
2. BIOS/UEFI settings
3. Windows Operating System settings

The procedure varies depending on the CPU type. Follow the procedure that matches the instrument's CPU option. For easier operation, we recommend connecting a keyboard and mouse to the instrument.

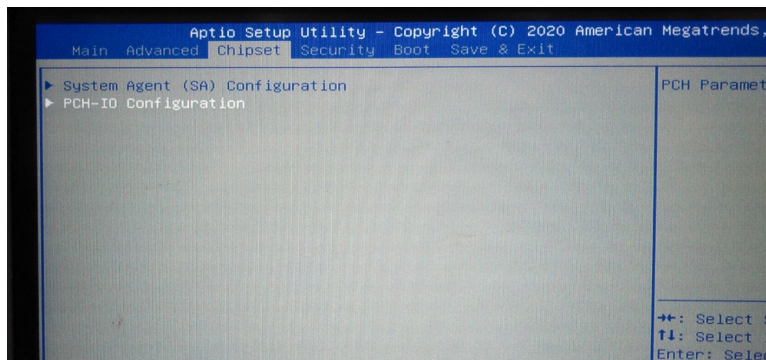
#### 4.12.3.1 BIOS/UEFI and Windows Operating System Configuration Procedure for PC8 and PC9 CPUs

This section includes:

- "BIOS/UEFI Procedure" on page 531
- "Windows Operating System Procedure" on page 532

##### BIOS/UEFI Procedure

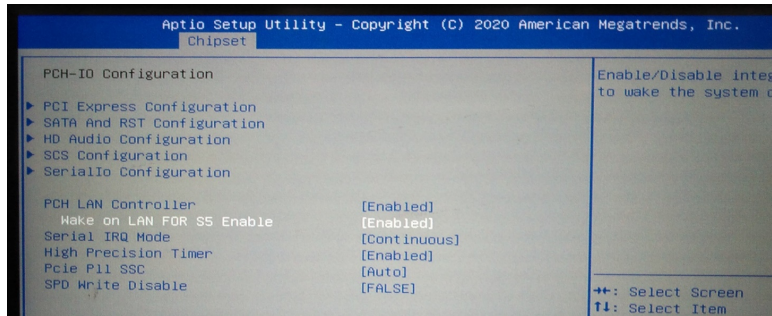
- 1 Restart the instrument
- 2 During the restart, press **Delete** to enter the BIOS/UEFI Setup menu
- 3 Select the **Chipset** tab
- 4 Select **PCH-IO Configuration**
- 5 Press **Enter**



- 6 Select **Wake on LAN FOR S5 Enable**
- 7 If it is not enabled, enable it

#### 4 System

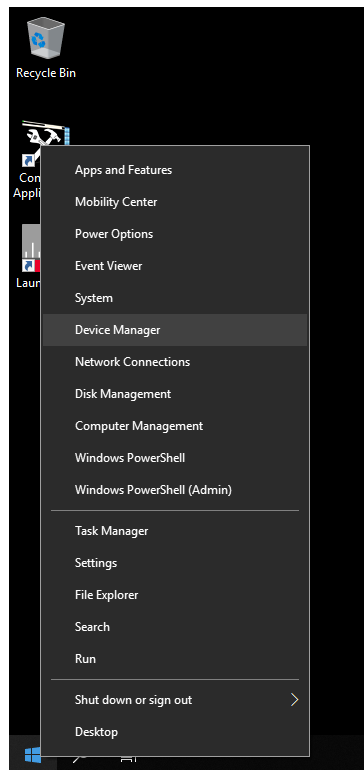
##### 4.12 Wake on LAN



- 8 Press **F10** to save and exit the BIOS/UEFI screen

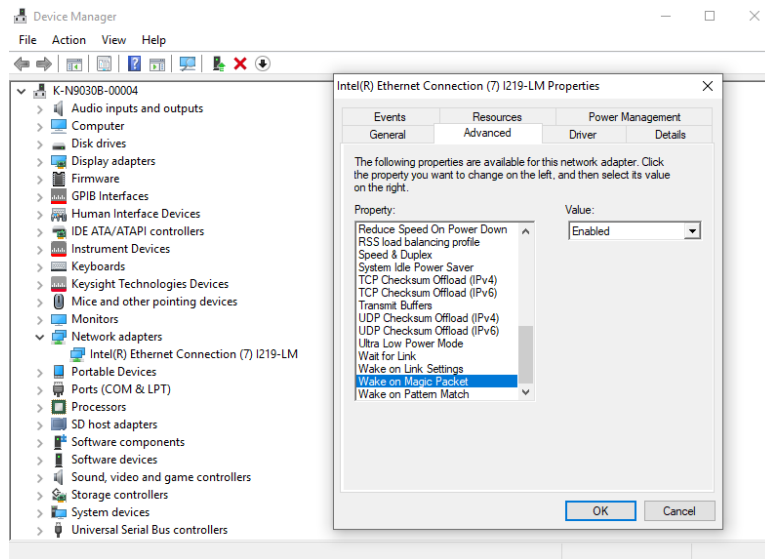
## Windows Operating System Procedure

- 1 Log in to the instrument as Administrator
- 2 Right-click **Start** and select **Device Manager**



- 3 Navigate to **Network adapters** à **"Intel(R) Ethernet Connection...**
- 4 Right-click, then select **Properties**
- 5 Select the **Advanced** tab
- 6 In the Property list, select **Wake on Magic Packet**
- 7 If the Value is not enabled, select **Enabled** and click **OK**





#### 4.12.3.2 LAN Port, BIOS/UEFI, and Windows Operating System Configuration Procedure for PCA and PCB CPUs

Note that **PCA** and **PCB** have two LAN ports, but only “LAN 1G” port supports Wake On LAN.

This section includes:

- "LAN Port Connection" on page 533
- "BIOS/UEFI Procedure" on page 534
- "Windows Operating System Procedure" on page 535

#### LAN Port Connection

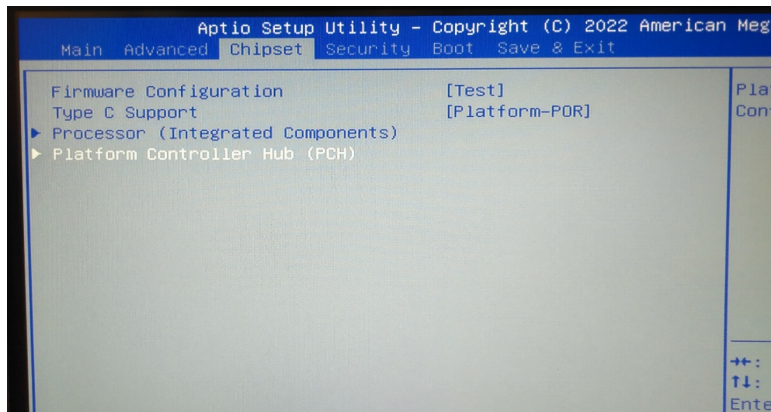
**PCA** and **PCB**-equipped instruments have two LAN ports: **LAN 1G** and **LAN 10G**, but only the **LAN 1G** port supports Wake On LAN. Connect the LAN cable to the **LAN 1G** port.

4 System  
4.12 Wake on LAN

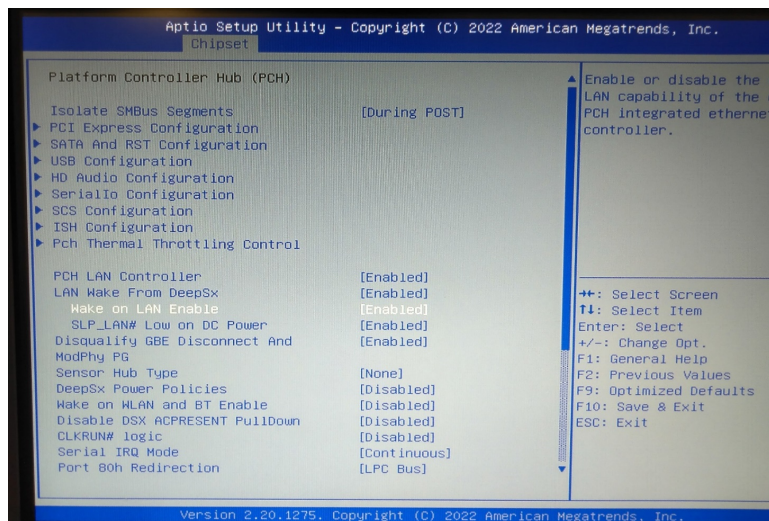


## BIOS/UEFI Procedure

- 1 Restart the instrument
- 2 During the restart, press **Delete** to enter the BIOS/UEFI Setup menu
- 3 Select the **Chipset** tab
- 4 Select **Platform Controller Hub (PCH)**
- 5 Press **Enter**

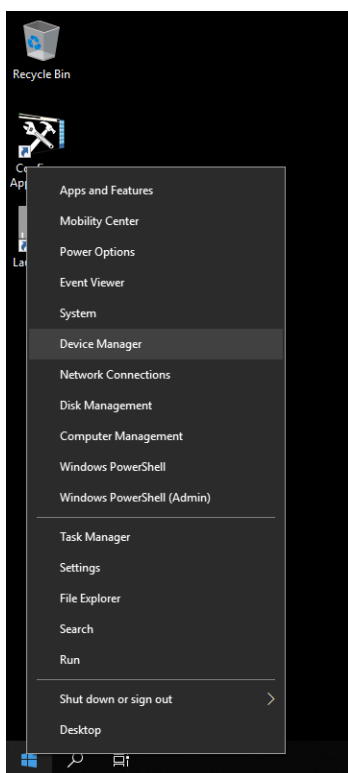


- 6 Select **Wake on LAN Enable**  
If it is not enabled, enable it
- 7 Press **F10** to save and exit BIOS/UEFI Setup



## Windows Operating System Procedure

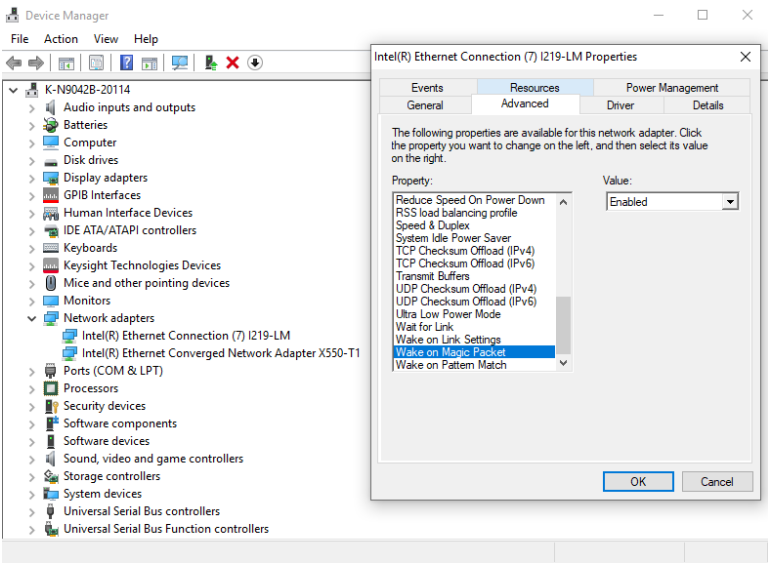
- 1 Log in to the instrument as Administrator
- 2 Right-click on the **Start** button and select **Device Manager**



- 3 Navigate to **Network adapters** > **Intel(R) Ethernet Connection...**

4 System  
4.12 Wake on LAN

- 4 Right-click and select **Properties**
- 5 Select the **Advanced** tab
- 6 In the Property list, select **Wake on Magic Packet**
- 7 If the Value is not enabled, select **Enabled** and click **OK**



### 4.13 System Remote Commands (Remote Commands Only)

These commands have no front-panel key equivalent.

- "List installed Options (Remote Query Only)" on page 537
- "Lock the Front-panel keys (Remote Command Only)" on page 538
- "Lock Workstation (Remote Command Only)" on page 538
- "List SCPI Commands (Remote Query Only)" on page 540
- "Front Panel activity history (Remote Query only)" on page 540
- "SCPI activity history (Remote Query only)" on page 541
- "Instrument start time (Remote Query only)" on page 541
- "SCPI Version Query (Remote Query Only)" on page 542
- "Date (Remote Command Only)" on page 542
- "Time (Remote Command Only)" on page 542
- "Input Overload Enable (Remote Command Only)" on page 543
- "Power Up (Remote Query Only)" on page 543

#### 4.13.1 List installed Options (Remote Query Only)

Lists the installed options that pertain to the instrument (signal analyzer).

|                |                                                                                                                                                |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | :SYSTem:OPTions?                                                                                                                               |
| Example        | :SYST:OPT?                                                                                                                                     |
| Notes          | The return string is a comma-separated list of the installed options. For example:<br>"503,P03,PFR"<br>:SYSTem:OPTions? and *OPT? are the same |
| State Saved    | No                                                                                                                                             |

4.13.2 Lock the Front-panel keys (Remote Command Only)

Disables the instrument keyboard to prevent local input when the instrument is controlled remotely. Annunciation showing a “K” for **KLOCK** (keyboard lock) alerts the local user that the keyboard is locked. **KLOCK** is similar to the GPIB Local Lockout function; namely that no front-panel keys are active except for the **Power Standby** key. (The instrument is allowed to be turned-off if **KLOCK** is **ON**.) The **KLOCK** command is used in remote control situations where Local Lockout cannot be used.

Although primary intent of **KLOCK** is to lock-out the front panel, it will lock-out externally connected keyboards through USB. **KLOCK** has no effect on externally connected pointing devices (mice).

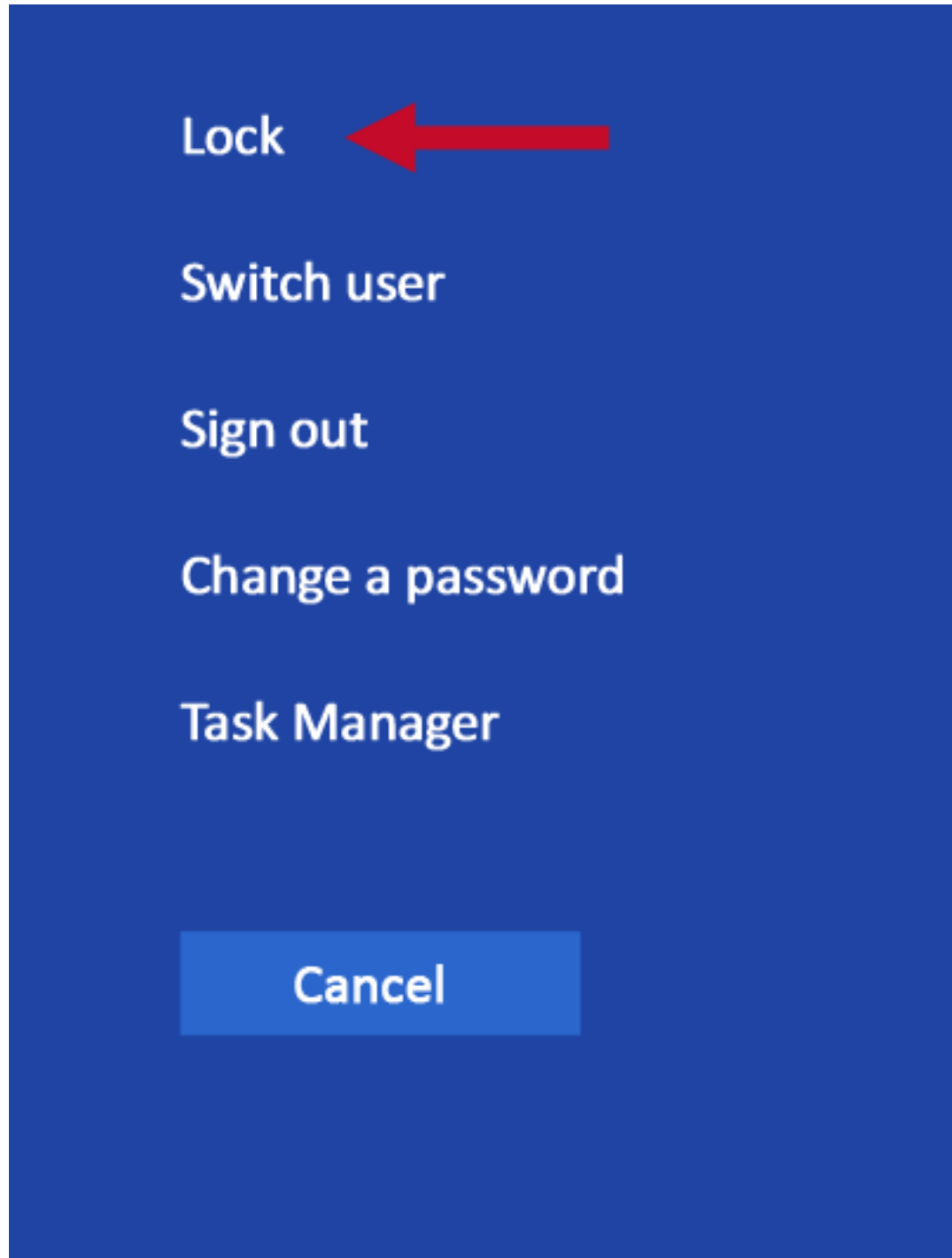
The front panel ‘**Local**’ key (**Cancel/Esc**) has no effect if **KLOCK** is **ON**.

See also "Local Button" on page 103.

|                |                                                                                           |
|----------------|-------------------------------------------------------------------------------------------|
| Remote Command | :SYSTem:KLOCK OFF   ON   0   1<br>:SYSTem:KLOCK?                                          |
| Example        | :SYST:KLOC ON                                                                             |
| Notes          | Keyboard lock remains in effect until turned-off, or until the instrument is power-cycled |
| Preset         | Initialized to <b>OFF</b> at startup, unaffected by <b>Preset</b>                         |
| State Saved    | No                                                                                        |

4.13.3 Lock Workstation (Remote Command Only)

Performs the same functionality as the **Win+L** function or the “Lock” function on the **CTL-ALT-DEL** screen in Windows.



As soon as you do this, the computer is locked. The initial login screen appears; no-one can access the computer at that point unless they have an account and know the account's password.

Failure to initiate adds an error to the Windows event log for SA;

## 4 System

### 4.13 System Remote Commands (Remote Commands Only)

"LockWorkStation - Failed to initiate function"

See also "Local Button" on page 103.

|                |                                                 |
|----------------|-------------------------------------------------|
| Remote Command | <code>:SYSTem:LWSTation</code>                  |
| Example        | <code>:SYST:LWST</code>                         |
| Notes          | The lock remains in effect until a user logs in |
| State Saved    | No                                              |

#### 4.13.4 List SCPI Commands (Remote Query Only)

Outputs a list of the valid SCPI commands for the currently selected Mode.

|                |                                                                                                                   |
|----------------|-------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SYSTem:HELP:HEADers?</code>                                                                                |
| Example        | <code>:SYST:HELP:HEAD?</code>                                                                                     |
| Notes          | The output is an IEEE Block format, with each command separated with the New-Line character ( <code>0x0A</code> ) |

#### 4.13.5 Front Panel activity history (Remote Query only)

Instrument front panel usage can be monitored using `:SYSTem:METRics:FPANel?`. The monitoring occurs for front panel hardkey or softkey operation (including mouse or touch operation on instruments with Multi-Touch User Interface). The information of the usage pertains to the activity since the instrument application was started; the information does not persist after the application is terminated, or the instrument has been rebooted.

To prevent the front panel from being placed into Remote the monitoring must occur via an I/O protocol such as LAN Socket, or the remote program performing the monitoring must explicitly place the instrument into Local after the query has been performed.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                              |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SYSTem:METRics:FPANel?</code>                                                                                                                                                                                                                                                                                                                                                                                         |
| Example        | <code>:SYST:METR:FPAN?</code>                                                                                                                                                                                                                                                                                                                                                                                                |
| Notes          | <p>The return value is a string with the format <code>"YYYY-MM-DD&lt;space&gt;HH:MM:SS"</code>, in instrument local time</p> <p>If no front panel activity has occurred since the instrument was booted (instrument application started), the return value will be the time the instrument application started. The instrument application start time can be obtained with the query <code>:SYSTem:METRics:STIME?</code></p> |



### 4.13.6 SCPI activity history (Remote Query only)

Instrument remote operation usage via SCPI can be monitored using `:SYSTem:METRics:SCPI?`. The monitoring occurs for SCPI control from any I/O channel (GPIB, USB, or LAN). The information of the usage pertains to the activity since the instrument application was started; the information does not persist after the application is terminated, or the instrument has been rebooted.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SYSTem:METRics:SCPI?</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Example        | <code>:SYST:METR:SCPI?</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Notes          | <p>The return value is a string with the format “YYYY-MM-DD&lt;space&gt;HH:MM:SS”, in instrument local time</p> <p>The following commands are excluded from the history accounting:</p> <ul style="list-style-type: none"> <li>– <code>*IDN?</code></li> <li>– <code>*OPT?</code></li> <li>– <code>:SYSTem:DATE?</code></li> <li>– <code>:SYSTem:TIME?</code></li> <li>– <code>:SYSTem:PON:TIME?</code></li> <li>– Queries in the <code>:SYSTem:ERRor</code> subsystem</li> <li>– Queries in the <code>:SYSTem:LKEY</code> subsystem</li> <li>– Queries in the <code>:SYSTem:METRics</code> subsystem</li> <li>– Queries in the <code>:SYSTem:MODule</code> subsystem</li> </ul> <p>If no SCPI activity has occurred since the instrument was booted (instrument application started), the return value will be the time the instrument application started. The instrument application start time can be obtained with <code>:SYSTem:METRics:STIME?</code></p> |

### 4.13.7 Instrument start time (Remote Query only)

To determine if instrument activity has occurred, `:SYSTem:METRics:STIME?` can be used to determine the instrument application start time.

|                |                                                                                                    |
|----------------|----------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SYSTem:METRics:STIME?</code>                                                                |
| Example        | <code>:SYST:METR:STIM?</code>                                                                      |
| Notes          | The return value is a string with the format “YYYY-MM-DD<space>HH:MM:SS”, in instrument local time |

### 4.13.8 SCPI Version Query (Remote Query Only)

Returns the SCPI version number with which the instrument complies. The SCPI industry standard changes regularly. This command indicates the version used when the instrument SCPI commands were defined.

|                |                  |
|----------------|------------------|
| Remote Command | :SYSTem:VERSion? |
| Example        | :SYST:VERS?      |

### 4.13.9 Date (Remote Command Only)

The recommended access to the Date, Time, and Time zone of the instrument is through the Windows native control (Control Panel, or accessing the Task Bar). You may also access this information remotely, as shown in here and in "Time (Remote Command Only)" on page 542.

Sets or queries the date in the instrument.

|                |                                                                                                                                                                                                                                                                                                                                                                                        |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | :SYSTem:DATE "<year>,<month>,<day>"<br>:SYSTem:DATE?                                                                                                                                                                                                                                                                                                                                   |
| Example        | :SYST:DATE "2006,05,26"                                                                                                                                                                                                                                                                                                                                                                |
| Notes          | <year> is the four-digit representation of year (for example, 2006)<br><month> is the two-digit representation of year (01 to 12)<br><day> is the two-digit representation of day (01 to 28, 29, 30, or 31, depending on the month and year)<br>Unless the current account has Power User or Administrator privileges, sending this command generates an error, and no action is taken |

### 4.13.10 Time (Remote Command Only)

Sets or queries the time in the instrument.

|                |                                                                                                                                                                                                                                                                                                                            |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | :SYSTem:TIME "<hour>,<minute>,<second>"<br>:SYSTem:TIME?                                                                                                                                                                                                                                                                   |
| Example        | :SYST:TIME "13,05,26"                                                                                                                                                                                                                                                                                                      |
| Notes          | <hour> is the two-digit representation of the hour in 24-hour format<br><minute> is the two-digit representation of minute<br><second> is the two-digit representation of second<br>Unless the current account has Power User or Administrator privileges, sending this command generates an error, and no action is taken |

### 4.13.11 Input Overload Enable (Remote Command Only)

Input Overload errors are reported using the Input Overload status bit (bit 12 in the Measurement Integrity Status Register). Input Overloads (for example, ADC Overload errors) can come and go with great frequency, generating many error events (for example, for signals just on the verge of overload), and so are not put into the SCPI error queue by default. Normally the status bit is the only way for detecting these errors remotely.

Use this command to enable or disable Input Overload reporting to the SCPI queue. By default, reporting is disabled. Send **:SYSTem:ERRor:OVERload ON** to enable, or **:SYSTem:ERRor:OVERload OFF** to disable. In either case, Input Overloads *always* set the status bit.

#### NOTE

For versions of firmware before A.10.01, Input Overload was only a Warning and so was never available in the SCPI queue, although it did set the status bit. For A.10.01 and later, Input Overload is an error, which can be enabled to the SCPI queue using this command.

|                |                                                                                   |
|----------------|-----------------------------------------------------------------------------------|
| Remote Command | <b>:SYSTem:ERRor:OVERload[:STATe] 0   1   OFF   ON</b>                            |
| Example        | Enable overload errors:<br><b>:SYST:ERR:OVER 1</b>                                |
| Preset         | Set to <b>OFF</b> by <b>Restore Misc Defaults</b> (no Overload errors go to SCPI) |
| State Saved    | Saved in instrument state                                                         |

### 4.13.12 Power Up (Remote Query Only)

Returns a list of errors encountered during the application boot-up, such as: mismatch FW-FPGA, missing Calibration data, missing hardware, and construction errors.

|                |                                                                                                                                                                                                                                                                                                                             |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <b>:SYSTem:ERRor:PUP?</b>                                                                                                                                                                                                                                                                                                   |
| Notes          | <p>If no error occurs, the return value is: "No Power Up Errors"</p> <p>Return Value: <b>&lt;List of error strings&gt;</b> in &lt;IEEE488 Block&gt; format</p> <p>Return Value Example:</p> <p>"Power up errors, see details in Windows Event Log"</p> <p>"Unmatched FPGA Version(s), See details in Windows Event Log"</p> |

## 5 Preset

The Preset functions can be accessed in two ways:

- By pressing the **Mode Preset** or **User Preset** front panel keys:



- From the menu **"Preset Dropdown"** on page 547, which appears when you press the green **Preset** icon (in the upper right corner of the display):



### Types of Preset

The table below shows all possible presets, their corresponding SCPI commands and front-panel access methods.

Instrument settings are tiered in scope from those local to the current measurement to those global to all measurements and Modes. There are presets tailored to each scope. The table identifies the scope of each preset type.

NOTE

To get a Mode back to a fully predefined state, you should execute **"Restore Mode Defaults"** on page 550 and **"Input/Output Preset"** on page 551, but since **Input/Output Preset** is a global function, it affects *all* Modes.

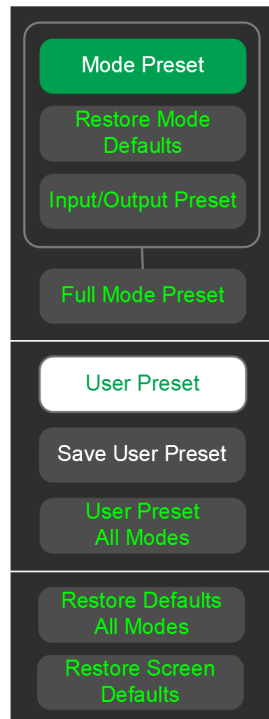
| Type Of Preset            | SCPI Command        | Scope of Preset                                                                                                                                                                                               | Front Panel Access                                      |
|---------------------------|---------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------|
| Auto Couple               | :COUPle ALL         | Local to the current measurement, only affects Auto/Man variables                                                                                                                                             | Meas Setup menu                                         |
| Meas Preset               | :CONFigure:<meas>   | Local to the current measurement<br>Does not preset the RF Source                                                                                                                                             | Meas Setup menu                                         |
| "Mode Preset" on page 548 | :SYSTem:PRESet      | Local to the current Mode, global to all measurements in the Mode, affects most but not all parameters in the Mode<br>Does not affect <b>Input/Output</b> or <b>System</b> variables<br>Presets the RF Source | <b>Mode Preset</b> key<br>"Preset Dropdown" on page 547 |
| "Restore Mode"            | :INSTrument:DEFault | Local to the current Mode, global to                                                                                                                                                                          | "Preset"                                                |

| Type Of Preset                           | SCPI Command                | Scope of Preset                                                                                                                                                                                         | Front Panel Access                                                              |
|------------------------------------------|-----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|
| Defaults" on page 550                    |                             | all measurements in the Mode, affects all parameters in the Mode, but does not affect <b>Input/Output</b> or <b>System</b> variables<br>Does not preset the RF Source.                                  | Dropdown" on page 547                                                           |
| "Restore Defaults All Modes" on page 557 | :SYSTem:DEFault MODEs       | Affects all parameters in <i>all</i> Modes, but does not affect <b>Input/Output</b> or <b>System</b> variables<br>Presets the RF Source                                                                 | "Preset Dropdown" on page 547                                                   |
| "Restore Screen Defaults" on page 560    | :SYSTem:DEFault SCReen      | Deletes all Screens but one, restores that screen to its default mode and performs Mode Preset for that mode<br>Does not affect <b>Input/Output</b> or <b>System</b> variables<br>Presets the RF Source | "Preset Dropdown" on page 547                                                   |
| "User Preset" on page 553                | :SYSTem:PRESet:USER         | Local to the current Mode, global to all measurements in the Mode, affects all parameters in the Mode, as well as <b>Input/Output</b> variables<br>Does not affect <b>System</b> variables              | User Preset key<br>"Preset Dropdown" on page 547                                |
| "User Preset All Modes" on page 556      | :SYSTem:PRESet:USER:ALL     | Same as <b>User Preset</b> , but affects all Modes in the current Screen                                                                                                                                | "Preset Dropdown" on page 547                                                   |
| "User Preset All Screens" on page 558    |                             | Affects the entire Screen Configuration; global to all Modes and Screens                                                                                                                                | "Preset Dropdown" on page 547                                                   |
| *RST                                     | *RST                        | Same as <b>Mode Preset</b> . Additionally always sets <b>Single/Cont</b> to <b>Single</b>                                                                                                               | Not available from front panel                                                  |
| "Input/Output Preset" on page 551        | :SYSTem:DEFault INPut       | Affects all <b>Input/Output</b> variables<br>Does not preset the RF Source                                                                                                                              | Input/Output menu<br>"Preset Dropdown" on page 547<br>System > Restore Defaults |
| "Full Mode Preset" on page 552           | :SYSTem:PRESet:FULL         | Same as <b>Mode Preset + Restore Mode Defaults + Input/Output Preset</b> . Essentially a factory preset of the current Mode<br>Presets the RF Source                                                    | "Preset Dropdown" on page 547                                                   |
| "Restore User                            | :SYSTem:DEFault UIINterface | Affects all variables in the "User                                                                                                                                                                      | System > Restore                                                                |

| Type Of Preset                           | SCPI Command                                       | Scope of Preset                                                                | Front Panel Access                           |
|------------------------------------------|----------------------------------------------------|--------------------------------------------------------------------------------|----------------------------------------------|
| Interface Defaults" on page 409          |                                                    | Interface" group<br>Does not preset the RF Source                              | Defaults<br>User Interface tabs              |
| "Restore Power On Defaults" on page 418  | :SYSTem:DEFault PON                                | Affects all variables in the "Power On" group<br>Presets the RF Source         | System > Restore Defaults<br>Power On tabs   |
| "Restore Alignment Defaults" on page 503 | :SYSTem:DEFault ALIGn                              | Affects all variables in the "Alignments" group<br>Presets the RF Source       | System > Restore Defaults<br>Alignments tabs |
| "Restore Defaults" on page 424 (Misc)    | :SYSTem:DEFault MISC                               | Affects various variables not reset by other commands<br>Presets the RF Source | System > Restore Defaults                    |
| "Restore Defaults" on page 424 (All)     | :SYSTem:DEFault [ALL]<br>:SYSTem:PRESet:PERSistent | Affects all variables<br>Presets the RF Source                                 | System > Restore Defaults                    |

## 5.1 Preset Dropdown

The Preset dropdown contains the following controls. In the image below, click a control for details of that control.



## 5.2 Mode Preset

Returns the current Mode to a known state. **Mode Preset** only presets the current Screen; it does not affect any other Screens.

**Mode Preset** also presets the RF Source. In this sense, it is equivalent to pressing **Source Preset** on the **Input/Output, RF Source** menu panel.

**Mode Preset** can be executed from the ["Preset Dropdown" on page 547](#), or by pressing the **Mode Preset** front panel key:



It does the following for the currently active Mode:

- Aborts the currently running measurement
- Switches to the default measurement and displays the default menu for that measurement
- Sets most parameters for the Mode and all its Measurements to a preset state
- Clears the input and output buffers
- Sets Status Byte to 0

**Mode Preset** does *not* cause a Mode switch, nor affect any **Input/Output** or **System** settings (those set in the **System Settings** dialog).

Furthermore, some Mode settings are unaffected by **Mode Preset** (for example, Noise Floor Extensions, Limit Line data, reference marker numbers, etc.) These are only reset by ["Restore Mode Defaults" on page 550](#). In each parameter's definition table there is a note that indicates whether it is reset by **Mode Preset** or by **Restore Mode Defaults**.

See ["Preset" on page 544](#) for more details.

|                              |                                                                                                                                                                                                                                                                                                                                               |
|------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command               | :SYSTem:PRESet                                                                                                                                                                                                                                                                                                                                |
| Example                      | :SYST:PRES                                                                                                                                                                                                                                                                                                                                    |
| Notes                        | <p><b>*RST</b> is preferred over :SYST:PRES for remote operation. <b>*RST</b> performs <b>Mode Preset</b>, as done by the :SYST:PRES command, and sets the measurement mode to <b>Single</b> measurement rather than <b>Continuous</b>, for optimal remote control throughput</p> <p>See also <a href="#">"*RST - Reset" on page 1035</a></p> |
| Status Bits/OPC dependencies | Clears all pending OPC bits. The Status Byte is set to 0                                                                                                                                                                                                                                                                                      |



## 5 Preset

### 5.2 Mode Preset

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#### Backwards Compatibility Notes

In X-Series, the legacy “Factory Preset” has been replaced by **Mode Preset**, which only presets the currently active Mode, not the entire instrument. In X-Series, you preset the entire instrument by using **System, Restore System Defaults All**, which behaves essentially the same way as restore System Defaults did in ESA and PSA

There is also no “Preset Type” as there was in PSA. The green **Mode Preset** front-panel key does a Mode Preset, and the **User Preset** front-panel key does a User Preset. The old **PRESet:TYPE** command is ignored (without generating an error), and **SYST:PRES** without a parameter does **Mode Preset**

The settings and correction data under the **Input/Output** front-panel key (examples: Input Z Corr, Ext Amp Gain, etc.) are no longer part of any Mode, so they are not preset by **Mode Preset**. They are preset by **Restore Input/Output Defaults, Restore System Defaults All**. Note that because “**User Preset**” on [page 553](#) performs Recall State, and all these settings are saved in State, they *are* recalled when using **User Preset**

## 5.3 Restore Mode Defaults

Most settings within a Mode are affected by "Mode Preset" on page 548, but some Mode settings are unaffected (for example, Noise Floor Extensions, Limit Line data, reference marker numbers, etc.) **Restore Mode Defaults** resets all these additional settings, as well as all the **Mode Preset** settings, *except* the RF Source.

In each parameter's definition table, there is a note that indicates whether that parameter is reset by **Mode Preset** or by **Restore Mode Defaults**.

Note that a Recall State affects all a Mode's settings, both the **Mode Preset** settings and the ones additionally affected by **Restore Mode Defaults**.

**Restore Mode Defaults** can be executed from the "Preset Dropdown" on page 547.

When **Restore Mode Defaults** is selected, a message appears saying

*This will reset all of the current Mode's variables to their default state.  
This action cannot be undone. Do you want to proceed?*

The message provides **OK** and **Cancel** buttons, to let you confirm or cancel the reset operation.

|                |                                                                                                                                                                              |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | :INSTrument:DEFault                                                                                                                                                          |
| Example        | :INST:DEF                                                                                                                                                                    |
| Notes          | Clears all pending OPC bits. The Status Byte is set to 0                                                                                                                     |
| Couplings      | Causes the currently running measurement to be aborted, and causes the default measurement to be active. Sets the Mode to a consistent state, with all default couplings set |

## 5.4 Input/Output Preset

Resets the group of settings and data associated with the **Input/Output** front-panel key to their default values. These settings are not affected by "Mode Preset" on page 548, because they are generally associated with connections to the instrument, which generally should remain unaltered.

All the variables set under the **Input/Output** front panel key are reset by **Input/Output Preset**, including Amplitude Corrections and Data (described in the **Corrections** section), with the exception of **RF Source** settings, which are unaffected.

By using **Input/Output Preset** and "Restore Mode Defaults" on page 550, a full preset of the current Mode can be performed, with the caveat that, since **Input/Output Preset** is a global function, it affects *all* Modes.

**Input/Output Preset** can be executed from the **Input/Output** menu, from the "Preset Dropdown" on page 547, or from the **Restore Defaults** menu under the **System** key.

When **Input/Output Preset** is selected, a message appears saying:

"This will reset all of the Input/Output variables to their default state, including which input is selected, all Amplitude Correction settings and data, all External Mixing settings, all Frequency Reference settings and all Output settings.

It will not affect Alignment data or settings.

It will not affect RF Source settings.

This action cannot be undone. Do you want to proceed?"

The message provides **OK** and **Cancel** buttons, to let you confirm or cancel the operation.

---

Example

`:SYST:DEF INP`

Presets all **Input/Output** variables to their factory default values

## 5.5 Full Mode Preset

Same as performing "Mode Preset" on page 548, "Restore Mode Defaults" on page 550, and "Input/Output Preset" on page 551. Essentially a factory preset of the current Mode.

When **Full Mode Preset** is selected, a message appears saying:

This will reset all of the current Mode's variables and all of the Input/Output variables to their default state, including Input and Output selection and settings, Amplitude Correction, Frequency Reference and RF Source settings. It will not affect Alignment data or settings.  
This action cannot be undone. Do you want to proceed?

The message provides **OK** and **Cancel** buttons, to let you confirm or cancel the operation.

|                              |                                                          |
|------------------------------|----------------------------------------------------------|
| Remote Command               | :SYSTem:PRESet:FULL                                      |
| Example                      | :SYST:PRES:FULL                                          |
| Status Bits/OPC dependencies | Clears all pending OPC bits. The Status Byte is set to 0 |

## 5.6 User Preset

Recalls a state previously saved using ["Save User Preset" on page 555](#). You can save a **User Preset** state for each Mode, allowing you to define your own favorite state for each Mode and recall it at the touch of a single button.

**User Preset** can be executed by pressing the **User Preset** front panel key, or from the ["Preset Dropdown" on page 547](#).



Because **User Preset** is actually a Recall State, rather than a predefined Preset, it works a little differently from ["Mode Preset" on page 548](#), in that it affects all the variables that normally only reset on ["Restore Mode Defaults" on page 550](#), and it affects the **Input/Output** variables, because both of these are included in State files.

A default **User Preset** file is provided for each Mode, which simply matches the current Mode's state after **Restore Mode Defaults** and ["Input/Output Preset" on page 551](#) has been performed.

NOTE

In products that run multiple instances of the X-Series Application, all instances use the same location to save User Preset state. So, saving User Preset of one instance will overwrite the Save User Preset of another instance.

|                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|-------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command                | :SYSTem:PRESet:USER                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Example                       | Save the User Preset:<br>:SYST:PREs:USER:SAVE<br><br>Recall the User Preset:<br>:SYST:PREs:USER                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Notes                         | :SYST:PREs:USER:SAVE is used to save the current state as the user preset state<br><br>If loading a User Preset file from a different instrument, some settings may be limited and/or coupled differently, since the capabilities of the mode may have changed from when the User Preset file was saved                                                                                                                                                                                                                                                                                         |
| Status Bits/OPC dependencies  | Clears all pending OPC bits. The Status Byte is set to 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Backwards Compatibility Notes | In X-Series A-models, the <b>User Preset</b> key opened a menu that let you select from User Preset, Save User Preset, or User Preset All Modes. In B-models, the <b>User Preset</b> key immediately performs a <b>User Preset</b> , and the menu items are found under the <b>Preset</b> dropdown<br><br><b>User Preset</b> actually loads a state, and in legacy analyzers, it was possible to load a state without affecting the trace data, limit lines or correction data. Similarly, it was possible to do a User Preset without affecting the trace data, limit lines or correction data |

---

In X-Series, “state” always includes all of this data; so whenever state is loaded, or **User Preset** is executed, all the traces, limit lines and corrections are affected

In ESA and PSA, **User Preset** affected the entire instrument’s state. In X-Series, **User Preset** only recalls the state for the active Mode. There is a User Preset file for each Mode. **User Preset** can never cause a Mode switch as it could in legacy analyzers. If you want to recall all Modes to their user preset file state, perform User Preset *after* switching into each Mode

**User Preset** recalls Mode state, which can now include data, such as traces, whereas in ESA and PSA, User Preset did not affect data

## 5.7 Save User Preset

Saves the state of the currently active Mode in a unique location, for recall by the key "User Preset" on page 553. Each Mode has one such location, so, for each Mode, one User Preset can be defined.

Save User Preset can be executed from the "Preset Dropdown" on page 547.

All the Mode variables are saved, including those reset by "Mode Preset" on page 548, those only reset by "Restore Mode Defaults" on page 550, and all Input/Output variables, so when you subsequently press User Preset, the instrument returns to the exact same setup that existed when you pressed Save User Preset. Thus, User Preset has wider scope than Mode Preset.

|                |                                                                                                                                                                          |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | :SYSTem:PRESet:USER:SAVE                                                                                                                                                 |
| Example        | :SYST:PRES:USER:SAVE                                                                                                                                                     |
| Notes          | :SYST:PRES:SAVE creates the same file as if you requested *SAV or :MMEM: STOR:STAT, except that Save User Preset does not allow you to specify the file name or location |

## 5.8 User Preset All Modes

Recalls all the User Preset files for each Mode, switches to the Power-on Mode, and activates the saved measurement from the Power-on Mode **User Preset** file.

**User Preset All Modes** can be executed from the "Preset Dropdown" on page 547

See also "User Preset" on page 553.

|                              |                                                                                              |
|------------------------------|----------------------------------------------------------------------------------------------|
| Remote Command               | <code>:SYSTem:PRESet:USER:ALL</code>                                                         |
| Example                      | <code>:SYST:PRES:USER:SAVE</code><br><code>:SYST:PRES:USER:ALL</code>                        |
| Notes                        | <code>:SYST:PRES:USER:SAVE</code> is used to save the current state as the user preset state |
| Status Bits/OPC dependencies | Clears all pending OPC bits. The Status Byte is set to 0                                     |



## 5.9 Restore Defaults All Modes

Resets all Modes in the current Screen back to their default states, just as **Restore Mode Defaults** does, switches the current Screen to the Power-on Mode, and causes the default measurement for the **Power On Mode** to be active in the current Screen. Only the current Screen is affected.

**Restore Defaults All Modes** can be executed from the "Preset Dropdown" on page 547.

When **Restore Defaults All Modes** is selected, a message appears saying:

*This will reset all of the variables for all of the Modes in the current Screen to their default state. This action cannot be undone. Do you want to proceed?*

The message provides **OK** and **Cancel** buttons.

|           |                                                                                                                                                    |
|-----------|----------------------------------------------------------------------------------------------------------------------------------------------------|
| Example   | :SYST:DEF MOD                                                                                                                                      |
| Couplings | Causes the currently running measurement to be aborted, a switch to the Power-on Mode, and activates the default measurement for the Power-on Mode |

## 5.10 User Preset All Screens

Recalls a screen configuration previously saved using **"Save User Preset All Screens" on page 559**. The complete configuration of all Screens is loaded, including the state of each Screen.

Because **User Preset All Screens** performs a Recall State as part of its function, it affects all variables that are normally only reset by **"Restore Mode Defaults" on page 550**, and affects **Input/Output** variables, because both are included in State files.

Note that recalling a screen configuration in this manner wipes out your current screen configuration, and all states of all Screens.

|                              |                                                                                                                                                                                                                                                                                                                                                                                                                        |
|------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Notes                        | <p><b>"Save User Preset All Screens" on page 559</b> is used to save the current screen configuration as the "user preset all screens" configuration</p> <p>If loading a <b>User Preset All Screens</b> file from a different instrument, some settings may be limited and/or coupled differently, since the capabilities of the Mode may have changed from when the <b>User Preset All Screens</b> file was saved</p> |
| Status Bits/OPC dependencies | <p>Clears all pending OPC bits</p> <p>The Status Byte is set to 0</p>                                                                                                                                                                                                                                                                                                                                                  |

## 5.11 Save User Preset All Screens

Saves the current Screen Configuration in a unique location, for recall by "[User Preset All Screens](#)" on page 558.

**Save User Preset All Screens** can be executed from the "[Preset Dropdown](#)" on page 547.

Besides the screen configuration, *all* Mode variables of all Screens are saved, including those reset by "[Mode Preset](#)" on page 548, and those only reset by "[Restore Mode Defaults](#)" on page 550, as well as all **Input/Output** variables, so when you subsequently press **User Preset All Screens**, the instrument returns to the exact Screen setup that existed when you pressed **Save User Preset All Screens**.

---

|       |                                                                                                                                                                                      |
|-------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Notes | Creates the same file as if you requested <b>Screen Config + State</b> save, except that <b>Save User Preset All Screens</b> does not allow you to specify the file name or location |
|-------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

## 5.12 Restore Screen Defaults

Resets the Screen configuration to the factory default; deleting all screens, all screen names, all screen states, and setting "Multiscreen" on page 143 to Off. A single screen will remain, set to the Power-on Mode, in a preset state with the default screen name.

**Restore Screen Defaults** can be executed from the "Preset Dropdown" on page 547.

When **Restore Screen Defaults** is selected, a message appears saying:

This function will delete all defined screens and their settings. This action cannot be undone.

Do you want to proceed?

The message provides **OK** and **Cancel** buttons.

---

Example

:SYST:DEF SCReen

### 5.13 Preset Type (Remote Command Only)

|                |                                                                                                                       |
|----------------|-----------------------------------------------------------------------------------------------------------------------|
| Remote Command | :SYSTem:PRESet:TYPE FACTory   MODE   USER<br>:SYSTem:PRESet:TYPE?                                                     |
| Example        | :SYST:PRES:TYPE FACT                                                                                                  |
| Notes          | Supported for backwards compatibility only. It is a no-op, which does not change the behavior of any preset operation |
| Preset         | Unaffected by Preset, but set to MODE by Restore System Defaults->All                                                 |
| State Saved    | No                                                                                                                    |

## 5.14 Restart Instrument (Shutdown)

Shuts down the instrument, then reboots it.

|                |             |
|----------------|-------------|
| Remote Command | :SYSTem:PUP |
| Example        | :SYST:PUP   |

## 5.15 Restart Application (Application Shutdown)

Restarts the instrument application without rebooting the instrument. Before you send this command, make sure you have saved any trace or measurement data that you want to preserve.

|                |                                                                                                                                                                                                                                                                                                                                                            |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | :SYSTem:PUP:PROcess                                                                                                                                                                                                                                                                                                                                        |
| Example        | :SYST:PUP:PROC<br>After sending this command, you must wait for the instrument software to restart                                                                                                                                                                                                                                                         |
| Notes          | You cannot use *WAI or *OPC? to synchronize operation after a restart. This command stops and restarts the instrument application, so the SCPI operation is terminated and restarted<br>A remote program must wait a fixed time before resuming sending commands to the instrument. The appropriate wait time depends on which applications are pre-loaded |

## 5.16 System Log Off (Remote Command Only)

Provides a means to terminate all open Windows applications, and log off the current user. This is equivalent to performing the Windows command:

```
shutdown -l -f -t0
```

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | :SYSTem:LOFF                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Example        | :SYST:LOFF                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Notes          | Initiates an immediate log off of the current user. Exits the instrument application, so any unsaved measurement results will be lost. You cannot use *WAI or *OPC? to synchronize operation. In addition to the instrument application, all other Windows programs will be terminated, without the opportunity to save any work in progress. To perform a subsequent login, and regain instrument operation, human intervention will be required |



## 5.17 Power Standby (Instrument Shutdown)

Pressing the power switch powers down the instrument. You are warned that shutting down will cause the application to lose unsaved data, and the instrument lets you respond to this warning before shutting down.

The command below has the same effect, except that you can specify Normal mode (**NORMa1**) or Forced mode(**FORCe**):

- In **NORMa1** mode, the system waits until you respond to the warning prompt
- In **FORCe** mode, the system shuts down after 20 seconds, and all data will be lost

If the instrument is not properly shut down prior to removal of line power, the system will validate the Journaling File System and the Power-On Last State (if the instrument is in Power-On Last State) during the following power-on. If a problem is detected, a message appears indicating that the system ‘recovered’ from an inappropriate shutdown. This is only an issue if **Power-On Type** is Last State. If the Last State is not valid, the instrument will power up in the last active Mode, but will perform "**Mode Preset**" on page 548.

|                |                                                   |
|----------------|---------------------------------------------------|
| Remote Command | :SYSTem:PDOWn [NORMa1   FORCe]                    |
| Example        | :SYST:PDOW<br>Executes a normal shutdown          |
| Notes          | If no parameter is sent, <b>NORMa1</b> is assumed |

## 6 Input/Output

Accesses menus that let you control the Input/Output parameters of the instrument. In general, these are functions associated with external connections to the instrument, either to the inputs or the outputs.

Input/output connections tend to be based on situation-specific hardware set up. For that reason, input/output settings do *not*, in general, change when you perform a Mode Preset. You can revert to the default values in one of three ways:

- Use **Restore Input/Output Defaults**, in the **Input/Output** menu
- Use **System->Restore System Defaults->Input/Output Settings**
- Use **System -> Restore System Defaults->All**

The settings survive a Preset and a Power cycle.

A few Input/Output settings *do* respond to Mode Preset. For example, if the Calibrator is on, **Preset** turns it off, and if DC coupling is in effect, **Preset** switches it to AC. These exceptions are noted in the SCPI tables for the excepted functions.

Input/Output features are common across multiple Modes and Measurements. In general, they do not change when you change Mode or Measurement, although some controls appear only in certain measurements.

## 6.1 RF Source

Lets you control and configure the internal RF Source. This tab only appears in models that support a built-in independent RF Source, which include E7760B, and modular products such as EXM and VXT.

External Source Control and built-in Tracking Sources are controlled using the **Source** tab in **Meas Setup**.

|              |                                                                                                   |
|--------------|---------------------------------------------------------------------------------------------------|
| Dependencies | Only appears in models that support a built-in independent RF Source, such as E7760B, EXM and VXT |
|--------------|---------------------------------------------------------------------------------------------------|

### 6.1.1 RF Output

Sets the source RF power output state.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:OUTPut[:EXternal][:STATe] ON   OFF   1   0</code><br><code>:OUTPut[:EXternal][:STATe]?</code>                                                                                                                                                                                                                                                                                                                                     |
| Example        | <code>:OUTP OFF</code><br><code>:OUTP?</code>                                                                                                                                                                                                                                                                                                                                                                                            |
| Notes          | This setting is for the independent mode and has no effect on the <a href="#">"List Sequencer" on page 578</a> . If <b>Sequencer</b> is <b>ON</b> , the List Sequencer controls the source output, and this key is grayed-out<br>When <b>Sequencer</b> is <b>OFF</b> , makes source leave List Sequencer and this setting is blanked out, taking effect immediately                                                                      |
| Dependencies   | For E7760B, the RF Output cannot be set to <b>ON</b> if the RF Output port is set to <b>NONE</b> . If you attempt to set RF Output to <b>ON</b> in this situation, the error message -221, "Settings conflict; Source Output is not available while Output Port is None" is displayed<br><code>:OUTPut:EXternal[:STATe]</code> is supported only when Option ESC is installed. Otherwise, only <code>:OUTPut[:STATe]</code> is supported |
| Preset         | <b>OFF</b>                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Range          | <b>ON OFF</b>                                                                                                                                                                                                                                                                                                                                                                                                                            |

### 6.1.2 RF Output Port

Specifies the RF Output Port used by the internal source.

Switching from the RF Output port to one of the RFIO ports changes the transmitter performance of the instrument.

The **NONE** selection is available to allow setting a half-duplex port to an Input, if it was previously assigned as an Output. Set the Output to **NONE** first, then any port can be assigned as an Input.

When using VXT M9410A/11A/15A/16A with Remote Radio Heads (such as the Keysight M1740A mmWave Transceiver for 5G), the choices in the dropdown menu appear as:

Head h RFHD p

For example, if you have two Radio Heads (numbered 1 and 2), each of which have two RF half-duplex ports, the choices for these ports will appear as below:

| Head and Port           | Choice in dropdown | SCPI parameter |
|-------------------------|--------------------|----------------|
| Head 1, port RF Tx/Rx 1 | Head 1 RFHD 1      | RRH1RFHD1      |
| Head 1, port RF Tx/Rx 2 | Head 1 RFHD 2      | RRH1RFHD2      |
| Head 2, port RF Tx/Rx 1 | Head 2 RFHD 1      | RRH2RFHD1      |
| Head 2, port RF Tx/Rx 2 | Head 2 RFHD 2      | RRH2RFHD2      |

When using the E7770A Common Interface Unit, outputs may come from the DUT IF OUT ports on the rear of the CIU or the half-duplex ports on the front of the CIU labeled DUT IF In/Out. You would select GUI parameter IF Out n or SCPI parameter IFOutn for the DUT IF OUT ports or GUI parameter IFHD n or SCPI parameter IFHDn for the DUT IF In/Out ports. See ["RF Input Port" on page 684](#) "Parameters for VXT M9410A/11A/15A/16A and EXM when used with Radio Heads/CIU" for more details.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <p><code>[ :SENSe]:FEED:RF:PORT:OUTPut RFOut   RFIO1   RFIO2   RFIO3   RFIO4   RFHD   RFFD   A1   A2   A3   B1   B2   B3   IFIO1   IFIO2   GEN   TR   RRHhRFHDp   IFOutn   IFHDn   NONE</code></p> <p>For details of each option, see <a href="#">"Port Options" on page 569</a></p> <p><code>[ :SENSe]:FEED:RF:PORT:OUTPut?</code></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Example        | <p>Set output to RF Output:<br/><code>:FEED:RF:PORT:OUTP RF0</code></p> <p>Set output to Radio Head 1, RF Tx/Rx Port 2:<br/><code>:FEED:RF:PORT:OUTP RRH1RFHD2</code></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Dependencies   | <p>Only appears in models that support multiple output ports. If the SCPI command is sent with unsupported parameters in any other model, an error is generated, -221, "Settings conflict; option not installed"</p> <p><b>RFHD</b> and <b>RFFD</b> are only available on VXT. Option HDX is required to enable RFHD port. Option FDX is required to enable RFFD port</p> <p>For E7760B: Ports IFIO1 and IFIO2 are available if Option RF2 is installed. Ports A1, A2, A3, B1, B2, B3 are available if Option RF3 is installed. Attempting to select a port for which the option is not present generates the error, -241, "Hardware missing; Output not available"</p> <p>A port cannot be selected as an Output while it is occupied as an Input. If the SCPI command is sent while the port is occupied, an error is generated, -221, "Settings conflict; Output Port is not available while occupied by Input"</p> <p>Additionally, the mmWave ports are divided into two banks: the A Bank and the B Bank. A port cannot be selected as an Output if any port on the <i>same</i> bank is occupied as an Input. If the SCPI command is sent for this situation, an error is generated, -221 "Settings conflict; Output Port is not available while</p> |

## 6 Input/Output

### 6.1 RF Source

|                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                              | <p>port bank is occupied by Input”</p> <p>Lastly, if RF3 is present, and RF4 is absent, a mmWave port cannot be selected as an Output if the Input Port is occupied by wwWave Transceiver with a different frequency range. If the SCPI command is sent for this situation an error is generated, -221 “Settings conflict; Output Port is not available while occupied by Input of incompatible frequency”</p> <p>Ports <b>GEN</b> and <b>TR</b> are only available in modular analyzers, and only when the M9470A module is installed, such as in M8920A. Option HDX is required to enable the T/R port</p> <p>When any output is selected in a measurement that does not support it, the "No result; Meas invalid with this output" error condition occurs, and the measurement returns invalid data when queried</p> |
| Preset                       | Unaffected by <b>Mode Preset</b> , but set to default by <b>Source Preset</b> or <b>Restore System Defaults -&gt; All</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| State Saved                  | Saved in State                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Backwards Compatibility SCPI | <p><b>:FEED:RF:PORT:OUTPut IFIO1</b></p> <p><b>IFIO1</b> is treated as <b>IF01</b> and sets the IF output to be the port labeled <b>DUT IF Out</b> on the CIU rear panel. This is for compatibility with earlier implementations on EXM and VXT when using the E7770A Common Interface Unit</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |

#### Port Options

| Value                     | Notes                                                                                                                                                                                                                                                                                                                                                                                               |
|---------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| RF Output<br><b>RFOut</b> | <p>On EXM with hardware M9430A, if RF Output is selected as RF Output Port, use the settings in the <b>Half Duplex Config</b> menu to determine which port (<b>RFIO3</b> or <b>RFIO4</b>) will be used</p> <p>On EXM with hardware M9431A, this setting is not supported. If the SCPI command is sent with this setting, an error is generated, -221, “Settings conflict; option not installed”</p> |
| <b>RFHD</b>               | <p>RFHD port is exclusive for RF Input and RF Output. If HD Port is chosen as RF Input port, pressing this key, or sending SCPI to set it, generates error message: “-221, Settings conflict; RFHD is being used as RF Input Port”</p> <p>Option HDX is required to enable RFHD port</p>                                                                                                            |
| <b>RFFD</b>               | Option FDX is required to enable RFFD port                                                                                                                                                                                                                                                                                                                                                          |
| <b>GEN</b>                | Selects the Gen port on M8920A/20B                                                                                                                                                                                                                                                                                                                                                                  |
| T/R<br><b>TR</b>          | Selects the T/R port on M8920A/20B                                                                                                                                                                                                                                                                                                                                                                  |
| <b>RRHhRFHDp</b>          | <p>Used to select a port on a Radio Head (such as the Keysight M1740A mmWave Transceiver) as an output</p> <p><b>RRHhRFHDp</b> corresponds to <b>Head h</b>, port <b>RF Tx/Rx p</b>. For example, <b>RRH1RFHD2</b> = the port labeled <b>RF Tx/Rx 2</b> on <b>Head 1</b></p>                                                                                                                        |

#### 6.1.3 Half Duplex Output Port

Specifies whether **RFIO3** or **RFIO4** is the Half Duplex Output port.

|                |                                                     |
|----------------|-----------------------------------------------------|
| Remote Command | <b>[ :SENSe ]:HDUPlex:PORT:OUTPut RFIO3   RFIO4</b> |
|----------------|-----------------------------------------------------|

|              |                                                                                                                                                                                                                                                                                               |
|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Example      | <code>:HDUPlex:PORT:OUTPut RFI03</code><br><code>:HDUPlex:PORT:OUTPut?</code>                                                                                                                                                                                                                 |
| Dependencies | Only appears in EXM<br>If <b>RFI03</b> is selected as “Half Duplex Input Port”, then “Half Duplex Output Port” will be set to <b>RFI04</b> automatically<br>If <b>RFI04</b> is selected as “Half Duplex Input Port”, then “Half Duplex Output Port” will be set to <b>RFI03</b> automatically |
| Preset       | <b>RFI04</b>                                                                                                                                                                                                                                                                                  |
| State Saved  | Saved in State                                                                                                                                                                                                                                                                                |

## 6.1.4 RF Power

Lets you control the amplitude of the Source output. Same as "RF Power" on page 570 in **Amplitude Setup**.

|         |                                 |
|---------|---------------------------------|
| Example | <code>:SOUR:POW -100 dBm</code> |
|---------|---------------------------------|

## 6.1.5 T/R Port High Power Attenuator

Controls whether additional attenuation is added at the T/R Port. The T/R port has two output paths, one that provides a 16 dB attenuator, another that bypasses this attenuator. When this control is **ON**, the path includes the 16 dB attenuator, so the maximum output level for this path is 0 dBm. When this control is **OFF**, the 16 dB attenuator is bypassed, so the maximum output level for this path is +5 dBm.

|         |                                           |
|---------|-------------------------------------------|
| Example | <code>:FEED:RF:PORT:TR:HPOW:ATT ON</code> |
|---------|-------------------------------------------|

## 6.1.6 Amplitude Setup

Lets you access the **Amplitude Setup** panel.

|       |                                                                                                                                                                                                                                                                                                                                                                                                       |
|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Notes | This menu under this control is for independent mode, and has no effect on "List Sequencer" on page 578. If "Sequencer" on page 579 is <b>ON</b> , the List Sequencer controls the source output, and this control is grayed-out on the front panel, to indicate out-of-scope. When you set "Sequencer" on page 579 to <b>OFF</b> , makes source leave List Sequencer and this control is blanked out |
|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

### 6.1.6.1 RF Power

Lets you adjust the power level of the source using the numeric keypad, step keys, or RPG. Pressing any digit, 0 through 9 on the numeric keypad displays the unit terminator.

## 6 Input/Output

### 6.1 RF Source

Please refer to the ["RF Power Range" on page 571](#) table below for the valid ranges.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SOURce:POWer[:LEVel][:IMMediate][:AMPLitude] &lt;ampl&gt;</code><br><code>:SOURce:POWer[:LEVel][:IMMediate][:AMPLitude]?</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Example        | <code>:SOUR:POW -100 dBm</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Notes          | <p>Amplitude corrections can be specified for use with the source. In the event of amplitude corrections being applied, the valid ranges for the RF power do not change dependent on the current amplitude correction setting. If the combination of RF power + amplitude correction is higher or lower than the source output range, the Source Unleveled bit is set, and the "Source Unleveled" indicator will appear on status panel to indicate that the source cannot maintain the output power that has been requested</p> <p>When signal generator is unable to maintain the requested output level, the "Source Unleveled" indicator will appear on status panel. When the source output setting is restored to the normal range, the "Source Unleveled" is removed from status panel</p> <p>Internal source has list sequence mode, which comprises of several steps which contain separate output power, frequency and waveform etc. When the source list sequence playing is complete, the last step keeps playing, and user can use this command to change the list sequence last step's output power</p> <p>For EXT, The multiport adapter RFIO TX ports and GPS ports cannot ensure power accuracy when power setting is lower than -130dBm, this power setting value is defined by the sum of RF Power setting and related amplitude correction value. But user settable value could be lower than this limit. When application detected there exists power setting lower than -130dBm on MPA RFIO TX ports, then popup warning message . When application detected there exists power setting lower than -130dBm on MPA GPS ports, then popup warning message . This is only warning message, and check is performed when RF is <b>ON</b></p> |
| Dependencies   | The RF power is dependent on the RF output port and frequency, such that the current frequency and selected output port determine the valid range of power values                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Couplings      | For if AWGN State is <b>ON</b> and ARB State is <b>ON</b> , this setting is adjusted to the value to maintain the AWGN power relationship defined by Power Control Mode and other noise settings                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Preset         | -100 dBm                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Min            | The range of values depends on the current frequency and selected RF output port. See <a href="#">"RF Power Range" on page 571</a> below for the valid ranges                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Max            | The range of values depends on the current frequency and selected RF output port. Refer to <a href="#">"RF Power Range" on page 571</a> below for the valid ranges                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |

### RF Power Range

| RF Output Port    | Frequency Range              | Min Output Power | Max Output Power |
|-------------------|------------------------------|------------------|------------------|
| High Power RF Out | 10 MHz $\leq$ f $\leq$ 6 GHz | -150 dBm         | 20 dBm           |
| RFIO 1 & RFIO 2   | 10 MHz $\leq$ f $\leq$ 6 GHz | -150 dBm         | 0 dBm            |

Note: This is the UI power range, which is larger than the actual specification.

## VXT model M9420A

| RF Output Port | Frequency Range              | Min Output Power | Max Output Power without Option "1EA" | Max Output Power with Option "1EA" |
|----------------|------------------------------|------------------|---------------------------------------|------------------------------------|
| RF Output      | 60 MHz $\leq$ f $\leq$ 6 GHz | -150 dBm         | 10 dBm                                | 25 dBm                             |
| RFHD           | 60 MHz $\leq$ f $\leq$ 6 GHz | -150 dBm         | 10 dBm                                | 15 dBm                             |
| RFFD           | 60 MHz $\leq$ f $\leq$ 6 GHz | -150 dBm         | 0 dBm                                 | 0 dBm                              |

Note 1: This is the UI power range, which is larger than the actual specification.

Note 2: Max output power with Option 1EA can be set to 25 dBm, but Meas Uncal (measurement uncalibrated) warning is given in the Status Bar in the lower right corner of the screen when output power set higher than 20 dBm.

## VXT models M9410A/11A

| Ports     | Option LFE         | Frequency Range               | Min Output Power | Max Output Power without option "1EA" | Max Output Power with "1EA" |
|-----------|--------------------|-------------------------------|------------------|---------------------------------------|-----------------------------|
| RF Output | With Option LFE    | 1 MHz $\leq$ f $\leq$ 60 MHz  | -150 dBm         | 5 dBm                                 | 5 dBm                       |
|           |                    | 60 MHz $\leq$ f $\leq$ 380MHz | -150 dBm         | 5 dBm                                 | 25 dBm                      |
|           | Without Option LFE | 380 MHz $\leq$ f $\leq$ 6 GHz | -150 dBm         | 5 dBm                                 | 25 dBm                      |
| RFHD      |                    | 1 MHz $\leq$ f $\leq$ 6 GHz   | -150 dBm         | 5 dBm                                 | 5 dBm                       |

Note 1: Min Output Power is the UI power range, which is smaller than the actual specification.

Note 2: Max output power with Option 1EA can be set to 25 dBm for RF Output Port, but Meas Uncal (measurement uncalibrated) warning is given in the Status Bar in the lower right corner of the screen when the output power is set higher than 20 dBm.

Note 3: Option LFE provides Low Frequency Extension, which covers frequency from 1 MHz to 380 MHz.



## VXT models M9415A/16A

| RF Output Port | Frequency Range                                | Min Output Power | Max Output Power without Option "1EA" | Max Output Power with Option "1EA" |
|----------------|------------------------------------------------|------------------|---------------------------------------|------------------------------------|
| RF Output      | $380 \text{ MHz} \leq f \leq 12.3 \text{ GHz}$ | -150 dBm         | 5 dBm                                 | 25 dBm                             |
| RFHD           | $380 \text{ MHz} \leq f \leq 12.3 \text{ GHz}$ | -150 dBm         | 5 dBm                                 | 18 dBm                             |

**Note 1:** For RF output port, the Max output power with Option 1EA can be set to 25 dBm for RF Output Port, but Meas Uncal (measurement uncalibrated) warning is given in the Status Bar in the lower right corner of the screen when the output power is set higher than 20 dBm.

**Note 2:** For RFHD port, the Max output power with Option 1EA can be set to 18 dBm for RF Output Port, but Meas Uncal (measurement uncalibrated) warning is given in the Status Bar in the lower right corner of the screen when the output power is set higher than 10 dBm.

## M9410E/11E/15E/16E

| Ports     | Option LFE         | Frequency Range                                | Min Output Power | Max Output Power |
|-----------|--------------------|------------------------------------------------|------------------|------------------|
| RF Output | With Option LFE    | $1 \text{ MHz} \leq f \leq 380 \text{ MHz}$    | -150 dBm         | 13 dBm           |
|           |                    | $380 \text{ MHz} \leq f \leq 25.9 \text{ GHz}$ | -150 dBm         | 25 dBm           |
|           | Without Option LFE | $380 \text{ MHz} \leq f \leq 25.9 \text{ GHz}$ | -150 dBm         | 25 dBm           |
| RFHD      |                    | $1 \text{ MHz} \leq f \leq 25.9 \text{ GHz}$   | -150 dBm         | 5 dBm            |

## VXT Models with Remote Radio Heads/CIU

| Solution | Port   | Option | Frequency Range      | Min Output Power | Max Output Power              |
|----------|--------|--------|----------------------|------------------|-------------------------------|
| S9100A   | Head h | --     | 22.7 GHz to 43.5 GHz | -150 dBm         | 10 dBm                        |
|          | RFHD p |        |                      |                  |                               |
|          | RF Out | RH1007 | 0.38 GHz to 6 GHz    | -150 dBm         | 20 dBm                        |
|          |        | 022    | 0.38 GHz to 6 GHz    | -150 dBm         | Primary: 17 dBm<br>Blocker: 2 |

| Solution | Port          | Option | Frequency Range      | Min Output Power | Max Output Power                  |
|----------|---------------|--------|----------------------|------------------|-----------------------------------|
|          |               |        |                      |                  | dBm                               |
| S9101A   | DUT IF OUT n  | --     | 6 GHz to 12 GHz      | -150 dBm         | 10 dBm                            |
|          | Head h RFHD p | --     | 22.7 GHz to 43.5 GHz | -150 dBm         | 10 dBm                            |
|          | RF Out        | TR1    | 0.38 GHz to 6 GHz    | -150 dBm         | 20 dBm                            |
|          |               | TR2    |                      |                  |                                   |
|          |               | BK1    | 0.38 GHz to 6 GHz    | -150 dBm         | Primary: 17 dBm<br>Blocker: 2 dBm |
| S9110A   | RFIO HD       | --     | 0.38 GHz to 6 GHz    | -150 dBm         | 5 dBm                             |
|          | Head h RFHD 1 | F32    | 10 GHz to 32 GHz     | -150 dBm         | 10 dBm                            |
|          | Head h RFHD 2 | F32    | 10 GHz to 32 GHz     | -150 dBm         | 8 dBm                             |
|          | RF Out        | --     | 0.38 GHz to 6 GHz    | -150 dBm         | 20 dBm                            |
| S9115A   | RFIO HD       | --     | 0.38 GHz to 6 GHz    | -150 dBm         | 5 dBm                             |
|          | Head h RFHD p | F43    | 22.7 GHz to 43.5 GHz | -150 dBm         | 10 dBm                            |
|          | Head h RFHD p | F49    | 22.7 GHz to 49.2 GHz | -150 dBm         | 10 dBm                            |
|          | RF Out        | --     | 0.38 GHz to 13.0 GHz | -150 dBm         | 27 dBm                            |
|          | RFIO HD       | --     | 0.38 GHz to 13.0 GHz | -150 dBm         | 27 dBm                            |
|          | Head h RFHD p | F43    | 22.7 GHz to 43.5 GHz | -150 dBm         | 10 dBm                            |
|          | Head h RFHD p | F49    | 22.7 GHz to 49.2 GHz | -150 dBm         | 10 dBm                            |
|          |               |        |                      |                  |                                   |

## M8920A/20B

| RF Output Port | Frequency Range           | Min Output Power | Max Output Power          |
|----------------|---------------------------|------------------|---------------------------|
| Gen            | 100 kHz $\leq$ f $\leq$ 6 | -150 dBm         | without option 1EA: 3 dBm |

| RF Output Port | Frequency Range     | Min Output Power | Max Output Power                                                                                                   |
|----------------|---------------------|------------------|--------------------------------------------------------------------------------------------------------------------|
| T/R            | 100 kHz ≤ f ≤ 6 GHz | -150 dBm         | with option 1EA: 15 dBm<br>T/R port high power attenuator On: -15 dBm<br>T/R port high power attenuator Off: 5 dBm |

Note: This is the UI power range, which is larger than the actual specification.

6.1.6.2 Set Reference Power

Turns the power reference state to **ON**, sets the reference power value to the current RF output power, maintains this power at the RF output, and sets the displayed power to 0.00 dB. All subsequent RF power values entered under **Source**, **Amplitude**, **RF Power** are interpreted as being relative to this reference power.

When you use a power reference, the signal generator outputs an RF power that is set relative to the reference power by the value entered under **Source**, **Amplitude**, **RF Power** as follows:

Output power = reference power – entered power

Where:

- reference power equals the original RF Power entered under **Source>Amplitude>RF Power** and set as the reference power
- entered power equals a new value entered under **Source>Amplitude>Amptd Offset**

In addition, the displayed power value is the same as a new value entered under **Source**, **Amplitude**, **RF Power**.

NOTE

If Power Ref is **ON** with a reference value set, entering a value under **Source**, **Amplitude**, **RF Power** and pressing **Set Reference Power** adds that value to the existing Power Ref value.

If you wish to change the reference power value to a new value entered under **Source**, **Amplitude**, **RF Power**, first set Power Ref to **OFF**, then press **Set Reference Power**.

|              |                                                                             |
|--------------|-----------------------------------------------------------------------------|
| Dependencies | Unavailable, and grayed-out, when "List Sequencer" on page 578 is <b>ON</b> |
|--------------|-----------------------------------------------------------------------------|

### 6.1.6.3 Power Ref

Lets you toggle the state of the power reference. When you use a power reference, the signal generator outputs an RF power that is set relative to the reference power by the value entered under **Source>Amplitude>RF Power** as follows:

Output power = reference power + entered power

Where:

- reference power equals the original RF Power entered under **Source>Amplitude>RF Power** and set as the reference power
- entered power equals a new value entered under **Source>Amplitude>Amptd Offset**

For more information on Reference Frequency, see ["Set Reference Power" on page 575](#).

|                |                                                                                                                                                                        |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SOURce:POWer:REFeRence &lt;ampl&gt;</code><br><code>:SOURce:POWer:REFeRence?</code>                                                                             |
| Example        | <code>:SOUR:POW:REF 0.00 dBm</code>                                                                                                                                    |
| Dependencies   | Unavailable and grayed-out when <a href="#">"List Sequencer" on page 578</a> is <b>ON</b>                                                                              |
| Couplings      | Coupled to <a href="#">"Set Reference Power" on page 575</a> , such that pressing <b>Set Reference Power</b> updates the reference power with the current output power |
| Preset         | 0.00 dBm                                                                                                                                                               |
| Min            | -125.00 dBm                                                                                                                                                            |
| Max            | 10.00 dBm                                                                                                                                                              |
| Auto Function  |                                                                                                                                                                        |
| Remote Command | <code>:SOURce:POWer:REFeRence:STATe OFF   ON   0   1</code><br><code>:SOURce:POWer:REFeRence:STATe?</code>                                                             |
| Example        | <code>:SOUR:POW:REF:STATe ON</code>                                                                                                                                    |
| Preset         | <b>OFF</b>                                                                                                                                                             |

### 6.1.6.4 Power Unit

Modifies the units for RF Power and Power Ref. The change is immediate and does not force a restart.

|                |                                                                                                                                                        |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SOURce:POWer[:LEVel][:IMMediate][:AMPLitude]:UNIT DBM   W   V   DBUV</code><br><code>:SOURce:POWer[:LEVel][:IMMediate][:AMPLitude]:UNIT?</code> |
| Example        | Set the RF Power units to volts:                                                                                                                       |

|             |                                                         |
|-------------|---------------------------------------------------------|
|             | <b>:SOUR:POW:UNIT V</b>                                 |
| Couplings   | RF Power and Power Ref units are modified by Power Unit |
| Preset      | dBm                                                     |
| State Saved | Saved in Instrument State                               |

### 6.1.6.5 Amptd Offset

Lets you specify the RF output power offset value.

When the amplitude offset is set to zero (0) and you set a new offset value (positive or negative), the displayed amplitude value changes as follows, and the RF output power does not change:

Displayed value = output power + offset value

Where:

- output power equals the original RF Power entered under **Source, Amplitude, RF Power**
- offset value equals the value entered under **Source, Amplitude, Amptd Offset**

When the amplitude offset is set to a value other than zero (0) and you enter a new RF power value under **Source, Amplitude, RF Power**, the displayed power will be the same as the value entered and the RF output power will be equal to the value entered minus the offset value as follows:

Output power = entered power – offset power

Displayed Power = output power + offset power

Displayed power = entered power

Where:

- entered power equals the amplitude entered under **Source, Amplitude, RF Power**
- offset power equals the value previously entered and set under **Source, Amplitude, Amptd Offset**

|                |                                                                                                                      |
|----------------|----------------------------------------------------------------------------------------------------------------------|
| Remote Command | <b>:SOURce:POWer[:LEVel][:IMMediate]:OFFSet &lt;rel_ampl&gt;</b><br><b>:SOURce:POWer[:LEVel][:IMMediate]:OFFSet?</b> |
| Example        | <b>:SOUR:POW:OFFS 0.00 dB</b>                                                                                        |
| Notes          | The amplitude Offset unit follows the units set in Power Unit                                                        |
| Dependencies   | Unavailable, and grayed-out, when List Sequencer is <b>ON</b>                                                        |
| Preset         | 0.00 dB                                                                                                              |

|     |            |
|-----|------------|
| Min | -200.00 dB |
| Max | 200.00 dB  |

### 6.1.6.6 Amplitude Increment

Changes the step size for the RF Power function. Once an increment size has been selected and the RF Amplitude function is active, the step keys (and the [UP | DOWN](#) parameters for RF Power from remote commands) change the RF Power by the set value. This feature exists in EXG and MXG.

|                |                                                                                                          |
|----------------|----------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SOURce:POWer:STEP[:INCRement] &lt;amp1&gt;</code><br><code>:SOURce:POWer:STEP[:INCRement]?</code> |
| Example        | <code>:SOUR:POW:STEP 1</code>                                                                            |
| Notes          | The Amplitude Increment unit follows the units set in Power Unit                                         |
| Couplings      | Coupled to the Step size of the RF Power function                                                        |
| Preset         | 1 dB                                                                                                     |
| Min            | 0.1 dB                                                                                                   |
| Max            | 10 dB                                                                                                    |

### 6.1.7 Frequency

Lets you control the frequency of the Source. Same as ["Frequency" on page 603](#) under ["Frequency Setup" on page 603](#).

|         |                                  |
|---------|----------------------------------|
| Example | <code>:SOUR:FREQ 1.00 GHz</code> |
|---------|----------------------------------|

### 6.1.8 List Sequencer

Accesses sub-menus for configuring the **List Sequencer**.

List sequences allow you to enter frequencies and amplitudes at unequal intervals in nonlinear ascending, descending or random order. Each step within the list can also include its own waveform file for playback, step duration, trigger event and trigger output.

The complexities involved in configuring the **List Sequencer** do not lend themselves to manual configuration; hence the manual configuration for this feature is limited. For easier configuration of the List Sequencer, it is recommended that you use either SCPI, or load a tab-delimited file containing the setup parameters in a tabular form. The details of the SCPI for configuring the List Sequencer can be found in ["Step Configuration \(Remote Command Only\)" on page 594](#).

Once the **List Sequencer** has been configured using the front panel, SCPI, or by loading a tab-delimited file, the sequence must be initiated using the front panel **Initiate Sequence** key, or the corresponding SCPI command.

|              |                         |
|--------------|-------------------------|
| Dependencies | Not available in E7760B |
|--------------|-------------------------|

### 6.1.8.1 Sequencer

Sets the state of ["List Sequencer" on page 578](#)

- When **List Sequencer** is **ON**, the source outputs the sequence defined by the sequencer
- When **List Sequencer** is **OFF**, the source outputs a single waveform segment or sequence (independent mode) at a single frequency and amplitude

|                |                                                                                                                                                                                                                                                                                                                                                                                   |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SOURce:LIST[:STATe] ON   OFF   1   0</code><br><code>:SOURce:LIST[:STATe]?</code>                                                                                                                                                                                                                                                                                          |
| Example        | <code>:SOUR:LIST OFF</code>                                                                                                                                                                                                                                                                                                                                                       |
| Notes          | When the sequencer is <b>ON</b> , the List Sequencer controls the output of the source                                                                                                                                                                                                                                                                                            |
| Dependencies   | Not available in E7760B                                                                                                                                                                                                                                                                                                                                                           |
| Couplings      | When in Sequence Analyzer Mode, and the List Sequencer state is <b>OFF</b> , <b>Include Source</b> is forced to <b>NO</b> , and the <b>Include Source</b> key is grayed-out<br>When in Sequence Analyzer Mode, and the List Sequencer state is <b>ON</b> , <b>Include Source</b> is available to set, and an ARB memory related operation such as load or delete will be rejected |
| Preset         | <b>OFF</b>                                                                                                                                                                                                                                                                                                                                                                        |
| Range          | <b>ON   OFF</b>                                                                                                                                                                                                                                                                                                                                                                   |

### 6.1.8.2 Initiate Sequence

Arms the sequence for single execution. Once the sequence is armed, the source begins the sequence as soon as the trigger is received. If trigger is set to **Free Run**, the sequence starts immediately.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SOURce:LIST:TRIGger[:IMMediate]</code>                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Example        | <code>:SOUR:LIST:TRIG</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Notes          | When in Sequence Analyzer Mode, and <b>Include Source</b> is <b>ON</b> , the Initiate List Sequencer operation is rejected, and the key is grayed-outIf the file needed by the sequencer is not already in ARB memory, the sequence cannot be initiated, and an error is generated<br>There is a blocking SCPI query that can be used to check whether source list sequence was initiated successfully (see <a href="#">"Remote Software Trigger (Remote command Only)" on page 602</a> ) |
| Dependencies   | In Sequence Analyzer Mode, if <b>Meas Setup</b> , <b>Include Source</b> is set to <b>YES</b> , <b>Source</b> , <b>List Sequencer</b> , <b>Initiate Sequence</b> is disabled<br>Not available in E7760B                                                                                                                                                                                                                                                                                    |

### 6.1.8.3 Repetition

Accesses a sub-menu to select the repetition type for the List Sequencer globally. It cannot be changed between different sequence steps.

In **Single**, the Source list plays one time after initiation. In **Continuous**, the Source list plays continuously after initiation.

This setting is available on EXM.

|                |                                                                            |
|----------------|----------------------------------------------------------------------------|
| Remote Command | <code>:SOURce:LIST:REPetition:TYPE SINGLE   CONTInuous</code>              |
| Example        | <code>:SOUR:LIST:REP:TYPE SING</code><br><code>:SOUR:LIST:REP:TYPE?</code> |
| Dependencies   | Available on EXM<br>Not available in E7760B                                |
| Preset         | <b>SINGLE</b>                                                              |
| Range          | <b>SINGLE</b>   <b>CONTInuous</b>                                          |

### 6.1.8.4 Trig Out Type

Accesses a sub-menu to select the output trigger type for the List Sequencer globally. It cannot be changed between different sequence steps. It sets the output trigger type for the whole source sequence.

|                              |                                                                                                               |
|------------------------------|---------------------------------------------------------------------------------------------------------------|
| Remote Command               | <code>:SOURce:LIST:TRIGger:OUTPut:TYPE STEP   MARKer</code><br><code>:SOURce:LIST:TRIGger:OUTPut:TYPE?</code> |
| Notes                        | <b>STEP</b> = Start of Step<br><b>MARKer</b> = Data Marker                                                    |
| Dependencies                 | Available on EXM<br>Not available in E7760B                                                                   |
| Preset                       | <b>STEP</b>                                                                                                   |
| Backwards Compatibility SCPI | <code>:SOURce:LIST:TRIGgerout:TYPe BEGInningofstep   DATAmarker</code>                                        |

### 6.1.8.5 Select Data Marker

When "Trig Out Type" on page 580 is set to Data **MARKer**, specifies which marker to route.

|                |                                                                                                                             |
|----------------|-----------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SOURce:LIST:TRIGger:OUTPut:TYPE:MARKer M1   ...   M4</code><br><code>:SOURce:LIST:TRIGger:OUTPut:TYPE:MARKer?</code> |
|----------------|-----------------------------------------------------------------------------------------------------------------------------|



|                                 |                                     |
|---------------------------------|-------------------------------------|
| Backwards Compatibility<br>SCPI | :SOURce:LIST:TRIGgerout:TYPe:Marker |
|---------------------------------|-------------------------------------|

6.1.8.6 Manual Trigger Now

Provides a software trigger event to the List Sequencer. During execution of a sequence, if the sequencer is halted on any step that has been configured with a “Manual” step trigger, then this keypress causes the sequencer to continue and execute the step.

|       |                                     |
|-------|-------------------------------------|
| Notes | No remote command, front panel only |
|-------|-------------------------------------|

6.1.8.7 List Sequencer Setup

Accesses the List Sequencer setup menus.

Number of Steps

Lets you specify the number of steps within the list sequence.

|                |                                                                                                                                                                                                                                                                                                                                                                                    |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | :SOURce:LIST:NUMBer:STEPs <integer><br>:SOURce:LIST:NUMBer:STEPs?                                                                                                                                                                                                                                                                                                                  |
| Example        | :SOUR:LIST:NUMB:STEP 1                                                                                                                                                                                                                                                                                                                                                             |
| Notes          | Increasing the number of steps creates additional steps at the end of the list, with all the settings within the steps set to their default values<br><br>Decreasing the number of steps removes steps from the end of the list. The settings within the removed steps are not reset. This means that increasing the number of steps again would allow you to retrieve these steps |
| Dependencies   | The Step Count parameter is increased or decreased when you insert or delete a point from within the GUI interface to the sequencer<br><br>Not available in E7760B                                                                                                                                                                                                                 |
| Preset         | 1                                                                                                                                                                                                                                                                                                                                                                                  |
| Min            | 1                                                                                                                                                                                                                                                                                                                                                                                  |
| Max            | 1000                                                                                                                                                                                                                                                                                                                                                                               |

Go To Step

Lets you select the step number you wish to view or edit.

|        |   |
|--------|---|
| Preset | 1 |
|--------|---|

|     |            |
|-----|------------|
| Min | 1          |
| Max | Step Count |

## Insert Step Before

Inserts a new step, with default values, before the currently selected step. Inserting a step automatically increases the Step Count parameter by 1. If a sequence has already reached the upper limit of 1000 steps, then this operation is rejected, and error -221, "Setting Conflict; Cannot insert more steps, maximum number of steps reached" is displayed.

|       |                                                                                                  |
|-------|--------------------------------------------------------------------------------------------------|
| Notes | If the list already contains the maximum limit (1000 steps), pressing this control has no effect |
|-------|--------------------------------------------------------------------------------------------------|

## Delete Step

Deletes the current step. Deleting a step automatically decreases the Step Count parameter by 1. If the sequence only has one step left, then this operation is rejected, and error -221, "Setting conflict; Cannot delete current step, minimum number of steps reached" is displayed

|       |                                                                                               |
|-------|-----------------------------------------------------------------------------------------------|
| Notes | If the list already contains the minimum limit of 1 step, pressing this control has no effect |
|-------|-----------------------------------------------------------------------------------------------|

## Clear List

Clears the list. Clearing the list sets the number of steps to the default value (1) and sets the parameters for the only step to their default values.

## Step Trigger

Lets you select the trigger input for the current step.

|                |                                                                                                                                                                                                                                                                                  |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SOURce:LIST:STEP[1] 2 ... 1000:SETup:INPut:TRIGger IMMEDIATE   INTERNAL   EXTERNAL2   KEY   BUS   EXTERNAL4</code><br><br>For details of options, see <a href="#">"More Information" on page 583</a><br><code>:SOURce:LIST:STEP[1] 2 ... 1000:SETup:INPut:TRIGger?</code> |
| Example        | <code>:SOUR:LIST:STEP2:SET:INP:TRIG BUS</code><br><code>:SOUR:LIST:STEP2:SET:INP:TRIG?</code>                                                                                                                                                                                    |
| Notes          | SCPI is supported after A.09.40                                                                                                                                                                                                                                                  |
| Dependencies   | Not available in E7760B                                                                                                                                                                                                                                                          |
| Preset         | <code>IMMEDIATE</code>                                                                                                                                                                                                                                                           |
| Range          | <code>IMMEDIATE INTERNAL EXTERNAL2 KEY BUS EXTERNAL4</code>                                                                                                                                                                                                                      |

## More Information

| Parameter               | SCPI                 | Notes                                                                                                                                                                                                                                                                                                                                                                                                                |
|-------------------------|----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Free Run                | <a href="#">IMM</a>  | Sets the trigger input for the current step to Free Run                                                                                                                                                                                                                                                                                                                                                              |
| Internal                | <a href="#">INT</a>  | Sets the trigger input for the current step to Internal                                                                                                                                                                                                                                                                                                                                                              |
| Manual<br>(Trigger Key) | <a href="#">KEY</a>  | Sets the trigger input for the current step to Manual (Trigger Key). Any step in the sequence set to Manual will cause the sequence execution to stop until the manual trigger key is pressed. Sending the Bus Trigger SCPI command will have no effect. At any point in the sequence where the List Sequencer is paused waiting for a software trigger, a pop-up dialog is displayed until the trigger event occurs |
| Bus                     | <a href="#">BUS</a>  | Sets the trigger input for the current step to Bus. Any step in the sequence set to Bus will cause the sequence execution to stop until the Bus Trigger command is sent. Pressing the manual trigger key has no effect. At any point in the sequence where the List Sequencer is paused waiting for a software trigger, a pop-up dialog is displayed until the trigger event occurs                                  |
| External 2              | <a href="#">EXT2</a> | Sets the trigger input for the current step to External 2<br>Note: When on EXM, trigger 2 is a bi-directional trigger port. So, when trigger 2 has been configured as OUTPUT type, choosing External 2 as the input trigger for the current step will generate error                                                                                                                                                 |

## Transition Time

Lets you specify the transition time for the current step.

The following table lists recommended values for appropriate settling times to allow for changes within the source.

| Value Changed | Recommended Transition Time                                 |
|---------------|-------------------------------------------------------------|
| Frequency     | 500 $\mu$ s                                                 |
| Amplitude     | 100 $\mu$ s to within 0.1 dB<br>20 $\mu$ s to within 1.0 dB |

If the Transition Time value is shorter than the time necessary for the hardware to settle and a List Sequence is initiated, a **warning** is generated. If the Transition Time value is longer than the Step Duration, an error is generated when initiating a source list sequence. For source list sequence, transition time is included in the step duration length. If the Transition Time value is longer than the Step Duration Time, the real step duration length is extended to equal the transition time and cause a timing shift.

|                |                                                                                                                                                              |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <a href="#">:SOURce:LIST:STEP[1] 2 ... 1000:SETup:TRANsition:TIME &lt;time&gt;</a><br><a href="#">:SOURce:LIST:STEP[1] 2 ... 1000:SETup:TRANsition:TIME?</a> |
| Example        | <a href="#">:SOUR:LIST:STEP2:SET:TRAN:TIME 1ms</a>                                                                                                           |

|              |                                              |
|--------------|----------------------------------------------|
|              | <code>:SOUR:LIST:STEP2:SET:TRAN:TIME?</code> |
| Notes        | SCPI is supported after A.09.40              |
| Dependencies | Not available in E7760B                      |
| Preset       | 1.0 ms                                       |
| Min          | 0.0 ms                                       |
| Max          | 4.0 ks                                       |

## Band

Lets you select the radio band for use in the current step.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SOURce:LIST:STEP[1] 2 ... 1000:SETup:RADio:BAND &lt;band&gt;</code><br>where <b>&lt;band&gt;</b> is one of:<br>NONE   PGSM   EGSM   RGSM   DCS1800   PCS1900   GSM450   GSM480   GSM700  <br>GSM850   TGSM810   USCELL   USPCS   JAPAN   KOREAN   NMT   IMT2K   UPPER  <br>SECOND   PAMR400   PAMR800   IMTEXT   PCS1DOT9G   AWS   US2DOT5G   PUBLIC  <br>LOWER   BANDI   BANDII   BANDIII   BANDIV   BANDV   BANDVI   BANDVII  <br>BANDVIII   BANDIX   BANDX   BANDXI   BANDXII   BANDXIII   BANDXIV   BANDXIX  <br>BAND1   BAND2   BAND3   BAND4   BAND5   BAND6   BAND7   BAND8   BAND9  <br>BAND10   BAND11   BAND12   BAND13   BAND14   BAND17   BAND18   BAND19  <br>BAND20   BAND21   BAND24   BAND25   BAND26   BAND27   BAND28   BAND29  <br>BAND30   BAND31   BAND65   BAND66   BAND67   BAND68   BAND71   BAND252  <br>BAND255   BAND33   BAND34   BAND35   BAND36   BAND37   BAND38   BAND39  <br>BAND40   BAND41   BAND42   BAND43   BAND44   BAND45   BAND46   BANDA  <br>BANDB   BANDC   BANDD   BANDE   BANDF   N1   N2   N3   N5   N7   N8   N12  <br>N20   N25   N28   N34   N38   N39   N40   N41   N50   N51   N66   N70   N71  <br>N74   N75   N76   N77   N78   N79   N80   N81   N82   N83   N84   N86  <br>N257   N258   N260   N261<br><code>:SOURce:LIST:STEP[1] 2 ... 1000:SETup:RADio:BAND?</code> |
| Example        | <code>:SOUR:LIST:STEP2:SET:RAD:BAND PGSM</code><br><code>:SOUR:LIST:STEP2:SET:RAD:BAND?</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Notes          | SCPI is supported after A.09.40                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Dependencies   | Not available in E7760B                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |

Here are the Radio Standards for each Band, and a SCPI example for each (Step 2 is assumed):

| Band     | Standard | SCPI Example                                       |
|----------|----------|----------------------------------------------------|
| None     | None     | <code>:SOUR:LIST:STEP2:SET:RAD:BAND NONE</code>    |
| P-GSM    | GSM/EDGE | <code>:SOUR:LIST:STEP2:SET:RAD:BAND PGSM</code>    |
| E-GSM    | GSM/EDGE | <code>:SOUR:LIST:STEP2:SET:RAD:BAND EGSM</code>    |
| R-GSM    | GSM/EDGE | <code>:SOUR:LIST:STEP2:SET:RAD:BAND RGSM</code>    |
| DCS 1800 | GSM/EDGE | <code>:SOUR:LIST:STEP2:SET:RAD:BAND DCS1800</code> |

6 Input/Output  
6.1 RF Source

| Band              | Standard  | SCPI Example                            |
|-------------------|-----------|-----------------------------------------|
| PCS 1900          | GSM/EDGE  | :SOUR:LIST:STEP2:SET:RAD:BAND PCS1900   |
| GSM 450           | GSM/EDGE  | :SOUR:LIST:STEP2:SET:RAD:BAND GSM450    |
| GSM 480           | GSM/EDGE  | :SOUR:LIST:STEP2:SET:RAD:BAND GSM480    |
| GSM 700           | GSM/EDGE  | :SOUR:LIST:STEP2:SET:RAD:BAND GSM700    |
| GSM 850           | GSM/EDGE  | :SOUR:LIST:STEP2:SET:RAD:BAND GSM850    |
| T-GSM 810         | GSM/EDGE  | :SOUR:LIST:STEP2:SET:RAD:BAND T-GSM810  |
| US Cell           | CDMA 2000 | :SOUR:LIST:STEP2:SET:RAD:BAND USCELL    |
| US PCS            | CDMA 2000 | :SOUR:LIST:STEP2:SET:RAD:BAND PCS       |
| Japan Cell        | CDMA 2000 | :SOUR:LIST:STEP2:SET:RAD:BAND JAPAN     |
| Korean PCS        | CDMA 2000 | :SOUR:LIST:STEP2:SET:RAD:BAND KOREAN    |
| NMT 450           | CDMA 2000 | :SOUR:LIST:STEP2:SET:RAD:BAND NMT       |
| IMT 2000          | CDMA 2000 | :SOUR:LIST:STEP2:SET:RAD:BAND IMT2K     |
| Upper 700         | CDMA 2000 | :SOUR:LIST:STEP2:SET:RAD:BAND UPPER     |
| Secondary 800     | CDMA 2000 | :SOUR:LIST:STEP2:SET:RAD:BAND SECOND    |
| 400 Euro PAMR     | CDMA 2000 | :SOUR:LIST:STEP2:SET:RAD:BAND PAMR400   |
| 800 PAMR          | CDMA 2000 | :SOUR:LIST:STEP2:SET:RAD:BAND PAMR800   |
| 2.5 GHz IMT EXT   | CDMA 2000 | :SOUR:LIST:STEP2:SET:RAD:BAND IMTEXT    |
| US PCS 1.9 GHz    | CDMA 2000 | :SOUR:LIST:STEP2:SET:RAD:BAND PCS1D0T9G |
| AWS               | CDMA 2000 | :SOUR:LIST:STEP2:SET:RAD:BAND AWS       |
| US 2.5 GHz        | CDMA 2000 | :SOUR:LIST:STEP2:SET:RAD:BAND US2D0T5G  |
| 700 Public Safety | CDMA 2000 | :SOUR:LIST:STEP2:SET:RAD:BAND PUBLIC    |
| C2K Lower 700     | CDMA 2000 | :SOUR:LIST:STEP2:SET:RAD:BAND LOWER     |
| Band I            | W-CDMA    | :SOUR:LIST:STEP2:SET:RAD:BAND BANDI     |
| Band II           | W-CDMA    | :SOUR:LIST:STEP2:SET:RAD:BAND BANDII    |
| Band III          | W-CDMA    | :SOUR:LIST:STEP2:SET:RAD:BAND BANDIII   |
| Band IV           | W-CDMA    | :SOUR:LIST:STEP2:SET:RAD:BAND BANDIV    |
| Band V            | W-CDMA    | :SOUR:LIST:STEP2:SET:RAD:BAND BANDV     |
| Band VI           | W-CDMA    | :SOUR:LIST:STEP2:SET:RAD:BAND BANDVI    |
| Band VII          | W-CDMA    | :SOUR:LIST:STEP2:SET:RAD:BAND BANDVII   |
| Band VIII         | W-CDMA    | :SOUR:LIST:STEP2:SET:RAD:BAND BANDVIII  |
| Band IX           | W-CDMA    | :SOUR:LIST:STEP2:SET:RAD:BAND BANDIX    |
| Band X            | W-CDMA    | :SOUR:LIST:STEP2:SET:RAD:BAND BANDX     |
| Band XI           | W-CDMA    | :SOUR:LIST:STEP2:SET:RAD:BAND BANDXI    |
| Band XII          | W-CDMA    | :SOUR:LIST:STEP2:SET:RAD:BAND BANDXII   |
| Band XIII         | W-CDMA    | :SOUR:LIST:STEP2:SET:RAD:BAND BANDXIII  |
| Band XIV          | W-CDMA    | :SOUR:LIST:STEP2:SET:RAD:BAND BANDXIV   |

| Band     | Standard | SCPI Example                          |
|----------|----------|---------------------------------------|
| Band XIX | W-CDMA   | :SOUR:LIST:STEP2:SET:RAD:BAND BANDXIX |
| Band 1   | LTE FDD  | :SOUR:LIST:STEP2:SET:RAD:BAND BAND1   |
| Band 2   | LTE FDD  | :SOUR:LIST:STEP2:SET:RAD:BAND BAND2   |
| Band 3   | LTE FDD  | :SOUR:LIST:STEP2:SET:RAD:BAND BAND3   |
| Band 4   | LTE FDD  | :SOUR:LIST:STEP2:SET:RAD:BAND BAND4   |
| Band 5   | LTE FDD  | :SOUR:LIST:STEP2:SET:RAD:BAND BAND5   |
| Band 6   | LTE FDD  | :SOUR:LIST:STEP2:SET:RAD:BAND BAND6   |
| Band 7   | LTE FDD  | :SOUR:LIST:STEP2:SET:RAD:BAND BAND7   |
| Band 8   | LTE FDD  | :SOUR:LIST:STEP2:SET:RAD:BAND BAND8   |
| Band 9   | LTE FDD  | :SOUR:LIST:STEP2:SET:RAD:BAND BAND9   |
| Band 10  | LTE FDD  | :SOUR:LIST:STEP2:SET:RAD:BAND BAND10  |
| Band 11  | LTE FDD  | :SOUR:LIST:STEP2:SET:RAD:BAND BAND11  |
| Band 12  | LTE FDD  | :SOUR:LIST:STEP2:SET:RAD:BAND BAND12  |
| Band 13  | LTE FDD  | :SOUR:LIST:STEP2:SET:RAD:BAND BAND13  |
| Band 14  | LTE FDD  | :SOUR:LIST:STEP2:SET:RAD:BAND BAND14  |
| Band 17  | LTE FDD  | :SOUR:LIST:STEP2:SET:RAD:BAND BAND17  |
| Band 18  | LTE FDD  | :SOUR:LIST:STEP2:SET:RAD:BAND BAND18  |
| Band 19  | LTE FDD  | :SOUR:LIST:STEP2:SET:RAD:BAND BAND19  |
| Band 20  | LTE FDD  | :SOUR:LIST:STEP2:SET:RAD:BAND BAND20  |
| Band 21  | LTE FDD  | :SOUR:LIST:STEP2:SET:RAD:BAND BAND21  |
| Band 24  | LTE FDD  | :SOUR:LIST:STEP2:SET:RAD:BAND BAND24  |
| Band 25  | LTE FDD  | :SOUR:LIST:STEP2:SET:RAD:BAND BAND25  |
| Band 26  | LTE FDD  | :SOUR:LIST:STEP2:SET:RAD:BAND BAND26  |
| Band 27  | LTE FDD  | :SOUR:LIST:STEP2:SET:RAD:BAND BAND27  |
| Band 28  | LTE FDD  | :SOUR:LIST:STEP2:SET:RAD:BAND BAND28  |
| Band 29  | LTE FDD  | :SOUR:LIST:STEP2:SET:RAD:BAND BAND29  |
| Band 30  | LTE FDD  | :SOUR:LIST:STEP2:SET:RAD:BAND BAND30  |
| Band 31  | LTE FDD  | :SOUR:LIST:STEP2:SET:RAD:BAND BAND31  |
| Band 65  | LTE FDD  | :SOUR:LIST:STEP2:SET:RAD:BAND BAND65  |
| Band 66  | LTE FDD  | :SOUR:LIST:STEP2:SET:RAD:BAND BAND66  |
| Band 67  | LTE FDD  | :SOUR:LIST:STEP2:SET:RAD:BAND BAND67  |
| Band 68  | LTE FDD  | :SOUR:LIST:STEP2:SET:RAD:BAND BAND68  |
| Band 71  | LTE FDD  | :SOUR:LIST:STEP2:SET:RAD:BAND BAND71  |
| Band 252 | LTE FDD  | :SOUR:LIST:STEP2:SET:RAD:BAND BAND252 |
| Band 255 | LTE FDD  | :SOUR:LIST:STEP2:SET:RAD:BAND BAND255 |
| Band 33  | LTE TDD  | :SOUR:LIST:STEP2:SET:RAD:BAND BAND33  |

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6.1 RF Source

| Band    | Standard | SCPI Example                         |
|---------|----------|--------------------------------------|
| Band 34 | LTE TDD  | :SOUR:LIST:STEP2:SET:RAD:BAND BAND34 |
| Band 35 | LTE TDD  | :SOUR:LIST:STEP2:SET:RAD:BAND BAND35 |
| Band 36 | LTE TDD  | :SOUR:LIST:STEP2:SET:RAD:BAND BAND36 |
| Band 37 | LTE TDD  | :SOUR:LIST:STEP2:SET:RAD:BAND BAND37 |
| Band 38 | LTE TDD  | :SOUR:LIST:STEP2:SET:RAD:BAND BAND38 |
| Band 39 | LTE TDD  | :SOUR:LIST:STEP2:SET:RAD:BAND BAND39 |
| Band 40 | LTE TDD  | :SOUR:LIST:STEP2:SET:RAD:BAND BAND40 |
| Band 41 | LTE TDD  | :SOUR:LIST:STEP2:SET:RAD:BAND BAND41 |
| Band 42 | LTE TDD  | :SOUR:LIST:STEP2:SET:RAD:BAND BAND42 |
| Band 43 | LTE TDD  | :SOUR:LIST:STEP2:SET:RAD:BAND BAND43 |
| Band 44 | LTE TDD  | :SOUR:LIST:STEP2:SET:RAD:BAND BAND44 |
| Band 45 | LTE TDD  | :SOUR:LIST:STEP2:SET:RAD:BAND BAND45 |
| Band 46 | LTE TDD  | :SOUR:LIST:STEP2:SET:RAD:BAND BAND46 |
| Band A  | TD-SCDMA | :SOUR:LIST:STEP2:SET:RAD:BAND BANDA  |
| Band B  | TD-SCDMA | :SOUR:LIST:STEP2:SET:RAD:BAND BANDB  |
| Band C  | TD-SCDMA | :SOUR:LIST:STEP2:SET:RAD:BAND BANDC  |
| Band D  | TD-SCDMA | :SOUR:LIST:STEP2:SET:RAD:BAND BANDD  |
| Band E  | TD-SCDMA | :SOUR:LIST:STEP2:SET:RAD:BAND BANDE  |
| Band F  | TD-SCDMA | :SOUR:LIST:STEP2:SET:RAD:BAND BANDF  |
| N 1     | 5G NR    | :SOUR:LIST:STEP2:SET:RAD:BAND N1     |
| N 2     | 5G NR    | :SOUR:LIST:STEP2:SET:RAD:BAND N2     |
| N 3     | 5G NR    | :SOUR:LIST:STEP2:SET:RAD:BAND N3     |
| N 5     | 5G NR    | :SOUR:LIST:STEP2:SET:RAD:BAND N5     |
| N 7     | 5G NR    | :SOUR:LIST:STEP2:SET:RAD:BAND N7     |
| N 8     | 5G NR    | :SOUR:LIST:STEP2:SET:RAD:BAND N8     |
| N 12    | 5G NR    | :SOUR:LIST:STEP2:SET:RAD:BAND N12    |
| N 20    | 5G NR    | :SOUR:LIST:STEP2:SET:RAD:BAND N20    |
| N 25    | 5G NR    | :SOUR:LIST:STEP2:SET:RAD:BAND N25    |
| N 28    | 5G NR    | :SOUR:LIST:STEP2:SET:RAD:BAND N28    |
| N 34    | 5G NR    | :SOUR:LIST:STEP2:SET:RAD:BAND N34    |
| N 38    | 5G NR    | :SOUR:LIST:STEP2:SET:RAD:BAND N38    |
| N 39    | 5G NR    | :SOUR:LIST:STEP2:SET:RAD:BAND N39    |
| N 40    | 5G NR    | :SOUR:LIST:STEP2:SET:RAD:BAND N40    |
| N 41    | 5G NR    | :SOUR:LIST:STEP2:SET:RAD:BAND N41    |
| N 50    | 5G NR    | :SOUR:LIST:STEP2:SET:RAD:BAND N50    |
| N 51    | 5G NR    | :SOUR:LIST:STEP2:SET:RAD:BAND N51    |

| Band  | Standard | SCPI Example                       |
|-------|----------|------------------------------------|
| N 66  | 5G NR    | :SOUR:LIST:STEP2:SET:RAD:BAND N66  |
| N 70  | 5G NR    | :SOUR:LIST:STEP2:SET:RAD:BAND N70  |
| N 71  | 5G NR    | :SOUR:LIST:STEP2:SET:RAD:BAND N71  |
| N 74  | 5G NR    | :SOUR:LIST:STEP2:SET:RAD:BAND N74  |
| N 75  | 5G NR    | :SOUR:LIST:STEP2:SET:RAD:BAND N75  |
| N 76  | 5G NR    | :SOUR:LIST:STEP2:SET:RAD:BAND N76  |
| N 77  | 5G NR    | :SOUR:LIST:STEP2:SET:RAD:BAND N77  |
| N 78  | 5G NR    | :SOUR:LIST:STEP2:SET:RAD:BAND N78  |
| N 79  | 5G NR    | :SOUR:LIST:STEP2:SET:RAD:BAND N79  |
| N 80  | 5G NR    | :SOUR:LIST:STEP2:SET:RAD:BAND N80  |
| N 81  | 5G NR    | :SOUR:LIST:STEP2:SET:RAD:BAND N81  |
| N 82  | 5G NR    | :SOUR:LIST:STEP2:SET:RAD:BAND N82  |
| N 83  | 5G NR    | :SOUR:LIST:STEP2:SET:RAD:BAND N83  |
| N 84  | 5G NR    | :SOUR:LIST:STEP2:SET:RAD:BAND N84  |
| N 86  | 5G NR    | :SOUR:LIST:STEP2:SET:RAD:BAND N86  |
| N 257 | 5G NR    | :SOUR:LIST:STEP2:SET:RAD:BAND N257 |
| N 258 | 5G NR    | :SOUR:LIST:STEP2:SET:RAD:BAND N258 |
| N 260 | 5G NR    | :SOUR:LIST:STEP2:SET:RAD:BAND N260 |
| N 261 | 5G NR    | :SOUR:LIST:STEP2:SET:RAD:BAND N261 |

## Device

Lets you specify the radio band link direction for the steps within the list sequence. The link is used in conjunction with the channel band and channel number to determine the output frequency.

| Setting  | Option | Description                                                                                                                         |
|----------|--------|-------------------------------------------------------------------------------------------------------------------------------------|
| Uplink   | UP     | The source calculates the uplink frequency according to an uplink formula together with selected channel band and channel number    |
| Downlink | DOWN   | The source calculates the downlink frequency according to a downlink formula together with selected channel band and channel number |

|                |                                                                                                                           |
|----------------|---------------------------------------------------------------------------------------------------------------------------|
| Remote Command | :SOURce:LIST:STEP[1] 2 ... 1000:SETup:RADio:BAND:LINK DOWN   UP<br>:SOURce:LIST:STEP[1] 2 ... 1000:SETup:RADio:BAND:LINK? |
| Example        | :SOUR:LIST:STEP2:SET:RAD:BAND:LINK UP<br>:SOUR:LIST:STEP2:SET:RAD:BAND:LINK?                                              |
| Notes          | SCPI is supported after A.09.40                                                                                           |



## 6 Input/Output

### 6.1 RF Source

|              |                                           |
|--------------|-------------------------------------------|
| Dependencies | Not available in E7760B                   |
| Preset       | <a href="#">DOWN</a>                      |
| Range        | <a href="#">DOWN</a>   <a href="#">UP</a> |

## Freq/Chan

Lets you select the frequency or channel value for the current step. If the Band selection for the current row is [NONE](#), you enter a frequency. Otherwise, enter a channel, which causes the frequency to be automatically selected, based on the Band selection.

### Entering a Frequency

If the Band selection for the current row is [NONE](#), enter a Frequency. This field in the table allows you to select the frequency value for the current step.

|                |                                                                                                                                                                                                                                                                                                                         |          |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| Remote Command | <a href="#">:SOURce:LIST:STEP[1] 2 ... 1000:SETup:CNFRrequency &lt;double&gt;</a><br><a href="#">:SOURce:LIST:STEP[1] 2 ... 1000:SETup:CNFRrequency?</a>                                                                                                                                                                |          |
| Example        | <a href="#">:SOUR:LIST:STEP2:SET:CNFR 1GHz</a><br><a href="#">:SOUR:LIST:STEP2:SET:CNFR?</a>                                                                                                                                                                                                                            |          |
| Notes          | SCPI is supported after A.09.40<br>Used to setup channel number or frequency setting, according to the current Radio Band setting. If Radio Band is <a href="#">NONE</a> , then the value is frequency. If Radio Band is not <a href="#">NONE</a> , then the value is channel number                                    |          |
| Dependencies   | Not available in E7760B                                                                                                                                                                                                                                                                                                 |          |
| Couplings      | The frequency value is coupled to the channel band and number for the step, such that updates to the radio band and channel number will update the frequency value to the corresponding absolute frequency. The reverse is also true, changing the frequency value causes the value of the channel number to be updated |          |
| Preset         | 1.00 GHz                                                                                                                                                                                                                                                                                                                |          |
| Min            | 10.00 MHz                                                                                                                                                                                                                                                                                                               |          |
| Max            | Hardware Dependent:                                                                                                                                                                                                                                                                                                     |          |
|                | Option 503                                                                                                                                                                                                                                                                                                              | 3.6 GHz  |
|                | Option 504                                                                                                                                                                                                                                                                                                              | 3.9 GHz  |
|                | Option 506                                                                                                                                                                                                                                                                                                              | 6.00 GHz |
|                | Option F06                                                                                                                                                                                                                                                                                                              | 6.08 GHz |
|                | Option F06 & EP6                                                                                                                                                                                                                                                                                                        | 6.60 GHz |

## Entering a Channel

If the Band selection for the current row is not **NONE**, enter a Channel Number. This field in the table allows you to select the channel value for the current step. The frequency is selected automatically, based on the Band.

|              |                                                                                                                                                                                                                                                                                                                                                                                                           |
|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Example      | <code>:SOUR:LIST:STEP2:SET:CNFR 124</code><br><code>:SOUR:LIST:STEP2:SET:CNFR?</code>                                                                                                                                                                                                                                                                                                                     |
| Notes        | SCPI is supported after A.09.40<br>Used to setup channel number or frequency setting, according to current Radio Band setting. If Radio Band is <b>NONE</b> , then the value is a frequency. If Radio Band is not <b>NONE</b> , then the value is a channel number                                                                                                                                        |
| Dependencies | Not available in E7760B                                                                                                                                                                                                                                                                                                                                                                                   |
| Couplings    | The channel number is coupled to the step frequency value. When the step frequency value is changed, the channel number increases or decreases to match the new step frequency. If the step frequency is not at an exact match for a channel number, the nearest channel number is displayed, along with a greater-than or less-than sign, to indicate the frequency is above or below the channel number |
| Preset       | 1                                                                                                                                                                                                                                                                                                                                                                                                         |
| Min/Max      | 0/10838 (See "Channel" on page 606 for valid ranges)                                                                                                                                                                                                                                                                                                                                                      |

## Power

Lets you specify the power value for the current step.

|                |                                                                                                                                                                                              |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SOURce:LIST:STEP[1] 2 ... 1000:SETup:AMPLitude &lt;double&gt;</code><br><code>:SOURce:LIST:STEP[1] 2 ... 1000:SETup:AMPLitude?</code>                                                 |
| Example        | <code>:SOUR:LIST:STEP2:SET:AMPL -50dBm</code><br><code>:SOUR:LIST:STEP2:SET:AMPL?</code>                                                                                                     |
| Dependencies   | The RF power is dependent on the RF output port and frequency, such that the current frequency and selected output port determine the valid range of power values<br>Not available in E7760B |
| Preset         | -100 dBm                                                                                                                                                                                     |
| Min/Max        | The range of values depends on the current frequency and selected RF output port<br>See "RF Power" on page 570 and the RF Power Range table for valid ranges                                 |

## Waveform

Lets you select the waveform to be played back during the current step. Options are: CW, a Waveform file, Continue the previous step's waveform, or Off.

|                |                                                                            |
|----------------|----------------------------------------------------------------------------|
| Remote Command | <code>:SOURce:LIST:STEP[1] 2 ... 1000:SETup:WAVEform &lt;string&gt;</code> |
|----------------|----------------------------------------------------------------------------|

|              |                                                                                                                                                                                                                                                                      |
|--------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|              | <p>where <b>&lt;string&gt;</b> is one of:<br/> <b>"CW"</b>, <b>"waveform name"</b>, <b>"Cont"</b>, <b>"Off"</b><br/> For full details of options, see <a href="#">"More Information" on page 591</a><br/> <b>:SOURce:LIST:STEP[1] 2 ... 1000:SETup:WAVeform?</b></p> |
| Example      | <b>:SOUR:LIST:STEP2:SET:WAV "CW"</b><br><b>:SOUR:LIST:STEP2:SET:WAV?</b>                                                                                                                                                                                             |
| Notes        | SCPI is supported after A.09.40                                                                                                                                                                                                                                      |
| Dependencies | <p>Not available in E7760B</p> <p>For VXT models M9410A/11A/16A, if the Waveform is not Continue Previous, there is always a time gap between the current step and the previous step</p>                                                                             |
| Preset       | <b>CW</b>                                                                                                                                                                                                                                                            |
| Range        | <b>"CW"</b> , <b>"waveform name"</b> , <b>"Cont"</b> , <b>"Off"</b>                                                                                                                                                                                                  |

## More Information

| Parameter         | SCPI                   | Notes                                                                                                                                                                                                                                                                                                    |
|-------------------|------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CW                | <b>"CW"</b>            | Sets the current step to output a CW tone                                                                                                                                                                                                                                                                |
| Selected Waveform | <b>"waveform name"</b> | <p>Inserts a waveform from the Select Waveform dialog as the waveform for playback during the current step</p> <p>If the selected waveform contains header (which contains ARB play parameters), source list sequence will automatically apply header settings of the selected waveform in that step</p> |
| Continue Previous | <b>"Cont"</b>          | Sets the current step to continue with playback of the waveform from the previous step. When continuing the previous waveform, the ARB playback will not pause while the source retunes to the new frequency or amplitude that may be defined for the new step                                           |
| Off               | <b>"Off"</b>           | Disable RF output of the current step                                                                                                                                                                                                                                                                    |

## Waveform File

Pressing the slide-aside field of this column (>) opens the ["Select Waveform" on page 649](#) screen, which lets you select a waveform in ARB memory to playback during the current step. When you select a waveform, and press **OK**, it returns to the List Sequencer Setup screen with that file name in the table.

## Step Duration

Lets you select the duration of play for the current step.

The duration can be set to be either the number of times for the ARB file associated with the sequence to play, or a specific time value, or continuous. If the step is set to play a CW tone, the step duration cannot be set to a play count.

|                |                                                                                                                                                                                                                                                                                                    |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SOURce:LIST:STEP[1] 2 ... 1000:SETup:DURation:TYPE TIME   COUNT   CONTInuous   CABort</code><br><br>See <a href="#">"Option Details" on page 592</a><br><code>:SOURce:LIST:STEP[1] 2 ... 1000:SETup:DURation:TYPE?</code>                                                                   |
| Example        | <code>:SOUR:LIST:STEP2:SET:DUR:TYPE TIME</code><br><code>:SOUR:LIST:STEP2:SET:DUR:TYPE?</code>                                                                                                                                                                                                     |
| Dependencies   | Not available in E7760B<br><br>If in VXT models M9410A/11A/16A, <b>Step Duration</b> is <b>TIME</b> or Play <b>COUNT</b> , only <b>Free Run</b> is available for the next step. Otherwise, an error message is generated: "Parameter error; only Free Run is available as step trigger on step<n>" |
| Range          | <b>TIME   COUNT   CONTInuous   CABort</b>                                                                                                                                                                                                                                                          |

## Option Details

| Parameter        | SCPI              | Notes                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|------------------|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Time             | <b>TIME</b>       | Sets the duration of the current step to be a time value for the length of time the step will play<br><br>When <b>TIME</b> is selected, the Time may be set using the second field under <b>Step Duration</b> and/or by the <a href="#">"Duration Time" on page 592</a> command                                                                                                                                                                                           |
| Count            | <b>COUNT</b>      | Sets the duration of the current step to be an integer value for the number of times (play count) the ARB file is selected for playback during this step. For example, a 5 second ARB will be set to play 5 times during the step<br><br>When <b>COUNT</b> is selected, the Count may be set using the second field under <b>Step Duration</b> and/or by the <a href="#">"Play Count" on page 593</a> command                                                             |
| Continuous       | <b>CONTInuous</b> | Sets the current step to be played continuously until the next step starts. The waveform will always play completely before transitioning to the next step                                                                                                                                                                                                                                                                                                                |
| Continuous Abort | <b>CABort</b>     | Sets the current step to be played continuously or until the trigger event of the next step is detected. When a trigger event is received, the waveform play will be aborted after the interval specified by the Duration Time parameter and it will then transition to the next step<br><br>When Continuous Abort is selected, the Duration Time may be set using the second field under Step Duration and/or by the <a href="#">"Duration Time" on page 592</a> command |

## Duration Time

Lets you specify the length of time the current step will play when ["Step Duration" on page 591](#) is Time.

## 6 Input/Output

### 6.1 RF Source

When **"Step Duration" on page 591** is Continuous Abort, this parameter specifies the maximum duration that the waveform will continue to play after a step trigger is received before the transition to the next waveform will occur. Duration is limited to a maximum of 20 seconds.

If the Transition Time value is longer than the Step Duration Time, an error is generated when initiating a source list sequence. For source list sequence, transition time is included in the step duration length (not occupy additional time). If the Transition Time value is longer than the Step Duration Time, the real step duration length is extended to equal the transition time and cause a timing shift.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SOURce:LIST:STEP[1] 2 ... 1000:SETup:DURation:TCOunt &lt;double&gt;</code><br><code>:SOURce:LIST:STEP[1] 2 ... 1000:SETup:DURation:TCOunt?</code>                                                                                                                                                                                                                                                                                                |
| Example        | <code>:SOUR:LIST:STEP2:SET:DUR:TCO 1s</code><br><code>:SOUR:LIST:STEP2:SET:DUR:TCO?</code>                                                                                                                                                                                                                                                                                                                                                              |
| Notes          | When Repetition is <b>Single</b> , the last step continues playing after the sequence is completed. In this extended playing time, <code>:STAT:OPER:COND?</code> returns 0 for the Source Sweeping Status Bit (bit 9)<br>SCPI is supported after A.09.40<br>If current <b>Duration Type</b> is <b>Continuous</b> , then error -221, "Settings conflict; Cannot accept time or count input when step duration type is Continuous on step #" is displayed |
| Dependencies   | Not available in E7760B                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Preset         | VXT models M9410A/11A/16A: 2.0 ms<br>All others: 1.00 ms                                                                                                                                                                                                                                                                                                                                                                                                |
| Min            | For VXT models M9410A/11A/16A, the minimum duration time for first step is 1.2 ms. If the Waveform is "waveform name", the minimum duration time is 1.2 ms<br>All others: 100 µs                                                                                                                                                                                                                                                                        |
| Max            | 1800 s                                                                                                                                                                                                                                                                                                                                                                                                                                                  |

## Play Count

Lets you specify the number of times the current ARB waveform file will play during a step when **"Step Duration" on page 591** is Count.

**"Duration Time" on page 592**

|                |                                                                                                                                                                                                                                                                                                              |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SOURce:LIST:STEP[1] 2 ... 1000:SETup:DURation:TCOunt &lt;double&gt;</code><br><code>:SOURce:LIST:STEP[1] 2 ... 1000:SETup:DURation:TCOunt?</code>                                                                                                                                                     |
| Example        | <code>:SOUR:LIST:STEP2:SET:DUR:TCO 10</code><br><code>:SOUR:LIST:STEP2:SET:DUR:TCO?</code>                                                                                                                                                                                                                   |
| Notes          | SCPI is supported after A.09.40<br>This command is reused by <b>Play Count</b> and <b>Duration Time</b> if <b>Duration Type</b> is set to <b>Play Count</b> or <b>Duration Time</b><br>If <b>Duration Type</b> is <b>Continuous</b> , then error -221, "Settings conflict; Cannot accept time or count input |

|              |                                                                                                                                                                                                                       |
|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|              | when step duration type is Continuous on step #" is displayed<br>If <b>Play Count</b> is set for the last step, the last step of ARB keeps playing as if set to <b>Continuous</b> after play count setting is reached |
| Dependencies | Not available in E7760B                                                                                                                                                                                               |
| Preset       | 1                                                                                                                                                                                                                     |
| Min          | 1                                                                                                                                                                                                                     |
| Max          | 65536                                                                                                                                                                                                                 |

## Trig Out

Lets you specify the trigger output for the current step. The trigger output signal is sent at the start of the step.

When this is **ON**, a trigger event occurs on both Internal and External2 paths. Selecting **OFF** turns off trigger output.

|                |                                                                                                                                                          |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SOURce:LIST:STEP[1] 2 ... 1000:SETup:OUTPut:TRIGger ON   OFF   1   0</code><br><code>:SOURce:LIST:STEP[1] 2 ... 1000:SETup:OUTPut:TRIGger?</code> |
| Example        | <code>:SOUR:LIST:STEP2:SET:OUTP:TRIG ON</code><br><code>:SOUR:LIST:STEP2:SET:OUTP:TRIG?</code>                                                           |
| Notes          | SCPI is supported after A.09.40                                                                                                                          |
| Dependencies   | Not available in E7760B                                                                                                                                  |
| Preset         | <b>OFF</b>                                                                                                                                               |
| Range          | <b>ON OFF</b>                                                                                                                                            |

## Step Configuration (Remote Command Only)

Used to configure the List Sequencer, as detailed in the table below. The command is defined such that you send one command per step, with the step number being specified as a subopcode of the SCPI command. Each command includes all the parameter settings for the step. As a step is set up, the values entered are run through several levels of validation.

|                |                                                                                                                                                                                                                                                                                                                                                                                                            |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SOURce:LIST:STEP[1] 2 ... 1000:SETup &lt;step_trigger&gt;, &lt;trans_time&gt;, &lt;band&gt;, &lt;link_type&gt;, &lt;freq_chan&gt;, &lt;power&gt;, &lt;waveform&gt;, &lt;duration&gt;, &lt;time_count&gt;, &lt;trig_state&gt;</code><br><br>For details of each option, see <a href="#">"Step Configuration Parameters" on page 595</a> below<br><code>:SOURce:LIST:STEP[1] 2 ... 1000:SETup?</code> |
| Example        | <code>:SOUR:LIST:STEP1:SET INT, 1ms, PGSM, DOWN, 10, -25 dBm, "GSM_Test1.bin", TIME, 10ms, OFF</code>                                                                                                                                                                                                                                                                                                      |
| Dependencies   | The range of subopcode values is 1 to 1000, and the value you enter is determined by the number of steps you have configured. For details see <a href="#">"Number of Steps" on page 581</a>                                                                                                                                                                                                                |

---

If you attempt to remotely set or query a subopcode that is out of range, an error is generated

## Step Configuration Parameters

There are 10 parameters for each step, which must be in the following order in the command:

- |   |                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|---|------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | Step Trigger<br><code>&lt;step_trigger&gt;</code>          | Data Type: enum<br>Specifies the input trigger for the step. For further details, see <a href="#">"Step Trigger" on page 582</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 2 | Transition Time<br><code>&lt;trans_time&gt;</code>         | Data Type: enum<br>Specifies the transition time for the step, in seconds. For further details, see <a href="#">"Transition Time" on page 583</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| 3 | Radio Band<br><code>&lt;band&gt;</code>                    | <p>Data Type: enum</p> <p>Specifies the radio band for the step, as any one of:</p> <p>NONE   PGSM   EGSM   RGSM   DCS1800   PCS1900   TGSM810   GSM450   GSM480   GSM700   GSM850   BANDI   BANDII   BANDIII   BANDIV   BANDV   BANDVI   BANDVII   BANDVIII   BANDIX   BANDX   BANDXI   BANDXII   BANDXIII   BANDXIV   BANDXIX   USCELL   USPCS   JAPAN   KOREAN   NMT   IMT2K   UPPER   SECOND   PAMR400   PAMR800   IMTEXT   PCS1DOT9G   AWS   US2DOT5G   PUBLIC   LOWER   NONE   BAND1   BAND2   BAND3   BAND4   BAND5   BAND6   BAND7   BAND8   BAND10   BAND11   BAND12   BAND13   BAND14   BAND17   BAND18   BAND19   BAND20   BAND21   BAND24   BAND25   BAND26   BAND33   BAND34   BAND35   BAND36   BAND37   BAND38   BAND39   BAND40   BAND41   BAND42   BAND43   BANDA   BANDB   BANDC   BANDD   BANDE   BANDF   N1   N2   N3   N5   N7   N8   N12   N20   N25   N28   N34   N38   N39   N40   N41   N50   N51   N66   N70   N71   N74   N75   N76   N77   N78   N79   N80   N81   N82   N83   N84   N86   N257   N258   N260   N261</p> <p>For further details, see <a href="#">"Band" on page 584</a></p> |
| 4 | Radio Band Link<br><code>&lt;link_type&gt;</code>          | <p>Data Type: enum</p> <p>Specifies the radio band link direction for the step, as either of:<br/><a href="#">DOWN</a>   <a href="#">UP</a></p> <p>For further details, see <a href="#">"Device" on page 588</a></p> <p>The old <b>Device</b> BTS MS is obsolete, but is still supported, acting as an alias for the <b>Link</b> parameter</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| 5 | Frequency/Channel Number<br><code>&lt;freq_chan&gt;</code> | <p>Data Type: freq/chan num</p> <p>Specifies the frequency in Hz or the channel number for the step. The channel number and frequency are combined as one parameter that represents the frequency or channel number depending on the radio band setting. If the radio band is set to <b>NONE</b>, this value is interpreted as a frequency value in Hz. If the radio band is set to a valid band, this value is interpreted as a channel number</p> <p>For further details, see <a href="#">"Freq/Chan" on page 589</a></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |

|    |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|----|--------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 6  | Power<br><power>               | Data Type: ampl<br>Specifies the output power for the step in dBm. For details of the valid ranges see <a href="#">"Power" on page 590</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| 7  | Waveform<br><waveform>         | Data Type: string<br>Specifies the waveform for playback during the step. The step can output either a new ARB waveform, continue playback of the previous waveform, or output a CW tone. The options for specifying these are:<br><br><div> <div>&lt;filename&gt;</div> <div>Plays the specified waveform from the start. The filename value is the name of the file within ARB playback memory, it is does not include the windows path to the file on the HDD. If you enter a filename for a waveform that does not reside within ARB playback memory, an error is generated</div> </div> <div> <div>CONT</div> <div>Continues playback of the ARB file from the previous step</div> </div> <div> <div>CW</div> <div>Outputs a CW tone</div> </div> <div> <div>OFF</div> <div>Disables RF output</div> </div> |
| 8  | Step Duration<br><duration>    | For further details, see <a href="#">"Waveform" on page 590</a> and <a href="#">"Waveform File" on page 591</a><br>Data Type: enum<br>Specifies the duration of the step, as one of:<br><a href="#">TIME</a>   <a href="#">COUNT</a>   <a href="#">CONTInuous</a><br><br>The duration can be specified to be either time, or play count of the ARB file associated with the step, or continuous. If Waveform is set to <a href="#">CW</a> , this value cannot be set to Play Count and an error will be generated. If <a href="#">CONTInuous</a> is selected, the following Time or Count value is ignored. For further details, see <a href="#">"Step Duration" on page 591</a>                                                                                                                                 |
| 9  | Time or Count<br><time_count>  | Data Type: time/int<br>Specifies time duration in seconds, or play count of the ARB file associated with the step<br><br>For further details, see <a href="#">"Play Count" on page 593</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| 10 | Output Trigger<br><trig_state> | Data Type: boolean<br>Specifies the output trigger state for the step, as one of:<br><a href="#">ON</a>   <a href="#">OFF</a>   <a href="#">1</a>   <a href="#">0</a><br><br>For further details, see <a href="#">"Trig Out" on page 594</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |

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## Step Configuration of Step Trigger parameter list (Remote Command Only)

Configures the “Step Trigger” parameter array of the whole List Sequencer at one time. The number of arrays is the same as the step number defined in ["Number of Steps" on page 581](#). As a step is setup, the value entered runs through several levels of validation.



|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SOURce:LIST:SETup:INPut:TRIGger &lt;enum&gt;, &lt;enum&gt;, &lt;enum&gt;, ...</code><br><code>:SOURce:LIST:SETup:INPut:TRIGger?</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Example        | <code>:SOUR:LIST:SET:INP:TRIG IMM,INT,EXT2</code><br><code>:SOUR:LIST:SET:INP:TRIG?</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Notes          | The command is to setup below parameter array of whole list sequence<br>Step Trigger <b>&lt;enum&gt;</b> - specifies the input trigger for the step. For details of the valid types of step trigger see <a href="#">"Step Trigger" on page 582</a><br>If input parameter number exceeds the step number defined by <a href="#">"Number of Steps" on page 581</a> , then error -221 "Settings conflict; The number of input parameters is too large and is truncated to current list step number" is generated, and only those parameters whose index number falls in number of steps will be updated |
| Dependencies   | The range is 1 to 1000, which is determined by the number of steps you have configured. For details see <a href="#">"Number of Steps" on page 581</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                |

### Step Configuration of Transition Time parameter list (Remote Command Only)

Configures the "Transition Time" parameter array of the whole List Sequencer at once. The array size is the same as step number defined in ["Number of Steps" on page 581](#). As a step is setup, the value entered runs through several levels of validation.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SOURce:LIST:SETup:TRANsition:TIME &lt;time&gt;, &lt;time&gt;, &lt;time&gt;, ...</code><br><code>:SOURce:LIST:SETup:TRANsition:TIME?</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Example        | <code>:SOUR:LIST:SET:TRAN:TIME 1ms,1ms,1ms</code><br><code>:SOUR:LIST:SET:TRAN:TIME?</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Notes          | The command is to setup below parameter array of whole list sequence<br>Transition Time <b>&lt;time&gt;</b> - specifies the transition time for the step in seconds. For details of the valid ranges for the transition time see <a href="#">"Transition Time" on page 583</a><br>If input parameter number exceeds the step number defined by <a href="#">"Number of Steps" on page 581</a> , then the error -221, "Settings conflict; The number of input parameters is too large and is truncated to current list step number" is generated, and only those parameters whose index number falls in number of steps will be updated |
| Dependencies   | The range is 1 to 1000 which is determined by the number of steps you have configured. For details see <a href="#">"Number of Steps" on page 581</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |

### Step Configuration of Radio Band parameter list (Remote Command Only)

Configures the **Radio Band** parameter array of the whole List Sequencer at once. The size of the array is the same as the step number defined in ["Number of Steps" on page 581](#). As a step is set up, the value entered runs through several levels of validation.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SOURce:LIST:SETup:RADio:BAND &lt;enum&gt;, &lt;enum&gt;, &lt;enum&gt;, ...</code><br><code>:SOURce:LIST:SETup:RADio:BAND?</code>                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Example        | <code>:SOUR:LIST:SET:RAD:BAND PGSM, EGSM, RGSM</code><br><code>:SOUR:LIST:SET:RAD:BAND?</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Notes          | The command sets up the parameter array of whole list sequence<br>Radio Band <enum> - specifies the radio band for the step. For available options, see <a href="#">"Band" on page 584</a><br>If the input parameter number exceeds the step number defined by <a href="#">"Number of Steps" on page 581</a> , then error -221, "Settings conflict; The number of input parameters is too large and is truncated to current list step number" is generated, and only those parameters whose index number falls within the number of steps will be updated |
| Dependencies   | The range is 1 to 1000, which is determined by the number of steps you have configured. For details see <a href="#">"Number of Steps" on page 581</a>                                                                                                                                                                                                                                                                                                                                                                                                     |

### Step Configuration of Radio Band Link parameter list (Remote Command Only)

Configures the **Radio Band Link** parameter array of the whole List Sequencer at one time. The number of arrays is same as step number defined in ["Number of Steps" on page 581](#). As a step is set up, the value entered runs through several levels of validation.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SOURce:LIST:SETup:RADio:BAND:LINK &lt;enum&gt;, &lt;enum&gt;, &lt;enum&gt;, ...</code><br><code>:SOURce:LIST:SETup:RADio:BAND:LINK?</code>                                                                                                                                                                                                                                                                                                                                                                                                   |
| Example        | <code>:SOUR:LIST:SET:RAD:BAND:LINK DOWN,UP,UP</code><br><code>:SOUR:LIST:SET:RAD:BAND:LINK?</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Notes          | The command sets up the parameter array of whole list sequence<br>Radio Band Link <enum> - specifies the radio band link direction for the step. Options are:<br><a href="#">DOWN UP</a><br>If input parameter number exceeds the step number defined by <a href="#">"Number of Steps" on page 581</a> , then error -221, "Settings conflict; The number of input parameters is too large and is truncated to current list step number" is generated, and only those parameters whose index number falls within the number of steps will be updated |
| Dependencies   | The range is 1 to 1000, which is determined by the number of steps you have configured. For details see <a href="#">"Number of Steps" on page 581</a>                                                                                                                                                                                                                                                                                                                                                                                               |

### Step Configuration of Frequency/Channel Number parameter list (Remote Command Only)

Configures the **Frequency** or **Channel Number** parameter array of the whole List Sequencer at one time. The number of arrays is same as step number defined in

"Number of Steps" on page 581. As a step is set up, the value entered runs through several levels of validation.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SOURce:LIST:SETup:CNFRequency &lt;double&gt;, &lt;double&gt;, &lt;double&gt;, ...</code><br><code>:SOURce:LIST:SETup:CNFRequency?</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Example        | <code>:SOUR:LIST:SET:CNFR 1GHz,100MHz,100MHz</code><br><code>:SOUR:LIST:SET:CNFR?</code><br><code>:SOUR:LIST:SET:CNFR 124,124,124</code><br><code>:SOUR:LIST:SET:CNFR?</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Notes          | <p>The command sets up the parameter array of whole list sequence</p> <p>Frequency/Channel Number &lt;freq&gt;/&lt;chan num&gt; - specifies the frequency in Hz or the channel number for the step. The channel number and frequency are combined as one parameter that represents the frequency or channel number depending on the radio band setting. If the radio band is set to <b>NONE</b>, this value is interpreted as a frequency value in Hz. If the radio band is set to a valid band, this value is interpreted as a channel number. For details of the valid ranges for frequency and channel numbers, see "Freq/Chan" on page 589 and "Freq/Chan" on page 589</p> <p>This command is used to setup/query channel number or frequency setting, according to current Radio Band setting of that step. If Radio Band is <b>NONE</b>, then it is frequency. If Radio Band is not <b>NONE</b>, then it is channel number</p> <p>If input parameter number exceeds the step number defined by "Number of Steps" on page 581, then generate error -221, "Settings conflict; The number of input parameters is too large and is truncated to current list step number", and only those parameters whose index number falls in legal step number will be updated</p> |
| Dependencies   | The range is 1 to 1000, which is determined by the number of steps you have configured. For details see "Number of Steps" on page 581                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |

## Step Configuration of Power parameter list (Remote Command Only)

Configures the **Power** parameter array of the whole List Sequencer at one time. The number of arrays is the same as step number defined in "Number of Steps" on page 581. As a step is set up, the value entered runs through several levels of validation.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SOURce:LIST:SETup:AMPLitude &lt;ampl&gt;, &lt;ampl&gt;, &lt;ampl&gt;, ...</code><br><code>:SOURce:LIST:SETup:AMPLitude?</code>                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Example        | <code>:SOUR:LIST:SET:AMPL -50dBm,-40dBm,-30dBm</code><br><code>:SOUR:LIST:SET:AMPL?</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Notes          | <p>The command sets up the parameter array of whole list sequence</p> <p>Power &lt;ampl&gt; - specifies the output power for the step in dBm. For details of the valid ranges, see "Power" on page 590</p> <p>If input parameter number exceeds the step number defined by "Number of Steps" on page 581, then error -221, "Settings conflict; The number of input parameters is too large and is truncated to current list step number" is generated, and only those parameters whose index number falls within legal step number will be updated</p> |

|              |                                                                                                                                                       |
|--------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|
| Dependencies | The range is 1 to 1000, which is determined by the number of steps you have configured. For details see <a href="#">"Number of Steps" on page 581</a> |
|--------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|

### Step Configuration of Waveform parameter list (Remote Command Only)

Configures the **Waveform** parameter array of the whole List Sequencer at one time. The number of arrays is same as step number defined in ["Number of Steps" on page 581](#). As a step is set up, the value entered runs through several levels of validation.

|                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                         |                                                                                                                                                                                                                                                                                                   |             |                                                           |           |                   |            |                        |
|-------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-----------------------------------------------------------|-----------|-------------------|------------|------------------------|
| Remote Command          | <code>:SOURce:LIST:SETup:WAVeform &lt;string&gt;, &lt;string&gt;, &lt;string&gt;, ...</code><br><code>:SOURce:LIST:SETup:WAVeform?</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                         |                                                                                                                                                                                                                                                                                                   |             |                                                           |           |                   |            |                        |
| Example                 | <code>:SOUR:LIST:SET:WAV "CW","Off","CONT"</code><br><code>:SOUR:LIST:SET:WAV?</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                         |                                                                                                                                                                                                                                                                                                   |             |                                                           |           |                   |            |                        |
| Notes                   | <p>Sets up or queries the parameter array of whole list sequence</p> <p>Waveform <b>&lt;string&gt;</b> - specifies the waveform for playback during the step. The step can output either a new ARB waveform, continue playback of the previous waveform, or output a CW tone. The options for specifying these are:</p> <table border="1"> <tr> <td><b>&lt;filename&gt;</b></td><td>Plays the specified waveform from the start. The filename value is the name of the file within ARB playback memory, it is does not include the windows path to the file on the HDD. If you enter a filename for a waveform that does not reside within ARB playback memory, an error is generated</td></tr> <tr> <td><b>CONT</b></td><td>Continues playback of the ARB file from the previous step</td></tr> <tr> <td><b>CW</b></td><td>Outputs a CW tone</td></tr> <tr> <td><b>OFF</b></td><td>Disables the RF output</td></tr> </table> <p>If input parameter number exceeds the step number defined by <a href="#">"Number of Steps" on page 581</a>, then error -221, "Settings conflict; The number of input parameters is too large and is truncated to current list step number" is generated, and only those parameters whose index number falls within number of steps will be updated</p> | <b>&lt;filename&gt;</b> | Plays the specified waveform from the start. The filename value is the name of the file within ARB playback memory, it is does not include the windows path to the file on the HDD. If you enter a filename for a waveform that does not reside within ARB playback memory, an error is generated | <b>CONT</b> | Continues playback of the ARB file from the previous step | <b>CW</b> | Outputs a CW tone | <b>OFF</b> | Disables the RF output |
| <b>&lt;filename&gt;</b> | Plays the specified waveform from the start. The filename value is the name of the file within ARB playback memory, it is does not include the windows path to the file on the HDD. If you enter a filename for a waveform that does not reside within ARB playback memory, an error is generated                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                         |                                                                                                                                                                                                                                                                                                   |             |                                                           |           |                   |            |                        |
| <b>CONT</b>             | Continues playback of the ARB file from the previous step                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                         |                                                                                                                                                                                                                                                                                                   |             |                                                           |           |                   |            |                        |
| <b>CW</b>               | Outputs a CW tone                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                         |                                                                                                                                                                                                                                                                                                   |             |                                                           |           |                   |            |                        |
| <b>OFF</b>              | Disables the RF output                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                         |                                                                                                                                                                                                                                                                                                   |             |                                                           |           |                   |            |                        |
| Dependencies            | The range is 1 to 1000 which is determined by the number of steps you have configured. For details see <a href="#">"Number of Steps" on page 581</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                         |                                                                                                                                                                                                                                                                                                   |             |                                                           |           |                   |            |                        |
| Range                   | <code>"filename"   "CW"   "Off"   "CONT"</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                         |                                                                                                                                                                                                                                                                                                   |             |                                                           |           |                   |            |                        |

### Step Configuration of Step Duration parameter list (Remote Command Only)

Configures the **Step Duration** parameter array of the whole List Sequencer at one time. The number of arrays is same as step number defined in ["Number of Steps" on page 581](#). As a step is set up, the value entered runs through several levels of validation.

|                |                                                                                                                                               |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SOURce:LIST:SETup:DURation:TYPE &lt;enum&gt;, &lt;enum&gt;, &lt;enum&gt;, ...</code><br><code>:SOURce:LIST:SETup:DURation:TYPE?</code> |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------|

|              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|--------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Example      | <pre>:SOUR:LIST:SET:DUR:TYPE COUN,TIME,CONT :SOUR:LIST:SET:DUR:TYPE?</pre>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Notes        | <p>Sets up or queries the parameter array of whole list sequence</p> <p>Step Duration <b>&lt;enum&gt;</b> - specifies the duration of the step. The duration can be specified to be either time, or play count of the ARB file associated with the step, or continuous. If Waveform is set to "CW", this value cannot be set to Play Count and an error will be generated. If continuous is selected, the following Time or Count value is ignored. For further details of this setting, see <a href="#">"Step Duration" on page 591</a></p> <p>Options are:</p> <p><b>TIME   COUNT   CONTinuous</b></p> <p>If input parameter number exceeds the step number defined by <a href="#">"Number of Steps" on page 581</a>, then error -221, "Settings conflict; The number of input parameters is too large and is truncated to current list step number" is generated, and only those parameters whose index number falls within number of steps will be updated</p> |
| Dependencies | <p>The range is 1 to 1000, which is determined by the number of steps you have configured. For details see <a href="#">"Number of Steps" on page 581</a></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |

### Step Configuration of Duration Time or Play Count parameter list (Remote Command Only)

Configures the **Duration Time** or **Play Count** parameter array of the whole List Sequencer at one time. The number of arrays is same as step number defined in ["Number of Steps" on page 581](#). As a step is set up, the value entered runs through several levels of validation.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <pre>:SOURce:LIST:SETup:TOCount &lt;time/int&gt;, &lt;time/int&gt;, &lt;time/int&gt;, ... :SOURce:LIST:SETup:TOCount?</pre>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Example        | <pre>:SOUR:LIST:SET:TOC 1s,2s,3s :SOUR:LIST:SET:TOC? :SOUR:LIST:SET:TOC 5,6,7 :SOUR:LIST:SET:TOC?</pre>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Notes          | <p>Sets up or queries the parameter array of whole list sequence</p> <p>Time or Count <b>&lt;time/int&gt;</b> - specifies time duration in seconds or play count of the ARB file associated with the step</p> <p>If input parameter number exceeds the step number defined by <a href="#">"Number of Steps" on page 581</a>, then an error is generated, and only those parameters whose index number falls within number of steps will be updated</p> <p>If current <a href="#">"Step Duration" on page 591</a> is "Continuous", then error -221, "Settings conflict; Cannot accept time or count input when step duration type is Continuous on step #" is generated</p> |
| Dependencies   | <p>The range is 1 to 1000, which is determined by the number of steps you have configured. For details see <a href="#">"Number of Steps" on page 581</a></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |

## Step Configuration of Output Trigger parameter list (Remote Command Only)

Configures the **Output Trigger** parameter array of the whole List Sequencer at one time. The number of arrays is same as step number defined in ["Number of Steps" on page 581](#). As a step is set up, the value entered runs through several levels of validation.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SOURce:LIST:SETup:OUTPut:TRIGger &lt;bool&gt;, &lt;bool&gt;, &lt;bool&gt;, ...</code><br><code>:SOURce:LIST:SETup:OUTPut:TRIGger?</code>                                                                                                                                                                                                                                                                                                                                                                                         |
| Example        | <code>:SOUR:LIST:SET:OUTP:TRIG ON,OFF,ON</code><br><code>:SOUR:LIST:SET:OUTP:TRIG?</code>                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Notes          | Sets up or queries the parameter array of whole list sequence<br>Output Trigger <Boolean> - specifies the output trigger for the step. Options are:<br><code>ON OFF 1 0</code><br><br>If input parameter number exceeds the step number defined by <a href="#">"Number of Steps" on page 581</a> , then error -221, "Settings conflict; The number of input parameters is too large and is truncated to current list step number" is generated, and only those parameters whose index number falls within legal step number are updated |
| Dependencies   | The range is 1 to 1000, which is determined by the number of steps you have configured. For details see <a href="#">"Number of Steps" on page 581</a>                                                                                                                                                                                                                                                                                                                                                                                   |

## Clear List (Remote Command Only)

The SCPI equivalent of the Clear List UI feature described in ["Clear List" on page 582](#).

|                |                                       |
|----------------|---------------------------------------|
| Remote Command | <code>:SOURce:LIST:SETup:CLEAr</code> |
| Example        | <code>:SOUR:LIST:SETup:CLE</code>     |
| Dependencies   | Not available in E7760B               |

### 6.1.8.8 Remote Software Trigger (Remote command Only)

During execution of a list sequence, the sequence halts and waits at any step that has Step Trigger set to "Bus". Sending this command triggers the step and continues the sequence.

|                |                                                        |
|----------------|--------------------------------------------------------|
| Remote Command | <code>:SOURce:LIST:TRIGger:INITiate[:IMMediate]</code> |
| Example        | <code>:SOUR:LIST:TRIG:INIT</code>                      |
| Dependencies   | Not available in E7760B                                |

### 6.1.8.9 Query List Sequence Initiation Armed Status (Remote Query Only)

This is a blocking SCPI query to determine whether a source list sequence has been initiated successfully.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SOURce:LIST:INITiation:ARMed?</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Example        | <code>:SOUR:LIST:INIT:ARMed?</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Notes          | <p>Returns “1” if list sequence has been initiated successfully, or “0” if not. If the response is “0”, use <code>:SYST:ERR?</code> to query the actual error</p> <p>Like <code>*OPC?</code>, this command can be blocked until event/status “IsSourceSweeping” occurs, and then returns. Doing so can help a script query the armed status only once during the time interval of the initiation. As an ancillary to the existing <code>:SOUR:LIST:TRIGger[:IMMediate]</code> (see <a href="#">"Initiate Sequence" on page 579</a>), send this query after <code>:SOUR:LIST:TRIG</code>. Otherwise, this query will return “1” immediately</p> <p>The return data is in the following format: Integer</p> <p>There is an alias: <code>:SOURce:LIST:TRIGger:INITiation:ARMed?</code></p> |
| Dependencies   | Not available in E7760B                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |

## 6.1.9 Frequency Setup

Lets you access the Frequency Setup sub-menu panel.

|       |                                                                                                                                                                                                                                                                                                                                                                                                                        |
|-------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Notes | <p>The menu under this control is for independent mode and has no effect on the <a href="#">"List Sequencer" on page 578</a>. If <a href="#">"Sequencer" on page 579</a> is <b>ON</b>, the List Sequencer controls the source output and this key is grayed-out, to indicate out-of-scope. When <a href="#">"Sequencer" on page 579</a> is <b>OFF</b>, source leaves List Sequencer and this button is blanked out</p> |
|-------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

### 6.1.9.1 Frequency

Lets you set the RF Output Frequency. You can adjust the frequency of the source using the numeric keypad, step keys, or RPG. Pressing any digit (0 through 9) on the numeric keypad displays the unit terminator.

|                |                                                                                                                                                                                                                                                                                                                       |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SOURce:FREQuency[:CW] &lt;freq&gt;</code><br><code>:SOURce:FREQuency[:CW]?</code>                                                                                                                                                                                                                              |
| Example        | <code>:SOUR:FREQ 1.00 GHz</code>                                                                                                                                                                                                                                                                                      |
| Notes          | <p>Internal source has list sequence mode, which comprises of several steps that contain separate output power, frequency and waveform etc. When the source list sequence playing is complete, the last step keeps playing, and you can use this command to change the list sequence last step's output frequency</p> |
| Couplings      | <p>The frequency value is coupled to the current channel band and number, such that updates to the band and number will update the frequency value to the corresponding absolute frequency</p>                                                                                                                        |

|        |                                                                                                                                                                                                                                                               |                                                          |
|--------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|
| Preset | E7760B                                                                                                                                                                                                                                                        | Depends on port selected                                 |
|        | EXM, with license F1A or 5WC                                                                                                                                                                                                                                  | 2.412 GHz                                                |
|        | VXT Models with Radio Heads/CIU                                                                                                                                                                                                                               | See "VXT Models with Remote Radio Heads/CIU" on page 605 |
|        | M941xE(VXT Models with M9471A)                                                                                                                                                                                                                                | See "M941xE(VXT Models with M9471A)" on page 606         |
|        | All other models                                                                                                                                                                                                                                              | 1.00 GHz                                                 |
| Min    | E7760B                                                                                                                                                                                                                                                        | Depends on port selected                                 |
|        | VXT model M9420A                                                                                                                                                                                                                                              | 60 MHz                                                   |
|        | VXT models M9410A/11A/15A/16A                                                                                                                                                                                                                                 | 380 MHz                                                  |
|        | VXT model M9411A with Option LFE                                                                                                                                                                                                                              | 1 MHz                                                    |
|        | VXT Models with Radio Heads/CIU                                                                                                                                                                                                                               | See "VXT Models with Remote Radio Heads/CIU" on page 605 |
|        | M941xE(VXT Models with M9471A)                                                                                                                                                                                                                                | See "M941xE(VXT Models with M9471A)" on page 606         |
|        | All other models                                                                                                                                                                                                                                              | 10.00 MHz                                                |
| Max    | Hardware Dependent:                                                                                                                                                                                                                                           |                                                          |
|        | Option 503                                                                                                                                                                                                                                                    | 3.6 GHz                                                  |
|        | Option 504                                                                                                                                                                                                                                                    | 3.8 GHz                                                  |
|        | Option 506                                                                                                                                                                                                                                                    | 6.00 GHz                                                 |
|        | Option F06                                                                                                                                                                                                                                                    | 6.00 GHz                                                 |
|        | Parameters for "VXT models M9415A/16A" on page 605                                                                                                                                                                                                            |                                                          |
|        | Parameters for "VXT Models with Remote Radio Heads/CIU" on page 605                                                                                                                                                                                           |                                                          |
|        | Parameters for "M941xE(VXT Models with M9471A)" on page 606                                                                                                                                                                                                   |                                                          |
|        | For E7760B: Depends on port selected                                                                                                                                                                                                                          |                                                          |
|        | For EXM, if license 5WC is present, the frequency range should be limited to: 1.1GHz-1.7GHz, 2.4GHz-2.5GHz, 4.8GHz-6.0GHz. If the user-defined frequency is outside of range, reports error message "Settings conflict; Frequency is outside available range" |                                                          |



6 Input/Output  
6.1 RF Source

**VXT models M9410A/11A**

| RF Output Port | Preset | Min Without Option “LFE” | Min With Option “LFE” | Max   |
|----------------|--------|--------------------------|-----------------------|-------|
| RF Output      | 1 GHz  | 380 MHz                  | 1 MHz                 | 6 GHz |
| RFHD           | 1 GHz  | 380 MHz                  | 1 MHz                 | 6 GHz |

**VXT models M9415A/16A**

| Freq Option | Preset | Min     | Max      |
|-------------|--------|---------|----------|
| F06         | 1 GHz  | 380 MHz | 6.0 GHz  |
| F08         | 1 GHz  | 380 MHz | 8.0 GHz  |
| F12         | 1 GHz  | 380 MHz | 12.3 GHz |

**E7760B**

| RF Output Port | Preset    | Min    | Max    |
|----------------|-----------|--------|--------|
| IFIO           | 16 GHz    | 2 GHz  | 18 GHz |
| M1650A         | 58.32 GHz | 55 GHz | 69 GHz |
| M1720A         | 28 GHz    | 25 GHz | 29 GHz |

**VXT Models with Remote Radio Heads/CIU**

| Products with Radio Heads/CIU | Port          | Preset | Min frequency | Max frequency |
|-------------------------------|---------------|--------|---------------|---------------|
| VXT + CIU + M1740A RRH        | RF Out        | 1 GHz  | 0.38 GHz      | 6 GHz         |
|                               | DUT IF OUT n  | 6 GHz  | 5.9 GHz       | 12 GHz        |
|                               | Head h RFHD p | 28 GHz | 22.7 GHz      | 43.5 GHz      |
| VXT + M1742A RRH              | RF Out        | 1 GHz  | 0.38 GHz      | 6 GHz         |
|                               | Head h RFHD p | 28 GHz | 10 GHz        | 32 GHz        |
| VXT + M1749B RRH-F43          | RF Out        | 1 GHz  | 0.38 GHz      | 6 GHz         |
|                               | Head h RFHD p | 28 GHz | 22.7 GHz      | 43.5 GHz      |
| VXT + M1749B RRH-F49          | RF Out        | 1 GHz  | 0.38 GHz      | 6 GHz         |
|                               | Head h RFHD p | 28 GHz | 22.7 GHz      | 49.2 GHz      |

**M941xE(VXT Models with M9471A)**

| Products with M9471A                                          | Preset | Minimum<br>settable<br>frequency | Minimum<br>frequency<br>with Spec | Maximum<br>settable<br>frequency |
|---------------------------------------------------------------|--------|----------------------------------|-----------------------------------|----------------------------------|
| M941xE without LFE option                                     | 1 GHz  | 330 MHz                          | 380MHz                            | 26.5GHz                          |
| M941xE with LFE option<br>(LFE option in M9411A or<br>M9471A) | 1 GHz  | 750 kHz                          | 1MHz                              | 26.5GHz                          |

**NOTE**

The minimum spec frequency is 380 MHz, minimum settable center frequency is 330 MHz.

With Option LFE in M9411A or in M9471A, the minimum settable frequency is 750 kHz, but Spec to customer only ensure down to 1 MHz.

**6.1.9.2 Channel**

The frequency of the source can be specified by a channel number of a given frequency band. This control allows you to specify the current channel number. For the appropriate range of channel numbers for a given frequency band, see the following tables: ["GSM/EDGE Channel Number Ranges" on page 607](#), ["W-CDMA Channel Number Ranges" on page 607](#), ["LTE FDD Channel Number Ranges" on page 609](#), and ["LTE TDD Channel Number Ranges" on page 610](#).

Channel is not available on E7760B.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SOURce:FREQuency:CHANnels:NUMBer &lt;int&gt;</code><br><code>:SOURce:FREQuency:CHANnels:NUMBer?</code>                                                                                                                                                                                                                                                                                                                                            |
| Example        | <code>:SOUR:LIST:STEP2:SET:RAD:NUMB 1</code>                                                                                                                                                                                                                                                                                                                                                                                                             |
| Notes          | Grayed-out when the <a href="#">"Radio Standard/Radio Band" on page 611</a> is set to <b>NONE</b>                                                                                                                                                                                                                                                                                                                                                        |
| Couplings      | The channel number is coupled to the frequency value when <a href="#">"Radio Standard/Radio Band" on page 611</a> is not set to <b>NONE</b><br><br>When the frequency value is changed, the channel number increases or decreases to match the new frequency. If the frequency is not at an exact match for a channel number, the nearest channel number is displayed, with > or < indicating whether the frequency is above or below the channel number |
| Preset         | 1                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Min/Max        | See <a href="#">"GSM/EDGE Channel Number Ranges" on page 607</a> , <a href="#">"W-CDMA Channel Number Ranges" on page 607</a> , <a href="#">"LTE FDD Channel Number Ranges" on page 609</a> , and <a href="#">"LTE TDD Channel Number Ranges" on page 610</a>                                                                                                                                                                                            |

### GSM/EDGE Channel Number Ranges

| Band     | Link (Device) | Range                  | Frequency (MHz)                 |
|----------|---------------|------------------------|---------------------------------|
| P-GSM    | Uplink (MS)   | $1 \leq n \leq 124$    | $890.0 + 0.2 \cdot n$           |
|          | Downlink (BS) | $1 \leq n \leq 124$    | $935.0 + 0.2 \cdot n$           |
| E-GSM    | Uplink (MS)   | $0 \leq n \leq 124$    | $890.0 + 0.2 \cdot n$           |
|          |               | $975 \leq n \leq 1023$ | $890.0 + 0.2 \cdot (n-1024)$    |
|          | Downlink (BS) | $0 \leq n \leq 124$    | $935.0 + 0.2 \cdot n$           |
|          |               | $975 \leq n \leq 1023$ | $935.0 + 0.2 \cdot (n-1024)$    |
| DCS 1800 | Uplink (MS)   | $512 \leq n \leq 885$  | $1710.200 + 0.20 \cdot (n-512)$ |
|          | Downlink (BS) | $512 \leq n \leq 885$  | $1805.200 + 0.20 \cdot (n-512)$ |
| PCS 1900 | Uplink (MS)   | $512 \leq n \leq 810$  | $1850.200 + 0.2 \cdot (n-512)$  |
|          | Downlink (BS) | $512 \leq n \leq 810$  | $1930.200 + 0.2 \cdot (n-512)$  |
| R-GSM    | Uplink (MS)   | $0 \leq n \leq 124$    | $890.0 + 0.2 \cdot n$           |
|          |               | $955 \leq n \leq 1023$ | $890.0 + 0.2 \cdot (n-1024)$    |
|          | Downlink (BS) | $0 \leq n \leq 124$    | $935.0 + 0.2 \cdot n$           |
|          |               | $955 \leq n \leq 1023$ | $935.0 + 0.2 \cdot (n-1024)$    |
| GSM 450  | Uplink (MS)   | $256 \leq n \leq 293$  | $450.6 + 0.2 \cdot (n-259)$     |
|          | Downlink (BS) | $256 \leq n \leq 293$  | $460.6 + 0.2 \cdot (n-259)$     |
| GSM 480  | Uplink (MS)   | $306 \leq n \leq 340$  | $479.000 + 0.20 \cdot (n-306)$  |
|          | Downlink (BS) | $306 \leq n \leq 340$  | $489.000 + 0.20 \cdot (n-306)$  |
| GSM 850  | Uplink (MS)   | $128 \leq n \leq 251$  | $824.200 + 0.20 \cdot (n-128)$  |
|          | Downlink (BS) | $128 \leq n \leq 251$  | $869.200 + 0.20 \cdot (n-128)$  |
| GSM 700  | Uplink (MS)   | $438 \leq n \leq 516$  | $777.200 + 0.20 \cdot (n-438)$  |
|          | Downlink (BS) | $438 \leq n \leq 516$  | $747.200 + 0.20 \cdot (n-438)$  |
| T-GSM810 | Uplink (MS)   | $350 \leq n \leq 425$  | $806.0 + 0.20 \cdot (n-350)$    |
|          | Downlink (BS) | $350 \leq n \leq 425$  | $851.0 + 0.20 \cdot (n-350)$    |

### W-CDMA Channel Number Ranges

| Band    | Link (Device) | Range                     | Frequency (MHz)     |
|---------|---------------|---------------------------|---------------------|
| Band I  | Downlink      | $10562 \leq n \leq 10838$ | $n \div 5$          |
|         | Uplink        | $9612 \leq n \leq 9888$   | $n \div 5$          |
| Band II | Downlink      | $412 \leq n \leq 687$     | $n \div 5 + 1850.1$ |
|         |               | $9662 \leq n \leq 9938$   | $n \div 5$          |
|         | Uplink        | $12 \leq n \leq 287$      | $n \div 5 + 1850.1$ |
|         |               | $350 \leq n \leq 425$     | $n \div 5$          |

| Band      | Link (Device) | Range           | Frequency (MHz) |
|-----------|---------------|-----------------|-----------------|
| Band III  | Downlink      | 1162 ≤ n ≤ 1513 | n ÷ 5 + 1575    |
|           | Uplink        | 937 ≤ n ≤ 1288  | n ÷ 5 + 1525    |
| Band IV   | Downlink      | 537 ≤ n ≤ 1738  | n ÷ 5 + 1805    |
|           |               | 1887 ≤ n ≤ 2087 | n ÷ 5 + 1735.1  |
|           | Uplink        | 1312 ≤ n ≤ 1513 | n ÷ 5 + 1450    |
|           |               | 1662 ≤ n ≤ 1862 | n ÷ 5 + 1380.1  |
| Band V    | Downlink      | 1007 ≤ n ≤ 1087 | n ÷ 5 + 670.1   |
|           |               | 4357 ≤ n ≤ 4458 | n ÷ 5           |
|           | Uplink        | 782 ≤ n ≤ 862   | n ÷ 5 + 670.1   |
|           |               | 4132 ≤ n ≤ 4233 | n ÷ 5           |
| Band VI   | Downlink      | 1037 ≤ n ≤ 1062 | n ÷ 5 + 670.1   |
|           |               | 4387 ≤ n ≤ 4413 | n ÷ 5           |
|           | Uplink        | 812 ≤ n ≤ 837   | n ÷ 5 + 670.1   |
|           |               | 4162 ≤ n ≤ 4188 | n ÷ 5           |
| Band VII  | Downlink      | 2237 ≤ n ≤ 2563 | n ÷ 5 + 2175    |
|           |               | 2587 ≤ n ≤ 2912 | n ÷ 5 + 2105.1  |
|           | Uplink        | 2012 ≤ n ≤ 2338 | n ÷ 5 + 2100    |
|           |               | 2362 ≤ n ≤ 2687 | n ÷ 5 + 2030.1  |
| Band VIII | Downlink      | 2937 ≤ n ≤ 3088 | n ÷ 5 + 340     |
|           | Uplink        | 2712 ≤ n ≤ 2863 | n ÷ 5 + 340     |
| Band IX   | Downlink      | 9237 ≤ n ≤ 9387 | n ÷ 5           |
|           | Uplink        | 8762 ≤ n ≤ 8912 | n ÷ 5           |
| Band X    | Downlink      | 3112 ≤ n ≤ 3388 | n ÷ 5 + 1490    |
|           |               | 3412 ≤ n ≤ 3687 | n ÷ 5 + 1430.1  |
|           | Uplink        | 2887 ≤ n ≤ 3163 | n ÷ 5 + 1135    |
|           |               | 3187 ≤ n ≤ 3462 | n ÷ 5 + 1075.1  |
| Band XI   | Downlink      | 3712 ≤ n ≤ 3812 | n ÷ 5 + 736     |
|           | Uplink        | 3487 ≤ n ≤ 3587 | n ÷ 5 + 733     |
| Band XII  | Downlink      | 3837 ≤ n ≤ 3903 | n ÷ 5 – 37      |
|           |               | 3927 ≤ n ≤ 3992 | n ÷ 5 – 54.9    |
|           | Uplink        | 3612 ≤ n ≤ 3678 | n ÷ 5 – 22      |
|           |               | 3702 ≤ n ≤ 3767 | n ÷ 5 – 39.9    |
| Band XIII | Downlink      | 4017 ≤ n ≤ 4043 | n ÷ 5 – 55      |
|           |               | 4067 ≤ n ≤ 4092 | n ÷ 5 – 64.9    |
|           | Uplink        | 3792 ≤ n ≤ 3818 | n ÷ 5 + 21      |
|           |               | 3702 ≤ n ≤ 3767 | n ÷ 5 – 39.9    |

## 6 Input/Output

### 6.1 RF Source

| Band     | Link (Device) | Range                   | Frequency (MHz)    |
|----------|---------------|-------------------------|--------------------|
| Band XIV | Downlink      | $4117 \leq n \leq 4143$ | $n \div 5 - 63$    |
|          |               | $4167 \leq n \leq 4192$ | $n \div 5 - 72.9$  |
|          | Uplink        | $3892 \leq n \leq 3918$ | $n \div 5 + 12$    |
|          |               | $3942 \leq n \leq 3967$ | $n \div 5 + 2.1$   |
| Band XIX | Downlink      | $712 \leq n \leq 763$   | $n \div 5 + 735$   |
|          |               | $787 \leq n \leq 837$   | $n \div 5 + 720.1$ |
|          | Uplink        | $312 \leq n \leq 363$   | $n \div 5 + 770$   |
|          |               | $387 \leq n \leq 437$   | $n \div 5 + 755.1$ |

### LTE FDD Channel Number Ranges

The carrier frequency in the uplink and downlink is designated by the E-UTRA Absolute Radio Frequency Channel Number (EARFCN) in the range 0 - 65535. The relation between EARFCN and the carrier frequency in MHz for the downlink is given by the following equation, where  $F_{DL\_low}$  and  $N_{Offs-DL}$  are given in table 5.4.4-1 and  $N_{DL}$  is the downlink EARFCN.

$$F_{DL} = F_{DL\_low} + 0.1(N_{DL} - N_{Offs-DL})$$

The relation between EARFCN and the carrier frequency in MHz for the uplink is given by the following equation where  $F_{UL\_low}$  and  $N_{Offs-UL}$  are given in table 5.4.4-1 and  $N_{UL}$  is the uplink EARFCN.

$$F_{UL} = F_{UL\_low} + 0.1(N_{UL} - N_{Offs-UL})$$

| Band | Downlink            |               |                   | Uplink              |               |                   |
|------|---------------------|---------------|-------------------|---------------------|---------------|-------------------|
|      | $F_{DL\_low}$ (MHz) | $N_{Offs-DL}$ | Range of $N_{DL}$ | $F_{UL\_low}$ (MHz) | $N_{Offs-UL}$ | Range of $N_{UL}$ |
| 1    | 2110                | 0             | 0 - 599           | 1920                | 18000         | 18000 - 18599     |
| 2    | 1930                | 600           | 600 - 1199        | 1850                | 18600         | 18600 - 19199     |
| 3    | 1805                | 1200          | 1200 - 1949       | 1710                | 19200         | 19200 - 19949     |
| 4    | 2110                | 1950          | 1950 - 2399       | 1710                | 19950         | 19950 - 20399     |
| 5    | 869                 | 2400          | 2400 - 2649       | 824                 | 20400         | 20400 - 20649     |
| 6    | 875                 | 2650          | 2650 - 2749       | 830                 | 20650         | 20650 - 20749     |
| 7    | 2620                | 2750          | 2750 - 3449       | 2500                | 20750         | 20750 - 20449     |
| 8    | 925                 | 3450          | 3450 - 3799       | 880                 | 21450         | 21450 - 21799     |
| 9    | 1844.9              | 3800          | 3800 - 4149       | 1749.9              | 21800         | 21800 - 22149     |
| 10   | 2110                | 4150          | 4150 - 4749       | 1710                | 22150         | 22150 - 22749     |
| 11   | 1475.9              | 4750          | 4750 - 4949       | 1427.9              | 22750         | 22750 - 22949     |
| 12   | 729                 | 5010          | 5010 - 5179       | 699                 | 23010         | 23010 - 23179     |
| 13   | 746                 | 5180          | 5180 - 5279       | 777                 | 23180         | 23180 - 23279     |

| Band | Downlink |      |             | Uplink      |       |               |
|------|----------|------|-------------|-------------|-------|---------------|
|      | 14       | 758  | 5280        | 5280 – 5379 | 788   | 23280         |
|      |          |      |             |             |       | 3             |
|      |          |      |             |             |       | 2             |
|      |          |      |             |             |       | 8             |
|      |          |      |             |             |       | 0             |
|      |          |      |             |             |       | –             |
|      |          |      |             |             |       | 2             |
|      |          |      |             |             |       | 3             |
|      |          |      |             |             |       | 3             |
|      |          |      |             |             |       | 7             |
|      |          |      |             |             |       | 9             |
| ...  |          |      |             |             |       |               |
| 17   | 734      | 5730 | 5730 – 5849 | 704         | 23730 | 23730 – 23849 |
| 18   | 860      | 5850 | 5850 – 5999 | 815         | 23850 | 23850 – 23999 |
| 19   | 875      | 6000 | 6000 – 6149 | 830         | 24000 | 24000 – 24149 |
| 20   | 791      | 6150 | 6150 – 6449 | 832         | 24150 | 24150 – 24449 |
| 21   | 1495.9   | 6450 | 6450 – 6599 | 1447.9      | 24450 | 24450 – 24599 |
| ...  |          |      |             |             |       |               |
| 24   | 1525     | 7700 | 7700 – 8039 | 1626.5      | 25700 | 25700 – 26039 |
| 25   | 1930     | 8040 | 8040 – 8689 | 1850        | 26040 | 26040 – 26689 |
| 26   | 859      | 8690 | 8690 – 9039 | 814         | 26690 | 26690 – 27039 |
| ...  |          |      |             |             |       |               |

**Note:** The channel numbers that designate carrier frequencies so close to the operating band edges that the carrier extends beyond the operating band edge shall not be used. This implies that the first 7, 15, 25, 50, 75 and 100 channel numbers at the lower operating band edge and the last 6, 14, 24, 49, 74 and 99 channel numbers at the upper operating band edge shall not be used for channel bandwidths of 1.4, 3, 5, 10, 15 and 20 MHz respectively.

### LTE TDD Channel Number Ranges

The carrier frequency in the uplink and downlink is designated by the E-UTRA Absolute Radio Frequency Channel Number (EARFCN) in the range 0 – 65535. The relation between EARFCN and the carrier frequency in MHz for the downlink is given by the following equation, where  $F_{DL\_low}$  and  $N_{Offs-DL}$  are given in table 5.4.4-1 and  $N_{DL}$  is the downlink EARFCN.

$$F_{DL} = F_{DL\_low} + 0.1(N_{DL} - N_{Offs-DL})$$

The relation between EARFCN and the carrier frequency in MHz for the uplink is given by the following equation where  $F_{UL\_low}$  and  $N_{Offs-UL}$  are given in table 5.4.4-1 and  $N_{UL}$  is the uplink EARFCN.

$$F_{UL} = F_{UL\_low} + 0.1(N_{UL} - N_{Offs-UL})$$

| Band | Downlink            |               |                   | Uplink              |               |                   |
|------|---------------------|---------------|-------------------|---------------------|---------------|-------------------|
|      | $F_{DL\_low}$ (MHz) | $N_{Offs-DL}$ | Range of $N_{DL}$ | $F_{UL\_low}$ (MHz) | $N_{Offs-UL}$ | Range of $N_{UL}$ |
| 33   | 1900                | 36000         | 36000 – 36199     | 1900                | 36000         | 36000 – 36199     |
| 34   | 2010                | 36200         | 36200 – 36349     | 2010                | 36200         | 36200 – 36349     |
| 35   | 1850                | 36350         | 36350 – 36949     | 1850                | 36350         | 36350 – 36949     |
| 36   | 1930                | 36950         | 36950 – 37549     | 1930                | 36950         | 36950 – 37549     |
| 37   | 1910                | 37550         | 37550 – 37749     | 1910                | 37550         | 37550 – 37749     |
| 38   | 2570                | 37750         | 37750 – 38249     | 2570                | 37750         | 37750 – 38249     |
| 39   | 1880                | 38250         | 38250 – 38649     | 1880                | 38250         | 38250 – 38649     |
| 40   | 2300                | 38650         | 38650 – 39649     | 2300                | 38650         | 38650 – 39649     |
| 41   | 2496                | 39650         | 39650 – 41589     | 2496                | 39650         | 39650 – 41589     |
| 42   | 3400                | 41590         | 41590 – 43589     | 3400                | 41590         | 41590 – 43589     |
| 43   | 3600                | 43590         | 43590 – 45589     | 3600                | 43590         | 43590 – 45589     |

**Note:** The channel numbers that designate carrier frequencies so close to the operating band edges that the carrier extends beyond the operating band edge shall not be used. This implies that the first 7, 15, 25, 50, 75 and 100 channel numbers at the lower operating band edge and the last 6, 14, 24, 49, 74 and 99 channel numbers at the upper operating band edge shall not be used for channel bandwidths of 1.4, 3, 5, 10, 15 and 20 MHz respectively.

### 6.1.9.3 Radio Setup

Lets you select the radio standard and associated radio band. You can also set the Radio Band Link to Uplink or Downlink.

#### Radio Standard/Radio Band

Lets you select the radio standard and associated radio band. The first column in the dialog lets you set the Radio Standard; for each standard, and the second column in the dialog changes to show you the available bands.

Once you have selected the radio standard, you can then set an active channel band. The radio standard and the active channel band allow you to use the ["Channel" on page 606](#) control to set Channel numbers, thus setting ["Frequency" on page 603](#) automatically.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <p><code>:SOURce:FREQuency:CHANnels:BAND &lt;band&gt;</code></p> <p>where <code>&lt;band&gt;</code> is one of:</p> <p>NONE   PGSM   EGSM   RGSM   DCS1800   PCS1900   GSM450   GSM480   GSM700   GSM850   TGSM810   USCELL   USPCS   JAPAN   KOREAN   NMT   IMT2K   UPPER   SECOND   PAMR400   PAMR800   IMTEXT   PCS1DOT9G   AWS   US2DOT5G   PUBLIC   LOWER   BANDI   BANDII   BANDIII   BANDIV   BANDV   BANDVI   BANDVII   BANDVIII   BANDIX   BANDX   BANDXI   BANDXII   BANDXIII   BANDXIV   BANDXIX   BAND1   BAND2   BAND3   BAND4   BAND5   BAND6   BAND7   BAND8   BAND9   BAND10   BAND11   BAND12   BAND13   BAND14   BAND17   BAND18   BAND19   BAND20   BAND21   BAND24   BAND25   BAND26   BAND27   BAND28   BAND29   BAND30   BAND31   BAND65   BAND66   BAND67   BAND68   BAND71   BAND252   BAND255   BAND33   BAND34   BAND35   BAND36   BAND37   BAND38   BAND39   BAND40   BAND41   BAND42   BAND43   BAND44   BAND45   BAND46   BANDA   BANDB   BANDC   BANDD   BANDE   BANDF   N1   N2   N3   N5   N7   N8   N12   N20   N25   N28   N34   N38   N39   N40   N41   N50   N51   N66   N70   N71   N74   N75   N76   N77   N78   N79   N80   N81   N82   N83   N84   N86   N257   N258   N260   N261</p> <p><code>:SOURce:FREQuency:CHANnels:BAND?</code></p> |
| Example        | <code>:SOUR:LIST:STEP2:SET:RAD:BAND PGSM</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Notes          | <p>Setting this to <b>NONE</b> grays-out "Channel" on page 606 under <b>Frequency Setup</b></p> <p>Here are the members of each group in Radio Standard and a SCPI example for each:</p> <p>None – no Radio Standard</p> <p>None <code>:SOUR:FREQ:CHAN:BAND NONE</code></p> <p>GSM</p> <p>Sets GSM/EDGE as the radio standard for use and accesses the GSM/EDGE specific channel band sub-menus.</p> <p>P-GSM <code>:SOUR:FREQ:CHAN:BAND PGSM</code></p> <p>E-GSM <code>:SOUR:FREQ:CHAN:BAND EGSM</code></p> <p>R-GSM <code>:SOUR:FREQ:CHAN:BAND RGSM</code></p> <p>DCS 1800 <code>:SOUR:FREQ:CHAN:BAND DCS1800</code></p> <p>PCS 1900 <code>:SOUR:FREQ:CHAN:BAND PCS1900</code></p> <p>GSM 450 <code>:SOUR:FREQ:CHAN:BAND GSM450</code></p> <p>GSM 480 <code>:SOUR:FREQ:CHAN:BAND GSM480</code></p> <p>GSM 700 <code>:SOUR:FREQ:CHAN:BAND GSM700</code></p> <p>GSM 850 <code>:SOUR:FREQ:CHAN:BAND GSM850</code></p> <p>T-GSM 810 <code>:SOUR:FREQ:CHAN:BAND T-GSM810</code></p> <p>W-CDMA</p> <p>Sets WCDMA as the radio standard for use and accesses the W-CDMA specific channel band sub-menus.</p>                                                                                                                                                                            |



## 6 Input/Output

### 6.1 RF Source

|           |                               |
|-----------|-------------------------------|
| Band I    | :SOUR:FREQ:CHAN:BAND BANDI    |
| Band II   | :SOUR:FREQ:CHAN:BAND BANDII   |
| Band III  | :SOUR:FREQ:CHAN:BAND BANDIII  |
| Band IV   | :SOUR:FREQ:CHAN:BAND BANDIV   |
| Band V    | :SOUR:FREQ:CHAN:BAND BANDV    |
| Band VI   | :SOUR:FREQ:CHAN:BAND BANDVI   |
| Band VII  | :SOUR:FREQ:CHAN:BAND BANDVII  |
| Band VIII | :SOUR:FREQ:CHAN:BAND BANDVIII |
| Band IX   | :SOUR:FREQ:CHAN:BAND BANDIX   |
| Band X    | :SOUR:FREQ:CHAN:BAND BANDX    |
| Band XI   | :SOUR:FREQ:CHAN:BAND BANDXI   |
| Band XII  | :SOUR:FREQ:CHAN:BAND BANDXII  |
| Band XIII | :SOUR:FREQ:CHAN:BAND BANDXIII |
| Band XIV  | :SOUR:FREQ:CHAN:BAND BANDXIV  |
| Band XIX  | :SOUR:FREQ:CHAN:BAND BANDXIX  |

#### LTE

Sets LTE FDD as the radio standard for use and accesses the LTE FDD specific channel band sub-menus.

|         |                             |
|---------|-----------------------------|
| Band 1  | :SOUR:FREQ:CHAN:BAND BAND1  |
| Band 2  | :SOUR:FREQ:CHAN:BAND BAND2  |
| Band 3  | :SOUR:FREQ:CHAN:BAND BAND3  |
| Band 4  | :SOUR:FREQ:CHAN:BAND BAND4  |
| Band 5  | :SOUR:FREQ:CHAN:BAND BAND5  |
| Band 6  | :SOUR:FREQ:CHAN:BAND BAND6  |
| Band 7  | :SOUR:FREQ:CHAN:BAND BAND7  |
| Band 8  | :SOUR:FREQ:CHAN:BAND BAND8  |
| Band 9  | :SOUR:FREQ:CHAN:BAND BAND9  |
| Band 10 | :SOUR:FREQ:CHAN:BAND BAND10 |
| Band 11 | :SOUR:FREQ:CHAN:BAND BAND11 |
| Band 12 | :SOUR:FREQ:CHAN:BAND BAND12 |
| Band 13 | :SOUR:FREQ:CHAN:BAND BAND13 |
| Band 14 | :SOUR:FREQ:CHAN:BAND BAND14 |
| Band 17 | :SOUR:FREQ:CHAN:BAND BAND17 |
| Band 18 | :SOUR:FREQ:CHAN:BAND BAND18 |
| Band 19 | :SOUR:FREQ:CHAN:BAND BAND19 |
| Band 20 | :SOUR:FREQ:CHAN:BAND BAND20 |
| Band 21 | :SOUR:FREQ:CHAN:BAND BAND21 |

|          |                              |
|----------|------------------------------|
| Band 24  | :SOUR:FREQ:CHAN:BAND BAND24  |
| Band 25  | :SOUR:FREQ:CHAN:BAND BAND25  |
| Band 26  | :SOUR:FREQ:CHAN:BAND BAND26  |
| Band 27  | :SOUR:FREQ:CHAN:BAND BAND27  |
| Band 28  | :SOUR:FREQ:CHAN:BAND BAND28  |
| Band 29  | :SOUR:FREQ:CHAN:BAND BAND29  |
| Band 30  | :SOUR:FREQ:CHAN:BAND BAND30  |
| Band 31  | :SOUR:FREQ:CHAN:BAND BAND31  |
| Band 65  | :SOUR:FREQ:CHAN:BAND BAND65  |
| Band 66  | :SOUR:FREQ:CHAN:BAND BAND66  |
| Band 67  | :SOUR:FREQ:CHAN:BAND BAND67  |
| Band 68  | :SOUR:FREQ:CHAN:BAND BAND68  |
| Band 71  | :SOUR:FREQ:CHAN:BAND BAND71  |
| Band 252 | :SOUR:FREQ:CHAN:BAND BAND252 |
| Band 255 | :SOUR:FREQ:CHAN:BAND BAND255 |

#### LTE TDD

Sets LTE TDD as the radio standard for use and accesses the LTE TDD specific channel band sub-menus.

|         |                             |
|---------|-----------------------------|
| Band 33 | :SOUR:FREQ:CHAN:BAND BAND33 |
| Band 34 | :SOUR:FREQ:CHAN:BAND BAND34 |
| Band 35 | :SOUR:FREQ:CHAN:BAND BAND35 |
| Band 36 | :SOUR:FREQ:CHAN:BAND BAND36 |
| Band 37 | :SOUR:FREQ:CHAN:BAND BAND37 |
| Band 38 | :SOUR:FREQ:CHAN:BAND BAND38 |
| Band 39 | :SOUR:FREQ:CHAN:BAND BAND39 |
| Band 40 | :SOUR:FREQ:CHAN:BAND BAND40 |
| Band 41 | :SOUR:FREQ:CHAN:BAND BAND41 |
| Band 42 | :SOUR:FREQ:CHAN:BAND BAND42 |
| Band 43 | :SOUR:FREQ:CHAN:BAND BAND43 |
| Band 44 | :SOUR:FREQ:CHAN:BAND BAND44 |
| Band 45 | :SOUR:FREQ:CHAN:BAND BAND45 |
| Band 46 | :SOUR:FREQ:CHAN:BAND BAND46 |

#### 5G NR

Sets 5G NR as the radio standard for use and accesses the 5G NR specific channel band sub-menus.

## 6 Input/Output

### 6.1 RF Source

|       |                           |
|-------|---------------------------|
| N 1   | :SOUR:FREQ:CHAN:BAND N1   |
| N 2   | :SOUR:FREQ:CHAN:BAND N2   |
| N 3   | :SOUR:FREQ:CHAN:BAND N3   |
| N 5   | :SOUR:FREQ:CHAN:BAND N5   |
| N 7   | :SOUR:FREQ:CHAN:BAND N7   |
| N 8   | :SOUR:FREQ:CHAN:BAND N8   |
| N 12  | :SOUR:FREQ:CHAN:BAND N12  |
| N 20  | :SOUR:FREQ:CHAN:BAND N20  |
| N 25  | :SOUR:FREQ:CHAN:BAND N25  |
| N 28  | :SOUR:FREQ:CHAN:BAND N28  |
| N 34  | :SOUR:FREQ:CHAN:BAND N34  |
| N 38  | :SOUR:FREQ:CHAN:BAND N38  |
| N 39  | :SOUR:FREQ:CHAN:BAND N39  |
| N 40  | :SOUR:FREQ:CHAN:BAND N40  |
| N 41  | :SOUR:FREQ:CHAN:BAND N41  |
| N 50  | :SOUR:FREQ:CHAN:BAND N50  |
| N 51  | :SOUR:FREQ:CHAN:BAND N51  |
| N 66  | :SOUR:FREQ:CHAN:BAND N66  |
| N 70  | :SOUR:FREQ:CHAN:BAND N70  |
| N 71  | :SOUR:FREQ:CHAN:BAND N71  |
| N 74  | :SOUR:FREQ:CHAN:BAND N74  |
| N 75  | :SOUR:FREQ:CHAN:BAND N75  |
| N 76  | :SOUR:FREQ:CHAN:BAND N76  |
| N 77  | :SOUR:FREQ:CHAN:BAND N77  |
| N 78  | :SOUR:FREQ:CHAN:BAND N78  |
| N 79  | :SOUR:FREQ:CHAN:BAND N79  |
| N 80  | :SOUR:FREQ:CHAN:BAND N80  |
| N 81  | :SOUR:FREQ:CHAN:BAND N81  |
| N 82  | :SOUR:FREQ:CHAN:BAND N82  |
| N 83  | :SOUR:FREQ:CHAN:BAND N83  |
| N 84  | :SOUR:FREQ:CHAN:BAND N84  |
| N 86  | :SOUR:FREQ:CHAN:BAND N86  |
| N 257 | :SOUR:FREQ:CHAN:BAND N257 |
| N 258 | :SOUR:FREQ:CHAN:BAND N258 |
| N 260 | :SOUR:FREQ:CHAN:BAND N260 |
| N 261 | :SOUR:FREQ:CHAN:BAND N261 |

## Radio Band Link

Lets you specify the channel band type as either uplink or downlink link direction. This value is used in conjunction with the channel band and channel number to determine the absolute frequency output by the source.

- When set to **Uplink (UP)**, the source calculates the uplink frequency using an uplink formula together with the selected channel band and channel number
- When set to **Downlink (DOWN)** the source calculates the downlink frequency using a downlink formula together with the selected channel band and channel number

|                               |                                                                                         |
|-------------------------------|-----------------------------------------------------------------------------------------|
| Remote Command                | <code>:SOURce:RADio:BAND:LINK DOWN   UP</code><br><code>:SOURce:RADio:BAND:LINK?</code> |
| Example                       | <code>:SOUR:RAD:BAND:LINK UP</code>                                                     |
| Preset                        | DOWN                                                                                    |
| Range                         | DOWN   UP                                                                               |
| Backwards Compatibility SCPI  | <code>:SOURce:RADio:DEVIce BTS   MS</code><br><code>:SOURce:RADio:DEVIce?</code>        |
| Backwards Compatibility Notes | DOWN = BTS<br>UP = MS                                                                   |

### 6.1.9.4 Set Reference Frequency

Lets you set the frequency reference. Pressing this control turns the frequency reference state to **ON**, sets the reference frequency value to the current frequency, maintains this frequency at the RF output, and sets the displayed frequency to 0.00 Hz. All subsequent frequencies entered under Source>Frequency>Frequency are interpreted as being relative to this reference frequency.

When you use a frequency reference, the signal generator outputs a frequency that is set relative to the reference frequency by the value entered under **Source, Frequency, Frequency** as follows:

Output frequency = reference frequency - entered frequency

Where:

- reference frequency equals the original RF frequency entered under Source>Frequency>Frequency and set as the reference frequency
- entered frequency equals a new value entered under **Source, Frequency, Frequency**

In addition, the displayed frequency value will be the same as the value entered under Source>Frequency>Frequency.

NOTE

If Freq Reference is **ON** with a reference value set, entering a value under **Source, Frequency, Frequency** and pressing **Set Frequency Reference** adds that value to the existing Freq Reference value.  
If you wish to change the reference frequency value to the new value entered under **Source, Frequency, Frequency**, first set Freq Reference **OFF** then press **Set Frequency Reference**.

|                |                                                               |
|----------------|---------------------------------------------------------------|
| Remote Command | :SOURce:FREQuency:REFeRence:SET                               |
| Example        | :SOUR:FREQ:REF:SET                                            |
| Dependencies   | Unavailable, and grayed-out, when List Sequencer is <b>ON</b> |

6.1.9.5 Freq Reference

Lets you toggle the state of the frequency reference. When the frequency reference state is **ON**, an annunciator is displayed on the main source view to indicate this state to the user.

When you use a frequency reference, the signal generator outputs a frequency that is set relative to the reference frequency by the value entered under **Source, Frequency, Frequency** as follows:

Output frequency = reference frequency + entered frequency

Where:

- reference frequency equals the original RF frequency entered under **Source, Frequency, Frequency** and set as the reference frequency
- entered frequency equals a new value entered under **Source, Frequency, Frequency**

For more information on Reference Frequency, see ["Set Reference Frequency" on page 616](#).

|                |                                                                                                                                                                                                                                |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | :SOURce:FREQuency:REFeRence <freq><br>:SOURce:FREQuency:REFeRence?                                                                                                                                                             |
| Example        | :SOUR:FREQ:REF 0.00 Hz                                                                                                                                                                                                         |
| Dependencies   | Unavailable, and grayed-out, when List Sequencer is <b>ON</b>                                                                                                                                                                  |
| Couplings      | The frequency reference state is coupled to the frequency reference set immediate action. When the reference set immediate action key is pressed, or the SCPI command issued, it turns the frequency reference state <b>ON</b> |
| Preset         | 0.00 Hz                                                                                                                                                                                                                        |

|                |                                                                                                                    |
|----------------|--------------------------------------------------------------------------------------------------------------------|
| Min            | 0.00 Hz                                                                                                            |
| Max            | Hardware Dependent:                                                                                                |
|                | Option 503 3.6 GHz                                                                                                 |
|                | Option 504 3.8 GHz                                                                                                 |
|                | Option 506 6.00 GHz                                                                                                |
|                | For E7760B: Dependent on port selected                                                                             |
|                | Auto Function                                                                                                      |
| Remote Command | <code>:SOURce:FREQuency:REFerence:STATe OFF   ON   0   1</code><br><code>:SOURce:FREQuency:REFerence:STATe?</code> |
| Example        | <code>:SOUR:FREQ:REF:STATe ON</code>                                                                               |
| Preset         | <code>OFF</code>                                                                                                   |

#### 6.1.9.6 Freq Offset

Lets you specify the frequency offset value. When the frequency offset state is **ON**, an annunciator is displayed on the main source view to indicate this state.

When the frequency offset is set to zero (0) and you set a new offset value, the displayed frequency value changes as follows, and the RF output frequency does not change:

Displayed value = output frequency + offset value

Where:

- output frequency equals the original frequency entered under **Source, Frequency, Frequency**
- offset value equals the value entered under **Source, Frequency, Freq Offset**

When the frequency offset is set to a value other than zero (0) and you enter a new frequency value under **Source, Frequency, Frequency**, the displayed frequency will be the same as the value entered and the RF output frequency will be equal to the value entered minus the offset value as follows:

Output frequency = entered frequency – offset frequency

Displayed frequency = output frequency + offset frequency

Displayed frequency = entered frequency

Where:

## 6 Input/Output

### 6.1 RF Source

- entered frequency equals the frequency entered under **Source, Frequency, Frequency**
- offset frequency equals the value previously entered and set under **Source, Frequency, Freq Offset**

|                |                                                                                              |
|----------------|----------------------------------------------------------------------------------------------|
| Remote Command | <code>:SOURce:FREQuency:OFFSet &lt;freq&gt;</code><br><code>:SOURce:FREQuency:OFFSet?</code> |
| Example        | <code>:SOUR:FREQ:OFFS 0 Hz</code>                                                            |
| Dependencies   | Unavailable, and grayed-out, when List Sequencer is <b>ON</b>                                |
| Preset         | 0 Hz                                                                                         |
| Min/Max        | -/+100.00 GHz                                                                                |

#### 6.1.9.7 Freq Increment

Changes the step size for the RF Output Frequency function. Once an increment size has been selected and the RF Output Frequency function is active, the step keys (and the **UP | DOWN** parameters for RF Frequency from remote commands) change the RF Output Frequency by the increment set value.

This feature exists in EXG and MXG.

|                |                                                                                                                    |
|----------------|--------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SOURce:FREQuency:STEP[:INCRe ment] &lt;freq&gt;</code><br><code>:SOURce:FREQuency:STEP[:INCRe ment]?</code> |
| Example        | <code>:SOUR:FREQ:STEP 1.0 kHz</code>                                                                               |
| Couplings      | Coupled to the Step size of the RF Frequency function                                                              |
| Preset         | Hardware Dependent. 10% of the span preset value                                                                   |
| Min            | 1 Hz                                                                                                               |
| Max            | Hardware Dependent:                                                                                                |
|                | Option 503 3.6 GHz                                                                                                 |
|                | Option 504 3.8 GHz                                                                                                 |
|                | Option 506 6.00 GHz                                                                                                |

For E7760B: Dependent on port selected

For EXM, if license 5WC is present, the frequency range should be limited to: 1.1GHz-1.7GHz, 2.4GHz-2.5GHz, 4.8GHz-6.0GHz. If the user-defined frequency is outside of range, reports error message "Settings conflict; Frequency is outside available range"

### 6.1.9.8 Rx/Tx Coupling

Allows coupling between the frequency of the Internal Source, RF Output Frequency, and the instrument Center Frequency. For all settings except **NONE**, this parameter couples the **Center Frequency** of the instrument to the RF Output Frequency of the source. Valid setting changes result in the Analyzer CF and RF Output Frequency parameters being set to the same value, plus the "Rx/Tx Offset" on page 620.

The four states for coupling are:

|                 |                                                                                                                                                                                                                                                                                                                                                 |
|-----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>SOURce</b>   | Source follows Analyzer<br>Coupling is in one direction only. Changes to the Center Frequency will result in the RF Output Frequency being set to the same value, with any Rx/Tx Frequency Offset applied. Changes to the RF Output Frequency will not change the Center Frequency and will change Rx/Tx Frequency Coupling to None             |
| <b>ANALyzer</b> | Analyzer follows Source<br>Coupling is in one direction only. Changes to the RF Output Frequency will result in the Center Frequency being set to the same value, with any Rx/Tx Frequency Offset applied. Changes to the Center Frequency will not change the RF Output Frequency and will change Rx/Tx Frequency Coupling to None             |
| <b>BOTH</b>     | Analyzer/Source Coupled<br>Coupling is bi-directional. Changes to the Center Frequency will result in the RF Output Frequency being set to the same value, with any Rx/Tx Frequency Offset applied. Changes to the RF Output Frequency will result in the Center Frequency being set to the same value, with any Rx/Tx Frequency Offset applied |
| <b>NONE</b>     | None<br>RF Output Frequency and CF Frequency are independently controlled                                                                                                                                                                                                                                                                       |

|                |                                                                                                                     |
|----------------|---------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SOURce:FREQuency:COUPling NONE   BOTH   SOURce   ANALyzer</code><br><code>:SOURce:FREQuency:COUPling?</code> |
| Example        | <code>:SOUR:FREQ:COUP BOTH</code>                                                                                   |
| Dependencies   | Only appears in Radio Test Mode                                                                                     |
| Preset         | <b>NONE</b><br>Input/Output Preset                                                                                  |
| State Saved    | Yes                                                                                                                 |

### 6.1.9.9 Rx/Tx Offset

Lets you offset the RF Output Frequency of the source from the **Center Frequency** of the instrument. See "Rx/Tx Coupling" on page 620 for coupling behavior.

|                |                                                                                                                |
|----------------|----------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SOURce:FREQuency:COUPling:OFFSet &lt;freq&gt;</code><br><code>:SOURce:FREQuency:COUPling:OFFSet?</code> |
|----------------|----------------------------------------------------------------------------------------------------------------|



## 6 Input/Output

### 6.1 RF Source

|              |                                                                                                                                                                                                                                                                                                                   |          |
|--------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| Example      | :SOUR:FREQ:COUP:OFF 100 kHz                                                                                                                                                                                                                                                                                       |          |
| Dependencies | Grayed-out when "Rx/Tx Coupling" on page 620 is set to NONE. If the grayed-out control is selected, the following message appears:<br>"The parameter cannot be changed when Rx/Tx Coupling is Off"<br>Only appears in Radio Test Mode                                                                             |          |
| Preset       | 0 Hz (Input/Output Preset)                                                                                                                                                                                                                                                                                        |          |
| Min          | -6 GHz                                                                                                                                                                                                                                                                                                            |          |
| Max          | Hardware Dependent:                                                                                                                                                                                                                                                                                               |          |
|              | Option 503                                                                                                                                                                                                                                                                                                        | 3.6 GHz  |
|              | Option 504                                                                                                                                                                                                                                                                                                        | 3.8 GHz  |
|              | Option 506                                                                                                                                                                                                                                                                                                        | 6.00 GHz |
|              | For E7760B: Dependent on port selected<br>For E6640A, if license 5WC is present, the frequency range should be limited to: 1.1GHz-1.7GHz, 2.4GHz-2.5GHz, 4.8GHz-6.0GHz. If the user-defined frequency is outside of range, UI reports an error message: "Settings conflict; Frequency is outside available range" |          |

#### 6.1.10 Modulation

Lets you toggle the state of modulation.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |  |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| Remote Command | <code>:OUTPut:MODulation[:STATe] ON   OFF   1   0</code><br><code>:OUTPut:MODulation[:STATe]?</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |
| Example        | <code>:OUTP:MOD OFF</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |  |
| Notes          | <p>This setting is for independent mode and has no effect on the "List Sequencer" on page 578. If <b>Sequencer</b> is <b>ON</b>, the List Sequencer controls the source output, and this key is grayed-out</p> <p>When <b>Sequencer</b> is <b>OFF</b>, source leaves List Sequencer, and this setting is blanked out, taking effect immediately</p> <p>When Modulation is <b>ON</b>, the "MOD" annunciator is displayed in the system settings panel. When Modulation is <b>OFF</b>, the "MOD" annunciator is cleared</p> <p>If <b>Sequencer</b> is <b>ON</b>, the "MOD" annunciator will be replaced by "SEQ" in the system settings panel, indicating that the output is controlled by List Sequencer</p> |  |
| Preset         | <b>OFF</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |  |
| Range          | <b>ON OFF</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |  |

#### 6.1.11 Modulation Setup

Allows access to the menus for setting up the available modulation types.

Not available in E7760B.

AM/FM/PM are not available for VXT models M9415A/16A and M9415E/16E .

### 6.1.11.1 AM

Enables or disables amplitude modulation.

Turning **AMON** when another modulation format is already on results in the previous modulation format being turned off, and generates an error.

|                |                                                                                  |
|----------------|----------------------------------------------------------------------------------|
| Remote Command | <code>:SOURce:AM:STATe ON   OFF   1   0</code><br><code>:SOURce:AM:STATe?</code> |
| Example        | <code>:SOUR:AM:STAT OFF</code>                                                   |
| Dependencies   | Not available in E7760B                                                          |
| Preset         | <b>OFF</b>                                                                       |
| Range          | <b>ON OFF</b>                                                                    |

### 6.1.11.2 AM Mod Depth

Lets you set the amplitude modulation depth in percent.

|                |                                                                                                    |
|----------------|----------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SOURce:AM[:DEPTh][:LINear] &lt;real&gt;</code><br><code>:SOURce:AM[:DEPTh][:LINear]?</code> |
| Example        | <code>:SOUR:AM 0.1</code>                                                                          |
| Dependencies   | Not available in E7760B                                                                            |
| Preset         | 0.1 %                                                                                              |
| Min            | 0.1 %                                                                                              |
| Max            | 95.0 %                                                                                             |

### 6.1.11.3 AM Rate

Lets you set the internal amplitude modulation rate.

|                |                                                                                                        |
|----------------|--------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SOURce:AM:INTernal:FREQuency &lt;freq&gt;</code><br><code>:SOURce:AM:INTernal:FREQuency?</code> |
| Example        | <code>:SOUR:AM:INT:FREQ 40.0 Hz</code>                                                                 |
| Dependencies   | Not available in E7760B                                                                                |
| Preset         | 400.0 Hz                                                                                               |
| Min            | 10 Hz                                                                                                  |
| Max            | 40 kHz                                                                                                 |

#### 6.1.11.4 AM Rate Increment

Changes the step size for "AM Rate" on page 622. Once an increment size has been selected and **AM Rate** is active, the step keys (and the **UP | DOWN** parameters for **AM Rate** from remote commands) change **AM Rate** by the increment value.

|                |                                                                                                                                          |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SOURce:AM:INTernal:FREQuency:STEP[:INCRement] &lt;freq&gt;</code><br><code>:SOURce:AM:INTernal:FREQuency:STEP[:INCRement]?</code> |
| Example        | <code>:SOUR:AM:INT:FREQ:STEP 100 Hz</code><br><code>:SOUR:AM:INT:FREQ:STEP?</code>                                                       |
| Couplings      | Coupled to the increment size of <b>AM Rate</b>                                                                                          |
| Preset         | 10 Hz                                                                                                                                    |
| State Saved    | Yes                                                                                                                                      |
| Min            | 1 Hz                                                                                                                                     |
| Max            | 40 kHz                                                                                                                                   |

#### 6.1.11.5 FM

Enables or disables frequency modulation.

Turning **FMON** when another modulation format is already on results in the previous modulation format being turned off and the generation of an error.

|                |                                                                                  |
|----------------|----------------------------------------------------------------------------------|
| Remote Command | <code>:SOURce:FM:STATe ON   OFF   1   0</code><br><code>:SOURce:FM:STATe?</code> |
| Example        | <code>:SOUR:FM:STAT OFF</code>                                                   |
| Dependencies   | Not available in E7760B                                                          |
| Preset         | <b>OFF</b>                                                                       |
| Range          | <b>ON OFF</b>                                                                    |

#### 6.1.11.6 FM Deviation

Lets you set the frequency modulation deviation.

|                |                                                                                          |
|----------------|------------------------------------------------------------------------------------------|
| Remote Command | <code>:SOURce:FM[:DEViation] &lt;freq&gt;</code><br><code>:SOURce:FM[:DEViation]?</code> |
| Example        | <code>:SOUR:FM 1.00 kHz</code>                                                           |
| Dependencies   | Not available in E7760B                                                                  |
| Preset         | 1.00 Hz                                                                                  |

|     |            |
|-----|------------|
| Min | 1.00 Hz    |
| Max | 100.00 kHz |

### 6.1.11.7 FM Rate

Lets you set the internal frequency modulation rate.

|                |                                                                                                        |
|----------------|--------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SOURce:FM:INTernal:FREQuency &lt;freq&gt;</code><br><code>:SOURce:FM:INTernal:FREQuency?</code> |
| Example        | <code>:SOUR:FM:INT:FREQ 40.0 Hz</code>                                                                 |
| Dependencies   | Not available in E7760B                                                                                |
| Preset         | 400.0 Hz                                                                                               |
| Min            | 10 Hz                                                                                                  |
| Max            | 40 kHz                                                                                                 |

### 6.1.11.8 FM Rate Increment

Changes the step size for "FM Rate" on page 624. Once an increment size has been selected and **FM Rate** is active, the step keys (and the [UP | DOWN](#) parameters for **FM Rate** from remote commands) change **FM Rate** by the increment value.

|                |                                                                                                                                          |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SOURce:FM:INTernal:FREQuency:STEP[:INCRement] &lt;freq&gt;</code><br><code>:SOURce:FM:INTernal:FREQuency:STEP[:INCRement]?</code> |
| Example        | <code>:SOUR:FM:INT:FREQ:STEP 100 Hz</code><br><code>:SOUR:FM:INT:FREQ:STEP?</code>                                                       |
| Couplings      | Coupled to the increment size of <b>FM Rate</b>                                                                                          |
| Preset         | 10 Hz                                                                                                                                    |
| State Saved    | Yes                                                                                                                                      |
| Min            | 1 Hz                                                                                                                                     |
| Max            | 40 kHz                                                                                                                                   |

### 6.1.11.9 PM

Enables or disables phase modulation.

Turning [PMON](#) when another modulation format is already on results in the previous modulation format being turned [OFF](#) and the generation of an error.

|                |                                                                                  |
|----------------|----------------------------------------------------------------------------------|
| Remote Command | <code>:SOURce:PM:STATe ON   OFF   1   0</code><br><code>:SOURce:PM:STATe?</code> |
|----------------|----------------------------------------------------------------------------------|

|              |                                |
|--------------|--------------------------------|
| Example      | <code>:SOUR:PM:STAT OFF</code> |
| Dependencies | Not available in E7760B        |
| Preset       | <code>OFF</code>               |
| Range        | <code>ON OFF</code>            |

6.1.11.10 PM Deviation

Lets you set the phase modulation deviation in radian.

| Remote Command  | <code>:SOURce:PM[:DEViation] &lt;real&gt;</code><br><code>:SOURce:PM[:DEViation]?</code>                                                                 |  |                 |       |            |          |            |          |
|-----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|--|-----------------|-------|------------|----------|------------|----------|
| Example         | <code>:SOUR:PM 1.00</code>                                                                                                                               |  |                 |       |            |          |            |          |
| Dependencies    | Not available in E7760B                                                                                                                                  |  |                 |       |            |          |            |          |
| Preset          | 0.1 rad                                                                                                                                                  |  |                 |       |            |          |            |          |
| Min             | 0.1 rad                                                                                                                                                  |  |                 |       |            |          |            |          |
| Max             | <table><tr><th>Instrument Type</th><th>Value</th></tr><tr><td>M9410A/11A</td><td>10.0 rad</td></tr><tr><td>All Others</td><td>20.0 rad</td></tr></table> |  | Instrument Type | Value | M9410A/11A | 10.0 rad | All Others | 20.0 rad |
| Instrument Type | Value                                                                                                                                                    |  |                 |       |            |          |            |          |
| M9410A/11A      | 10.0 rad                                                                                                                                                 |  |                 |       |            |          |            |          |
| All Others      | 20.0 rad                                                                                                                                                 |  |                 |       |            |          |            |          |

6.1.11.11 PM Rate

Lets you set the internal phase modulation rate.

|                |                                                                                                        |  |
|----------------|--------------------------------------------------------------------------------------------------------|--|
| Remote Command | <code>:SOURce:PM:INTernal:FREQuency &lt;freq&gt;</code><br><code>:SOURce:PM:INTernal:FREQuency?</code> |  |
| Example        | <code>:SOUR:PM:INT:FREQ 40.0 Hz</code>                                                                 |  |
| Dependencies   | Not available in E7760B                                                                                |  |
| Preset         | 400.0 Hz                                                                                               |  |
| Min            | 10 Hz                                                                                                  |  |
| Max            | 40 kHz                                                                                                 |  |

6.1.11.12 PM Rate Increment

Changes the step size for "PM Rate" on page 625. Once an increment size has been selected and **PM Rate** is active, the step keys (and the `UP | DOWN` parameters for **PM Rate** from remote commands) change **PM Rate** by the increment value.

|                |                                                                                                                                          |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SOURce:PM:INTernal:FREQuency:STEP[:INCRement] &lt;freq&gt;</code><br><code>:SOURce:PM:INTernal:FREQuency:STEP[:INCRement]?</code> |
| Example        | <code>:SOUR:PM:INT:FREQ:STEP 100 Hz</code><br><code>:SOUR:PM:INT:FREQ:STEP?</code>                                                       |
| Couplings      | Coupled to the increment size of PM Rate                                                                                                 |
| Preset         | 10 Hz                                                                                                                                    |
| State Saved    | Yes                                                                                                                                      |
| Min            | 1 Hz                                                                                                                                     |
| Max            | 40 kHz                                                                                                                                   |

### 6.1.11.13 ARB Setup

Accesses menus for setting up the Arbitrary Waveform Generator.

#### Basic Control

Lets you set up the basic ARB parameters and select a waveform to play.

#### ARB State

Lets you toggle the state of the ARB function. When the ARB is **ON**, a “MOD” annunciator is displayed in the system settings panel. When the ARB is **OFF**, the MOD annunciator is cleared

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SOURce:RADio:ARB[:STATe] ON   OFF   1   0</code><br><code>:SOURce:RADio:ARB[:STATe]?</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Example        | <code>:SOUR:RAD:ARB OFF</code><br><code>:SOUR:RAD:ARB?</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Notes          | If ARB is <b>ON</b> , and you then load or delete another file to ARB memory, the playing waveform segment may not keep phase continuity during the ARB memory operation. The waveform will be replayed after the ARB operation is finished                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Dependencies   | <p>This setting is for the independent mode, and has no effect on "<a href="#">List Sequencer</a>" on page 578. If <b>Sequencer</b> is <b>ON</b>, this will make the source enter List Sequencer mode, and even if ARB state is <b>ON</b>, the ARB file will not be played. When <b>Sequencer</b> is <b>OFF</b>, source leaves List Sequencer and this setting takes effect immediately</p> <p>The ARB can only be turned on when there is a waveform file selected for playback. On the GUI, If no waveform is selected, this key is grayed out. If you send the SCPI command to turn the ARB on with no waveform selected for playback, the ARB state remains <b>OFF</b> and an error is generated</p> <p>-If you try to recall a certain set of states in which the selected waveform is not in ARB memory and the ARB state is <b>ON</b>, errors are reported</p> |

## 6 Input/Output

### 6.1 RF Source

|        |        |
|--------|--------|
| Preset | OFF    |
| Range  | ON OFF |

## Sample Rate

Lets you set the ARB waveform playback sample rate.

See ["More Information" on page 628](#)

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                            |          |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| Remote Command | :SOURce:RADio:ARB:SCLock:RATE <freq><br>:SOURce:RADio:ARB:SCLock:RATE?                                                                                                                                                                                                                                                                                                                                                                                     |          |
| Example        | :SOUR:RAD:ARB:SCL:RATE 48.00 MHz                                                                                                                                                                                                                                                                                                                                                                                                                           |          |
| Notes          | If there is a sample rate specified in the header of the waveform file, changing that sample rate is not recommended, as it may cause problems with burst timing<br>For E7760B, the Sample Rate is fixed. If this control is attempted to be set the error -221, "Settings conflict; Sample Rate is fixed" is generated                                                                                                                                    |          |
| Dependencies   | When a new waveform is selected for playback the settings contained within the associated waveform header file are applied to the ARB. The sample rate is one of the values stored within the header file. If the newly selected waveform file has an associated header file, the sample rate is updated with the value from the header file. The sample rate will remain unchanged if the newly selected waveform does not have an associated header file |          |
| Preset         | E7760B                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 2.64 GHz |
|                | Option B40                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 50 MHz   |
|                | Option B85                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 100 MHz  |
|                | Option B1X                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 200 MHz  |
|                | Option B3X                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 375 MHz  |
|                | Option B6X                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 750 MHz  |
|                | Option B4X                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 500 MHz  |
|                | Option B8X                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 1.0 GHz  |
|                | Option B12                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 1.5 GHz  |
| Min            | E7760B: 2.64 GHz<br>All Others: 1.00 kHz                                                                                                                                                                                                                                                                                                                                                                                                                   |          |
| Max            | Hardware Dependent:<br>E7760B 2.64 GHz                                                                                                                                                                                                                                                                                                                                                                                                                     |          |

|                                      |            |         |
|--------------------------------------|------------|---------|
| VXT model M9420A                     | Option B40 | 50 MHz  |
|                                      | Option B85 | 100 MHz |
|                                      | Option B1X | 200 MHz |
| VXT models M9410A/11A and M9410E/11E | Option B40 | 50 MHz  |
|                                      | Option B3X | 375 MHz |
|                                      | Option B6X | 750 MHz |
|                                      | Option B12 | 1.5 GHz |
| VXT models M9415A/16A and M9415E/16E | Option B4X | 500 MHz |
|                                      | Option B8X | 1.0 GHz |
|                                      | Option B12 | 1.5 GHz |

For VXT models M9410A/11A/15A/16A, M9410E/11E/15E/16E and E6680A/81A, the sample rate is only limited by the option, but the IF BW is limited by center frequency in addition to options. See ["More Information" on page 628](#). Performance is guaranteed only when the bandwidth of the selected waveform is smaller than the Max IF BW

### More Information

Although the range of Sample Rate only depends on the installed option, the Maximum IF BW depends on options as well as the Center Frequency.

## VXT models M9410A/11A, E6680A and E6681A

Option Limitation:

| Option | Maximum IF BW |
|--------|---------------|
| B40    | 40 MHz        |
| B3X    | 300 MHz       |
| B6X    | 600 MHz       |
| B12    | 1200 MHz      |

Center Frequency Limitation:

| Center Frequency             | Maximum IF BW                |
|------------------------------|------------------------------|
| 6.5 kHz ~ 9 kHz (Option LFE) | $(CF - 6.5 \text{ kHz}) * 2$ |
| 9 kHz ~ 100 kHz (Option LFE) | 5 kHz                        |
| 100 kHz ~ 1 MHz (Option LFE) | 50 kHz                       |
| 1 MHz ~ 10 MHz (Option LFE)  | 500 kHz                      |
| 10 MHz ~ 20 MHz (Option LFE) | 5 MHz                        |
| 20 MHz ~ 60 MHz (Option LFE) | 10 MHz                       |



6 Input/Output  
6.1 RF Source

| Center Frequency                         | Maximum IF BW                 |
|------------------------------------------|-------------------------------|
| 60 MHz ~ 80 MHz (Option LFE)             | 20 MHz                        |
| 80 MHz ~ 380 MHz (Option LFE)            | 40 MHz                        |
| 330 MHz ~ 380 MHz (without Option LFE)   | $(CF - 330 \text{ MHz}) * 2$  |
| 380 MHz ~ 550 MHz                        | 100 MHz                       |
| 550 MHz ~ 1310 MHz                       | 200 MHz                       |
| 1310 MHz ~ 2000 MHz (without Option EP6) | 600 MHz                       |
| 2000 MHz ~ 5480 MHz (without Option EP6) | 1200 MHz                      |
| 5480 MHz ~ 6080 MHz (without Option EP6) | $(6080 \text{ MHz} - CF) * 2$ |
| 1310 MHz ~ 1900 MHz (Option EP6)         | 600 MHz                       |
| 1900 MHz ~ 6000 MHz (Option EP6)         | 1200 MHz                      |
| 6000 MHz ~ 6600 MHz (Option EP6)         | $(6600 \text{ MHz} - CF) * 2$ |

## VXT models M9415A/16A

Option Limitation:

| Option | Maximum IF BW |
|--------|---------------|
| B4X    | 400 MHz       |
| B8X    | 800 MHz       |
| B12    | 1200 MHz      |

Center Frequency Limitation:

| Center Frequency      | Maximum IF BW                  |
|-----------------------|--------------------------------|
| 330 MHz ~ 380 MHz     | $(CF - 330 \text{ MHz}) * 2$   |
| 380 MHz ~ 550 MHz     | 100 MHz                        |
| 550 MHz ~ 1310 MHz    | 200 MHz                        |
| 1310 MHz ~ 2000 MHz   | 600 MHz                        |
| 2000 MHz ~ 12300 MHz  | 1200 MHz                       |
| 12300 MHz ~ 12900 MHz | $(12900 \text{ MHz} - CF) * 2$ |

## M9410E/11E

Option Limitation:

| Option | Maximum IF BW |
|--------|---------------|
| B40    | 40 MHz        |
| B3X    | 300 MHz       |

| Option | Maximum IF BW |
|--------|---------------|
| B6X    | 600 MHz       |
| B12    | 1200 MHz      |

Center Frequency Limitation:

| Center Frequency                         | Maximum IF BW                                   |
|------------------------------------------|-------------------------------------------------|
| 1 MHz ~ 10 MHz (Option LFE)              | 500 kHz                                         |
| 10 MHz ~ 20 MHz (Option LFE)             | 5 MHz                                           |
| 20 MHz ~ 60 MHz (Option LFE)             | 10 MHz                                          |
| 60 MHz ~ 80 MHz (Option LFE)             | 20 MHz                                          |
| 80 MHz ~ 380 MHz (Option LFE)            | 40 MHz                                          |
| 330 MHz ~ 380 MHz (without Option LFE)   | (CF - 330 MHz) * 2                              |
| 380 MHz ~ 550 MHz                        | 100 MHz                                         |
| 550 MHz ~ 1310 MHz                       | 200 MHz                                         |
| 1310 MHz ~ 2000 MHz (without Option EP6) | 600 MHz                                         |
| 2000 MHz ~ 25.9 GHz (without Option EP6) | 1200 MHz                                        |
| 1310 MHz ~ 1900 MHz (Option EP6)         | 600 MHz                                         |
| 1900 MHz ~ 25.9 GHz (Option EP6)         | 1200 MHz                                        |
| 25.9 GHz ~ 26.5 GHz                      | Min(Max BW by option, 2*(26.5 GHz-Center Freq)) |

## M9415E/16E

Option Limitation:

| Option | Maximum IF BW |
|--------|---------------|
| B4X    | 400 MHz       |
| B8X    | 800 MHz       |
| B12    | 1200 MHz      |

Center Frequency Limitation:

| Center Frequency                       | Maximum IF BW      |
|----------------------------------------|--------------------|
| 1 MHz ~ 10 MHz (Option LFE)            | 500 kHz            |
| 10 MHz ~ 20 MHz (Option LFE)           | 5 MHz              |
| 20 MHz ~ 60 MHz (Option LFE)           | 10 MHz             |
| 60 MHz ~ 80 MHz (Option LFE)           | 20 MHz             |
| 80 MHz ~ 380 MHz (Option LFE)          | 40 MHz             |
| 330 MHz ~ 380 MHz (without Option LFE) | (CF - 330 MHz) * 2 |
| 380 MHz ~ 550 MHz                      | 100 MHz            |

## 6 Input/Output

### 6.1 RF Source

| Center Frequency    | Maximum IF BW                                                              |
|---------------------|----------------------------------------------------------------------------|
| 550 MHz ~ 1310 MHz  | 200 MHz                                                                    |
| 1310 MHz ~ 2000 MHz | 600 MHz                                                                    |
| 2000 MHz ~ 25.9 GHz | 1200 MHz                                                                   |
| 25.9 GHz ~ 26.5 GHz | Min(Max BW by option, $2 \times (26.5 \text{ GHz} - \text{Center Freq})$ ) |

## Run-Time Scaling

Lets you adjust the run-time scaling value. The run-time scaling value is applied in real-time while the waveform is playing.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SOURce:RADio:ARB:RSCaling &lt;real&gt;</code><br><code>:SOURce:RADio:ARB:RSCaling?</code>                                                                                                                                                                                                                                                                                                                                                                          |
| Example        | <code>:SOUR:RAD:ARB:RSC 100.00</code>                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Notes          | Cannot be set in EXM and VXT. Grayed-out in menu, and the value is fixed at 70.00%                                                                                                                                                                                                                                                                                                                                                                                        |
| Dependencies   | When a new waveform is selected for playback the settings contained within the associated waveform header file are applied to the ARB. The run-time scaling is one of the values stored within the header file. If the newly selected waveform file has an associated header file, the run-time scaling is updated with the value from the header file. The run-time scaling will remain unchanged if the newly selected waveform does not have an associated header file |
| Preset         | 70.00 %                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Min            | 1.00 %                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Max            | 100.00 %                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |

## Baseband Freq Offs

Lets you adjust the value by which the baseband frequency is offset relative to the carrier.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SOURce:RADio:ARB:BASEband:FREQuency:OFFSet &lt;freq&gt;</code><br><code>:SOURce:RADio:ARB:BASEband:FREQuency:OFFSet?</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Example        | <code>:SOUR:RAD:ARB:BAS:FREQ:OFFS 0.00 Hz</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Dependencies   | <p>When a new waveform is selected for playback the settings contained within the associated waveform header file are applied to the ARB. The baseband frequency offset is one of the values stored within the header file. If the newly selected waveform file has an associated header file, the baseband frequency offset is updated with the value from the header file. The baseband frequency offset will remain unchanged if the newly selected waveform does not have an associated header file</p> <p>For VXT models M9410A/11A/15A/16A (and associated with M9470A/71A), the settable range can be found in <a href="#">Parameters for VXT models</a>. However, the signal could be filtered when the offset exceeds current max IF BW</p> <p>Not available in E7760B</p> |

|        |            |
|--------|------------|
| Preset | 0.00 Hz    |
| Min    | -50.00 MHz |
| Max    | 50.00 MHz  |

### Parameters for VXT models

| Models                                       | Option     | Minimum  | Maximum |
|----------------------------------------------|------------|----------|---------|
| VXT models M9410A/11A, M9410E/11E and M8920B | Option B40 | -20 MHz  | 20 MHz  |
|                                              | Option B3X | -150 MHz | 150 MHz |
|                                              | Option B6X | -300 MHz | 300 MHz |
|                                              | Option B12 | -600 MHz | 600 MHz |
| VXT models M9415A/16A and M9415E/16E         | Option B4X | -200 MHz | 200 MHz |
|                                              | Option B8X | -400 MHz | 400 MHz |
|                                              | Option B12 | -600 MHz | 600 MHz |

## Baseband Power

Lets you quickly control the power of the modulator prior to up-conversion to the RF carrier.

|                |                                                                                                                                                                                                                                                                             |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SOURce:RADio:ARB:BASEband:POWer &lt;ampl&gt;</code><br><code>:SOURce:RADio:ARB:BASEband:POWer?</code>                                                                                                                                                                |
| Example        | <code>:SOUR:RAD:ARB:BAS:POW -10 dB</code>                                                                                                                                                                                                                                   |
| Notes          | The Source Power level equals RF Power plus Baseband Power. For example, if the RF Power is set to -10 dBm and the Baseband Power is set to -4 dB, the actual Source Power level is -14 dBm<br>Can be used to change the output level very quickly compared to the RF Power |
| Dependencies   | Only appears in VXT models M9410A/11A/15A/16A and M9410E/11E/15E/16E                                                                                                                                                                                                        |
| Preset         | 0 dB                                                                                                                                                                                                                                                                        |
| Min            | -50 dB                                                                                                                                                                                                                                                                      |
| Max            | 20 dB                                                                                                                                                                                                                                                                       |

## Mkr 1-4 Polarity

Lets you set the polarity of markers 1 through 4 respectively.

|                |                                                                                                                                       |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SOURce:RADio:ARB:MPOLarity:MARKer1 ... 4 POSitive   NEGative</code><br><code>:SOURce:RADio:ARB:MPOLarity:MARKer1 ... 4?</code> |
| Example        | <code>:SOUR:RAD:ARB:MPOL:MARK1 NEG</code>                                                                                             |
| Dependencies   | When a new waveform is selected for playback the settings contained within the associated waveform                                    |

|        |                                                                                                                                                                                                                                                                                                                                                                                                |
|--------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|        | header file are applied to the ARB. The marker polarity is one of the values stored within the header file. If the newly selected waveform file has an associated header file, the marker polarity is updated with the value from the header file. The marker polarity will remain unchanged if the newly selected waveform does not have an associated header file<br>Not available in E7760B |
| Preset | POSitive                                                                                                                                                                                                                                                                                                                                                                                       |
| Range  | POSitive NEGative                                                                                                                                                                                                                                                                                                                                                                              |

### Clear Marker (Remote Command Only)

Let you clear a single marker point or a range of marker points on a waveform segment for the selected marker (1-4).

|                |                                                                                                                      |
|----------------|----------------------------------------------------------------------------------------------------------------------|
| Remote Command | :SOURce:RADio:ARB:MARKer:CLEar <file_name>, <marker>, <first_point>, <last_point>                                    |
| Example        | :SOUR:RAD:ARB:MARK:CLE "Test_data",1,1,30                                                                            |
| Dependencies   | Available in VXT models M9410A/11A/15A/16A and M9410E/11E/15E/16E                                                    |
| Range          | <marker>: 1-4<br><first_point>: 1-number of waveform points<br><last_point>: <first_point>-number of waveform points |

#### For Setup SCPI

For the Setup SCPI command, the parameters are:

<filename> - String Type

Specifies the name of the waveform file in volatile waveform memory.

<marker> - Integer Type

Selects the marker number, an integer value from one to four.

<first\_point> - Integer Type

Defines the first point in a range of points. The number must be greater than or equal to one, and less than or equal to the total number of waveform points.

<last\_point> - Integer Type

Defines the last point in a range of points. The number must be greater than or equal to the first point, and less than or equal to the total number of waveform points.

To clear a single marker point, use the same marker point for the first and the last point variables.

Error Checks for Setup SCPI command:

If you specify a filename does not exist in volatile waveform memory, an error is generated.

If you specify marker less than 1 or larger than 4, an error is generated.

If you specify the first point less than 1, an error is generated.

If you specify the last point less than 1, an error is generated.

If you specify first point larger than last point, an error is generated.

If you specify last point larger than number of waveform points, an error is generated.

## Pulse/RF Blank

Lets you select which marker is used for **Pulse/RF Blank** . This function blanks the RF when the marker signal goes low. The marker polarity determines when the marker signal is high. For a positive polarity, this is during the marker points. For a negative polarity, this is when there are no marker points.

Marker points should be set before using this function. Enabling this function without setting maker points may create a continuous low or high signal, dependent on the marker polarity. This causes either no RF output, or a continuous RF output.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SOURce:RADio:ARB:MDEStination:PULSe NONE   M1   M2   M3   M4</code><br>For option details, see <a href="#">"More Information" on page 634</a><br><code>:SOURce:RADio:ARB:MDEStination:PULSe?</code>                                                                                                                                                                                                                                                                                                   |
| Example        | <code>:SOUR:RAD:ARB:MDES:PULS NONE</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Dependencies   | When a new waveform is selected for playback the settings contained within the associated waveform header file are applied to the ARB. The <b>Pulse/RF Blank</b> setting is one of the values stored within the header file. If the newly selected waveform file has an associated header file, the <b>Pulse/RF Blank</b> setting is updated with the value from the header file. The <b>Pulse/RF Blank</b> setting remains unchanged if the newly selected waveform does not have an associated header file |
| Range          | <code>NONE   M1   M2   M3   M4</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |

## More Information

| Parameter | SCPI              | Notes                                                                                                          |
|-----------|-------------------|----------------------------------------------------------------------------------------------------------------|
| None      | <code>NONE</code> | Sets no marker to be used for <b>Pulse/RF Blank</b> function, essentially turning the RF blanking function off |
| Marker 1  | <code>M1</code>   | Sets marker 1 to be used for <b>Pulse/RF Blank</b>                                                             |
| Marker 2  | <code>M2</code>   | Sets marker 2 to be used for <b>Pulse/RF Blank</b>                                                             |
| Marker 3  | <code>M3</code>   | Sets marker 3 to be used for <b>Pulse/RF Blank</b>                                                             |
| Marker 4  | <code>M4</code>   | Sets marker 4 to be used for <b>Pulse/RF Blank</b>                                                             |

## ALC Hold

Lets you specify which marker is routed for use within **ALC Hold**. This function holds the ALC circuitry at the average value of the sample points set by the marker.

**ALC Hold** operates during the low periods of the marker signal. The marker polarity determines when the marker signal is high. For positive polarity, this is during the marker points. For a negative polarity, this is when there are no maker points.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SOURce:RADio:ARB:MDEStination:ALCHold NONE   M1   M2   M3   M4</code><br>For option details, see <a href="#">"Option Details" on page 635</a><br><code>:SOURce:RADio:ARB:MDEStination:ALCHold?</code>                                                                                                                                                                                                                                                                                                                                                                    |
| Example        | <code>:SOUR:RAD:ARB:MDES:ALCH NONE</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Dependencies   | When a new waveform is selected for playback the settings contained within the associated waveform header file are applied to the ARB. The <b>ALC Hold</b> setting is one of the values stored within the header file. If the newly selected waveform file has an associated header file, the <b>ALC Hold</b> setting is updated with the value from the header file. The <b>ALC Hold</b> setting remains unchanged if the newly selected waveform does not have an associated header file<br>Not available in E7760B, and VXT models M9410A/11A/15A/16A and M9410E/11E/15E/16E |
| Range          | <code>NONE   M1   M2   M3   M4</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |

### Option Details

| Parameter | SCPI              | Notes                                                                       |
|-----------|-------------------|-----------------------------------------------------------------------------|
| None      | <code>NONE</code> | Use no marker for <b>ALC Hold</b> , essentially turning <b>ALC Hold</b> off |
| Marker 1  | <code>M1</code>   | Use marker 1 for <b>ALC Hold</b>                                            |
| Marker 2  | <code>M2</code>   | Use marker 2 for <b>ALC Hold</b>                                            |
| Marker 3  | <code>M3</code>   | Use marker 3 for <b>ALC Hold</b>                                            |
| Marker 4  | <code>M4</code>   | Use marker 4 for <b>ALC Hold</b>                                            |

## Trigger Type

Determines the behavior of the waveform when it plays.

|                |                                                                                                                            |
|----------------|----------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SOURce:RADio:ARB:TRIGger:TYPE CONTInuous   SINGle   SADVance</code><br><code>:SOURce:RADio:ARB:TRIGger:TYPE?</code> |
| Example        | <code>:SOUR:RAD:ARB:TRIG:TYPE CONT</code><br><code>:SOUR:RAD:ARB:TRIG:TYPE?</code>                                         |
| Preset         | <code>CONTInuous</code>                                                                                                    |
| Range          | Continuous   Single   Seg Adv                                                                                              |

## Continuous trigger

Sets the active trigger type to **Continuous**. If **Continuous** is already selected as the active trigger type, pressing this control allows access to the **Continuous trigger** type setup menu. In **Continuous** trigger mode, the waveform repeats continuously.

|                |                                                                                                                                                                                            |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SOURce:RADio:ARB:TRIGger:TYPE:CONTInuous[:TYPE] FREE   TRIGger   RESet</code><br>See "Option Details" on page 636<br><code>:SOURce:RADio:ARB:TRIGger:TYPE:CONTInuous[:TYPE]?</code> |
| Example        | <code>:SOUR:RAD:ARB:TRIG:TYPE:CONT FREE</code>                                                                                                                                             |
| Preset         | <code>FREE</code>                                                                                                                                                                          |
| Range          | Free Run   Trigger + Run   Reset + Run                                                                                                                                                     |

### Option Details

| Parameter     | SCPI                 | Notes                                                                                                                                                                                                                      |
|---------------|----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Free Run      | <code>FREE</code>    | Sets the waveform generator to play a waveform sequence or segment continuously, without waiting for a trigger. In this mode, the waveform generator does not respond to triggers                                          |
| Trigger + Run | <code>TRIGger</code> | Sets the waveform generator to play a waveform sequence or segment continuously when the first trigger is received, and to ignore any subsequent triggers                                                                  |
| Reset + Run   | <code>RESet</code>   | Sets the waveform generator to play a waveform sequence or segment continuously when the first trigger is received. Subsequent triggers reset the waveform sequence or segment to the start, and then play it continuously |

## Single trigger

Sets the active trigger type to **Single**. If **Single** is already selected as the active trigger type, pressing this control allows access to the single trigger type setup menu. In **Single** trigger mode, the waveform plays once.

|                |                                                                                                                                                                                                                                                                                                                                                        |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SOURce:RADio:ARB:RETRigger ON   OFF   IMMEDIATE</code><br>See "Option Details" on page 637<br><code>:SOURce:RADio:ARB:RETRigger?</code>                                                                                                                                                                                                         |
| Example        | <code>:SOUR:RAD:ARB:RETR OFF</code>                                                                                                                                                                                                                                                                                                                    |
| Notes          | <code>ON</code> : Buffered Trigger<br><code>OFF</code> : No Retrigger<br><code>IMMEDIATE</code> : Restart on Trigger<br>This is defined as an enumerated SCPI command, with <code>ON OFF</code> being considered as enumerated types rather than Boolean. This means the query returns <code>OFF</code> instead of 0, and <code>ON</code> instead of 1 |
| Preset         | <code>ON</code>                                                                                                                                                                                                                                                                                                                                        |



### Option Details

| Parameter          | SCPI      | Notes                                                                                                                                                                                                                                                       |
|--------------------|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| No Retrigger       | OFF       | Sets the waveform generator to play a waveform sequence or segment once when a trigger is received. Any triggers then received during playback are ignored                                                                                                  |
| Buffered Trigger   | ON        | Sets the waveform generator to play a waveform sequence or segment once when a trigger is received. If a trigger is received during playback, the waveform generator plays the sequence or segment to the end, then plays the sequence or segment once more |
| Restart on Trigger | IMMediate | Sets the waveform generator to play a waveform sequence or segment once when a trigger is received. If a trigger is received during playback, the waveform generator resets and plays the sequence or segment from the start                                |

### Segment Advance trigger

Sets the active trigger type to **Segment Advance**. If **Segment Advance** is already selected as the active trigger type, pressing this control allows access to the segment advance trigger type setup menu.

**Segment Advance** triggering allows you to control the playback of waveform segments within a waveform sequence. When a trigger is received the ARB advances to the next waveform segment within the waveform sequence. This type of triggering ignores the repetition count for the waveform segment within the waveform sequence. For example, if a waveform segment has a repetition count of 10 and you select single segment advance triggering mode, the waveform segment will only play once.

**Segment Advance** triggering can also be used for waveform segments only. In this situation, the same waveform segment is played again when a trigger is received.

|                |                                                                                                                                                           |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | :SOURce:RADio:ARB:TRIGger:TYPE:SADVance[:TYPE] SINGle   CONTInuous<br>See "Option Details" on page 637<br>:SOURce:RADio:ARB:TRIGger:TYPE:SADVance[:TYPE]? |
| Example        | :SOUR:RAD:ARB:TRIG:TYPE:SADV SING                                                                                                                         |
| Dependencies   | Not available in E7760B                                                                                                                                   |
| Preset         | CONTInuous                                                                                                                                                |
| Range          | SINGle CONTInuous                                                                                                                                         |

### Option Details

| Parameter | SCPI   | Notes                                                                                                                                                                           |
|-----------|--------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Single    | SINGle | Once a trigger is received a segment is played once. If a trigger is received during playback of a segment, the segment plays to completion and the next segment is played once |

| Parameter        | SCPI              | Notes                                                                                                                                                                                                  |
|------------------|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Continuous       | <b>CONTinuous</b> | Once a trigger is received a segment is played continuously. When subsequent triggers are received, the currently playing segment plays to completion and then the next segment is played continuously |
| Trigger Initiate | Front panel only  | If <b>"Trigger Source" on page 638</b> is set to <b>KEY</b> , initiates an immediate trigger event                                                                                                     |

## Trigger Source

Determines how the source receives the trigger that starts the waveform playing. Grayed-out if **"Trigger Type" on page 635** is free run, since free run triggers immediately with no trigger source required.

|                |                                                                                                                                                              |  |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| Remote Command | :SOURce:RADio:ARB:TRIGger[:SOURce] KEY   BUS   EXTerna11   EXTerna12   PXI<br>See <b>"Option Details" on page 638</b><br>:SOURce:RADio:ARB:TRIGger[:SOURce]? |  |
| Example        | :SOUR:RAD:ARB:TRIG KEY                                                                                                                                       |  |
| Notes          | For E7760B, the available selections are <b>KEY BUS</b>                                                                                                      |  |
| Dependencies   | Grayed-out if <b>Trigger Type</b> is Continuous, Free Run                                                                                                    |  |
| Preset         | <b>EXTerna12</b><br>For E7760B: <b>BUS</b>                                                                                                                   |  |
| Range          | <b>Key   Bus   External1   External 2   PXI</b>                                                                                                              |  |

### Option Details

| Parameter  | SCPI             | Notes                                                                                                                                                                                                                                                                                                                                                                                            |
|------------|------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Key        | <b>KEY</b>       | The waveform is triggered when you press the front panel <b>Trigger</b> key                                                                                                                                                                                                                                                                                                                      |
| Bus        | <b>BUS</b>       | Enables triggering over GPIB, LAN, or USB using:<br>:SOURce:RADio:ARB:TRIGger:INITiate                                                                                                                                                                                                                                                                                                           |
| External 1 | <b>EXTerna11</b> | Enables triggering a waveform by an externally-applied signal                                                                                                                                                                                                                                                                                                                                    |
| External 2 | <b>EXTerna12</b> | Enables triggering a waveform by an externally-applied signal<br>Note: in EXM, trigger 2 is a bi-directional trigger port, so when trigger 2 has been configured as OUTPUT type, selecting External 2 as the input trigger for the current step generates an error<br>Note 2: in VXT model M9420A, triggers on an externally connected trigger source marked <b>Trigger 1</b> on the front panel |
| PXI        | <b>PXI</b>       | Enables triggering a waveform by a PXI backplane Line applied signal                                                                                                                                                                                                                                                                                                                             |

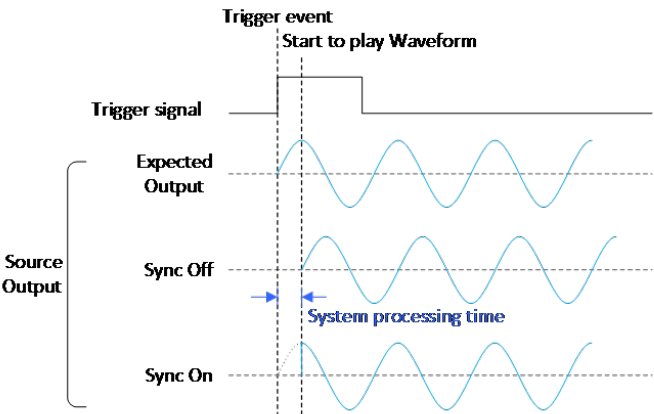
Bus Trigger Command (Remote Command Only)

Used to initiate an immediate trigger event if "Trigger Source" on page 638 is set to BUS.

|                |                                    |
|----------------|------------------------------------|
| Remote Command | :SOURce:RADio:ARB:TRIGger:INITiate |
| Example        | :SOUR:RAD:ARB:TRIG:INIT            |

Sync to Trigger Source

There is a time interval (system processing time) between the trigger event and the beginning of playing waveform. Turn on this control to compensate the system latency at the cost of cutting off the beginning of the ARB. The figure below shows the turn-on and turn-off behavior of the control.



|                |                                                                                                                                                                                                                        |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | :SOURce:RADio:ARB:TRIGger:SYNC[:STATe] ON   OFF   1   0<br>:SOURce:RADio:ARB:TRIGger:SYNC[:STATe]?                                                                                                                     |
| Example        | :SOUR:RAD:ARB:TRIG:SYNC ON<br>:SOUR:RAD:ARB:TRIG:SYNC?                                                                                                                                                                 |
| Notes          | Compensates for the instrument internal latency. The negative trigger delay compensates the external latency (that is, heads and cables). See "External Trigger Delay" on page 640 and "PXI Trigger Delay" on page 642 |

|              |                                                                                                                |
|--------------|----------------------------------------------------------------------------------------------------------------|
|              | The first PerARB trigger is cut off if <b>Sync to Trigger Source</b> is <b>ON</b>                              |
| Dependencies | Only available when <b>"Trigger Source" on page 638</b> is <b>EXternal1</b> , <b>EXternal2</b> , or <b>PXI</b> |
| Preset       | <b>OFF</b>                                                                                                     |
| Range        | <b>ON OFF</b>                                                                                                  |

## External Trigger Delay

Lets you toggle the state and value of external trigger delay. The value you enter sets a delay time between when an external trigger is received and when it is applied to the waveform. Only active if **"Trigger Source" on page 638** is **EXternal1** or **EXternal2**.

Negative trigger delay is only supported by VXT models M9410A/11A/15A/16A and M9410E/11E/15E/16E (see **"More Information" on page 641**).

| Remote Command                | :SOURce:RADio:ARB:TRIGger[:SOURce]:EXternal:DElay <time><br>:SOURce:RADio:ARB:TRIGger[:SOURce]:EXternal:DElay?                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                  |  |                      |       |            |                               |               |                      |                    |               |                      |                            |               |                      |                          |               |                |            |               |                                  |
|-------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|--|----------------------|-------|------------|-------------------------------|---------------|----------------------|--------------------|---------------|----------------------|----------------------------|---------------|----------------------|--------------------------|---------------|----------------|------------|---------------|----------------------------------|
| Example                       | :SOUR:RAD:ARB:TRIG:EXT:DEL 100ns<br>:SOUR:RAD:ARB:TRIG:EXT:DEL?                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                  |  |                      |       |            |                               |               |                      |                    |               |                      |                            |               |                      |                          |               |                |            |               |                                  |
| Notes                         | External trigger delay time set by users will be rounded to the nearest integer multiple of the resolution                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                  |  |                      |       |            |                               |               |                      |                    |               |                      |                            |               |                      |                          |               |                |            |               |                                  |
| Dependencies                  | Unavailable and grayed-out when <b>Trigger Source</b> is not set to <b>EXternal1</b> or <b>EXternal2</b><br>Not available in E7760B                                                                                                                                                                                                                                                                                                                                                                                                                              |                                  |  |                      |       |            |                               |               |                      |                    |               |                      |                            |               |                      |                          |               |                |            |               |                                  |
| Preset                        | 1 ms                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                  |  |                      |       |            |                               |               |                      |                    |               |                      |                            |               |                      |                          |               |                |            |               |                                  |
| Min                           | VXT models M9410A/11A/15A/16A and M9410E/11E/15E/16E: -10 s<br>All others: 0 s                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                  |  |                      |       |            |                               |               |                      |                    |               |                      |                            |               |                      |                          |               |                |            |               |                                  |
| Max                           | <table><tr><th>Instrument/Condition</th><th>Value</th><th>Derivation</th></tr><tr><td>VXT models M9410A/11A/15A/16A</td><td>11.45324612 s</td><td>2.666667ns *(2^32-1)</td></tr><tr><td>M9410E/11E/15E/16E</td><td>11.45324612 s</td><td>2.666667ns *(2^32-1)</td></tr><tr><td>Continuous – Trigger + Run</td><td>11.45324612 s</td><td>2.666667ns *(2^32-1)</td></tr><tr><td>Other trigger conditions</td><td>17.17986918 s</td><td>4 ns *(2^32-1)</td></tr><tr><td>All others</td><td>8.589934588 s</td><td>4ns * (2^31 – 1) = 8589934588 ns</td></tr></table> |                                  |  | Instrument/Condition | Value | Derivation | VXT models M9410A/11A/15A/16A | 11.45324612 s | 2.666667ns *(2^32-1) | M9410E/11E/15E/16E | 11.45324612 s | 2.666667ns *(2^32-1) | Continuous – Trigger + Run | 11.45324612 s | 2.666667ns *(2^32-1) | Other trigger conditions | 17.17986918 s | 4 ns *(2^32-1) | All others | 8.589934588 s | 4ns * (2^31 – 1) = 8589934588 ns |
| Instrument/Condition          | Value                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Derivation                       |  |                      |       |            |                               |               |                      |                    |               |                      |                            |               |                      |                          |               |                |            |               |                                  |
| VXT models M9410A/11A/15A/16A | 11.45324612 s                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 2.666667ns *(2^32-1)             |  |                      |       |            |                               |               |                      |                    |               |                      |                            |               |                      |                          |               |                |            |               |                                  |
| M9410E/11E/15E/16E            | 11.45324612 s                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 2.666667ns *(2^32-1)             |  |                      |       |            |                               |               |                      |                    |               |                      |                            |               |                      |                          |               |                |            |               |                                  |
| Continuous – Trigger + Run    | 11.45324612 s                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 2.666667ns *(2^32-1)             |  |                      |       |            |                               |               |                      |                    |               |                      |                            |               |                      |                          |               |                |            |               |                                  |
| Other trigger conditions      | 17.17986918 s                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 4 ns *(2^32-1)                   |  |                      |       |            |                               |               |                      |                    |               |                      |                            |               |                      |                          |               |                |            |               |                                  |
| All others                    | 8.589934588 s                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 4ns * (2^31 – 1) = 8589934588 ns |  |                      |       |            |                               |               |                      |                    |               |                      |                            |               |                      |                          |               |                |            |               |                                  |

## Auto Function

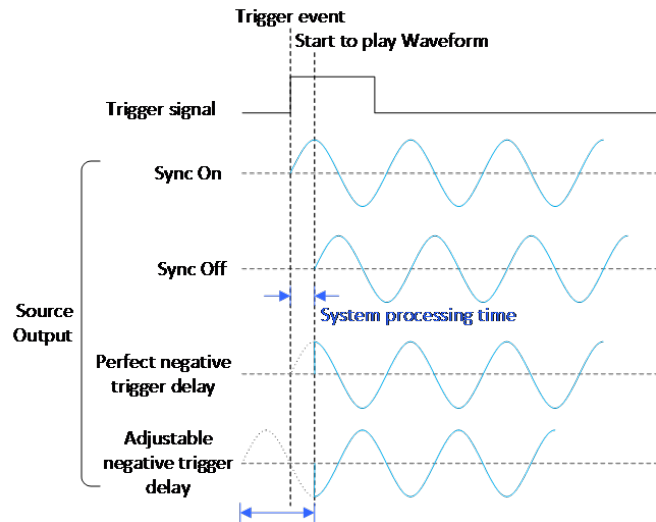
|                |                                                                                                                                      |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | :SOURce:RADio:ARB:TRIGger[:SOURce]:EXternal:DElay:STATe OFF   ON   0   1<br>:SOURce:RADio:ARB:TRIGger[:SOURce]:EXternal:DElay:STATe? |
| Example        | :SOUR:RAD:ARB:TRIG:EXT:DEL:STAT ON<br>:SOUR:RAD:ARB:TRIG:EXT:DEL:STAT?                                                               |

Preset

OFF

## More Information

There is a time interval (system processing time) between the trigger event and the beginning of playing waveform. The figure below shows you the behavior. The negative trigger delay allows you to specify the beginning of a waveform.



Note: the first PerArb trigger signal will be missed when the trigger delay is negative.

## External Trigger Polarity

Sets the polarity of the external trigger. When **POSitive** is selected, trigger event happens on a rising edge of the external trigger in signal. When **NEGative** is selected, trigger event happens on a falling edge of the external trigger in signal.

Active only if "Trigger Source" on page 638 is **EXTernal1** or **EXTernal2**.

Remote Command    `:SOURce:RADio:ARB:TRIGger[:SOURce]:EXTernal:SLOPe POSitive | NEGative`  
                          `:SOURce:RADio:ARB:TRIGger[:SOURce]:EXTernal:SLOPe?`

|              |                                                                                                                                     |
|--------------|-------------------------------------------------------------------------------------------------------------------------------------|
| Example      | <code>:SOUR:RAD:ARB:TRIG:EXT:SLOP POS</code><br><code>:SOUR:RAD:ARB:TRIG:EXT:SLOP?</code>                                           |
| Dependencies | Unavailable and grayed-out when "Trigger Source" on page 638 is not <b>EXTernal1</b> or <b>EXTernal2</b><br>Not available in E7760B |
| Preset       | <b>POSitive</b>                                                                                                                     |
| Range        | <b>POSitive</b>   <b>NEGative</b>                                                                                                   |

## Select PXI Line

Controls which **PXI\_TRIG[0..7]** backplane line is used for the trigger source.

Only appears in modular analyzer products.

|                |                                                                                                                                    |
|----------------|------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SOURce:RADio:ARB:TRIGger[:SOURce]:PXI:LINE &lt;line&gt;</code><br><code>:SOURce:RADio:ARB:TRIGger[:SOURce]:PXI:LINE?</code> |
| Example        | <code>:SOUR:RAD:ARB:TRIG:PXI:LINE 2</code>                                                                                         |
| Dependencies   | Unavailable and grayed-out when "Trigger Source" on page 638 is not set to <b>PXI</b><br>Not available in E7760B                   |
| Preset         | 0                                                                                                                                  |
| State Saved    | Saved in instrument state                                                                                                          |
| Range          | [0,7]                                                                                                                              |

## PXI Trigger Delay

Lets you toggle the state and value of PXI trigger delay. The value you enter sets a delay time between when an PXI trigger is received and when it is applied to the waveform.

Only active if "Trigger Source" on page 638 is **PXI**.

|                |                                                                                                                                      |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SOURce:RADio:ARB:TRIGger[:SOURce]:PXI:DElay &lt;time&gt;</code><br><code>:SOURce:RADio:ARB:TRIGger[:SOURce]:PXI:DElay?</code> |
| Example        | <code>:SOUR:RAD:ARB:TRIG:PXI:DEL 100ns</code><br><code>:SOUR:RAD:ARB:TRIG:PXI:DEL?</code>                                            |
| Notes          | PXI trigger delay time set by users will be rounded to the nearest integer multiple of the resolution                                |
| Dependencies   | Unavailable and grayed-out when "Trigger Source" on page 638 is not <b>PXI</b><br>Not available in E7760B                            |
| Preset         | 1 ms                                                                                                                                 |
| Min            | VXT models M9410A/11A/15A/16A and M9410E/11E/15E/16E: -10 s                                                                          |

## 6 Input/Output

### 6.1 RF Source

| Max | Instrument/Condition                | Value         | Derivation                       |
|-----|-------------------------------------|---------------|----------------------------------|
|     | VXT models M9410A/11A/15A/16A       | 11.45324612 s | $2.666667\text{ns} * (2^{32}-1)$ |
|     | M9410E/11E/15E/16E                  | 11.45324612 s | $2.666667\text{ns} * (2^{32}-1)$ |
|     | Continuous – Trigger + Run” trigger | 11.45324612 s | $2.666667\text{ns} * (2^{32}-1)$ |
|     | Other trigger conditions            | 17.17986918 s | $4\text{ ns} * (2^{32}-1)$       |
|     | All Others                          | 8.589934588 s | $4\text{ns} * (2^{31} - 1)$      |

#### Auto Function

|                |                                                                                                                                                      |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SOURce:RADio:ARB:TRIGger[:SOURce]:PXI:DElay:STATe OFF   ON   0   1</code><br><code>:SOURce:RADio:ARB:TRIGger[:SOURce]:PXI:DElay:STATe?</code> |
| Example        | <code>:SOUR:RAD:ARB:TRIG:PXI:DEL:STAT ON</code><br><code>:SOUR:RAD:ARB:TRIG:PXI:DEL:STAT?</code>                                                     |
| Preset         | OFF                                                                                                                                                  |

## PXI Trigger Polarity

Sets the polarity of the PXI trigger:

- When **POSitive** is selected, trigger event happens on a rising edge of the PXI trigger in signal
- When **NEGative** is selected, trigger event happens on a falling edge of the PXI trigger in signal

Active only if "Trigger Source" on page 638 is **PXI**.

|                |                                                                                                                                             |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SOURce:RADio:ARB:TRIGger[:SOURce]:PXI:SLOPe POSitive   NEGative</code><br><code>:SOURce:RADio:ARB:TRIGger[:SOURce]:PXI:SLOPe?</code> |
| Example        | <code>:SOUR:RAD:ARB:TRIG:PXI:SLOP POS</code><br><code>:SOUR:RAD:ARB:TRIG:PXI:SLOP?</code>                                                   |
| Dependencies   | Unavailable and grayed-out when "Trigger Source" on page 638 is <b>PXI</b><br>Not available in E7760B                                       |
| Preset         | <b>POSitive</b>                                                                                                                             |
| Range          | <b>POSitive</b>   <b>NEGative</b>                                                                                                           |

## I/Q Adjustments

Enables or disables the I/Q adjustments.

|                |                                                                                                                              |
|----------------|------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SOURce:RADio:ARB:IQADjustment:[STATe] OFF   ON   0   1</code><br><code>:SOURce:RADio:ARB:IQADjustment:[STATe]?</code> |
| Example        | <code>:SOUR:RAD:ARB:IQAD ON</code><br><code>:SOUR:RAD:ARB:IQAD?</code>                                                       |
| Dependencies   | Not available in E7760B                                                                                                      |
| Preset         | OFF                                                                                                                          |

## I/Q Gain

Lets you adjust the ratio of I to Q while preserving the composite, vector magnitude. Adding Gain (+x dB) to the signal increases the I component and decreases the Q component proportionally. Reducing Gain (-x dB) decreases the I component and increases the Q component proportionally.

|                |                                                                                                                                 |
|----------------|---------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SOURce:RADio:ARB:IQADjustment:GAIN &lt;value&gt;&lt;unit&gt;</code><br><code>:SOURce:RADio:ARB:IQADjustment:GAIN?</code> |
| Example        | <code>:SOUR:RAD:ARB:IQAD:GAIN 0.5</code><br><code>:SOUR:RAD:ARB:IQAD:GAIN?</code>                                               |
| Notes          | Effective only if the I/Q adjustment function is <b>ON</b>                                                                      |
| Dependencies   | Unavailable and grayed-out when the ARB state is <b>OFF</b><br>Not available in E7760B                                          |
| Preset         | +0.00000000E+000                                                                                                                |
| Min            | -1 dB                                                                                                                           |
| Max            | 1 dB                                                                                                                            |

## I/Q Delay

Lets you change the absolute phase of both I and Q with respect to triggers and markers. A positive value delays I and Q. This value affects both the external I/Q out signals and the baseband signal modulated on the RF output. This adjustment does not affect external I/Q inputs.

|                |                                                                                                                                   |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SOURce:RADio:ARB:IQADjustment:DELaY &lt;value&gt;&lt;unit&gt;</code><br><code>:SOURce:RADio:ARB:IQADjustment:DELaY?</code> |
| Example        | <code>:SOUR:RAD:ARB:IQAD:DEL 10ps</code><br><code>:SOUR:RAD:ARB:IQAD:DEL?</code>                                                  |
| Notes          | User-set IQ delay time values are rounded to the nearest integer multiple of the resolution                                       |
| Dependencies   | Unavailable and grayed-out when the ARB state is off<br>Not available in E7760B                                                   |



## 6 Input/Output

### 6.1 RF Source

|         |                        |            |            |
|---------|------------------------|------------|------------|
| Preset  | +0.00000000E+000       |            |            |
| Min/Max | <b>Instrument Type</b> | <b>Min</b> | <b>Max</b> |
|         | M9410A/11A/15A/16A     | -80ns      | 80ns       |
|         | All Others             | -250ns     | 250ns      |

## RMS

Lets you directly specify current RMS value used to playback currently selected waveform.

For EXM, note that an incorrect RMS value may cause inaccurate power output that is sensitive to RMS value.

This setting is also updated by RMS in waveform header or updated when invoking RMS calculation operation.

This setting can be saved to the header of currently selected waveform by **"Save Header" on page 665**.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                               |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SOURce:RADio:ARB:RMS &lt;float&gt;</code><br><code>:SOURce:RADio:ARB:RMS?</code>                                                                                                                                                                                                                                                                                                                                       |
| Example        | <code>:SOUR:RAD:ARB:HEAD:RMS 0.7</code><br><code>:SOUR:RAD:ARB:HEAD:RMS?</code>                                                                                                                                                                                                                                                                                                                                               |
| Notes          | The valid range for this setting is 0 to 1.414 (linear). Values outside the range are clipped to the closest boundary<br><br>This value does not affect Source List Sequencer, which always uses the RMS value included in each ARB header. If this setting is to take effect in List Sequencer, use <b>"Save Header" on page 665</b> to save the current RMS value to the header, then play the ARB in Source List Sequencer |
| Dependencies   | When a new waveform is selected for playback this setting is updated by the RMS value included in the associated waveform header file. If the selected waveform has no associated header file or the header file does not include the RMS value then the instrument will try to calculate the value automatically based on the RMS Calculation Mode setting<br>Pressing <b>Calculate</b> also updates this setting            |
| Preset         | 0                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Range          | 0 ~ 1.414                                                                                                                                                                                                                                                                                                                                                                                                                     |

## RMS Calculation Mode

Lets you specify the mode to calculate the current RMS.

|        |                                                                              |
|--------|------------------------------------------------------------------------------|
| Remote | <code>:SOURce:RADio:ARB:RMS:CALCulation:MODE AUTO   M1   M2   M3   M4</code> |
|--------|------------------------------------------------------------------------------|

|         |                                                                                                          |
|---------|----------------------------------------------------------------------------------------------------------|
| Command | See <a href="#">"Option Details" on page 646</a><br><code>:SOURce:RADio:ARB:RMS:CALCulation:MODE?</code> |
| Example | <code>:SOUR:RAD:ARB:RMS:CALC:MODE AUTO</code>                                                            |
| Notes   | If no waveform is selected, or selected waveform is waveform sequence, the key is grayed-out             |
| Preset  | <code>AUTO</code>                                                                                        |
| Range   | <code>AUTO   M1   M2   M3   M4</code>                                                                    |

### Option Details

| Parameter | SCPI              | Notes                                                                                         |
|-----------|-------------------|-----------------------------------------------------------------------------------------------|
| Auto      | <code>AUTO</code> | In Auto, RMS is calculated based on the whole sample range of the currently selected waveform |
| Marker 1  | <code>M1</code>   | Marker 1 designates the sample range for RMS calculation                                      |
| Marker 2  | <code>M2</code>   | Marker 2 designates the sample range for RMS calculation                                      |
| Marker 3  | <code>M3</code>   | Marker 3 designates the sample range for RMS calculation                                      |
| Marker 4  | <code>M4</code>   | Marker 4 designates the sample range for RMS calculation                                      |

## Calculate

Lets you calculate current RMS based on mode selected. Updates the setting in the ["RMS" on page 645](#) control.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SOURce:RADio:ARB:RMS:CALCulate</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Example        | <code>:SOUR:RAD:ARB:RMS:CALC</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Notes          | <p>If no waveform is selected, invoking this operation generates error “-221 Setting conflict; No waveform is selected for RMS operation”</p> <p>Grayed-out if no waveform is selected, or selected waveform is waveform sequence</p> <p>If selected waveform does not contain marker data, but <a href="#">"RMS Calculation Mode" on page 645</a> is set to marker, invoking a calculation operation generates error “-221 Setting conflict; There is no marker for currently selected waveform, auto RMS calculation mode is used instead”, and <a href="#">"RMS Calculation Mode" on page 645</a> is coupled to <b>Auto</b> mode automatically</p> <p>RMS calculation is not suitable for waveform sequence. If selected waveform is waveform sequence file, invoking this operation generates error “-221 Setting conflict; RMS calculation does not apply to waveform sequence”</p> <p>You can still edit current RMS as play parameter, and save current RMS to waveform sequence header for later use</p> |

## Use Header RMS

Lets you quickly set RMS to value in ARB header. Updates the setting in the "RMS" on page 645 control.

|       |                                                                                                                                                                                            |
|-------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Notes | <p>Grayed-out if no waveform is selected</p> <p>If no waveform is selected, invoking this operation generates error "-221 Setting conflict; No waveform is selected for RMS operation"</p> |
|-------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

## Real-Time 5G NR Compensation

Phase compensation is a new concept introduced into 5G NR baseband signal generation in TS38.211 as below, to address a typical 5G scenario that Tx and Rx frequencies may not be the same. In that case, without properly compensating the phase, receiver would not be able to correctly demodulate the received signal.

Modulation and up-conversion to the carrier frequency  $f_0$  of the complex-valued OFDM baseband signal for antenna port  $p$ , subcarrier spacing configuration  $\mu$ , and OFDM symbol  $l$  in a subframe assumed to start at  $t = 0$  is given by the following equation for all channels and signals except PRACH:

$$Re \left\{ s_l^{(p,\mu)}(t) \cdot e^{j2\pi f_0(t - t_{start,l}^\mu - N_{CP,l}^\mu T_C)} \right\}$$

$$Re \left\{ s_l^{(p,\mu)}(t) \cdot e^{j2\pi f_0(t - t_{start,l}^\mu - N_{CP,l}^\mu T_C)} \right\}$$

From the 3GPP specification equation above, it can be observed that phase compensation is performed for a specific transmission frequency  $f_0$ . So that means, even if a same signal configuration needs to be transmitted at multiple frequencies, we'll have to generate a different waveform for each frequency point. As a result, the number of test waveforms will increase significantly along with the frequency number. This would be a big challenge for test engineers, considering the complexity of 5G NR signal configurations - they have to maintain a large waveform library and identify each waveform carefully with its "frequency tag".

Real-Time 5G NR Phase Compensation allows you to play the same 5G NR waveform while performing phase compensation along with transmission frequency change automatically. This control allows you to turn on or off the real-time phase compensation for 5G NR waveform.

|                |                                                                                                                                     |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <p><code>:SOURce:RADio:ARB:NR5G:PHASe[:STATe] ON   OFF   1   0</code></p> <p><code>:SOURce:RADio:ARB:NR5G:PHASe[:STATe]?</code></p> |
| Example        | <code>:SOUR:RAD:ARB:NR5G:PHAS ON</code>                                                                                             |

|              |                                                                                                                                                                                                                                                                                                                                                                   |
|--------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|              | <code>:SOUR:RAD:ARB:NR5G:PHAS?</code>                                                                                                                                                                                                                                                                                                                             |
| Dependencies | Only appears when Option RPC is present<br>If the waveform is not for 5G NR, there may be error message and the output signal may be incorrect<br>To ensure that you do <i>not</i> compensate for phase twice, once at waveform generation and again during playback, turn off this control if you had turned on phase compensation while generating the waveform |
| Preset       | <code>OFF</code>                                                                                                                                                                                                                                                                                                                                                  |
| Range        | <code>ON OFF</code>                                                                                                                                                                                                                                                                                                                                               |

## SCS

Sets the SCS for real-time 5G NR phase compensation.

|                |                                                                                                     |          |         |
|----------------|-----------------------------------------------------------------------------------------------------|----------|---------|
| Remote Command | :SOURce:RADio:ARB:NR5G:PHASe:SCS SCS15K   SCS30K   SCS60K   SCS60KECP   SCS120K   SCS240K   SCS480K |          |         |
|                | :SOURce:RADio:ARB:NR5G:PHASe:SCS?                                                                   |          |         |
| Example        | :SOUR:RAD:ARB:NR5G:PHAS:SCS SCS15K                                                                  |          |         |
|                | :SOUR:RAD:ARB:NR5G:PHAS:SCS?                                                                        |          |         |
| Preset         | SCS30K                                                                                              |          |         |
| Range          | $\mu$                                                                                               | CP       | Value   |
|                | 0                                                                                                   |          | 15 kHz  |
|                | 1                                                                                                   |          | 30 kHz  |
|                | 2                                                                                                   | Normal   | 60 kHz  |
|                |                                                                                                     | Extended | 60 kHz  |
|                | 3                                                                                                   |          | 120 kHz |
|                | 4                                                                                                   |          | 240 kHz |
|                | 5                                                                                                   |          | 480 kHz |

## Filter

Sets the state of Filter usage after real-time 5G NR phase compensation.

|                |                                                                                                                                        |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SOURce:RADio:ARB:NR5G:PHASe:FILTer[:STATe] ON   OFF   1   0</code><br><code>:SOURce:RADio:ARB:NR5G:PHASe:FILTer[:STATe]?</code> |
| Example        | <code>:SOUR:RAD:ARB:NR5G:PHAS:FILT ON</code><br><code>:SOUR:RAD:ARB:NR5G:PHAS:FILT?</code>                                             |
| Preset         | <code>OFF</code>                                                                                                                       |
| Range          | <code>ON OFF</code>                                                                                                                    |

Filter Bandwidth

Sets the Filter Bandwidth if Filter is used.

By searching <FilterBandwidth> node in the \*.scp file, you can get the correct filter bandwidth value for phase compensation.

|                |                                                                                                                                        |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SOURce:RADio:ARB:NR5G:PHASe:FILTer:BANDwidth &lt;freq&gt;</code><br><code>:SOURce:RADio:ARB:NR5G:PHASe:FILTer:BANDwidth?</code> |
| Example        | <code>:SOUR:RAD:ARB:NR5G:PHAS:FILT:BAND 99MHz</code><br><code>:SOUR:RAD:ARB:NR5G:PHAS:FILT:BAND?</code>                                |
| Preset         | 100 MHz                                                                                                                                |
| Min            | 10 Hz                                                                                                                                  |
| Max            | 1200 MHz                                                                                                                               |

Select Waveform

Lets you select a waveform segment or sequence to be played by the ARB player. Presents you with a list of waveform segments files and waveform sequence files. The list of waveform segment files and waveform sequence files contains the names of all the waveform segments and waveform sequence files currently loaded into ARB playback memory.

Waveform sequences are not available in E7760B.

Waveforms formatted as \*.mat, \*.csv and \*.txt are supported by models with a built-in source, such as VXT and EXM.

NOTE

To load a file from the hard drive into ARB memory, go to the **Recall, Waveform** dialog

NOTE

Selecting a waveform file does not result in automatic adjustments to burst timing; that adjustment occurs only when a waveform is loaded to ARB memory.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                               |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SOURce:RADio:ARB:WAVEform &lt;string&gt;</code><br><code>:SOURce:RADio:ARB:WAVEform?</code>                                                                                                                                                                                                                                                                                                                            |
| Example        | <code>:SOUR:RAD:ARB:WAV "test_waveform.bin"</code>                                                                                                                                                                                                                                                                                                                                                                            |
| Notes          | If the intended waveform is not in the memory yet, then issuing this command invokes ARB loading operation first, which involves a delay of unpredictable length, so this command should be followed by <code>*OPC?</code> , which holds off subsequent commands until the loading operation is complete<br><code>&lt;string&gt;</code> - specifies the name of the waveform segment or waveform sequence to be played by the |

---

## ARB

Sequence Analyzer Mode only:

- If Include Source is Yes, and you attempt to play a waveform sequence but not all the required waveform segments are in the ARB playback memory, the application rejects the loading operation, and an error is generated
- If Include Source is No, and you attempt to play a waveform sequence but not all the required waveform segments are contained in the ARB playback memory, the application attempts to load the required segments from either the default directory or the current directory. If the ARB memory does not have enough space for all the waveform segments to be loaded, an error is generated and none of the waveform segments is loaded

If ARB is **ON**, and you attempt to play a waveform sequence but not all the waveform segments within the sequence could be found to be loaded into ARB memory, an error is generated. The selected waveform keeps the previous value and ARB state remains On

If you specify a waveform segment via SCPI but the waveform segment is not present within ARB playback memory, and cannot be found for auto loading within the current directory or the default directory, an error is generated and the file selection remains unchanged

If you select a waveform for playback and the waveform requires a license that is not installed on the instrument, an error is generated

.

If ARB is **ON** and you load a file to ARB memory or delete a file from ARB memory, the playing waveform segment may not keep phase continuity during the ARB memory operation. The waveform will be replayed after the ARB operation is finished

## Segments in ARB Memory

Shows you which files are loaded into the ARB memory and lets you select a file for playback.

## Recall Waveform

This is the same as **Recall From File** in the dialog **Recall**, "**Waveform**" on page 886.

## Delete Segment From ARB Mem

This is the same as **Delete Segment From ARB Mem** in the **Recall**, "**Waveform**" on page 886.

## Delete All From ARB Memory

This is the same as **Delete All From ARB Memory** in the **Recall**, "**Waveform**" on page 886.

Query ARB Memory File List (Remote Query Only)

Queries the test set for the list of waveform segments in the ARB memory.

NOTE

Returns a string for waveform segment names in ARB memory. If you require a string list of waveform segments in the ARB memory, use "Query ARB Memory Full File List (Remote Query Only)" on page 651

|                |                                                                                                                                                                                                                                                                                             |           |                    |           |                    |              |                                                             |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|--------------------|-----------|--------------------|--------------|-------------------------------------------------------------|
| Remote Command | :SOURce:RADio:ARB:CATalog?                                                                                                                                                                                                                                                                  |           |                    |           |                    |              |                                                             |
| Example        | :SOUR:RAD:ARB:CAT?                                                                                                                                                                                                                                                                          |           |                    |           |                    |              |                                                             |
| Notes          | The return data is in the following format: <table><tr><td>&lt;integer&gt;</td><td>Memory used, in kB</td></tr><tr><td>&lt;integer&gt;</td><td>Memory free, in kB</td></tr><tr><td>&lt;string&gt; ...</td><td>Comma-separated list of waveform segments within ARB memory</td></tr></table> | <integer> | Memory used, in kB | <integer> | Memory free, in kB | <string> ... | Comma-separated list of waveform segments within ARB memory |
| <integer>      | Memory used, in kB                                                                                                                                                                                                                                                                          |           |                    |           |                    |              |                                                             |
| <integer>      | Memory free, in kB                                                                                                                                                                                                                                                                          |           |                    |           |                    |              |                                                             |
| <string> ...   | Comma-separated list of waveform segments within ARB memory                                                                                                                                                                                                                                 |           |                    |           |                    |              |                                                             |

Query ARB Memory Full File List (Remote Query Only)

Queries the test set for the string list of waveform segments in the ARB memory. Returns a string list for waveform segment names in the ARB memory.

|                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |           |                    |           |                    |           |                          |                                |                                                                    |
|--------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|--------------------|-----------|--------------------|-----------|--------------------------|--------------------------------|--------------------------------------------------------------------|
| Remote Command                 | :SOURce:RADio:ARB:FCATalog?                                                                                                                                                                                                                                                                                                                                                                                                                                            |           |                    |           |                    |           |                          |                                |                                                                    |
| Example                        | :SOUR:RAD:ARB:FCAT?                                                                                                                                                                                                                                                                                                                                                                                                                                                    |           |                    |           |                    |           |                          |                                |                                                                    |
| Notes                          | The return data is in the following format: <table><tr><td>&lt;integer&gt;</td><td>Memory used, in kB</td></tr><tr><td>&lt;integer&gt;</td><td>Memory free, in kB</td></tr><tr><td>&lt;integer&gt;</td><td>File count in ARB memory</td></tr><tr><td>&lt;string&gt;,&lt;string&gt;, ...&lt;string&gt;</td><td>Comma-separated string list of waveform segments within ARB memory</td></tr></table> <p>EXT returns: 27499,2069653,3,"c2k.wfm","gsm.wfm","wcdma.wfm"</p> | <integer> | Memory used, in kB | <integer> | Memory free, in kB | <integer> | File count in ARB memory | <string>,<string>, ...<string> | Comma-separated string list of waveform segments within ARB memory |
| <integer>                      | Memory used, in kB                                                                                                                                                                                                                                                                                                                                                                                                                                                     |           |                    |           |                    |           |                          |                                |                                                                    |
| <integer>                      | Memory free, in kB                                                                                                                                                                                                                                                                                                                                                                                                                                                     |           |                    |           |                    |           |                          |                                |                                                                    |
| <integer>                      | File count in ARB memory                                                                                                                                                                                                                                                                                                                                                                                                                                               |           |                    |           |                    |           |                          |                                |                                                                    |
| <string>,<string>, ...<string> | Comma-separated string list of waveform segments within ARB memory                                                                                                                                                                                                                                                                                                                                                                                                     |           |                    |           |                    |           |                          |                                |                                                                    |

Waveform Sequences

Not available in E7760B.

Lets you build new sequences or edit existing sequences. The Sequences table displayed in this dialog shows you the sequences in the current directory. You may build a new sequence or select one of the sequences in the table and tap **Edit**

**Selected Sequence.** The default current directory is **C : \NVARB**. Tapping any element of this path lets you select an alternate route. Tapping the **Computer** arrow lets you select a different drive. Tapping the **Back** arrow navigates to the previously selected directory.

Build New Sequence

Lets you build a new sequence of waveform segments. When you build a sequence you are building the “current sequence”, and the next time you press “Build New Sequence” the sequence you have been building will still be there, allowing you to add or remove segments from it.

Segment

Shows the segment number assigned to this row.

Waveform

Shows the file name for the waveform inserted into this row. Use **"Insert Waveform"** on page 653 to insert a waveform.

Repetitions

Lets you specify the number of times the currently selected waveform is played within the sequence.

|        |       |
|--------|-------|
| Preset | 1     |
| Min    | 1     |
| Max    | 65535 |

Marker 1 – Marker 4

Lets you enable or disable Marker 1, 2, 3, or 4 for the currently selected waveform. For a waveform sequence, you can enable and disable markers on a per-segment basis, allowing you to output markers from some waveform segments within the sequence, but not for others.

|        |                    |
|--------|--------------------|
| Preset | Enabled            |
| Range  | Enabled   Disabled |



Sync Seq File

Enables or disables the saving of secondary modules' waveform sequence files based on the current primary module segment's waveform settings.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | :SOURce:RADio:ARB:SEquence:SYNC ON   OFF<br>:SOURce:RADio:ARB:SEquence:SYNC?                                                                                                                                                                                                                                                                                                                                                                   |
| Example        | :SOUR:RAD:ARB:SEQ:SYNC OFF                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Notes          | Available only on primary modules<br>If this setting is ON, when Sync Config is not NONE, the responding secondary module's waveform sequence file will be saved accordingly when save sequence... on the primary module, and the primary sequence file name should end with xxx0.seq, so the secondary module will be named according to the "Naming Rule" on page 653<br>Waveform names in sequence files should also follow the Naming Rule |
| Dependencies   | Not available in E7760B                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Preset         | OFF                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Range          | ON OFF                                                                                                                                                                                                                                                                                                                                                                                                                                         |

Naming Rule

If Sync Config is not 2x2 +2x2 or 1x1+1x1, the waveform files to be used should follow this naming convention: the waveform file for the primary source should end in 0; the waveform files for the controlled sources should end in 1, 2, or 3 (reflecting the order of the TRXs). For example, for DL 11AC80 3X3 MIMO, sequence file names for TRX1,TRX2 and TRX3 should be xxx0.xx, xxx1.xx and xxx2.xx

If Sync Config is 2x2+2x2, the waveform files to be used should follow this naming convention: the waveform file for the primary source of first 2x2 should end in 0\_0; the waveform files for the secondary source of first 2x2 should end in 0\_1; the waveform files for the primary source of second 2x2 should end in 1\_0; the waveform files for the secondary source of second 2x2 should end in 1\_1. For example, for DL 11AC80 2x2 + 2x2 MIMO, waveform file names for TRX1,TRX2,TRX3 and TRX4 should be xxx0\_0.xx, xxx0\_1.xx, xxx1\_0.xx and xxx1\_1.xx

If Sync Config is 1x1+1x1, the waveform files to be used should follow this naming convention: the waveform file for the first source should end in 0\_0; the waveform files for the second source should end in 1\_0. For example, for DL 11AC80 1x1 + 1x1 MIMO, waveform file names for TRX1 and TRX2 should be xxx0\_0.xx and xxx1\_0.xx

Insert Waveform

Lets you select a waveform segment to be added to the sequence.

NOTE

To load a file from the hard drive into ARB memory, go to the **Recall, Waveform** dialog

---

## Segments in ARB Memory

Shows you which files are loaded into the ARB memory and lets you select a file for inclusion in the sequence.

## Delete Segment From ARB Mem

This is the same as **Delete Segment From ARB Mem** in the **Recall, Waveform** dialog.

## Delete All From ARB Memory

This is the same as **Delete All From ARB Memory** in the **Recall, Waveform** dialog.

## Delete Segment

Lets you delete the selected segment from the waveform sequence.

## Save Sequence

Lets you save the newly built Waveform Sequence to the disk drive.

Sequence files have the extension **.seq**. The default filename is **WfmSequence\_0000.seq**, where the 4-digit number is the lowest number that does not conflict with any filename in the current directory. Use "File Name" and "File Type" to specify your waveform sequence. The newly build sequence will be stored in the current directory.

## Build New Sequence (Remote Command Only)

This is the SCPI equivalent of the waveform sequence creation features described in ["Build New Sequence" on page 652](#).

Writes a waveform sequence file to the hard disk. You must specify the waveform sequence file path and filename which will be saved on the hard disk, and the waveform segment file path and name which will be nested into the waveform sequence file. You can utilize mass storage unit specifier (MSUS) "NVWFM" or use a real full path representation. See the example below. MSUS "NVWFM" is mapped to D:\NVARB directory on test set hard disk.

Any number of segments, up to a segment count limit of 64, can be used to create a sequence. Repeated segments are included in the count limit.

Each waveform segment name string length upper limit is 128 chars. Do not attempt to insert a waveform with a name string that exceeds 128 chars.

The internal source does not support nesting one waveform sequence file into another waveform sequence file.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <pre>:SOURce:RADio:ARB:SEquence[:MWAVeform] &lt;filename&gt;, &lt;waveform1&gt;, &lt;reps&gt;, NONE   M1   M2   M3   M4   M1M2   M1M3   M1M4   M2M3   M2M4   M3M4   M1M2M3   M1M2M4   M1M3M4   M2M3M4   M1M2M3M4   ALL, \{&lt;waveform2&gt;, &lt;reps&gt;, NONE   M1   M2   M3   M4   M1M2   M1M3   M1M4   M2M3   M2M4   M3M4   M1M2M3   M1M2M4   M1M3M4   M2M3M4   M1M2M3M4   ALL, \} ...</pre> <p>For additional description of each item, see <a href="#">"For Setup SCPI" on page 655</a> below</p> <pre>:SOURce:RADio:ARB:SEquence[:MWAVeform]? &lt;filename&gt;</pre> <p>For additional description of each item, see <a href="#">"For Query SCPI" on page 656</a> below</p> |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|---------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Example | <p>For setup:</p> <pre>:SOUR:RAD:ARB:SEQ "NVWFM:testSeq1.seq", "NVWFM:wfmSegment1.wfm",10, M2M3M4, "NVWFM:wfmSegment2.wfm", 20, M1M3</pre> <p>Or</p> <pre>:SOUR:RAD:ARB:SEQ "D:\NVARB\testSeq1.seq", "D:\NVARB\wfmSegment1.wfm",10, M2M3M4, "D:\NVARB\wfmSegment2.wfm", 20, M1M3</pre> <p>For query, must specify which waveform sequence file to query</p> <pre>:SOUR:RAD:ARB:SEQ? "NVWFM:testSeq1.seq"</pre> <p>Or</p> <pre>:SOUR:RAD:ARB:SEQ? "D:\NVARB\testSeq1.seq"</pre> |
|---------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

**For Setup SCPI**

For the Setup SCPI command, the parameters are:

**<filename>** - String Type

This variable specifies the path and name for the waveform sequence file. The path supports MSUS (NVWFM) or a real full path representation. See example.

**<waveform1>** - String Type

This variable specifies the path and name of the first existing waveform segment. The path supports MSUS (NVWFM) or a real full path representation. See example.

The segment file must reside within ARB playback memory before it can be played by the ARB player.

**<reps>** - Integer Type

This variable specifies the number of times a segment or sequence plays before moving on to the next segment or sequence.

**<marker>** - Enum Type

**NONE** – This choice disables all four markers for the waveform. Disabling markers means that the waveform sequence ignores the segments or sequence marker settings.

**M1, M2, M3, M4** – these choices, either individually or a combination of them, enable the markers for the waveform segment or sequence. Markers not specified are ignored for that segment or sequence.

**ALL** – This choice enables all four markers in the waveform segment or sequence.

**<waveform2>** - String type.

This variable specifies the name of a second existing waveform segment. The path supports MSUS (NVWFM) and real full path representation both. See example.

The segment file must reside within ARB playback memory before it can be played by the ARB player.

**<reps>** same as above, for the 2<sup>nd</sup> waveform segment.

**<marker>** same as above, for the 2<sup>nd</sup> waveform segment.

You can insert several waveform segments into a waveform sequence file. Just repeat inserting waveform segments as described above.

Error Checks for Setup SCPI command:

If you do not specify a filename, or you use an unsupported MSUS (that is, not NVWFM), or have an error in the waveform sequence file path, an error is generated.

If the specified waveform sequence file name suffix is not “.seq”, error is generated.

If you use an unsupported MSUS (that is, not NVWFM), or have an error in the waveform segment file path, an error is generated.

If the first specified waveform file cannot be found, an error is generated.

If you nest one waveform sequence file into another waveform sequence file, an error is generated.

If the specified repetition value is larger than 65535 or smaller than 1, an error is generated.

If the specified marker type is unrecognized, an error is generated.

### For Query SCPI

For the Query the parameters are:

**<filename>** - String type.

This variable specifies the path and name of the waveform sequence file being queried. The path supports MSUS (NVWFM) or a real full path representation. See example.

The return value is a `<string>`, which includes each waveform segment file name, repetitions, and marker type. For example:

```
>:SOUR:RAD:ARB:SEQ? "NVWFM:testSeq1.seq",  
<"wfmSegment1. wfm, 10, ALL, wfmSegment2.wfm, 20, M1M3",
```

Error Checks for Query SCPI command:

If you do not specify a filename, an error is generated.

If the waveform sequence file name is empty, an error is generated.

If the specified waveform sequence file cannot be found, an error is generated.

Edit Selected Sequence

This dialog lets you edit an existing sequence of waveform segments. A table of the segments in the currently selected sequence displays, allowing you to insert waveform segments or edit the characteristics of each segment.

Segment

This field in the table shows the segment number assigned to this row.

Waveform

This field in the table shows the file name for the waveform inserted into this row. Use ["Insert Waveform" on page 653](#) to insert a waveform.

Repetitions

Lets you specify the number of times the currently selected waveform is played within the sequence.

|        |   |
|--------|---|
| Preset | 1 |
| Min    | 1 |

## Marker 1 – Marker 4

Lets you enable or disable Marker 1, 2, 3, or 4 for the currently selected waveform. For a waveform sequence, you can enable and disable markers on a per-segment basis, allowing you to output markers from some waveform segments within the sequence, but not for others.

|        |                                     |
|--------|-------------------------------------|
| Notes  | No remote command, front panel only |
| Preset | Enabled                             |
| Range  | Enabled   Disabled                  |

## Sync Seq File

Change this setting to enable/disable the function of saving secondary modules' waveform sequence files based on the current primary segment's waveform settings.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | See <a href="#">"Sync Seq File" on page 653</a>                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Notes          | Available only on primary modules<br>If this setting is <b>ON</b> , when Sync Config is not <b>NONE</b> , the responding secondary module's waveform sequence file will be saved accordingly when save sequence... on the primary module, and the primary sequence file name should end with <b>xxx0.seq</b> , so the secondary module will be named according to the <a href="#">"Naming Rule" on page 658</a><br>Waveform names in sequence files should also follow the Naming Rule |
| Dependencies   | Not available in E7760B                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Preset         | <b>OFF</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Range          | <b>ON   OFF</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |

## Naming Rule

If Sync Config is not 2x2 +2x2 or 1x1+1x1, the waveform files to be used should follow this naming convention: the waveform file for the primary source should end in 0; the waveform files for the controlled sources should end in 1, 2, or 3 (reflecting the order of the TRXs). For example, for DL 11AC80 3X3 MIMO, sequence file names for TRX1, TRX2 and TRX3 should be xxx0.xx, xxx1.xx and xxx2.xx

If Sync Config is 2x2+2x2, the waveform files to be used should follow this naming convention: the waveform file for the primary source of first 2x2 should end in 0\_0; the waveform files for the secondary source of first 2x2 should end in 0\_1; the waveform files for the primary source of second 2x2 should end in 1\_0; the waveform files for the secondary source of second 2x2 should end in 1\_1. For

example, for DL 11AC80 2x2 + 2x2 MIMO, waveform file names for TRX1,TRX2,TRX3 and TRX4 should be xxx0\_0.xx, xxx0\_1.xx, xxx1\_0.xx and xxx1\_1.xx

If Sync Config is 1x1+1x1, the waveform files to be used should follow this naming convention: the waveform file for the first source should end in 0\_0; the waveform files for the second source should end in 1\_0. For example, for DL 11AC80 1x1 + 1x1 MIMO, waveform file names for TRX1 and TRX2 should be xxx0\_0.xx and xxx1\_0.xx

Insert Waveform

This dialog p select a waveform segment to be added to the sequence.

NOTE

To load a file from the hard drive into ARB memory, go to the Recall, Waveform dialog

---

Segments in ARB Memory

This table shows you which files are loaded into the ARB memory and lets you select a file for inclusion in the sequence.

Delete Segment From ARB Mem

Deletes a segment from ARB memory. This is the same as **Delete Segment From ARB Mem** in the **Recall, Waveform** dialog.

Delete All From ARB Memory

Removes all segments from ARB memory. This is the same as **Delete All From ARB Memory** in the **Recall, Waveform** dialog.

Delete Segment

Lets you delete the current segment from the waveform sequence.

---

|       |                                     |
|-------|-------------------------------------|
| Notes | No remote command, front panel only |
|-------|-------------------------------------|

Waveform Utilities

Not available in E7760B.  
Only appears if there is at least one Multi-pack license installed in the instrument.

On modular instruments, such as EXM , multi-pack license operations are only allowed on the default module, that is, “TRX1” module for EXM.

For EXM, if access multi-pack license sub-menu from modules other than “TRX1”, an advisory message like “Please go to “TRX1” to operate multi-pack license” will display.

## Add Waveform

Use this dialog to select and add waveforms. Pressing **OK** in this dialog adds the currently highlighted waveform to the next available slot and returns you to the ["Waveform Utilities" on page 659](#) dialog.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SYSTem:LKEY:WAVeform:ADD &lt;string&gt;</code><br>or<br><code>:SYSTem:LICense[:FPACK]:WAVeform:ADD &lt;string&gt;</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Example        | <code>:SYST:LKEY:WAV:ADD "mywaveform.wfm"</code><br>or<br><code>:SYST:LIC:WAV:ADD "mywaveform.wfm"</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Notes          | <p>The second form, <code>:SYSTem:LICense[:FPACK]:WAVeform:ADD</code>, is provided for consistency with Keysight signal sources. You can use either form</p> <p>Since adding a waveform segment to a Multi-Pack license causes the license slot to enter the trial period of only 48 hours, pressing this key causes a confirmation dialog to be displayed to ensure you do want to add the waveform segment to the Multi-Pack</p> <p>If you attempt to license a waveform that is already licensed using another slot an error is generated</p> <p>For EXM, if current module is not “TRX1” module, the key is grayed-out, and error message is generated “-221 Setting conflict; Not allowed on current module. Go to “TRX1” to operate multi-pack license” when invoking SCPI</p> |
| Dependencies   | Only available if the currently selected file is a secure waveform requiring a license, and there is at least one slot available within at least one multi-pack license. Unavailable if the waveform highlighted is a secure waveform, but is already licensed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |

## Replace Selected Waveform

Lets you replace the waveform in the currently selected slot with the waveform currently selected in the Multi-Pack License Waveform Add view. Pressing **OK** in this dialog replaces the waveform in the currently selected slot with that currently highlighted, and returns you to the ["Waveform Utilities" on page 659](#) dialog.

|                |                                                                                                                                                                   |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SYSTem:LKEY:WAVeform:REPLace &lt;int&gt;, &lt;string&gt;</code><br>or<br><code>:SYSTem:LICense[:FPACK]:WAVeform:REPLace &lt;int&gt;, &lt;string&gt;</code> |
| Example        | <code>:SYST:LKEY:WAV:REPL 1, "myotherwaveform.wfm"</code>                                                                                                         |



|       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|-------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|       | or<br>:SYST:LIC:WAV:REPL 1, "myotherwaveform.wfm"                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Notes | <p>The second command form, :SYSTem:LIcense[:FPAck]:WAVeform:REPLace is provided for consistency with Keysight signal sources. You can use either form</p> <p>If you attempt to license a waveform that is already licensed using another slot an error is generated</p> <p>Waveform slot number &lt;int&gt; is positive. If you attempt to input a slot number less than or equals 0, an error is generated</p> <p>For EXM, if current module is not "TRX1" module, the key is grayed-out, and error message is generated "-221 Setting conflict; Not allowed on current module. Go to "TRX1" to operate multi-pack license" when invoking SCPI</p> |

## Clear Waveform from Slot

Lets you clear the waveform from the selected slot.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | :SYSTem:LKEY:WAVeform:CLEar <int><br>or<br>:SYSTem:LIcense[:FPAck]:WAVeform:CLEar <int>                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Example        | :SYST:LKEY:WAV:CLE 1<br>or<br>:SYST:LIC:WAV:CLE 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Notes          | <p>The second form: :SYSTem:LIcense[:FPAck]:WAVeform:CLEar is provided for consistency with the style of Keysight signal sources. You can use either form</p> <p>Waveform slot number &lt;int&gt; is positive. If you attempt to input a slot number less than or equal to 0, an error is generated</p> <p>For EXM, if current module is not "TRX1" module, the key is grayed-out, and error message is generated "-221 Setting conflict; Not allowed on current module. Go to "TRX1" to operate multi-pack license" when invoking SCPI</p> |
| Dependencies   | Only available if the currently selected slot is in the trial state                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |

## Lock Waveform in Slot

If the selected slot is in the trial state or the lock required state, the waveform that occupies the slot is locked and permanently licensed.

|                |                                                                                       |
|----------------|---------------------------------------------------------------------------------------|
| Remote Command | :SYSTem:LKEY:WAVeform:LOCK <int><br>or<br>:SYSTem:LIcense[:FPAck]:WAVeform:LOCK <int> |
| Example        | :SYST:LKEY:WAV:LOCK 1<br>or<br>:SYST:LIC:WAV:LOCK 1                                   |

|              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|--------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Notes        | <p>The command form <b>:SYSTem:LiCense[:FPack]:WAVeform:LOCK</b> is provided for consistency with Keysight signal sources. You can use either form</p> <p>Waveform slot number <b>&lt;int&gt;</b> is positive. If you attempt to input a slot number less than or equal to 0, an error is generated</p> <p>For EXM, if current module is not "TRX1" module, the key is grayed-out, and error message is generated "-221 Setting conflict; Not allowed on current module. Go to "TRX1" to operate multi-pack license" when invoking SCPI</p> |
| Dependencies | Only available if the currently selected slot is in the trial state, or the lock required state                                                                                                                                                                                                                                                                                                                                                                                                                                             |

### Slot Status Query (Remote Command Only)

Returns the status of the specified slot.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                              |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <b>:SYSTem:LKEY:WAVeform:STATUS? &lt;int&gt;</b><br>or<br><b>:SYSTem:LiCense[:FPack]:WAVeform:STATUS? &lt;int&gt;</b>                                                                                                                                                                                                                                                                                                        |
| Example        | <b>:SYST:LKEY:WAV:STAT? 1</b><br><"Locked"<br>or<br><b>:SYST:LiC:WAV:STAT? 1</b><br><"Locked"                                                                                                                                                                                                                                                                                                                                |
| Notes          | <p>The command form <b>:SYSTem:LiCense[:FPack]:WAVeform:STATUS</b> is provided for consistency with Keysight signal sources. You can use either form</p> <p>Waveform slot number <b>&lt;int&gt;</b> is positive. If you attempt to input a slot number less than or equal to 0, an error is generated</p> <p>Result type is string. If input slot number exceeds total available slot numbers, "Nonexistent" is returned</p> |
| Range          | "Locked"   "Available"   "Trail"   "LockRequired"   "Nonexistent"                                                                                                                                                                                                                                                                                                                                                            |

### Slots Free Query (Remote Query Only)

Returns the number of license slots free.

|                |                                                                                                                                                                    |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <b>:SYSTem:LKEY:WAVeform:FREE?</b><br>or<br><b>:SYSTem:LiCense[:FPack]:WAVeform:FREE?</b>                                                                          |
| Example        | <b>:SYST:LKEY:WAV:FREE?</b><br>or<br><b>:SYST:LiC:WAV:FREE?</b>                                                                                                    |
| Notes          | <p>The second form: <b>:SYSTem:LiCense[:FPack]:WAVeform:FREE</b> is provided for consistency with the style of Keysight signal sources. You can use either one</p> |

## Slots Used Query (Remote Query Only)

Returns the number of license slots used.

|                |                                                                                                                                                                         |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SYSTem:LKEY:WAVeform:USED?</code><br>or<br><code>:SYSTem:LICense[:FPACK]:WAVeform:USED?</code>                                                                   |
| Example        | <code>:SYST:LKEY:WAV:USED?</code><br>or<br><code>:SYST:LIC:WAV:USED?</code>                                                                                             |
| Notes          | The second form: SCPI <code>:SYSTem:LICense[:FPACK]:WAVeform:USED</code> is provided for consistency with the style of Keysight signal sources. You can use either form |

## Slot Waveform Name Query (Remote Command Only)

Returns the waveform name of the specified slot.

|                |                                                                                                                                                                                                                                                                                                                                              |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SYSTem:LKEY:WAVeform:NAME? &lt;int&gt;</code><br>or<br><code>:SYSTem:LICense[:FPACK]:WAVeform:NAME? &lt;int&gt;</code>                                                                                                                                                                                                                |
| Example        | <code>:SYST:LKEY:WAV:NAME? 1</code><br><br><"CDMA2K_22.wfm"<br>or<br><code>:SYST:LIC:WAV:NAME? 1</code><br><br><"CDMA2K_22.wfm"                                                                                                                                                                                                              |
| Notes          | Waveform slot number <code>&lt;int&gt;</code> is positive. If you attempt to input a slot number less than or equal to 0, an error is generated<br>Result type is string. If input slot number exceeds total available slot numbers, "Nonexistent" is returned<br>If no waveform stored in the specified slot, then empty string is returned |

## Slot Waveform Unique ID Query (Remote Command Only)

Returns the waveform unique ID of the specified slot.

|                |                                                                                                                             |
|----------------|-----------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SYSTem:LKEY:WAVeform:UID? &lt;int&gt;</code><br>or<br><code>:SYSTem:LICense[:FPACK]:WAVeform:UID? &lt;int&gt;</code> |
| Example        | <code>:SYST:LKEY:WAV:UID? 2</code><br><br><"1346752140"                                                                     |

|       |                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|       | or<br>:SYST:LIC:WAV:UID? 2<br><"1346752140"                                                                                                                                                                                                                                                                                                                                                                                     |
| Notes | Waveform slot number <int> is positive. If you attempt to input a slot number less than or equal to 0, an error is generated<br>Result type is string. If input slot number exceeds total available slot numbers, "Nonexistent" is returned<br>Only Signal Studio waveform has a unique ID, which is a positive number. User-generated waveforms have no unique ID. If no waveform is stored in the specified slot, returns "0" |

### Locked Waveform Name List Query (Remote Query Only)

Returns the waveform name list of locked.

|                |                                                                                 |
|----------------|---------------------------------------------------------------------------------|
| Remote Command | :SOURce:RADio:ARB:MPLicensed:NAME:LOCKed?                                       |
| Example        | :SOUR:RAD:ARB:MPL:NAME:LOCKed?<br>< "CDMA2K_27.wfm","GSM_MCS1.WFM","c2kWfm.wfm" |

### Locked Waveform Unique ID List Query (Remote Query Only)

Returns the waveform unique id list of locked.

|                |                                                                                                                                                                                                                                                              |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | :SOURce:RADio:ARB:MPLicensed:UID:LOCKed?                                                                                                                                                                                                                     |
| Example        | :SOUR:RAD:ARB:MPL:UID:LOCKed?<br>< "2996927136","3812603511","3710986266"                                                                                                                                                                                    |
| Notes          | Each Signal Studio waveform has a unique id recorded in header. If the unique ids are same, that means they are the same waveform. For this reason, in addition to the locked waveform name list query, there is also a locked waveform unique id list query |

### Multi-Pack License multi-module control state (Remote Command Only)

When **ON**, multi-pack license operations (such as adding/locking/replacinwaveform etc.) from TRXs other than TRX1 are allowed. If **OFF**, only TRX1 is allowed to operate multi-pack license, while other TRXs are only able to show the related multi-pack license information.

|                |                                                                                                                                      |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | :SERVice[:PRODUCTION]:SOURce:MCONtrol:MPLicense[:STATe] ON   OFF   1   0<br>:SERVice[:PRODUCTION]:SOURce:MCONtrol:MPLicense[:STATe]? |
| Example        | :SERV:SOUR:MCON:MPL OFF                                                                                                              |

|        |                                                   |
|--------|---------------------------------------------------|
| Notes  | Only effective in modular-based OBTs, such as EXM |
| Preset | OFF                                               |
| Range  | ON OFF                                            |

## Header Utilities

If there is currently a waveform selected for playback, this table shows you the header information for the file. You can clear the header information out or edit it and save it.

|              |                                                                                                              |
|--------------|--------------------------------------------------------------------------------------------------------------|
| Dependencies | Only available if there is currently a waveform selected for playback. Grayed-out if no waveform is selected |
|--------------|--------------------------------------------------------------------------------------------------------------|

## Clear Header

Lets you clear the header information from the file header associated with the currently selected waveform.

|                |                                                                                                               |
|----------------|---------------------------------------------------------------------------------------------------------------|
| Remote Command | :SOURce:RADio:ARB:HEADer:CLEar                                                                                |
| Example        | :SOUR:RAD:ARB:HEAD:CLE                                                                                        |
| Notes          | Attempting to clear the header details via SCPI when no waveform was selected for playback generates an error |

## Save Header

Lets you save new file header information details to the file.

|                |                                                                                                              |
|----------------|--------------------------------------------------------------------------------------------------------------|
| Remote Command | :SOURce:RADio:ARB:HEADer:SAVE                                                                                |
| Example        | :SOUR:RAD:ARB:HEAD:SAVE                                                                                      |
| Notes          | Attempting to save the header details via SCPI when no waveform was selected for playback generates an error |

## Query Waveform Unique ID (Remote Query Only)

Each Signal Studio waveform contains a unique waveform ID, which recorded in the header. This command allows you to query the unique waveform ID from the header.

|                |                                   |
|----------------|-----------------------------------|
| Remote Command | :MMEMory:HEADer:ID? "<file name>" |
|----------------|-----------------------------------|

|         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|---------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Example | <p>Query the waveform already loaded into the ARB memory:</p> <pre>:MMEM:HEAD:ID? "test.wfm"</pre> <p>Query the waveform on the hard disk by absolute path:</p> <pre>:MMEM:HEAD:ID? "D:\NVARB\test.wfm"</pre> <p>Query the waveform on the hard disk by MSUS:</p> <pre>:MMEM:HEAD:ID? "NVWFM:test.wfm"</pre>                                                                                                                                                            |
| Notes   | <p>The queried waveform file can be in ARB memory, or on hard disk. If want to query ARB in ARB memory, then give out the file name directly. If want to query ARB on the hard disk, then absolute file path or MSUS should be given along with the file name. The valid MSUS is <b>NVWFM</b>, which is mapped to <b>D:\NVARB</b> on the hard disk</p> <p>If the file cannot be found in ARB memory or on hard disk, an error is generated and value -1 is returned</p> |

### Query Selected Waveform Header info (Remote Query Only)

Returns a listing of the current selected ARB header info. If no ARB selected, then empty string is returned.

| Remote Command | <b>:SOURce:RADio:ARB:HEADer:INFormation?</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |      |             |    |             |     |                  |     |                  |     |                   |     |                   |     |                   |     |                   |       |                  |      |                  |      |                  |        |            |        |                |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-------------|----|-------------|-----|------------------|-----|------------------|-----|-------------------|-----|-------------------|-----|-------------------|-----|-------------------|-------|------------------|------|------------------|------|------------------|--------|------------|--------|----------------|
| Example        | <b>:SOUR:RAD:ARB:HEAD:INF?</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |      |             |    |             |     |                  |     |                  |     |                   |     |                   |     |                   |     |                   |       |                  |      |                  |      |                  |        |            |        |                |
| Notes          | <p>After each colon of field title string, related header info string is appended</p> <p>The field title string in "Range" part cannot change, for Sequence Studio needs to accurately match those string character to know which header info field it is</p> <p>Below are the abbreviation descriptions:</p> <table border="1"> <thead> <tr> <th>DESC</th><th>Description</th></tr> </thead> <tbody> <tr> <td>SR</td><td>Sample Rate</td></tr> <tr> <td>RTS</td><td>Run Time Scaling</td></tr> <tr> <td>RMS</td><td>Root Mean Square</td></tr> <tr> <td>M1P</td><td>Marker 1 Polarity</td></tr> <tr> <td>M2P</td><td>Marker 2 Polarity</td></tr> <tr> <td>M3P</td><td>Marker 3 Polarity</td></tr> <tr> <td>M4P</td><td>Marker 4 Polarity</td></tr> <tr> <td>ALCHR</td><td>ALC Hold Routing</td></tr> <tr> <td>RFBR</td><td>RF Blank Routing</td></tr> <tr> <td>FOFF</td><td>Frequency Offset</td></tr> <tr> <td>AWGNST</td><td>AWGN State</td></tr> <tr> <td>AWGNCN</td><td>AWGN C/N Ratio</td></tr> </tbody> </table> | DESC | Description | SR | Sample Rate | RTS | Run Time Scaling | RMS | Root Mean Square | M1P | Marker 1 Polarity | M2P | Marker 2 Polarity | M3P | Marker 3 Polarity | M4P | Marker 4 Polarity | ALCHR | ALC Hold Routing | RFBR | RF Blank Routing | FOFF | Frequency Offset | AWGNST | AWGN State | AWGNCN | AWGN C/N Ratio |
| DESC           | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |      |             |    |             |     |                  |     |                  |     |                   |     |                   |     |                   |     |                   |       |                  |      |                  |      |                  |        |            |        |                |
| SR             | Sample Rate                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |      |             |    |             |     |                  |     |                  |     |                   |     |                   |     |                   |     |                   |       |                  |      |                  |      |                  |        |            |        |                |
| RTS            | Run Time Scaling                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |      |             |    |             |     |                  |     |                  |     |                   |     |                   |     |                   |     |                   |       |                  |      |                  |      |                  |        |            |        |                |
| RMS            | Root Mean Square                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |      |             |    |             |     |                  |     |                  |     |                   |     |                   |     |                   |     |                   |       |                  |      |                  |      |                  |        |            |        |                |
| M1P            | Marker 1 Polarity                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |      |             |    |             |     |                  |     |                  |     |                   |     |                   |     |                   |     |                   |       |                  |      |                  |      |                  |        |            |        |                |
| M2P            | Marker 2 Polarity                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |      |             |    |             |     |                  |     |                  |     |                   |     |                   |     |                   |     |                   |       |                  |      |                  |      |                  |        |            |        |                |
| M3P            | Marker 3 Polarity                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |      |             |    |             |     |                  |     |                  |     |                   |     |                   |     |                   |     |                   |       |                  |      |                  |      |                  |        |            |        |                |
| M4P            | Marker 4 Polarity                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |      |             |    |             |     |                  |     |                  |     |                   |     |                   |     |                   |     |                   |       |                  |      |                  |      |                  |        |            |        |                |
| ALCHR          | ALC Hold Routing                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |      |             |    |             |     |                  |     |                  |     |                   |     |                   |     |                   |     |                   |       |                  |      |                  |      |                  |        |            |        |                |
| RFBR           | RF Blank Routing                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |      |             |    |             |     |                  |     |                  |     |                   |     |                   |     |                   |     |                   |       |                  |      |                  |      |                  |        |            |        |                |
| FOFF           | Frequency Offset                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |      |             |    |             |     |                  |     |                  |     |                   |     |                   |     |                   |     |                   |       |                  |      |                  |      |                  |        |            |        |                |
| AWGNST         | AWGN State                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      |             |    |             |     |                  |     |                  |     |                   |     |                   |     |                   |     |                   |       |                  |      |                  |      |                  |        |            |        |                |
| AWGNCN         | AWGN C/N Ratio                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |      |             |    |             |     |                  |     |                  |     |                   |     |                   |     |                   |     |                   |       |                  |      |                  |      |                  |        |            |        |                |

|       |                                                                                                                                                                                 |                           |
|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|
|       | <a href="#">AWGNCBW</a>                                                                                                                                                         | AWGN Carrier Bandwidth    |
|       | <a href="#">AWGNNBW</a>                                                                                                                                                         | AWGN Noise Bandwidth      |
|       | <a href="#">AWGNCRMS</a>                                                                                                                                                        | AWGN Carrier RMS          |
|       | <a href="#">ORP</a>                                                                                                                                                             | DAC Over Range Protection |
|       | <a href="#">UID</a>                                                                                                                                                             | Unique ID                 |
|       | <a href="#">LICSTS</a>                                                                                                                                                          | License Status            |
| Range | "DESC:", "SR:", "RTS:", "RMS:", "M1P:", "M2P:", "M3P:", "M4P:", "ALCHR:", "RFBR:", "FOFF:", "AWGNST:", "AWGNCN:", "AWGNCBW:", "AWGNNBW:", "AWGNCRMS:", "ORP:", "UID:", "LICSTS" |                           |

### 6.1.12 Trigger Initiate

Initiates an immediate trigger event if the trigger source (under ARB Setup) is set to [KEY](#).

|              |                                                                                                  |
|--------------|--------------------------------------------------------------------------------------------------|
| Dependencies | Grayed-out unless Trigger Source is set to <a href="#">KEY</a> and an ARB waveform is configured |
|--------------|--------------------------------------------------------------------------------------------------|

### 6.1.13 Source Sync

Accesses a menu for setting up Source Synchronization for multiple models.

Only appears in modular products such as VXT, and only when the instrument is configured for MIMO analysis.

#### 6.1.13.1 Sync Config

Lets you config MIMO type for source.

Grayed-out when Primary and Secondary modules are in Sync State.

|                |                                                                                                                                                                         |                                                                                 |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|
| Remote Command | :SOURce:SYNC:CONFig NONE   TWO   THRee   FOUR   SIX   EIGHT   DONE   DTWO   DTHR   DFOU<br><br>See <a href="#">"Option Details" on page 668</a><br>:SOURce:SYNC:CONFig? |                                                                                 |
| Example        | :SOUR:SYNC:CONF TWO                                                                                                                                                     |                                                                                 |
| Dependencies   | EXM                                                                                                                                                                     | 2x2 and 1x1+1x1 MIMO are supported when license E6640A-M22 is enabled           |
|                |                                                                                                                                                                         | 2x2 and 3x3 MIMO are supported when license E6640A-M33 is enabled               |
|                |                                                                                                                                                                         | 2x2, 3x3, 4x4 and 2x2+2x2 MIMO are supported when license E6640A-M44 is enabled |
|                |                                                                                                                                                                         |                                                                                 |

|       |                                                                     |                                                                        |
|-------|---------------------------------------------------------------------|------------------------------------------------------------------------|
|       | VXT models<br>M9410A/11A                                            | No-Across chassis MIMO is supported when license M941xA-MMO is enabled |
|       |                                                                     | Across chassis MIMO is supported when license M941xA-MTS is enabled    |
|       | VXT models<br>M9415A/16A                                            | No-Across chassis MIMO is supported when license M941xA-MMO is enabled |
| Range | NONE   TWO   THRee   FOUR   SIX   EIGHT   DONE   DTWO   DTHR   DFOU |                                                                        |

## Option Details

| Parameter | SCPI  | Notes                                                                                                                                                                                                                   |
|-----------|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| None      | NONE  | Sets MIMO Config type as None                                                                                                                                                                                           |
| 2x2       | TWO   | Sets 2x2 as MIMO Config Type. 2 models are configured to Sync                                                                                                                                                           |
| 3x3       | THRee | Sets 3x3 as MIMO Config Type. 3 models are configured to Sync                                                                                                                                                           |
| 4x4       | FOUR  | Sets 4x4 as MIMO Config Type. 4 models are configured to Sync                                                                                                                                                           |
| 6x6       | SIX   | Sets 6x6 as MIMO Config Type. 6 models are configured to Sync                                                                                                                                                           |
| 8x8       | EIGHT | Sets 8x8 as MIMO Config Type. 8 models are configured to Sync                                                                                                                                                           |
| 1x1+1x1   | DONE  | Sets 1x1+1x1 as MIMO Config Type. 2 models are configured to Sync with different center frequency. Use Segment 2 Setup to config the second model                                                                       |
| 2x2+2x2   | DTWO  | Sets 2x2+2x2 as MIMO Config Type. 2 groups of 2x2 MIMO. First group consists of Primary and TRX1. Second group consists of TRX2 and TRX3. Segment 2 Setup allows you to config the second group                         |
| 3x3+3x3   | DTHR  | Sets 3x3+3x3 as MIMO Config Type. 2 groups of 3x3 MIMO. First group consists of Primary, TRX1 and TRX2. Second group consists of TRX3, TRX4 and TRX5. Segment 2 Setup allows you to config the second group             |
| 4x4+4x4   | DFOU  | Sets 4x4+4x4 as MIMO Config Type. 2 groups of 4x4 MIMO. First group consists of Primary, TRX1, TRX2 and TRX3. Second group consists of TRX4, TRX5, TRX6 and TRX7. Segment 2 Setup allows you to config the second group |

### 6.1.13.2 Sync Type

Grayed-out when models are in Sync State.

|                |                                                                                                                                  |
|----------------|----------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | :SOURce:SYNC:TYPE PRIMary   SECondary   OFF<br>For details of parameter options, see "Options" on page 669<br>:SOURce:SYNC:TYPE? |
| Example        | :SOUR:SYNC:TYPE PRIM                                                                                                             |
| Preset         | OFF                                                                                                                              |
| Range          | PRIMary   SECondary   OFF                                                                                                        |



## Options

| Parameter | Notes                                                                       |
|-----------|-----------------------------------------------------------------------------|
| OFF       | This model is not listed in the Secondary module List                       |
| SECondary | Use :SOURce:SYNC:CONNEcted:NAME? to obtain the Primary's name in Sync State |
| PRIMary   | Sync Setup is only available for Primary                                    |

### 6.1.13.3 Sync Settings

Grayed-out when Primary and Secondary are in Sync State.

|              |                                                      |
|--------------|------------------------------------------------------|
| Dependencies | Grayed-out when Sync Type is set to OFF or Secondary |
|--------------|------------------------------------------------------|

## Secondary Module List

Lists the parameters of Secondary modules. The Selected checkbox in each row allows you to select the Secondary module when the Sync Type is set to Primary.

- When Sync Config is set to NxN, use this control to enable N-1 Secondary modules
- When Sync Config is set to NxN+NxN, use this control to enable 2N-1 Secondary modules

See ["More Information" on page 669](#)

|                |                                                                                              |
|----------------|----------------------------------------------------------------------------------------------|
| Remote Command | :SOURce:SYNC:REMOte:SECondary<integer> ON   OFF   1   0<br>:SOURce:SYNC:REMOte:SEC<integer>? |
| Example        | :SOUR:SYNC:REM:SEC1 ON<br>:SOUR:SYNC:REM:SEC2 OFF                                            |
| Notes          | <integer> Secondary module number in Available Models                                        |
| Preset         | OFF                                                                                          |

## More Information

| Parameter                   | SCPI Example              | Notes                                                            |
|-----------------------------|---------------------------|------------------------------------------------------------------|
| Available Secondary modules | :SOUR:SYNC:REM:SEC:List?  | All the available Secondary models are listed                    |
| IP Address                  | :SOUR:SYNC:REM:SEC1:ADDR? | Refer to Remote Chassis to add the IP Address for remote chassis |

| Parameter              | SCPI Example                           | Notes                                                                                                                                 |
|------------------------|----------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|
| Slot Number            | <code>:SOUR:SYNC:REM:SEC2:SLOT?</code> | “Local Host” indicates that the Primary and Secondary modules share the same chassis<br>Indicates the slot number of available models |
| Socket Port            | <code>:SOUR:SYNC:REM:SEC2:SPOR?</code> | Indicates the socket port of available models                                                                                         |
| Secondary module Order |                                        | Shows you the models to be Secondary devices<br>Use Selected to choose from available Secondary models                                |

## Sync Settings

Lets you apply the source settings of the Primary module to its Secondary modules.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SOURce:SYNC:SETTings:ENABle ON   OFF   1   0</code><br><code>:SOURce:SYNC:SETTings:ENABle?</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Example        | <code>:SOUR:SYNC:SETT:ENAB ON</code><br><code>:SOUR:SYNC:SETT:ENAB?</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Notes          | When Sync Settings is <b>ON</b> , the source settings of Primary are applied to Secondary modules. The supported settings are Amplitude, Frequency, Trigger Source, Trigger Type, RF Output and waveform related information<br>When Sync Segment 2 is switched <b>ON</b> , this Toggle is set <b>ON</b> simultaneously                                                                                                                                                                                                                                                                                                                                                                          |
| Dependencies   | Waveform files naming convention:<br>For NxN MIMO:<br><ul style="list-style-type: none"> <li>– xxx0.wfm for Primary</li> <li>– xxx[n].wfm for TRX[n]</li> </ul> For example, in 3x3 MIMO:<br><ul style="list-style-type: none"> <li>– xxx0.wfm for Primary</li> <li>– xxx1.wfm for TRX1</li> <li>– xxx2.wfm for TRX2</li> </ul> For NxN+NxN MIMO, in the first group:<br><ul style="list-style-type: none"> <li>– xxx0_0.wfm for Primary</li> <li>– xxx0_n.wfm for TRX[n]</li> </ul> in the second group:<br><ul style="list-style-type: none"> <li>– xxx1_n.wfm for TRX[n+N]</li> </ul> For example, in 3x3+3x3 MIMO:<br><ul style="list-style-type: none"> <li>– xxx0_0 for Primary</li> </ul> |

## 6 Input/Output

### 6.1 RF Source

|        |                                                                                                                                                                                                   |
|--------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|        | <ul style="list-style-type: none"> <li>- xxx0_1.wfm for TRX1</li> <li>- xxx0_2.wfm for TRX2</li> <li>- xxx1_0.wfm for TRX3</li> <li>- xxx1_1.wfm for TRX4</li> <li>xxx1_2.wfm for TRX5</li> </ul> |
| Preset | OFF                                                                                                                                                                                               |
| Range  | ON OFF                                                                                                                                                                                            |

## Sync Segment 2

Lets you config the models in the second group of NxN+NxN MIMO.

|                |                                                                                                  |
|----------------|--------------------------------------------------------------------------------------------------|
| Remote Command | :SOURCE:SYNC:SETTings:SEGMENT2:ENABle ON   OFF   1   0<br>:SOURCE:SYNC:SETTings:SEGMENT2:ENABle? |
| Example        | :SOUR:SYNC:SETT:SEGM2:ENAB ON<br>:SOUR:SYNC:SETT:SEGM2:ENAB?                                     |
| Notes          | Only Frequency in settings is supported                                                          |
| Dependencies   | When this setting is <b>ON</b> , Sync Settings will be turned on accordingly                     |
| Preset         | OFF                                                                                              |
| Range          | ON OFF                                                                                           |

## Segment 2 Frequency

When Sync Segment 2 is **ON**, allows you to set the frequency of models in the second group of NxN+NxN MIMO.

|                |                                                                                                                               |
|----------------|-------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | :SOURCE:SYNC:SETTings:SEGMENT2:FREQuency <freq><br>:SOURCE:SYNC:SETTings:SEGMENT2:FREQuency?                                  |
| Example        | :SOUR:SYNC:SETT:SEGM2:FREQ 1.00 GHz<br>:SOUR:SYNC:SETT:SEGM2:FREQ?                                                            |
| Preset         | 1.00 GHz                                                                                                                      |
| Min            | VXT models M9410A/11A/15A/16A: 380 MHz                                                                                        |
| Max            | Hardware Dependent<br>VXT models M9410A/11A/15A/16A: <ul style="list-style-type: none"> <li>- Option F06 = 6.0 GHz</li> </ul> |

## IP Address

Sets up the controller's IP address of Remote Secondary models.

|                |                                                         |
|----------------|---------------------------------------------------------|
| Remote Command | <code>:SOURce:SYNC:REMOte:ADDRess &lt;string&gt;</code> |
| Example        | <code>:SOUR:SYNC:REM:ADDR "192.168.1.2"</code>          |
| Notes          | <code>&lt;string&gt;</code> - IP Address                |

## SCPI Socket Port

Sets up the controller's SCPI socket port of Remote Secondary models.

|                |                                                         |
|----------------|---------------------------------------------------------|
| Remote Command | <code>:SOURce:SYNC:REMOte:IPPort &lt;integer&gt;</code> |
| Example        | <code>:SOUR:SYNC:REM:IPP 5025</code>                    |
| Notes          | <code>&lt;integer&gt;</code> - Port                     |

## Add Secondary Module

Lets you connect the remote chassis specified by IP Address and Socket Port.

|                |                                                                                                                                                                                                                                                                                          |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SOURce:SYNC:REMOte:ADDRess:ADD</code>                                                                                                                                                                                                                                             |
| Example        | <code>:SOUR:SYNC:REM:ADDR:ADD</code>                                                                                                                                                                                                                                                     |
| Notes          | <p>Example of how to add a remote chassis:</p> <pre>:SOUR:SYNC:REM:ADDR "192.168.1.2" :SOUR:SYNC:REM:IPP 5025 :SOUR:SYNC:REM:ADDR:ADD</pre> <p>Once a remote chassis is connected, the <a href="#">"Secondary Module List" on page 669</a> shows you the available Secondary modules</p> |

## Delete Secondary Module

Lets you delete a selected remote chassis IP Address from the ["Secondary Module List" on page 669](#).

|                |                                                                                                |
|----------------|------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SOURce:SYNC:REMOte:ADDRess:DELeTe</code>                                                |
| Example        | <code>:SOUR:SYNC:REM:ADDR:DEL</code>                                                           |
| Notes          | <p>Example of how to delete a remote chassis:</p> <pre>:SOUR:SYNC:REM:ADDR "192.168.1.2"</pre> |

---

:SOUR:SYNC:REM:ADDR:DEL

### Sync Runtime Settings (Remote Command Only)

Lets you Sync runtime settings to the Secondary modules without restarting Sync.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | :SOURce:SYNC:RTSetting:STATe ON   OFF   1   0<br>:SOURce:SYNC:RTSetting:STATe?                                                                                                                                                                                                                                                                                                                                                 |
| Example        | :SOUR:SYNC:RTS:STAT ON<br>:SOUR:SYNC:RTS:STAT?                                                                                                                                                                                                                                                                                                                                                                                 |
| Notes          | When <b>OFF</b> , Sync is interrupted when changing frequency or power settings on the Primary module. After applying the new settings to the Secondary modules, Sync will restart<br>When <b>ON</b> , setting changes on the Primary module are applied to the Secondary modules immediately without interrupting Sync status. This is the default behavior. The supported settings are <b>Amplitude</b> and <b>Frequency</b> |
| Preset         | ON                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Range          | ON OFF                                                                                                                                                                                                                                                                                                                                                                                                                         |

#### 6.1.13.4 Sync Start

Lets you start synchronizing Primary and Secondary modules to play Arb synchronously.

When the Sync connection is built successfully, Primary and Secondary modules are in the Sync State.

Sync Start and Sync Config menu are grayed-out when Primary and Secondary modules are in Sync State.

|                |                                                                                                                                                                                                                 |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | :SOURce:SYNC:START                                                                                                                                                                                              |
| Example        | :SOUR:SYNC:STAR                                                                                                                                                                                                 |
| Notes          | If you change the source settings during Sync State, an error message appears in the status bar: "Settings conflict; Sync connection is already established" and the change will not be applied until Sync Stop |

#### 6.1.13.5 Sync Stop

Stops the synchronization.

When Sync Stops, Sync Config menu and Sync Start will be available.

|                |                   |
|----------------|-------------------|
| Remote Command | :SOURce:SYNC:STOP |
| Example        | :SOUR:SYNC:STOP   |

**6.1.13.6 Sync Connected (Remote Query Only)**

Lets you query the state of synchronization.

|                                                                                   |                         |
|-----------------------------------------------------------------------------------|-------------------------|
| Remote Command                                                                    | :SOURce:SYNC:CONNected? |
| Example                                                                           | :SOUR:SYNC:CONN?        |
| Returns: 1 when synchronization is established, 0 when synchronization is stopped |                         |

**6.1.14 Source Preset**

Lets you preset the source settings to their default values.

|                |                |
|----------------|----------------|
| Remote Command | :SOURce:PRESet |
| Example        | :SOUR:PRES     |

## 6.2 Input

The controls on this tab let you select and configure the instrument's inputs.

### 6.2.1 Select Input

Lets you choose which signal input you want to analyze:

- "RF Input" on page 677
- "External Mixer" on page 677
- "I/Q" on page 680

See also:

- "External Mixer Setup" on page 702
- "I/Q Setup" on page 722

|                |                                                                                                                                                                                                                                                                                                                                                                                      |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe ] :FEED RF   AIQ   EMIXer</code><br><code>[ :SENSe ] :FEED?</code>                                                                                                                                                                                                                                                                                                    |
| Example        | Select the RF Input:<br><code>:FEED RF</code><br><br>Select External Mixing:<br><code>:FEED EMIX</code><br><br>Select BBIQ:<br><code>:FEED AIQ</code>                                                                                                                                                                                                                                |
| Dependencies   | I/Q only appears when Option BBA present<br>Ext Mix only appears when Option EXM present                                                                                                                                                                                                                                                                                             |
| Couplings      | Connecting a U7227A USB Preamplifier to one of the instrument's USB ports causes the Input to automatically switch to the RF Input. If the RF Calibrator is on, it is turned off. Subsequently disconnecting the USB Preamp from USB does not change the Input selection, nor restore the previous selection<br><br><code>[ :SENSe ] :FEED RF</code> turns the calibrator <b>OFF</b> |
| Preset         | Unaffected by Preset or power cycle. Survives a Mode Preset and mode changes<br>Set to <b>RF</b> by <b>Restore Input/Output Defaults</b> or <b>Restore System Defaults-&gt;All</b>                                                                                                                                                                                                   |
| State Saved    | Saved in instrument state                                                                                                                                                                                                                                                                                                                                                            |
| Annotation     | Displayed in the Meas Bar as "Input::" followed by:<br>RF or Ext Mix or I/Q<br>depending on which input is selected                                                                                                                                                                                                                                                                  |

|                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|-------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Backwards Compatibility SCPI  | <p><code>[ :SENSe]:FEED AREFERENCE</code></p> <p>In the PSA the calibrator was one of the inputs and selected using the AREF parameter to the same <code>:FEED</code> command that switched the inputs. In the X-Series, it is controlled in a separate menu and overrides the input selection. For code compatibility, <code>[ :SENSe]:FEED AREFERENCE</code> is provided, and is aliased to <code>[SENSe]:FEED:AREF REF50</code>, which causes the input to be switched to the 50 MHz calibrator. <code>[ :SENSe]:FEED RF</code> switches the input back to the RF port and turns the calibrator <b>OFF</b>, thus providing full compatibility with the PSA calibrator function</p> <p>Note that after sending this, <code>[ :SENSe]:FEED?</code> does <i>not</i> return “AREF” but instead the currently selected input:</p> <p><code>[ :SENSe]:FEED IQ   IONLy   QONLy</code></p> <p><code>[ :SENSe]:FEED?</code></p> <p>The parameters <code>IQ   IONLy   QONLy</code> are supported for backwards compatibility with the E44406A</p> <p><code>[ :SENSe]:FEED IQ</code> aliases to <code>[ :SENSe]:FEED: IQ:TYPE IQ</code></p> <p><code>[ :SENSe]:FEED IONLy</code> aliases to <code>[ :SENSe]:FEED:IQ:TYPE IONLy</code></p> <p><code>[ :SENSe]:FEED QONLy</code> aliases to <code>[ :SENSe]:FEED:IQ:TYPE QONLy</code></p> <p><code>[ :SENSe]:FEED?</code> always returns <b>AIQ</b>, whatever type of legacy parameter <code>IQ   IONLy   QONLy</code> has been used</p> |
| Backwards Compatibility Notes | <p>Most of the settings in the X-Series Input/Output system, including External Gain, Amplitude Corrections settings and data, etc., are shared by all modes and are not changed by a mode switch. Furthermore, most variables under the <b>Input/Output</b> menu are not affected by Mode Preset. Both of these behaviors represent a departure from legacy behavior</p> <p>In X-Series, Input/Output settings are reset by using <b>Restore Input/Output Defaults</b>. They can also be reset to their default values by <b>System-&gt;Restore System Defaults-&gt; In/Out Config</b>, or by <b>System -&gt;Restore System Defaults -&gt; All</b> (and corresponding SCPI)</p> <p>While this matches most use cases better, it does create some code compatibility issues. For example, Amplitude Corrections are no longer turned off by Mode Preset, but instead by <b>Restore Input/Output Defaults</b></p> <p>Although Input/Output settings are not part of each Mode's State, they are saved in Save State files, so that all of the instrument settings can be recalled with <b>Recall, State</b>, as in legacy instruments</p>                                                                                                                                                                                                                                                                                                                                       |
| Notes                         | <p>In legacy analyzers you choose between the Internal mixer or an External Mixer. In X-Series, the External Mixer is one of the choices for the Input and is selected using the <b>FEED</b> command (<code>:SENSe:FEED EXTMixer</code>)</p> <p>For compatibility, the <code>:INPut:MIXer EXTErnal   INTernal</code> legacy command is mapped as follows:</p> <ol style="list-style-type: none"> <li>1. When <code>:INPut:MIXer EXTErnal</code> is received, <code>:SENSe:FEED EMIXer</code> is executed</li> <li>2. When <code>:INPut:MIXer INTernal</code> is received, <code>:SENSe:FEED RF</code> is executed</li> <li>3. When <code>:INPut:MIXer?</code> is received, the response is <b>INT</b> if any input other than the external mixer is selected, and <b>EXT</b> if the external mixer is selected</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Preset                        | <b>INT</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Backwards                     | <code>:INPut:MIXer EXTErnal   INTernal</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |



|                                     |                                                                                                                                                                                                                                |
|-------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Compatibility<br>SCPI               | <code>:INPut:MIXer?</code>                                                                                                                                                                                                     |
| Backwards<br>Compatibility<br>Notes | <p>PSA supports the following SCPI Command :</p> <p><code>:INPut:MIXer:TYPE PRESelected   UNPReselect</code></p> <p><code>:INPut:MIXer:TYPE?</code></p> <p>PXA does not support the <code>:INPut:MIXer:TYPE</code> command</p> |

**RF Input**

Selects the front-panel RF input port to be the instrument signal input. If RF is already selected, pressing this key accesses the RF input setup functions.

**External Mixer**

Lets you select an External Mixer through which to apply signal input to the instrument. When selected, the LO/IF port becomes the input to the instrument.

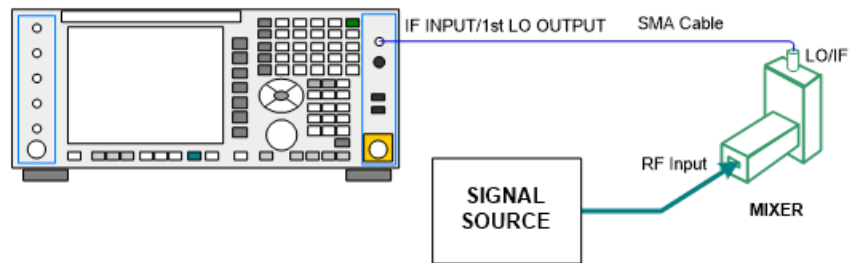
External Mixing requires option EXM. The External Mixer key will not appear unless option EXM is installed. The presence of the LO/IF connector alone does not indicate that you have Option EXM licensed. To verify that option EXM is installed, press **System, Show, System**.

When External Mixer is selected, the **Center Freq** key controls the setting of the Center Freq in external mixing, which is separate from the settings of Center Freq for the RF Input or BBIQ. Each input retains its unique settings for Center Freq. A unique SCPI command is provided solely for the external mixing Center Freq (see the **Center Freq** key description), which only affects the External Mixer CF, although sending the generic Center Freq command while External Mixer is selected also controls the External Mixer CF.

Unless option EXM is present, the External Mixer key is blanked, and all SCPI commands associated with menus accessed by this key return an error  
Manual FFT mode is available with external mixing, but not with Signal ID.

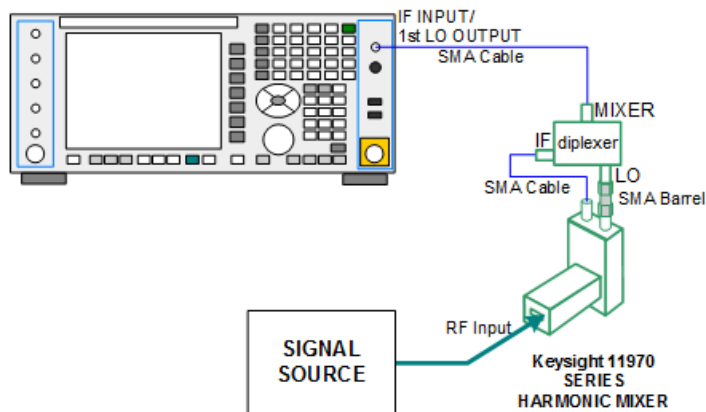
All settings under this key, and all Frequency settings, are remembered when you go out of External Mixer, so that when **External Mixer** is chosen again, all the external mixer functions will retain their previous settings, with the exception of Signal ID which is set to OFF (Signal ID is also set to Off unless External Mixer is the selected Input). Note that this differs from ESA and PSA, in which all external mixer settings including Center Frequency are lost when you turn off External Mixing or Preset the instrument.

X-series instruments have a combined LO Out/IF In connection, whereas earlier instruments used separate ports for the LO Out and the IF in. Internal duplexers in the instrument and the mixer simplify the connection for users – only a single SMA cable is required.



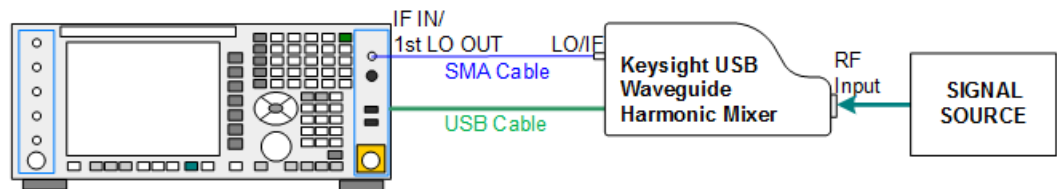
Legacy HP/Agilent and some third-party mixers have separate LO In and IF out connections. This requires you to use an external diplexer to connect these mixers. A diplexer can easily be purchased for this purpose (for example, Diplexer Model # DPL.26 or # DPL.313B from OML Inc., Morgan Hill, California, USA).

The connection diagram for such a legacy mixer is:



In addition, External Mixing in the X-Series supports the new Keysight M1970 series of Harmonic Mixers, which provide a USB connection for download of calibration data and additional control.

The connection diagram for one of the Keysight USB mixers is:

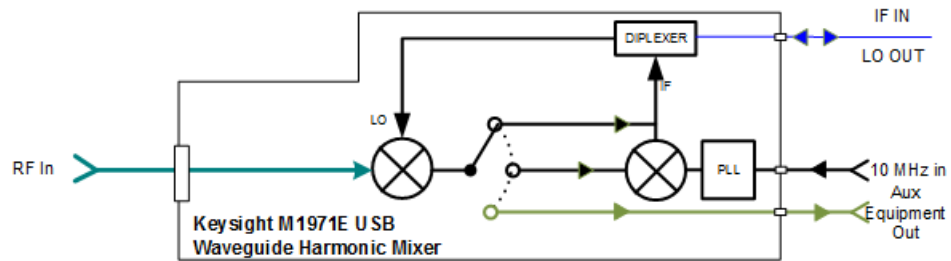


Also available in the M197x series are the M1971 series USB Mixers, which provide additional inputs and outputs for special functionality as described below. These mixers have multiple signal paths which allow them to function in three different states:

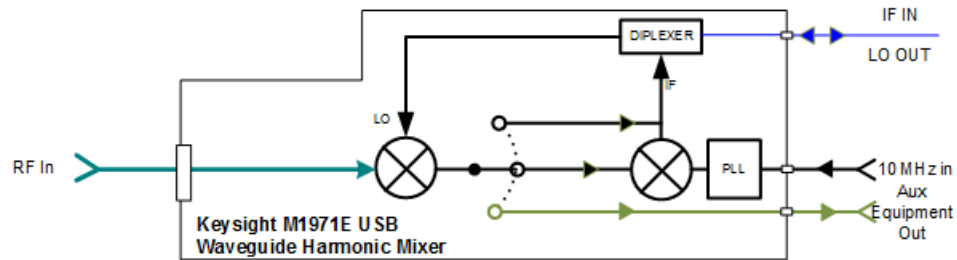
- Normal, in which the mixer functions as a classic external mixer with a single conversion:

## 6 Input/Output

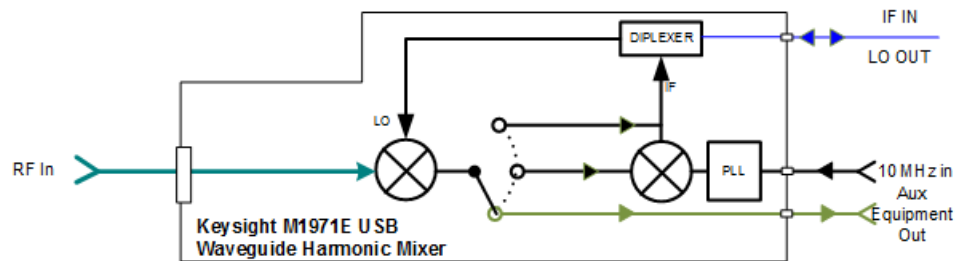
### 6.2 Input



- Dual Conversion, which gives you a wider image-free range. In Dual Conversion, the first conversion is to a higher IF frequency and you provide a 10 MHz signal to which an internal PLL is locked, to effect a second downconversion:



- Aux Equipment, wherein the first mixer output drives an output connector on the mixer and the instrument is out of the circuit:



External Mixing is only supported in certain Modes and Measurements in the X-Series, as shown in the table below. When External Mixer is selected in a measurement that does not support it, the "No result; Meas invalid with Ext Mixing" error condition occurs:

| Mode                   | Measurements            | Sig ID (Image Suppress only) |
|------------------------|-------------------------|------------------------------|
| Spectrum Analyzer      | Swept SA                | Y*                           |
|                        | TOI                     | Y                            |
|                        | Harmonics               | N                            |
|                        | Spurious Emissions      | Y                            |
|                        | Channel Power           | Y                            |
|                        | Occupied BW             | Y                            |
|                        | ACP                     | Y                            |
|                        | Spectrum Emissions Mask | Y                            |
|                        | CCDF                    | N                            |
|                        | Burst Power             | N                            |
|                        | List Sweep              | N                            |
| Phase Noise            | Monitor Spectrum        | Y                            |
|                        | Log Plot                | Y                            |
|                        | Spot Frequency          | N                            |
|                        | Waveform                | N                            |
| I/Q Analyzer           | Complex Spectrum        | N                            |
|                        | Waveform                | N                            |
| Vector Signal Analyzer | Vector Analysis         | N                            |
|                        | Analog Demod            | N                            |
|                        | Digital Demod           | N                            |
| Analog Demod           | AM                      | N                            |
|                        | FM                      | N                            |
|                        | PM                      | N                            |
|                        | FM Stereo               | N                            |

\* the Swept SA measurement also supports Image Shift

## I/Q

Selects the front-panel I/Q input ports to be the instrument signal input. If I/Q is already selected, pressing this key accesses the I/Q setup menu.

The Baseband I/Q functionality is a hardware option. It is option BBA. If the option is not installed, none of the I/Q functionality is enabled.

The Baseband I/Q has four input ports and one output port. The input ports are I, I-bar, Q, and Q-bar. The I and I-bar together compose the I channel, and the Q and Q-bar together compose the Q channel. Each channel has two modes of operation, Single-Ended (also called "unbalanced") and Differential Input (also called "balanced"). When in Single-Ended operation, only the main port (I or Q) is used,

## 6 Input/Output

### 6.2 Input

and the complementary port (I-bar or Q-bar) is ignored. When in Differential Input mode, both main and complementary ports are used.

The input settings (range, attenuation, skew, impedance, external gain) apply to the channels, not the individual ports.

The system supports a variety of 1 M $\Omega$  input passive probes as well as the Keysight 113x Series active differential probes using the Infinimax probe interface.

The Keysight 113x Series active probes can be used for both single ended and differential measurements. In either case a single connection is made for each channel (on either the I or Q input). The input is automatically configured to 50  $\Omega$  single ended and the probe power is supplied through the Infinimax interface. The probe can be configured for a variety of input coupling and low frequency rejection modes. In addition, a wide range of offset voltages and probe attenuation accessories are supported at the probe interface. The active probe has the advantage that it does not significantly load the circuit under test, even with unity gain probing.

With passive 1 M $\Omega$  probes, the probe will introduce a capacitive load on the circuit, unless higher attenuation is used at the probe interface. Higher attenuation reduces the signal level and degrades the signal-to-noise-ratio of the measurement. Passive probes are available with a variety of attenuation values for a moderate cost. Most Keysight passive probes can be automatically identified by the system, setting the input impedance setting required as well as the nominal attenuation. For single ended measurements a single probe is used for each channel. Other passive probes can be used, with the attenuation and impedance settings configured manually.

For full differential measurements, the system supports probes on each of the four inputs. The attenuation of the probes should be the same for good common mode rejection and channel match.

Both active and passive probes in single ended and differential configurations can be calibrated. This calibration uses the Cal Out BNC connection and a probe connection accessory. The calibration achieves excellent absolute gain flatness in a probed measurement. It matches both the gain and frequency response of the I and Q channels as well as any delay skew, resulting in high accuracy in derived measurements such as Error Vector Magnitude (EVM).

When a probe is connected a status message will be displayed. The message will indicate if calibration data is available or not. Calibration data is saved for each type of probe (including "none") for each port and will be reapplied whenever that type of probe is re-connected to the same port. For probes with EEPROM identification, the calibration data will be stored based on the unique probe identifier and will reapply data for that particular probe if it is available. The data will not follow a probe from one port to another. For probes without EEPROM identification, the instrument cannot distinguish between different probes of the same type, and it will use the data from the last calibration for that probe type on that port.

When in differential mode, both the main and complementary probes are expected to be of the same type.

In some situations, the I and Q channels should be configured identically. In other situations, it is convenient to control them independently. Some menus have a "Q Same as I" setting that will cause the Q channel configuration to mirror the I channel configuration, avoiding the overhead of double data entry when the channels should be the same.

The output port is for calibrating the I/Q input ports, although it can also be manually controlled.

There are two types of calibrations available: cable calibration and probe calibration. The cable calibration will guide the user through connecting each input port in turn. All ports must be calibrated together. The probe calibration is done for a specific channel (I or Q). If in Single-Ended mode, only the main port is calibrated. When in Differential Input mode, the user is guided through calibrating both main and complementary ports.

The front panel I/Q port LEDs indicate the current state of that port. On (green) indicates it is active, and off (dark) indicates it is not in use. For example, the Cal Out port LED is on if and only if there is signal coming out of that port.

The input is a context, and some parameters have separate values for each context. The SCPI for these parameters has an optional "[:RF|IQ]" node. If the specific context is omitted, the command acts on the current input context's value. Here are the parameters that are input context sensitive:

- Center Frequency
- Trigger Source

It is important to distinguish between the I and Q input ports and the displayed I and Q data values. The I and Q input ports feed into a digital receiver that does digital tuning and filtering. The I and Q data seen by the user (either on the display or through SCPI) corresponds to the real ("I") and the imaginary ("Q") output from the digital receiver. When the input path is I+jQ or I Only and the center frequency is 0 Hz the I input ends up in as the real output from the receiver and appears as "I" data. Likewise, when the input path is I+jQ and the center frequency is 0 Hz, the Q input ends up as the imaginary output from the receiver and appears as "Q" data. However, when the input path is Q Only, the Q input is sent to the receiver as Q+j0, so the receiver output has the Q input coming out on the real output, and so in Q Only, the signal from the Q input port appears as the "I" data. Another situation where the I and Q data do not necessarily correspond directly to the I and Q inputs is when the center frequency is non-zero. The digital processing involved in the tuning is a complex operation. This will result in I Only data appearing as both "I" and "Q" data, the same as that signal would appear if seen through the RF input port.

## 6 Input/Output

### 6.2 Input

BBIQ is only supported in certain Modes and Measurements in the X-Series. When I/Q is selected in a measurement that does not support it, the “No Result; Meas invalid with I/Q inputs” message appears. This is error 135

#### Baseband I/Q Remote Language Compatibility

For the Agilent E4406A VSA Series Transmitter Tester, Option B7C provided baseband I/Q inputs. Code compatibility has been provided to allow many of the commands for Option B7C to function properly with X-Series. X-Series has hardware differences and additional capabilities (for example, E4406A does not have independent settings of I & Q, nor does it provide for probe calibrations), which make 100% compatibility impossible.

The following commands are supported:

```
:CALibration:IQ:FLATness
```

```
:INPut:IMPedance:IQ U50 | B50 | U1M | B1M
```

```
:INPut:IMPedance:REference <integer>
```

[ :SENSe]:FEED RF | IQ | IONLY | QONLY | AREference | IFALign supports all parameters except IFALign. The FEED? query returns only RF | AIQ | AREF.

The following commands are not supported:

```
:CALibration:GIQ
```

```
:CALibration:IQ:CMR
```

```
:INPut:IQ:ALIGN OFF | ON | 0 | 1
```

The Rohde & Schwarz FSQ-B71 also provides baseband I/Q inputs. A certain amount of code compatibility is provided in X-Series, but hardware differences make this a somewhat limited set.

Supported:

The "<1|2>" is supported as "[1]".

```
INPut<1|2>:IQ:BALanced[:STATE] ON | OFF
```

```
INPut<1|2>:IQ:TYPE I | Q | IQ
```

```
INPut<1|2>:IQ:IMPedance LOW | HIGH
```

Not Supported:

```
DIAGnostic<1|2>:SERVICE:IQ:CALibration:DC 0 | 0.1 | 0.178 | 0.316 | 0.562 | 1.0
```

```
DIAGnostic<1|2>:SERVICE:IQ:CALibration:DESTination IHigh | ILOW | QHigh | QLOW
```

```
DIAGnostic<1|2>:SERVICE:IQ:CALibration:PULSe: PRATe 10 kHz | ... | 4 MHz
```

```
DIAGnostic<1|2>:SERVICE:IQ:INPut IQ | GND | CALDc | CALPulse
```

```
INPut<1|2>:SElect AIQ | RF
```

```
TRACe<1|2>:IQ:DATA:FORMat COMPatible | IQBlock | IQPair>
```

```
TRACe<1|2>:IQ:DATA:MEMory? <offset samples>,<# of samples>
```

```
TRACe<1|2>:IQ:DATA?
```

```
TRACe<1|2>:IQ:SET <filter type>,<rbw>,<sample rate>,<trigger source>,<trigger slope>,<pretrigger samples>,<# of samples>
```

```
TRACe<1|2>:IQ:SRATe 10.0kHz to 81.6MHz
```

```
TRACe<1|2>:IQ[:STATe] ON | OFF
```

The Rohde & Schwarz FMU has the following SCPI, which is *not* supported (these commands start/abort the probe calibration procedure, which is manually interactive from the front panel):

```
CALibration:ABORt
```

```
CALibration:PROBe[:STARt]
```

## 6.2.2 RF Input Port

Specifies the RF input port used. Only appears on units with multiple RF inputs, and lets you switch between the inputs.

Instruments that include multiple RF Input ports include:

- N9041B, N9042B
- N9000B (CXA)
- N9048B (PXE)
- VXT, M941xE and EXM
- M8920A/20B
- E7760B

### NOTE

Switching input ports may change the receiver performance of the instrument.

See ["Instruments with 2 Inputs" on page 686](#)

Remote Command `[ :SENSe ] :FEED[ :RF ] :PORT[ :INPut ] <port>`

For instrument-specific definitions of `<port>`, see:

["Parameters for UXA/PXA/MXA/EXA/CXA/MXE/PXE/NFA" on page 686](#)

["Parameters for EXT, EXF and EXM Wireless Test Sets" on page 687](#)

["Parameters for VXT M9410A/11A/15A16A, M9410E/11E/15E/16E and M9420A Vector Transceivers" on page 687](#)



## 6 Input/Output

### 6.2 Input

|                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                              | <p>"Parameters for VXT M9410A/11A/15A/16A and EXM when used with Radio Heads/CIU" on page 688</p> <p>"Parameters for E7760B Wideband Transceiver" on page 691</p> <p>"Parameters for M8920A/20B Radio Test Set" on page 693</p> <p>"Parameters for UXM Wireless Test Set" on page 693</p> <p><b>[ :SENSe] :FEED[ :RF] :PORT[ :INPut] ?</b></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Example                      | <p>Use the port labeled RF Input when the selected input is RF:</p> <p><b>:FEED:RF:PORT RFIN</b></p> <p>Use the port labeled RF Input 2 when the selected input is RF:</p> <p><b>:FEED:RF:PORT RFIN2</b></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Dependencies                 | <p>Only appears when RF Input is selected as the Input</p> <p>Only appears in models that support multiple inputs. If the SCPI command is sent with unsupported parameters in any other model, an error is generated, -221, "Settings conflict; option not installed"</p> <p>When any input is selected in a measurement that does not support it, the "No result; Meas invalid with this input" error condition occurs, and the measurement returns invalid data when queried</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Couplings                    | <p>When switching between inputs, you may find the new input has a different frequency range than the current input. This means the frequency at the new input may be limited, depending on where you were tuned</p> <p>When you switch from an input whose maximum frequency is greater than the input to which you are switching:</p> <ol style="list-style-type: none"> <li>1. If the current Stop Freq is below the Max Freq for the new input, then neither Stop Freq or Start Freq needs to change</li> <li>2. But if the current Stop Freq is above the Max Freq for the new input, Stop Freq must change; so, it is set to the Max Freq for the new input</li> <li>3. If the Stop Freq is forced to change then, if possible, the Span is preserved with the new Stop Freq; however, the Start Freq can't go below zero</li> </ol> <p>Example: Input 2 has a Max Freq of 110 GHz and Input 1 has a Max Freq of 52 GHz</p> <p>Case 1: Input 2 is selected and Start Freq=40 GHz, Stop Freq=60 GHz. Change to Input 1. Stop Freq changes to 52 GHz so, to preserve Span, Start Freq is set to 32 GHz</p> <p>Case 2: Input 2 is selected and Start Freq=40 GHz, Stop Freq=110 GHz. Change to Input 1. Stop Freq changes to 52 GHz. Span was 70 GHz, but new Span maximum is 52 GHz so Start Freq is set to 0 Hz</p> <p>Case 3: Input 2 is selected and Start Freq=10 GHz, Stop Freq=20 GHz. Change to Input 1. No change is necessary, Start Freq and Stop Freq don't change</p> |
| Preset                       | <p>Unaffected by Mode Preset, but set to <b>RFIN</b> on <b>Restore Input/Output Defaults</b> or <b>Restore System Defaults -&gt; All</b>, unless noted in the platform-specific sections below</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| State Saved                  | <p>Saved in instrument state</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Annotation                   | <p>Annotation in the Meas Bar reads as follows:</p> <p>When input is RF In: Input: RF</p> <p>When input is RF In 2: Input: RF2</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Backwards Compatibility SCPI | <p><b>:INPut&lt;1 2&gt;:TYPE INPUT1   INPUT2</b></p> <p><b>:INPut&lt;1 2&gt;:TYPE?</b></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |

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Included for R&S ESU compatibility. In MXE, the INPUT1 parameter is aliased to RFIN and the INPUT2 parameter is aliased to RFIN2

## Instruments with 2 Inputs

In models with two inputs, the second input usually has a different maximum frequency than the first input. For your convenience, the actual “Max Freq” value is allowed to go slightly higher than the nominal Max Freq for the second input, just as is the case with the first input.

| Model                  | Nominal Input 2 Max Freq | Absolute Input 2 Max Freq | Transition rule for switching from Input 1 to Input 2                                                                                                                                                                  |
|------------------------|--------------------------|---------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| N9038A                 | 1 GHz                    | 1.000025 GHz              | If Stop Freq is above 1.000025 GHz, it is set to 1.000025 GHz, otherwise it does not change<br>If Start Freq is above 1.000024990 Hz, Start Freq is set to 1.000024990 Hz and Span to 10 Hz, otherwise nothing changes |
| N9000A with option C75 | 1.5 GHz                  | 1.58 GHz                  | If Stop Freq is above 1.58 GHz, it is set to 1.58 GHz, otherwise it does not change<br>If Start Freq is above 1.579999990 GHz, Start Freq is set to 1.579999990 GHz and Span to 10 Hz, otherwise nothing changes       |

## Parameters for UXA/PXA/MXA/EXA/CXA/MXE/PXE/NFA

| <port> | Input       |
|--------|-------------|
| RFIN   | RF Input    |
| RFIN2  | RF Input 2  |
| ERFIN  | External RF |

---

|              |                                                                                                                                                                                                                                       |
|--------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Example      | Set the RF input to be RF Input:<br>:FEED:RF:PORT RFIN<br>Set the RF input to be RF Input 2 if that port exists:<br>:FEED:RF:PORT RFIN2<br>Set the RF input to be External RF if the V3050A unit is connected:<br>:FEED:RF:PORT ERFIN |
| Dependencies | If the command is sent with RFIN2 or ERFIN and that port does not exist, an error is generated, -221, “Settings conflict; option not installed”<br>ERFIN requires option “EXW”                                                        |
| Couplings    | Connecting a V3050A changes the Preset to ERFIN and automatically switches the input to ERFIN. Disconnecting the V3050A changes the Preset back to RFIN and automatically switches the input to RFIN                                  |
| Preset       | ERFIN when V3050A is connected, otherwise RFIN                                                                                                                                                                                        |

---

## 6 Input/Output

### 6.2 Input

Annotation Annotation in the Meas Bar reads as follows:

- When input is RFIN: Input: RF
- When input is RFIN2: Input: RF2
- When input is ERFIN: Input: Ext RF

#### Parameters for EXT, EXF and EXM Wireless Test Sets

| <port> | Input   |
|--------|---------|
| RFIO1  | RFIO 1  |
| RFIO2  | RFIO 2  |
| RFIO3  | RF3 I/O |
| RFIO4  | RF4 I/O |

See also "Parameters for VXT M9410A/11A/15A/16A and EXM when used with Radio Heads/CIU" on page 688

Example Set the RF input to RFIO 1:

:FEED:RF:PORT RFIO1

Dependencies In EXF, or in EXM with hardware M9430A, if RF Input is selected as RF Input Port, you need to choose the settings in the Half Duplex Config menu to determine which port (RFIO3 or RFIO4) will be used  
In EXM with hardware M9431A, this setting is not supported. If the SCPI command is sent with this setting, an error is generated, -221, "Settings conflict; option not installed"

Preset RFIO1

Annotation Annotation in the Meas Bar reads as follows:

- When input is RFIO1: Input: RFIO1
- When input is RFIO2: Input: RFIO2
- When input is RFIO3: Input: RFIO3
- When input is RFIO4: Input: RFIO4

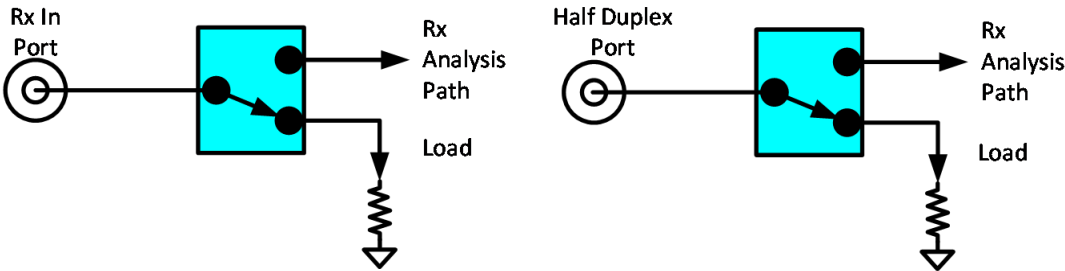
#### Parameters for VXT M9410A/11A/15A/16A, M9410E/11E/15E/16E and M9420A Vector Transceivers

| <port> | Input                |
|--------|----------------------|
| RFIN   | RF Input             |
| RFFD   | RFIO FD              |
| RFHD   | RFIO HD, Half Duplex |

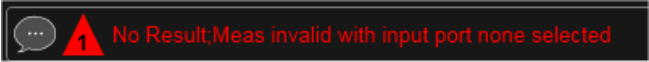
Example :FEED:RF:PORT RFIN

|  |                                 |
|--|---------------------------------|
|  | <code>:FEED:RF:PORT RFFD</code> |
|  | <code>:FEED:RF:PORT RFHD</code> |
|  | <code>:FEED:RF:PORT NONE</code> |

|       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|-------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Notes | <p><b>RFIN</b> sets the RF input to be the RF Input port, labeled RF Input</p> <p><b>RFFD</b> sets the RF input to be the full duplex port, labeled RFIO FD. Note that Option “FDX” is required to enable this port</p> <p><b>RFHD</b> sets the RF input to be the half duplex port, labeled Half Duplex (M9410A/11A/15A/16A) or RFIO HD (M9420A)</p> <p>M9410E/11E/15E/16E also has HD port, which is the HD port on M9471A module</p> <p><b>NONE</b> sets the RF In port and Half Duplex port (if HD Port is not set to RF Output) to connect to 50Ω load, as shown below:</p> |
|-------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|



When using Source only, set RF Input to **NONE** to provide better isolation. When the input port is set to **NONE**, an error appears in the status area:



|              |                                                                                                                                                                                                                                                                                                                                                           |
|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Dependencies | <p>Option HDX is required to enable the Half Duplex (RFIO HD) port</p> <p>You cannot set this port to be the input if it is already set to be the output. Attempting to do so generates error message: “-221, Settings conflict; RF Input cannot be set to RFIO HD when RF Output is RFIO HD”</p> <p><b>NONE</b> is not available in VXT model M9420A</p> |
|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|        |             |
|--------|-------------|
| Preset | <b>RFIN</b> |
|--------|-------------|

|            |                                                                                                                                                                                                                                        |
|------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Annotation | <p>Annotation in the Meas Bar reads as follows:</p> <p>When input is RF Input: Input: RF</p> <p>When input is RFIO FD: Input: RFFD</p> <p>When input is RFIO HD or Half Duplex: Input: RFHD</p> <p>When input is None: Input: NONE</p> |
|------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

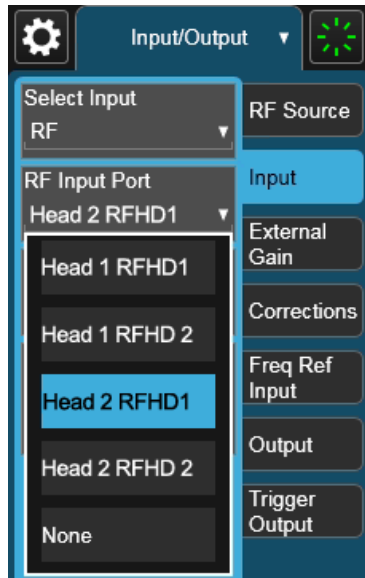
**Parameters for VXT M9410A/11A/15A/16A and EXM when used with Radio Heads/CIU**

| <port>           | Input                                                                                       |
|------------------|---------------------------------------------------------------------------------------------|
| <b>RRHhRFHDp</b> | Head <i>h</i> , RF Tx/Rx <i>p</i> , for example <b>RRH1RFHD2</b> = Head 1, RF Tx/Rx 2       |
| <b>IFINn</b>     | DUT IF IN for Channel <i>n</i> , for example <b>IFIN1</b> = DUT IF IN for Channel 1         |
| <b>IFHDn</b>     | DUT IF In/Out for Channel <i>n</i> , for example <b>IFHD1</b> = DUT IF In/Out for Channel 1 |

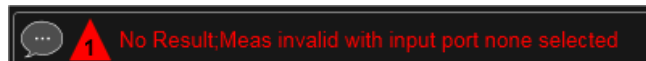
## 6 Input/Output

### 6.2 Input

When using a Remote Radio Head (RRH), such as the Keysight M1740A mmWave Transceiver for 5G, with the VXT or EXM, the choices in the dropdown are dependent on which heads are installed. For example, in the case where two M1740As are present, each with two ports, the dropdown will look like this:

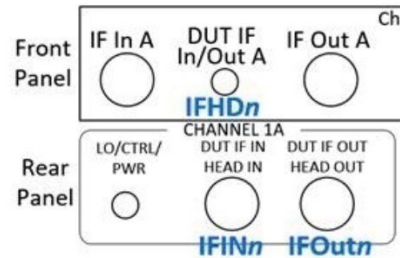


Note the inclusion of the **None** choice, which allows the input port to become unassigned, and thus allows any Output port to be assigned without concern about an Input port conflict. When the input port is unassigned, an error appears in the status area:



The user interface parameter RFHD p corresponds to the port labeled RF Tx/Rx p; for example, RFHD 2 means the port labeled RF Tx/Rx 2 on the M1740A.

When using a E7770A Common Interface Unit, you may make connections to the half-duplex port on the front of the CIU labeled DUT IF In/Out, and/or to ports on the rear of the CIU labeled DUT IF IN and DUT IF OUT. For example, if your DUT has an IF Output you will usually connect it to one of the DUT IF IN ports on the rear panel of the CIU. The user interface parameter IFIN n corresponds to the DUT IF IN port for Channel n on the CIU, so you would choose IFIN 1 in the dropdown to connect to the DUT IF IN port for Channel 1, and the corresponding SCPI parameter would be IFIN1. See the figure below:



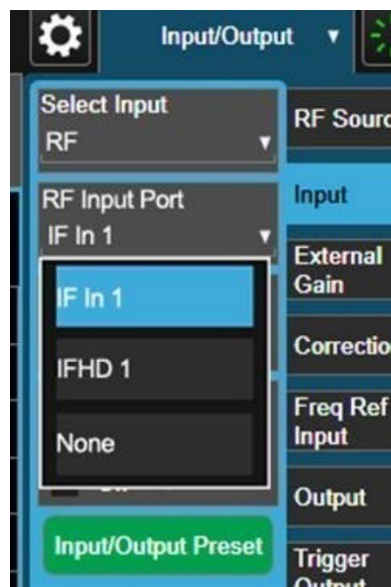
The following table lists the GUI parameter for each input or output on the CIU, and the SCPI parameter for the RF Input Port command (`[[:SENSe]:FEED[:RF]:PORT[:INPut]]`) and the RF Output Port command (`[[:SENSe]:FEED:RF:PORT:OUTPut]`):

| Port                 | Port name on CIU | Name displayed in GUI | SCPI parameter for RF Input Port and Output Port commands |
|----------------------|------------------|-----------------------|-----------------------------------------------------------|
| IF input port        | DUT IF IN        | IF In n               | <code>IFInn</code> , for example <code>IFIN1</code>       |
| IF output port       | DUT IF OUT       | IF Out n              | <code>IFOutn</code> , for example <code>IFO1</code>       |
| IF port, half duplex | DUT IF In/Out    | IFHD n                | <code>IFHDn</code> , for example, <code>IFHD1</code>      |

NOTE

The value of n for each port, in the multiple-port use case, may vary according to your system configuration. For the value of n for your use case, consult the Startup Guide for your particular system (for example S9100A).

An example of the GUI for the CIU ports appears below:



## 6 Input/Output

### 6.2 Input

|                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Example                      | <p>Set the RF input to be the port labeled RF Tx/Rx 2 on Head 1:<br/> <b>:FEED:RF:PORT RRH1RFHD2</b></p> <p>Set the RF input to be the Channel 1 port labeled DUT IF IN on the CIU:<br/> <b>:FEED:RF:PORT IFIN1</b></p>                                                                                                                                                                                                                                                                |
| Notes                        | <p>Parameter <b>RRHhRFHDp</b> corresponds to <b>Head h</b>, port <b>RF Tx/Rx p</b>; for example, <b>RRH1RFHD2</b> = the port labeled <b>RF Tx/Rx 2</b> on <b>Head 1</b></p> <p>For the CIU, the parameter <b>IFINc</b> corresponds to the <b>DUT IF IN</b> for channel <b>c</b>. For example, <b>IFIN1</b> would connect to the <b>DUT IF IN</b> port for Channel 1</p>                                                                                                                |
| Dependencies                 | The Radio Head and CIU parameters only appear when a Remote Radio Head or CIU is connected to the instrument. If these parameters are sent at any other time, an error is generated, “-221, Settings conflict; option not installed”                                                                                                                                                                                                                                                   |
| Preset                       | <b>RRH1RFHD1</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Annotation                   | <p>Annotation in the Meas Bar reads as follows:<br/>           Input:Hd <i>h</i> RFHD <i>p</i><br/>           For example, in the case above, with RFHD 2 on Head 1 selected:<br/>           Input:Hd 1 RFHD 1<br/>           When using the CIU:</p> <ul style="list-style-type: none"> <li>– When input is IFIN1: Input: IFIN 1</li> <li>– When input is IFIN2: Input: IFIN 2</li> <li>– When input is IFIN3: Input: IFIN 3</li> <li>– When input is IFIN4: Input: IFIN 4</li> </ul> |
| Backwards Compatibility SCPI | <p><b>:FEED:RF:PORT A1</b></p> <p>A1 is treated as RRH1RFHD1 and sets the RF input to be the port labeled RF Tx/Rx 1 on Head 1<br/> <b>:FEED:RF:PORT B1</b></p> <p>B1 is treated as RRH1RFHD2 and sets the RF input to be the port labeled RF Tx/Rx 2 on Head 1<br/> <b>:FEED:RF:PORT IFIO2</b></p> <p>IFIO2 is treated as IFIN1, and sets the IF input to be the port labeled “DUT IF In/Out” on the CIU rear panel</p>                                                               |

#### Parameters for E7760B Wideband Transceiver

| <port>              | Input                                                     |
|---------------------|-----------------------------------------------------------|
| <b>An</b>           | Bank A, Channel <i>n</i> , for example <b>A1</b>          |
| <b>Bn</b>           | Bank B, Channel <i>n</i> , for example <b>B1</b>          |
| <b>IFIO<i>n</i></b> | IF In/Out for Channel <i>n</i> , for example <b>IFIO1</b> |

|         |                                                                    |
|---------|--------------------------------------------------------------------|
| Example | <p>Set the RF input to <b>A1</b>:<br/> <b>:FEED:RF:PORT A1</b></p> |
|---------|--------------------------------------------------------------------|

|              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|--------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|              | <p>Set the RF input to <b>B3</b>:<br/>:FEED:RF:PORT B3</p> <p>Set the RF input to <b>IFIO1</b>:<br/>:FEED:RF:PORT IFIO1</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Dependencies | <p>Ports <b>A1</b>, <b>A2</b>, <b>A3</b>, <b>B1</b>, <b>B2</b>, and <b>B3</b> are available if Option RF3 is installed. Ports <b>IFIO1</b> and <b>IFIO2</b> are available if option RF2 is installed</p> <p>Note that for E7760B:</p> <ul style="list-style-type: none"> <li>- Attempting to select a port for which the option is not present will generate the error, -241, "Hardware missing; Input not available"</li> <li>- A port cannot be selected as an Input while it is occupied as an Output. Sending such a command while the port is occupied generates error: -221, "Settings conflict; Input Port is not available while occupied by Output"</li> <li>- The mmWave ports are divided into two banks; the A Bank and the B Bank. A port cannot be selected as an Input if any port on the same bank is occupied as an Output. Sending a command for this situation generates error: -221 "Settings conflict; Input Port is not available while port bank is occupied by Output"</li> </ul> <p>If RF3 is present and RF4 is absent, a mmWave port cannot be selected as an Input if the Output Port is occupied by mmWave Transceiver with a different frequency range. Sending a command for this situation generates error: -221 "Settings conflict; Input Port is not available while occupied by Output of incompatible frequency"</p> |
| Preset       | <p>E7760B with Option RF2: <b>IFIO1</b></p> <p>E7760B without Option RF2: the first port with mmWave Transceiver attached. If no mmWave Transceiver attached: <b>NONE</b></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Annotation   | <p>Annotation in the Meas Bar reads as follows:</p> <ul style="list-style-type: none"> <li>- When input is A1: Input: A1</li> <li>- When input is A2: Input: A2</li> <li>- When input is A3: Input: A3</li> <li>- When input is B1: Input: B2</li> <li>- When input is B2: Input: B2</li> <li>- When input is B3: Input: B3</li> <li>- When input is IFIO1: Input: IFIO1</li> <li>- When input is IFIO2: Input: IFIO2</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |



### Parameters for M8920A/20B Radio Test Set

|                         | <div>&lt;port&gt;</div> <div>Input</div>                                                                                                                                                                                                                                                         |
|-------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                         | <div>ANT</div> <div>Ant</div>                                                                                                                                                                                                                                                                    |
|                         | <div>TR</div> <div>T/R</div>                                                                                                                                                                                                                                                                     |
| <div>Example</div>      | <div>Set the RF input to be the Antenna port on M9470A, labeled <b>Ant</b>:</div> <div>:FEED:RF:PORT ANT</div> <div>Set the RF input to be the T/R port on M9470A and M8920A/20B, labeled <b>T/R</b>. Note that Option HDX is required to enable the T/R port:</div> <div>:FEED:RF:PORT TR</div> |
| <div>Dependencies</div> | <div>ANT and TR are only available in modular analyzers, and only when the M9470A module is installed, such as in M8920A. Option HDX is required to enable the T/R port</div>                                                                                                                    |
| <div>Preset</div>       | <div>ANT</div>                                                                                                                                                                                                                                                                                   |
| <div>Annotation</div>   | <div>Annotation in the Meas Bar reads as follows:</div> <ul style="list-style-type: none"> <li>When input is Ant: Input: Ant</li> <li>When input is T/R: Input: T/R</li> </ul>                                                                                                                   |

### Parameters for UXM Wireless Test Set

|                    | <div>&lt;port&gt;</div> <div>Input</div>                              |
|--------------------|-----------------------------------------------------------------------|
|                    | <div>RFIN</div> <div>RF Input</div>                                   |
|                    | <div>RFIO1</div> <div>RFIO 1</div>                                    |
|                    | <div>RFIO2</div> <div>RFIO 2</div>                                    |
| <div>Example</div> | <div>Set the RF input to RFIO 2:</div> <div>:FEED:RF:PORT RFIO2</div> |
| <div>Preset</div>  | <div>RFIN</div>                                                       |

## 6.2.3 SA Frequency Extender Firmware Update (Front Panel Only)

When a Frequency Extender device (for example, V3050A) is connected and selected, if a firmware update is available for that device, this control will be visible. Because the measurement will be stopped for the duration of the firmware update, and because the update cannot be un-done, a confirmation dialog will be presented before proceeding with the firmware update. The update can take some time, so while in process, a modal dialog will be shown indicating that the update is in process and warning not to disconnect the device or turn off power. Typically, the update will take about a minute, but time can vary with the model of the Frequency Extender. When complete, the modal dialog will be dismissed, and a pop-up

message will be shown for a few seconds indicating the success or failure of the update.

See ["Error Messages" on page 694](#)

|              |                                                                                                                                                             |
|--------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Notes        | Measurement is stopped while the update is in process                                                                                                       |
| Dependencies | Not available unless an External RF device is connected, External RF is the selected RF Input Port, and there is a firmware update available for the device |

## Error Messages

### Update Already in Process Error

If a firmware update is already in process, the following message is displayed:

```
Another external device FW update is already in process. Only one update is
allowed at a time
```

If received, wait until the current FW update is complete and then try again if still needed.

### Unknown Assembly Error

When updating the firmware, the target hardware assembly needs to be identified. If for some reason the assembly cannot be identified, the firmware will not be able to initiate the update, and this error message will be displayed:

```
Error updating FW for external device model <model number>' serial number
<serial number>
```

```
Could not find HW assembly, cannot perform FW update
```

The `<model number>` and `<serial number>` contain the actual numbers for the device.

This is a failure that warrants investigation, so you should contact Keysight Customer Support for service.

### Error During Firmware Update Process

If there is an execution problem during the FW update, the specific error message(s) is written to the SA Event Log and this error message is displayed:

```
Error updating FW for external device model <model number>' serial number
<serial number>
```

```
Error during FW update. See windows event log for more details
```

The `<model number>` and `<serial number>` contain the actual numbers for the device.

## 6.2.4 SA Frequency Extender Cable Correction

An SA Frequency Extender, such as V3050A, is attached to the instrument with several cables. Keysight provides several cables for purchase with the frequency extender. Typically, these are 1-, 2-, or 3-meter cables for the RF and IF connections. Keysight has characterized these cables and can correct for their loss. This control allows you to specify which cable is being used.

If you are using another type of cable, the instrument *cannot* automatically correct for it, so this function must be set to **OFF**. In this case, you can use RCal to characterize the corrections.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:INPut:FEXTender:CABLe:CORRection OFF   V3050A1M   V3050A2M   V3050A3M</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Example        | <code>:INP:FEXT:CABL:CORR V3050A1M</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Notes          | <p>The RF Input Port selections that support an SA Frequency Extender (such as V3050A) are:</p> <p>N9042B: External RF</p> <p>No other instruments support an SA Frequency Extender</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Dependencies   | <p>An SA Frequency Extender must be attached, and the frequency extender's port must be the selected input for this control to be visible</p> <ul style="list-style-type: none"> <li>– If the instrument does not support frequency extenders, the SCPI command returns error -241, "Hardware missing; option not available"</li> <li>– If the instrument does support frequency extenders, but a frequency extender is not attached, the SCPI command returns error -241, "Hardware missing; Cable selection only available when supporting frequency extender attached"</li> </ul> <p>When a frequency extender is attached, the control is not visible unless the frequency extender's port is the selected RF input, but the command will still be available. Setting the cable selection when the frequency extender's port is not active has no effect until the port is selected</p> |
| Preset         | Unaffected by <b>Mode Preset</b> but set to preset value by <b>Restore Input/Output Defaults</b> or <b>Restore System Defaults -&gt; All</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| State Saved    | Saved in instrument state                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |

## 6.2.5 Half Duplex Input Port

Specify whether **RFIO3** or **RFIO4** is the Half Duplex Input port.

|                |                                                                                                                                                       |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:HDUPlex:PORT:INPut RFIO3   RFIO4</code>                                                                                               |
| Example        | <code>:HDUPlex:PORT:INPut RFIO3</code><br><code>:HDUPlex:PORT:INPut?</code>                                                                           |
| Dependencies   | <p>Only appears in EXM</p> <p>If <b>RFIO3</b> is selected as "Half Duplex Output Port", then "Half Duplex Input Port" will be set to <b>RFIO4</b></p> |

|             |                                                                                                                                                  |
|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------|
|             | automatically. If <b>RFIO4</b> is selected as “Half Duplex Output Port”, then “Half Duplex Input Port” will be set to <b>RFIO3</b> automatically |
| Preset      | <b>RFIO3</b>                                                                                                                                     |
| State Saved | Saved in State                                                                                                                                   |

## 6.2.6 Port Information (Remote Command Only)

Provides information about an instrument port. The return information consists of two comma-separated fields:

- Field 1: the connection status (0 or 1)
- Field 2: a string of port information

The return information is device-dependent.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:FEED[:RF]:PORT:INformation? RFIN   RFIN2   RFFD   RFHD   A1   A2   A3   B1   B2   B3   IFIO1   IFIO2   ANT   TR</code>                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Example        | <code>:FEED:PORT:INF? A1</code><br><br>example = <b>1</b> , “ <b>US56160060</b> ” where <b>1</b> is the connection status and “ <b>US56160060</b> ” is the port information                                                                                                                                                                                                                                                                                                                                                                                    |
| Notes          | For E7760B:<br>The connection status (first field in the return value) indicates:<br>0 – the port is either not licensed for use or is not connected to a mmWave Transceiver<br>1 – the port is licensed; and for the case of mmWave ports, the port is connected to a mmWave Transceiver<br>The port information (second field in the return value) contains:<br>“” (empty string) – no applicable information<br>Serial Number – the serial number of the connected mmWave Transceiver<br>If you send an incompatible parameter, the return values are: 0,”” |
| Dependencies   | Only valid for E7760B                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |

## 6.2.7 RF Preselector

In models that support the RF Preselector, such as PXE (N9048B), allows you to turn the preselector on or off.

### NOTE

When using the RF Preselector, if your measurement starts below 3.6 GHz and finishes above 3.6 GHz, the preselector bypass switch will have to switch in and out for every measurement. When this is the case, you will hear a clicking sound from the instrument and a warning message will be displayed: “Settings Alert:

**Mechanical switch cycling**". You are advised to *avoid* such setups as much as possible, to minimize switch wear. Pressing **Mode Preset** resets Stop Freq to 3.6 GHz, to exit this state, or you can manually set Stop Freq to be below 3.6 GHz.

|                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command               | <code>[ :SENSe]:POWer[:RF]:RFPSelector[:STATe] 1   0   ON   OFF</code><br><code>[ :SENSe]:POWer[:RF]:RFPSelector[:STATe]?</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Example                      | <code>:POW:RFPS 1</code><br><code>:INP:PRES:STAT ON</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Notes                        | Set full compliance measurement:<br><code>[ :SENSe]:POWer[:RF]:RFPSelector[:STATe] 1   ON</code><br><br>Set pre-compliance measurement:<br><code>[ :SENSe]:POWer[:RF]:RFPSelector[:STATe] 0   OFF</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Dependencies                 | Only appears when RF Input is selected as the Input<br>Only appears in MXE and PXE<br>The RF Preselector is not available in all measurements. The key is grayed out in measurements that do not support it, unless you are in a Mode in which no measurements support it, in which case the key does not appear at all. If the preselector is unavailable, it is forced to Off. Attempting to turn it on or off in measurements that do not support it generates the error message:<br>-221, Settings conflict; Feature not supported for this measurement<br>The RF Preselector is not available when FFT Sweep Type is manually selected. Attempting to turn it on or off when this is the case generates an error message:<br>-221, Settings conflict; RF Presel unavailable when Sweep Type=Manual FFT<br>Only appears in Modes that support the RF Preselector, in other Modes, sending the SCPI command or query generates an error<br>In Frequency Scan measurement, this key is grayed-out when final measurement is running. Warning message "Function not available while measurement is running" appears if the grayed-out key is pressed |
| Preset                       | <b>ON</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Annotation                   | When RF Preselector=On, "RF PRESEL" is displayed on the Settings Panel                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Backwards Compatibility SCPI | <code>:INPut&lt;1 2&gt;:PRESelection[:STATe] ON   OFF</code><br><code>:INPut&lt;1 2&gt;:PRESelection[:STATe]?</code><br><br>Included for R&S ESU compatibility                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |

## 6.2.8 Notch Filter

In some models that support the RF Preselector, such as PXE, there is also a notch filter to suppress signals in the frequency band from 2.4 GHz to 2.5 GHz. This control allows you to turn the notch filter on or off.

|                |                                                                                |
|----------------|--------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:POWer[:RF]:RFPSelector:NFilter[:STATe] OFF   ON   0   1</code> |
|----------------|--------------------------------------------------------------------------------|

|                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                              | <code>[ :SENSe]:POWer[:RF]:RFPSelector:NFIltEr[:STATe]?</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Example                      | <code>:POW:RFPS:NFIL 1</code><br><code>:POW:RFPS:NFIL?</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Dependencies                 | <p>Only appears when RF Input is selected as the Input</p> <p>Only appears in models that support the notch filter, such as PXE. Attempting to turn it on or off via SCPI in models that do not support it generates error message: -241 Hardware missing; Not available for this model number</p> <p>Only appears in measurements that support the Notch Filter, such as EMI Receiver measurements. Attempting to turn it on or off via SCPI in measurements that do not support it generates error message: -221, Settings conflict; Feature not supported for this measurement</p> <p>In Frequency Scan measurement, this control is grayed-out when final measurement is running, aligned with the <b>RF Presel</b> key. The warning message "Function not available while measurement is running" appears if the grayed-out control is pressed</p> |
| Preset                       | <b>OFF</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| State Saved                  | Saved in instrument state                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Range                        | <b>OFF   ON</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Annotation                   | <p>Due to limited space in the Measurement Bar, Notch Filter annotation is shown as part of the RF Presel state</p> <ul style="list-style-type: none"> <li>- <b>RF Presel: On, NF</b>, when both RF Presel and Notch Filter are turned on</li> <li>- <b>RF Presel: On</b>, when RF Presel = on and Notch Filter= off</li> <li>- <b>RF Presel: Off</b>, when RF Presel = off</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Backwards Compatibility SCPI | <code>:INPut&lt;1 2&gt;:PRESelection:FILTer:NOTCh[:STATe] ON   OFF</code><br><code>:INPut&lt;1 2&gt;:PRESelection:FILTer:NOTCh[:STATe]?</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |

## 6.2.9 RF Calibrator

Lets you choose a calibrator signal to look at or turns the calibrator off.

|                |                                                                                                                                                                                                                                                                                                                                |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:FEED:AREFERENCE REF50   REF4800   OFF</code><br><code>[ :SENSe]:FEED:AREFERENCE?</code>                                                                                                                                                                                                                        |
| Example        | <p>Select the 50 MHz amplitude reference as the signal input:<br/><code>:FEED:AREF REF50</code></p> <p>Select the 4.8 GHz amplitude reference as the signal input:<br/><code>:FEED:AREF REF4800</code></p> <p>Turn the calibrator "off" (switches back to the selected input - RF or I/Q):<br/><code>:FEED:AREF OFF</code></p> |
| Dependencies   | <p>Only appears when RF Input is selected as the Input</p> <p>Selecting an input (RF, Ext Mix or I/Q) turns the Calibrator <b>OFF</b>. This is true whether the input is selected using the menu panel or <code>[ :SENSe]:FEED</code></p>                                                                                      |

## 6 Input/Output

### 6.2 Input

|                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                              | <p>The 4.8 GHz internal reference is only available in some models and frequency range options. If the 4.8 GHz reference is not present, the <b>4.8 GHz</b> choice does not show, and if the REF4800 parameter is sent, the instrument generates an error</p> <p>In <b>Measuring Receiver (MMR) Mode</b>, <b>RF Calibrator</b> is turned off and disabled in RF Power and TRFL measurements, to prevent impedance mismatch at the input of the instrument. Trying to turn on <b>RF Calibrator</b> in these measurements generates an error</p> |
| Couplings                    | When one of the calibrator signals is selected, the instrument routes that signal (an internal amplitude reference) to the instrument, and changes the main input selection to RF so the calibrator signal can be seen. When you turn the calibrator off it does not switch back to the previously selected input                                                                                                                                                                                                                              |
| Preset                       | <b>OFF</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| State Saved                  | Saved in instrument state                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Annunciation                 | An advisory message is sent, indicating that the input is set to internal                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Backwards Compatibility SCPI |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Notes                        | <p>For ESA backwards compatibility</p> <p>In the ESA the calibrator was a separate output which you connected to the input and switched on with this command</p> <p>In X-Series, the <b>ON</b> parameter is aliased to <b>[ :SENSe]:FEED:AREF REF50</b> and the <b>OFF</b> parameter is aliased to <b>[ :SENSe]:FEED:AREF OFF</b></p> <p>When <b>:CALibration:SOURce:STATe?</b> is received, 1 is returned if any of the references is selected, or 0 if the Calibrator is <b>OFF</b></p>                                                      |
| Preset                       | <b>OFF</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Backwards Compatibility SCPI | <b>:CALibration:SOURce:STATe OFF   ON   0   1</b><br><b>:CALibration:SOURce:STATe?</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                         |

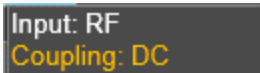
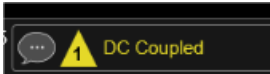
#### 6.2.10 RF Coupling

Specifies alternating current (**AC**) or direct current (**DC**) coupling at the instrument RF input port. Selecting **AC** coupling switches in a blocking capacitor that blocks any DC voltage present at the instrument input. This decreases the input frequency range of the instrument, but prevents damage to the input circuitry of the instrument if there is a DC voltage present at the RF input.

##### NOTE

When operating in **DC** coupled mode, ensure protection of the instrument input circuitry by limiting the DC part of the input level to within 200 mV of 0 Vdc. In **AC** or **DC** coupling, limit the input RF power to +30 dBm (1 Watt).

|                |                                                           |
|----------------|-----------------------------------------------------------|
| Remote Command | <b>:INPut:COUPling AC   DC</b><br><b>:INPut:COUPling?</b> |
|----------------|-----------------------------------------------------------|

|              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Example      | <code>:INP:COUP DC</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Dependencies | <p>Only appears when RF Input is selected as the Input</p> <p>Does not appear in models that are always AC coupled. When the SCPI command to set DC coupling is sent to these models, it generates the error "Illegal parameter value; This model is always AC coupled" In these models, <code>:INP:COUP?</code> always returns <code>AC</code></p> <p>Does not appear in models that are always DC coupled. When the SCPI command to set AC coupling is sent to these models, it generates the error "Illegal parameter value; This instrument is always DC coupled" In these models, <code>:INP:COUP?</code> always returns <code>DC</code></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Preset       | <p><code>AC</code> on models that support AC coupling</p> <p>On models that are always DC coupled, such as millimeter wave models (frequency ranges 30 GHz and above), the preset is <code>DC</code></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| State Saved  | Saved in instrument state                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Annunciation | <p>When the RF Input is selected, and AC coupling is selected, annunciators appear in the Meas Bar to that effect:</p>  <p>appears in the settings panel (the row of annunciators across the top of the display) to that effect, as shown below:</p> <p>When the RF Input is selected, and DC coupling is in effect, the annunciator changes as shown below:</p>  <p>Note the amber color, which indicates that you should exercise caution when applying a signal to any DC coupled input (see note above this table for the specific cautions)</p> <p>On models that support both AC and DC coupling: when DC coupling is selected, a warning condition message appears in the status line "DC coupled" as shown below:</p>  <p>On models that support both AC and DC coupling: when AC coupling is selected, and any part of the displayed frequency range is below 10 MHz, a warning condition message appears in the status line: "AC: Accy unspec'd below 10 MHz"</p> <p>In AC coupling mode, you can view signals below the corner frequency of the DC block, but below a certain frequency the amplitude accuracy is not specified.</p> <p>The lowest frequency for which specifications apply is:</p> |

| X-Series Model  | Lowest Freq for meeting specs when AC coupled | Lowest Freq for meeting specs when DC coupled |
|-----------------|-----------------------------------------------|-----------------------------------------------|
| CXA-503/507     | 100 kHz                                       | n/a                                           |
| CXA-C75 Input 2 | 1 MHz                                         | n/a                                           |
| CXA-513/526     | 10 MHz                                        | 9 kHz                                         |
| CXA-m           | 10 MHz                                        | 9 kHz                                         |



| X-Series Model | Lowest Freq for meeting specs when AC coupled | Lowest Freq for meeting specs when DC coupled |
|----------------|-----------------------------------------------|-----------------------------------------------|
| EXA            | 10 MHz                                        | 9 kHz                                         |
| MXA            | 10 MHz                                        | 20 Hz                                         |
| PXA            | 10 MHz                                        | 3 Hz                                          |
| UXA            | 10 MHz                                        | 3 Hz                                          |

Some amplitude specifications apply only when coupling is set to DC. Refer to the appropriate amplitude specifications and characteristics for your instrument.

### 6.2.11 Input Z Correction

Sets the input impedance for unit conversions. This affects the results when the y-axis unit is voltage or current units (dBmV, dBμV, dBμA, V, A), but not when it is power units (dBm, W). The impedance you select is for computational purposes only, since the actual impedance is set by internal hardware to 50 ohms. Setting the computational input impedance to 75 ohms is useful when using a 75 ohm to 50-ohm adapter to measure a 75-ohm device on an instrument with a 50-ohm input impedance.

There are a variety way to make 50-to-75-ohm transitions, such as impedance transformers or minimum loss pads. The choice of the solution that is best for your measurement situation requires balancing the amount of loss that you can tolerate with the amount of measurement frequency range that you need. If you are using one of these pads/adaptors with the **Input Z Corr** function, you might also want to use the **Ext Gain** key. This function is used to set a correction value to compensate for the gain (loss) through your pad. This correction factor is applied to the displayed measurement values.

|                |                                                                                                                                                                                                                                                                                                    |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:CORRection:IMPedance[:INPut][:MAGNitude] 50   75</code><br><code>[ :SENSe]:CORRection:IMPedance[:INPut][:MAGNitude]?</code>                                                                                                                                                        |
| Example        | Set the input impedance correction to 75 ohms:<br><code>:CORR:IMP 75</code>                                                                                                                                                                                                                        |
| Couplings      | In CXA option C75, when RF Input 2 is selected, the Input Z Correction automatically changes to 75 ohms. You may then change it to whatever is desired. When the main RF Input is selected, the Input Z Correction automatically changes to 50 ohms. You may then change it to whatever is desired |
| Preset         | Unaffected by Preset, but set to 50 ohms by <b>Restore Input/Output Defaults</b> or <b>Restore System Defaults-&gt;All</b><br>Some instruments/options may have 75 ohms available                                                                                                                  |
| State Saved    | Saved in instrument state                                                                                                                                                                                                                                                                          |

### 6.2.12 All Screens Use Same Input

If **ON**, then all Screens share the same Input settings. This is the default state.

If **OFF**, then certain settings are allowed to be local to each Screen, meaning one Screen can have them set one way and another can have them set another way.

The Input settings that become local to each Screen when **All Screens Use Same Input** is **OFF** are:

Input Tab:

- Selected Input (RF, Ext Mix, BBIQ)
- RF Input Port (only appears in instruments with multiple RF ports, such as N9041B, MXE, and CXA)
- RF Coupling (AC/DC)
- Input Z Correction

External Gain Tab:

- External Preamp
- MS
- BTS

Corrections Tab:

- For each Correction, whether it is on or off

Note that if **All Screens Use Same Input** is **OFF** and you press the + control to create a new Screen, the new Screen contains a copy of the old Screen’s state, including all its Input/Output variables.

|                                                                                     |                                                                                      |
|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
| Remote Command                                                                      | :INSTrument:COUPle:SCReen:INPut ON   OFF   1   0<br>:INSTrument:COUPle:SCReen:INPut? |
| Example                                                                             | :INST:COUP:SCR:INP OFF                                                               |
| Preset                                                                              | ON                                                                                   |
| Not affected by Input/Output Preset, but set to ON by Restore Input/Output Defaults |                                                                                      |

### 6.2.13 External Mixer Setup

Lets you select the mixer type, and lets you configure your mixer (if necessary). The first page of the dialog shows you the current settings for the selected mixer. These

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settings may be dependent on which IF path is currently in use, whether a + or – harmonic is currently selected, etc.

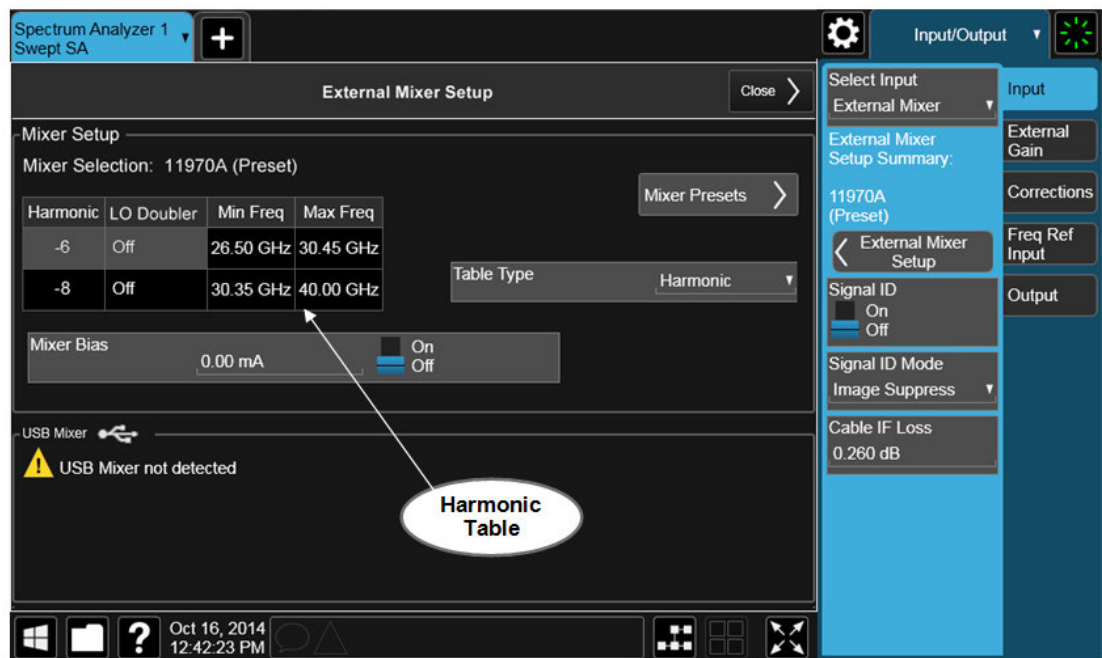
To apply any amplitude correction factors needed to correct mixer flatness, you enter values into one of the Correction tables (under **Input/Output, Corrections**). The correction conversion loss values can be extracted from data supplied with the mixer or from manual measurements you make to determine the conversion loss. Note that the correction applied by the Correction tables is global to the instrument; therefore, you should make sure to turn off the External Mixer corrections when you are not using the External Mixer input.

NOTE

Keysight USB Mixers automatically supply their flatness data to the instrument, and the correction is applied internally. No correction needs be entered, and the correction does not appear in the user-accessible Corrections tables. You are free to enter additional corrections into the Correction tables under **Input/Output, Corrections**.

|              |                                                                                                                                  |
|--------------|----------------------------------------------------------------------------------------------------------------------------------|
| Notes        | The setup summary on the menu panel appears just above this control, showing the current external mixer setup                    |
| Dependencies | Only appears when External Mixer is selected as the Input                                                                        |
| State Saved  | All settings in the External Mixer Setup dialog are part of the Input/Output system, and hence are saved whenever State is saved |

The **External Mixer Setup** screen looks like this:



The current Mixer selection (the current or most recently connected USB Mixer, or the most recent Mixer Preset, or **Custom** if you have modified the setup) reads out at the top of this screen as **Mixer Selection**

The Harmonic Table currently being used reads out below the Mixer Selection. It shows each range being used for the current mixer. Note that a band may be made up of up to 3 ranges. Each range represents a choice of mixer harmonic and doubler state. When you select a Mixer Preset, it sets the instrument Start and Stop frequency to the values shown in the Harmonic Table; Start Freq is set to the Min Freq for the bottom range, and Stop Freq is set to the Max Freq for the top range. In many cases you can exceed these nominal values; the absolute maximum and minimum frequency for each preset are shown in the tables that accompany the control descriptions for the Mixer Presets.

**NOTE**

**If the current measurement has a limited Span available to it and cannot achieve the Span shown in the table ( $\text{Span} = \text{Stop Freq} - \text{Start Freq}$ ), the instrument uses the maximum Span the measurement allows, and sets **Center Frequency** to the midpoint of the Start and Stop Freq values in the Harmonic Table.**

---

You may edit some of the Harmonic and LO Doubler fields in the Harmonic Table, as shown by the gray backgrounds of these fields. When you edit the Harmonic Table, the Mixer Selection changes to **Custom**. To change it back you must go back into the Mixer Presets menu and select a Preset.

When you edit the Harmonic Table, the nominal Min Freq and Max Freq that are available will usually be different than the Preset you were using; and the absolute frequency limits will change as well. This may result in a change to your Start and/or Stop Freq, if the current values fall outside the new range, requiring you to retune your Center Freq to get your signal back in the center.

The instrument supports the Keysight M1970 Series Harmonic Mixers with USB connection. While in External Mixing, if one of these mixers is plugged in to a USB port, it is automatically detected and displayed in the “USB Mixer” area of the setup screen, including its model number and serial number.

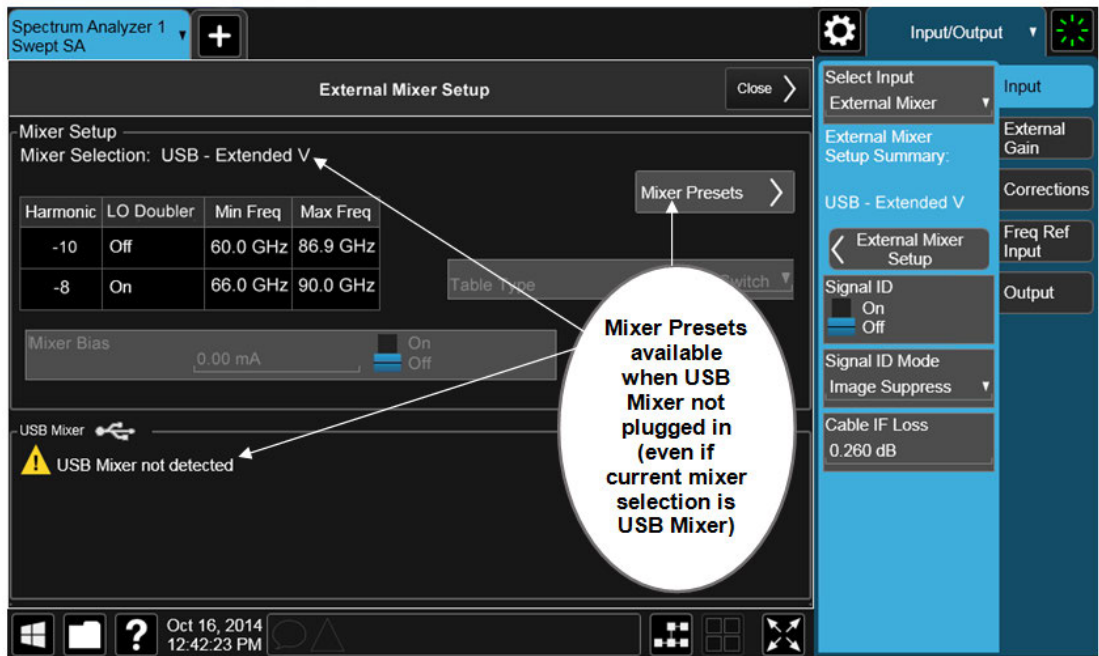
The instrument assumes that if you plug a mixer into the USB you want to use that mixer, so:

1. If a USB mixer is connected to the USB port, the Mixer Presets button is grayed-out, as none of the presets make sense with a USB Mixer connected. Note that once the instrument has acquired the USB Mixer, the mixer selection will remain if it is subsequently unplugged from the USB, allowing you to plug it back in with no change to your settings. However, once you unplug it, the Mixer Presets control ceases to be grayed-out, allowing you to preset to a different mixer
2. When Restore Input/Output Defaults is performed, if a Keysight USB Mixer is plugged into the instrument's USB port, the Mixer Selection remains unchanged

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3. When recalling an instrument state, if a Keysight USB Mixer is plugged into the instrument's USB port, and the Mixer Selection in the recalled state is for a USB Mixer that does not match the mixer currently plugged in, you will have to unplug your mixer and then plug it back in to get the instrument to recognize your mixer

As long as the selection in Ext Mixer Setup shows one of the USB mixers, the **Mixer Bias** control is grayed-out and the Harmonic Table is no longer editable, as shown by the fact that the fields in the Harmonic Table are now black and the **Table Type** control is grayed-out.



Only one USB Mixer is supported at a time. To switch to a different USB Mixer, disconnect the one that is no longer being used prior to connecting a new one.

The **Mixer Selection** displayed and menu panel readback for the Keysight M1970 series mixers is:

| Mixer Model                                                           | Mixer Selection display on Setup Screen | Readback            |
|-----------------------------------------------------------------------|-----------------------------------------|---------------------|
| Keysight M1970E: Option 001: 60 to 90 GHz<br>Waveguide Harmonic Mixer | USB - M1970E-001 E-Band                 | USB Mixer<br>E-Band |
| Keysight M1971E: Option 001: 60 to 90 GHz<br>Waveguide Harmonic Mixer | USB - M1971E-001 E-Band                 | USB Mixer<br>E-Band |
| Keysight M1971E: Option 003: 55 to 90 GHz                             | USB - M1971E-003 Extended E-Band        | USB Mixer           |

| Mixer Model                                                            | Mixer Selection display on Setup Screen | Readback                |
|------------------------------------------------------------------------|-----------------------------------------|-------------------------|
| GHz<br>Waveguide Harmonic Mixer                                        |                                         | Extended E              |
| Keysight M1971V: Option 001: 50 to 75 GHz<br>Waveguide Harmonic Mixer  | USB - M1971E-001 V-Band                 | USB Mixer<br>V-Band     |
| Keysight M1971W: Option 001: 75 to 110 GHz<br>Waveguide Harmonic Mixer | USB - M1971E-001 W-Band                 | USB Mixer<br>W-Band     |
| Keysight M1970V Option 001: 50 to 75 GHz<br>Waveguide Harmonic Mixer   | USB - M1970V-001 V-Band                 | USB Mixer<br>V-Band     |
| Keysight M1970V Option 002: 50 to 80 GHz<br>Waveguide Harmonic Mixer   | USB - M1970V-002 Extended V-Band        | USB Mixer<br>Extended V |
| Keysight M1970W Option 001: 75 to 110 GHz<br>Waveguide Harmonic Mixer  | USB - M1970W-001 W-Band                 | USB Mixer<br>W-Band     |

The Keysight USB mixer essentially acts as a “remote front end” and is fully calibrated over the specified frequency range, without requiring any user interaction. This is particularly useful at high mm-wave frequencies, where cable loss is typically quite large, and it is desirable to bring the front end right up to the device under test, rather than bringing the mm-wave signal to the instrument using a lossy and uncalibrated cable or waveguide connection.

Connecting the mixer to the USB port on the instrument switches you to External Mixing, aborts the current measurement, and initiates an alignment of the mixer. A popup message, “USB Mixer connected” appears on the display. When a USB mixer and the LO/IF cable are connected the alignment is performed. When the alignment begins, an “Aligning” popup replaces the previous message on the display. When the alignment completes, the current measurement restarts.

### 6.2.13.1 Mixer Presets

Presets the mixer setup for the particular type of mixer that you are using.

These presets are divided into four groups:

- One for legacy HP/Agilent/Keysight mixers (11970)
- Three for general purpose mixers:

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### 6.2 Input

- presets that use a single harmonic and no doubling
- presets that use a single harmonic but double the LO
- presets that use multiple harmonics

Note that the IF/LO port provides a 3.8-14 GHz LO in two bands: 3.8-8.7 (LO fundamental), and 8.6-14 GHz (doubled LO).

In most cases, once you have executed the preset, you will not need to adjust any further settings.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |            |                           |             |                           |                |                                    |             |                           |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|---------------------------|-------------|---------------------------|----------------|------------------------------------|-------------|---------------------------|
| Remote Command | <pre>[ :SENSe]:MIXer:BAND A   Q   U   V   W   NA   ND   NE   NF   NG   NJ   NK   NQ   NU   NV   NW   NY   NEXT   DD   DF   DG   DJ   DK   DQ   DV   DW   DY   DEXT   MA   ME   MU   MCOAX   USB   VDIWR6PT5M4  [:SENSe]:MIXer:BAND?</pre>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |            |                           |             |                           |                |                                    |             |                           |
| Example        | <pre>:MIX:BAND A  :MIX:BAND?</pre>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |            |                           |             |                           |                |                                    |             |                           |
| Notes          | <p><b>A   Q   U   V   W</b> select HP/Agilent/Keysight 11970 mixer presets<br/> <b>NA   ND   NE   NF   NG   NJ   NK   NQ   NU   NV   NW   NY   NEXT</b><br/> select single harmonic, non-doubled LO presets<br/> <b>DD   DF   DG   DJ   DK   DQ   DV   DW   DY   DEXT</b> select single harmonic, doubled LO presets<br/> <b>MA   ME   MU   MCOAX</b> select multiple harmonic presets<br/> VDIWR6PT5M4 selects presets for the VDI WR6.5CCD-M4 external mixer (a Compact Down-Converter in the Keysight N9029ACST Series)<br/> <b>VDIWR6PT5M4</b> requires Model N9042B with the EXW option. To use this selection, you must connect cables from the external mixer to the High LO Out and High IF In ports (not the Ext Mixer port) of the N9042B</p> <p>All these presets are detailed in their respective control descriptions</p> <p>The query returns the most recent preset, <i>unless</i> the harmonic table has been edited after the preset was executed. If the harmonic table has been edited, returns <b>CUSTOM</b></p> <p>The command <b>USB</b> refreshes the USB mixer connection and automatically detects the mixer band. The query returns the following if a Keysight USB Mixer is plugged into the instrument's USB port:</p> <table> <tr> <td><b>USB</b></td><td>Keysight E-Band USB Mixer</td></tr> <tr> <td><b>USBV</b></td><td>Keysight V-Band USB Mixer</td></tr> <tr> <td><b>USBVEXT</b></td><td>Keysight Extended V-Band USB Mixer</td></tr> <tr> <td><b>USBW</b></td><td>Keysight W-Band USB Mixer</td></tr> </table> <p>Note that the parameters <b>CUSTOM</b>, <b>USBV</b>, <b>USBVEXT</b>, and <b>USBW</b> are query responses only, and cannot be sent to the instrument</p> <p>The following cross-reference matches the mixer band designators used by Keysight to the EIA waveguide designations:</p> | <b>USB</b> | Keysight E-Band USB Mixer | <b>USBV</b> | Keysight V-Band USB Mixer | <b>USBVEXT</b> | Keysight Extended V-Band USB Mixer | <b>USBW</b> | Keysight W-Band USB Mixer |
| <b>USB</b>     | Keysight E-Band USB Mixer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |            |                           |             |                           |                |                                    |             |                           |
| <b>USBV</b>    | Keysight V-Band USB Mixer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |            |                           |             |                           |                |                                    |             |                           |
| <b>USBVEXT</b> | Keysight Extended V-Band USB Mixer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |            |                           |             |                           |                |                                    |             |                           |
| <b>USBW</b>    | Keysight W-Band USB Mixer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |            |                           |             |                           |                |                                    |             |                           |

| EIA   | Keysight | Freq Range    |
|-------|----------|---------------|
| WR-28 | A        | 26.5 - 40 GHz |
| WR-22 | Q        | 33 - 50 GHz   |
| WR-19 | U        | 40 - 60 GHz   |
| WR-15 | V        | 50 - 75 GHz   |
| WR-12 | E        | 60 - 90 GHz   |
| WR-10 | W        | 75 - 110 GHz  |
| WR-8  | F        | 90 - 140 GHz  |
| WR-6  | D        | 110 - 170 GHz |
| WR-5  | G        | 140 - 220 GHz |
| WR-3  | J        | 220 - 325 GHz |

Preset When **Restore Input/Output Defaults** is performed, an "A" mixer preset is also issued (11970A band), unless a Keysight USB Mixer is plugged into the instrument's USB port, in which case the Mixer Selection remains unchanged

When using Keysight USB Mixers, if **Restore All Defaults (:SYSTem:DEFault)** has been performed, either remove and reinsert the USB cable or press the **Refresh USB Mixer Connection** control

### VDI CCD (N9029)

These presets select a setup that uses a single harmonic and no LO doubling.

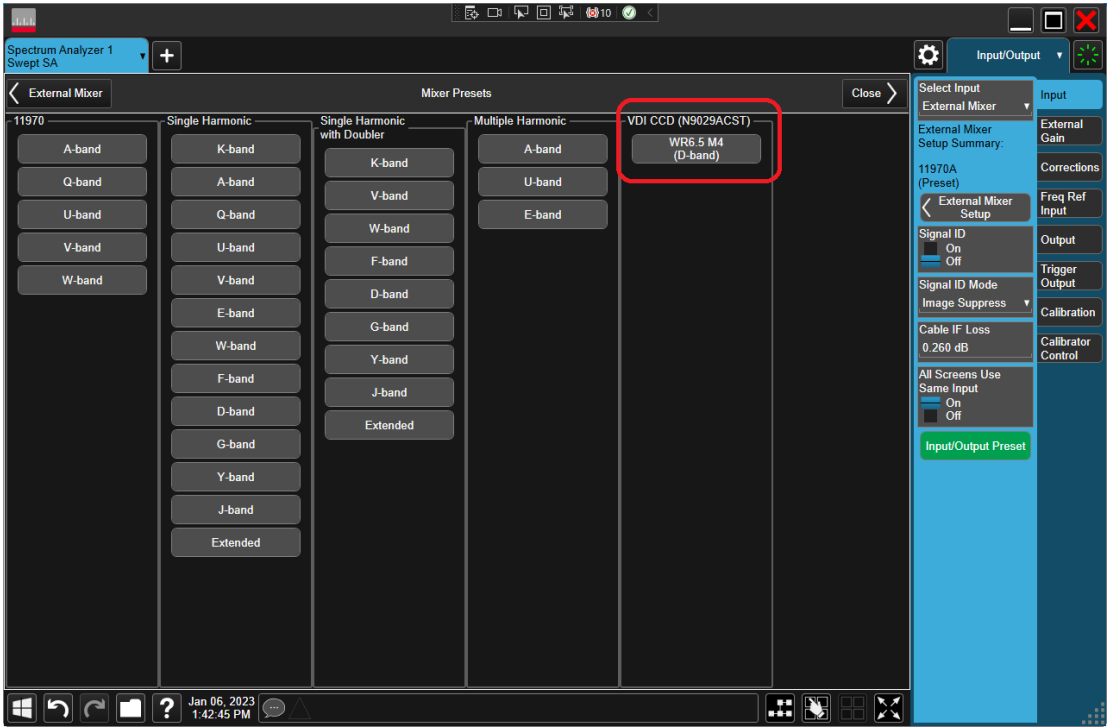
This setup is used with an external mixer in the series VDI CCD (N9029ACST). The currently supported example is the D-band mixer VDI WR6.5CCD-M4.

| Mixer             | Readout on setup dialog and menu panel | Harm # | RF start | RF stop | RF center |
|-------------------|----------------------------------------|--------|----------|---------|-----------|
| WR6.5 M4 (D-band) | VDI WR6.5CCD-M4                        | -4     | 110      | 170     | 140       |

This mixer setup is enabled only for model N9042B with the EXW option. You must connect cables from this external mixer to the High LO Out and High IF In ports (not the Ext Mixer port) of the N9042B, as illustrated below:



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11970

Lets you preset for a model in the HP/Agilent/Keysight 11970 series.

Because the X-Series has an LO range of 3.8 - 14 GHz, and older analyzers had an LO range of 3.0 - 6.8 GHz, the harmonic numbers used in the X-Series may differ from those used on older analyzers for the same mixers. Additionally, some of the 11970 mixers cannot be operated over their full range with the X-Series without switching harmonics. Consequently, you will find that some of the bands (A-Band, for example) are broken into two ranges for use with the X-Series.

Below are the 11970A presets. The 11970U and the 11970W use a single harmonic. The other three switch harmonics mid-band. Both harmonic ranges are shown in the table. None of these mixers use LO doubling.

The 11970 K-band mixer and the 11974 preselected mixer series are not supported.

| Preset | Readout on setup dialog and menu panel | Range | Harm # | RF start | RF stop | RF center |
|--------|----------------------------------------|-------|--------|----------|---------|-----------|
| A-band | 11970A                                 | 1     | -6     | 26.5     | 30.45   | 28.475    |
|        |                                        | 2     | -8     | 30.35    | 40      | 35.175    |
| Q-band | 11970Q                                 | 1     | -8     | 33       | 40.8    | 36.9      |
|        |                                        | 2     | -10    | 39.8     | 50      | 44.9      |
| U-band | 11970U                                 | ..    | -10    | 40       | 60      | 50        |
| V-band | 11970V                                 | 1     | -12    | 50       | 66      | 58        |
|        |                                        | 2     | -14    | 53       | 75      | 64        |
| W-band | 11970W                                 | ..    | -18    | 75       | 110     | 92.5      |

### Single Harmonic

These presets select a setup that uses a single harmonic and no doubling for the LO.

| Mixer    | Readout on setup dialog and menu panel | Harm # | RF start | RF stop | RF center |
|----------|----------------------------------------|--------|----------|---------|-----------|
| K-band   | K-band Single Harmonic, no doubler     | -4     | 18       | 26.5    | 22.25     |
| A-band   | A-band Single Harmonic, no doubler     | -6     | 26.5     | 40      | 33.25     |
| D-band   | D-band Single Harmonic, no doubler     | -20    | 110      | 170     | 140       |
| E-band   | E-band Single Harmonic, no doubler     | -12    | 60       | 90      | 75        |
| F-band   | F-band Single Harmonic, no doubler     | -18    | 90       | 140     | 115       |
| Q-band   | Q-band Single Harmonic, no doubler     | -6     | 33       | 50      | 41.5      |
| U-band   | U-band Single Harmonic, no doubler     | -8     | 40       | 60      | 50        |
| V-band   | V-band Single Harmonic, no doubler     | -10    | 50       | 75      | 62.5      |
| W-band   | W-band Single Harmonic, no doubler     | -14    | 75       | 110     | 92.5      |
| G-band   | G-band Single Harmonic, no doubler     | -26    | 140      | 220     | 180       |
| Y-band   | Y-band Single Harmonic, no doubler     | -30    | 170      | 260     | 215       |
| J -band  | J-band Single Harmonic, no doubler     | -38    | 220      | 325     | 272.5     |
| Extended | Extended Single Harmonic, no doubler   | -40    | 155      | 345     | 250       |

### Single Harmonic with doubler

These presets select a setup that uses a single harmonic and doubling for the LO.

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### 6.2 Input

| Mixer    | Readout on setup dialog and menu panel | Harm # | RF start | RF stop | RF center |
|----------|----------------------------------------|--------|----------|---------|-----------|
| D-band   | D-band Single Harmonic w/doubler       | -14    | 110      | 170     | 140       |
| F-band   | F-band Single Harmonic w/doubler       | -10    | 90       | 140     | 115       |
| G-band   | G-band Single Harmonic w/doubler       | -16    | 140      | 220     | 180       |
| J-band   | J-band Single Harmonic w/doubler       | -24    | 220      | 325     | 272.5     |
| K-band   | K-band Single Harmonic w/doubler       | -2     | 18       | 26.5    | 22.25     |
| Q-band   | Q-band Single Harmonic w/doubler       | -4     | 33       | 50      | 41.5      |
| V-band   | V-band Single Harmonic w/doubler       | -6     | 50       | 75      | 62.5      |
| W-band   | W-band Single Harmonic w/doubler       | -8     | 75       | 110     | 92.5      |
| Y-band   | Y-band Single Harmonic w/doubler       | -20    | 170      | 260     | 215       |
| Extended | Extended Single Harmonic w/doubler     | -28    | 245      | 390     | 317.5     |

### Multiple Harmonics

These presets select a setup that uses multiple harmonics and may or may not use doubling for the LO.

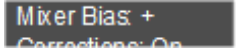
| Mixer   | Readout on setup dialog and menu panel | Range | Harm # | Dblr? | RF start | RF stop | RF Center |
|---------|----------------------------------------|-------|--------|-------|----------|---------|-----------|
| A-band  | A-band Multiple Harmonic               | 1     | -4     | N     | 26.5     | 34.1    | 30.3      |
|         |                                        | 2     | -4     | Y     | 33.1     | 40      | 36.55     |
| E-band  | E-band Multiple Harmonic               | 1     | -6     | Y     | 60       | 83      | 71.5      |
|         |                                        | 2     | -8     | Y     | 65       | 90      | 77.5      |
| U-band  | U-band Multiple Harmonic               | 1     | -6     | N     | 40       | 51.5    | 45.75     |
|         |                                        | 2     | -6     | Y     | 49.5     | 60      | 54.75     |
| Coaxial | Coaxial Multiple Harmonic              | 1     | -4     | N     | 26.5     | 34      | 30.25     |
|         |                                        | 2     | -4     | Y     | 32.5     | 55      | 43.75     |
|         |                                        | 3     | -6     | Y     | 50       | 70      | 60        |

### 6.2.13.2 Mixer Bias

Adjusts an internal bias source for use with external mixers. The bias signal is present on the center conductor of the IF input connector on the front panel. The shunt current range is from -10 mA to 10 mA, and it can be set whether Mixer Bias state is On or Off, but it will only be applied if it is On.

The bias remains as set if you switch to another input (for example, the RF Input).

|         |                                                |
|---------|------------------------------------------------|
| Remote  | <code>[ :SENSe]:MIXer:BIAS &lt;real&gt;</code> |
| Command | <code>[ :SENSe]:MIXer:BIAS?</code>             |

|                |                                                                                                                                                                                                                                                           |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Example        | <code>:MIX:BIAS 0</code><br><code>:MIX:BIAS?</code>                                                                                                                                                                                                       |
| Preset         | Unaffected by Preset, but set to <b>OFF</b> (0) by <b>Restore Input/Output Defaults</b>                                                                                                                                                                   |
| State Saved    | Saved in instrument state                                                                                                                                                                                                                                 |
| Min            | -10 mA                                                                                                                                                                                                                                                    |
| Max            | 10 mA                                                                                                                                                                                                                                                     |
| Annunciation   | When the bias is turned on this (together with the bias polarity) is indicated in the Meas Bar with a plus or minus sign:<br> otherwise, it reads "Off"<br>Auto Function |
| Remote Command | <code>[ :SENSe]:MIXer:BIAS:STATe OFF   ON   0   1</code><br><code>[ :SENSe]:MIXer:BIAS:STATe?</code>                                                                                                                                                      |
| Example        | <code>:MIX:BIAS:STAT 0</code><br><code>:MIX:BIAS:STAT?</code>                                                                                                                                                                                             |
| Preset         | <b>OFF</b>                                                                                                                                                                                                                                                |

### 6.2.13.3 Table Type

Determines the Custom Mixer configuration type. You can choose: Single Row, Harmonic Switching, or Doubler Switching. For details, see ["Available Types" on page 712](#).

The Harmonic Table can be configured as:

- A single row (meaning only one harmonic number is used and the LO Doubler is either on or off)
- Two rows where the harmonic number switches between the first row and the second
- Two rows where the LO Doubler state switches between the first row and the second

#### Available Types

| Table Type | Behavior                                                                                                                                                                                                                    |
|------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Single Row | The External Mixer always stays in the same Harmonic Number and the LO Doubler is either on or off and does not change state during a sweep. You may change the Harmonic Number and you may change the state of the Doubler |
| Harmonic   | The External Mixer switches the Harmonic Number in the middle of the sweep. The LO Doubler may be on                                                                                                                        |

| Table Type        | Behavior                                                                                                                                                                                                                                                                                                                                                                                  |
|-------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Switching         | or off, but it is the same for both Harmonic Numbers. You can set the initial Harmonic Number, and when it switches it decrements by two when the harmonic is negative and increments by two when the harmonic is positive<br>For example, if you set the initial number to -6, when it switches it will go to -8. If you set the harmonic number to 8, when it switches it will go to 10 |
| Doubler Switching | The External Mixer switches the doubler from Off to On in the middle of the sweep. You can set the Harmonic Number, but it stays the same for the Doubler Off state as for the Doubler On state. The LO Doubler control is grayed-out in this table type                                                                                                                                  |

## Editable Fields

| Table Type         | Fields you can edit                                |
|--------------------|----------------------------------------------------|
| Single Row         | Harmonic and LO Doubler cells                      |
| Harmonic Switching | Harmonic and LO Doubler cells (only the first row) |
| Doubler Switching  | Harmonics cell (only the first row)                |

Note that you cannot add or delete rows from the table; you can only modify the rows that are already there.

|                |                                                                                                                                                                                              |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:MIXer:TTYPe SINGLE   HARMonic   DOUBler</code><br><code>[ :SENSe]:MIXer:TTYPE?</code>                                                                                        |
| Example        | <code>:MIX:TTYP SING</code>                                                                                                                                                                  |
| Couplings      | When you change the Table Type, the Mixer Selection changes to <b>Custom</b>                                                                                                                 |
| Preset         | Depends on the current Mixer Preset. Unaffected by <b>Mode Preset</b> , but <b>Restore Input/Output Defaults</b> presets the Mixer to 11970A, for which the Table Type is Harmonic Switching |
| State Saved    | Saved in instrument state                                                                                                                                                                    |

### 6.2.13.4 Select VDI CCD Correction

Selects the appropriate VDI CCD Correction data by mixer Serial Number.

|                |                                                                                                                                                                                                                                                                                                                                                                                                    |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:VCORrection:SElect NONE   &lt;serialNumber&gt;</code><br><code>[ :SENSe]:VCORrection:SElect?</code>                                                                                                                                                                                                                                                                                |
| Example        | <code>:VCOR:SEL NONE</code><br><code>:VCOR:SEL 123123</code>                                                                                                                                                                                                                                                                                                                                       |
| Dependencies   | Requires EXW (External Mixing Wide Bandwidth) and Ampcor (Amplitude Correction) licenses                                                                                                                                                                                                                                                                                                           |
| Couplings      | When the External Mixer Model or VDI CCD Corrections data changes, this field checks whether VDI CCD corrections are stored for the currently-selected External Mixer Model, and automatically selects the first serial number found, or <b>NONE</b> if no matching corrections are found<br>When setting this parameter via SCPI, if no match is found for the given serial number, the parameter |

|             |                                                                                                                                                                                                    |
|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|             | is set to <b>NONE</b> . If the correction should be automatically selected, this can be done by setting the value via SCPI to <b>Any</b> (see <a href="#">"External Mixer Setup" on page 702</a> ) |
| State Saved | Saved in instrument state                                                                                                                                                                          |

### 6.2.13.5 Delete All VDI CCD Corrections

Erases all stored VDI CCD corrections.

|                |                                                                                                                                     |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <b>[ :SENSe]:VCORrection:DELeTe</b>                                                                                                 |
| Example        | <b>:VCOR:DEL</b>                                                                                                                    |
| Dependencies   | Requires EXW (External Mixing Wide Bandwidth) and Ampcor (Amplitude Correction) licenses                                            |
| Couplings      | When the VDI CCD corrections are deleted from memory, <a href="#">"Select VDI CCD Correction" on page 713</a> is set to <b>NONE</b> |

### 6.2.13.6 Harmonic

Lets you enter the **Harmonic** value with its associated sign (mixing mode). Only the first row of the table is editable. When you edit a value or change ["Table Type" on page 712](#), the Mixer Selection changes to **Custom**.

In **Custom** mode, the maximum start and stop frequencies are strictly set by the LO range and the harmonic number you have chosen. The undoubled LO range is approximately 3.8 – 8.7 GHz , and (for LOs that support doubling) the doubled range is approximately 8.0 – 14.0 GHz. That range times the harmonic you have selected determines the tuning range. If your frequency is currently outside that range when you edit the Harmonic Table, the frequency will be changed to fall at the edge of the range. To change it back, go to the **Mixer Presets** menu and select a Preset.

The harmonic number is a signed integer, where the sign distinguishes between positive and negative mixing products. Desired mixing products occur at an IF frequency that equals the difference between the RF frequency ( $f_{RF}$ ) and the LO frequency ( $Nf_{LO}$ ). When this difference is positive, we can say  $f_{IF} = f_{RF} - Nf_{LO}$ . When this difference is negative, we can say  $f_{IF} = Nf_{LO} - f_{RF}$ . Thus, a negative harmonic means the instrument will be tuned such that the harmonic of the LO is higher than the indicated frequency by the frequency of the first IF. A positive harmonic means the instrument will be tuned such that the harmonic of the LO is lower than the indicated frequency by the frequency of the first IF.

|                |                                                                                     |
|----------------|-------------------------------------------------------------------------------------|
| Remote Command | <b>[ :SENSe]:MIXer:HARMonic &lt;integer&gt;</b><br><b>[ :SENSe]:MIXer:HARMonic?</b> |
| Example        | <b>:MIX:HARM -28</b><br><b>:MIX:HARM?</b>                                           |
| Notes          | The query returns the harmonic value of the first row of the harmonic table         |

## 6 Input/Output

### 6.2 Input

|             |                                                                                                                                                                                                                             |
|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Couplings   | When you set a value for <b>Harmonic</b> via SCPI, the Mixer Selection changes to <b>Custom</b>                                                                                                                             |
| Preset      | Unaffected by <b>Mode Preset</b> , but <b>Restore Input/Output Defaults</b> turns editing off, the Harmonic Table returns to normal, and the Mixer is preset to 11970A, which has -6 in the first row of its Harmonic Table |
| State Saved | Saved in instrument state                                                                                                                                                                                                   |
| Min         | -400                                                                                                                                                                                                                        |
| Max         | 400                                                                                                                                                                                                                         |

#### 6.2.13.7 LO Doubler

Lets you specify whether the Doubler is on or off. Only the first row of the table is editable, and the LO Doubler field is only editable in Single Row and Harmonic Switching table types. When you edit a value or change the Table Type, the Mixer Selection changes to **Custom**.

The LO Doubler setting controls the choice of the LO doubler state for LO's that support doubled operation. In Single Row mode it is either on or off for the one row in the table. In Harmonic Switching mode it is on for both rows or off for both rows. In Doubler switching it is off for row 1 and on for row 2, so it is not editable.

In LOs that support doubling, the fundamental band is approximately 3.8 – 8.7 GHz, and the doubled band is approximately 8.0 – 14 GHz. The higher LO frequency can result in a lower mixer harmonic and reduced mixer conversion loss.

|                |                                                                                                                                                                                                                                          |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:MIXer:LODoubler ON   OFF   0   1</code><br><code>[ :SENSe]:MIXer:LODoubler?</code>                                                                                                                                       |
| Example        | <code>:MIX:LOD 0</code><br><code>:MIX:LOD?</code>                                                                                                                                                                                        |
| Notes          | The query returns the doubler value of the first row of the harmonic table                                                                                                                                                               |
| Dependencies   | Grayed-out and set to <b>OFF</b> when "Table Type" on page 712 is set to Doubler Switching<br>Grayout message: "-221 Settings conflict; Function unavailable while Table Type=Doubler Switching"                                         |
| Couplings      | When you set a value via SCPI, the Mixer Selection changes to <b>Custom</b>                                                                                                                                                              |
| Preset         | Unaffected by <b>Mode Preset</b> , but <b>Restore Input/Output Defaults</b> turns off editing, the Harmonic Table returns to normal, and the Mixer is preset to 11970A, which has the doubler Off in the first row of its Harmonic Table |
| State Saved    | Saved in instrument state                                                                                                                                                                                                                |

#### 6.2.13.8 Refresh USB Mixer Connection

Re-reads the USB devices and refreshes connection to Keysight USB mixers. This operation is the same as physically removing and reinserting the mixer's USB connection.

|         |                                                                                                                                                                                                           |
|---------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Example | <code>:MIX:BAND USB</code>                                                                                                                                                                                |
| Notes   | When using Keysight USB Mixers, if <b>Restore All Defaults</b> ( <code>:SYSTem:DEFault</code> ) has been performed, either remove and reinsert the USB cable or press <b>Refresh USB Mixer Connection</b> |

## 6.2.14 Mixer Path

Determines which path you wish to use when using M1971 series USB mixers:

- **NORMa1**, in which they function as a classic external mixer with a single conversion
- **DUAL** Conversion, in which the first conversion is to a higher IF frequency (nominally 1.5 GHz) and you provide a 10 MHz signal to which an internal PLL is locked, to effect a second downconversion. The higher IF frequency used in Dual Conversion increases the image frequency offset, giving you a wider image-free conversion range. This reduces aliasing effects and improves the image suppress functionality for wideband signals
- **AUX** Equipment, wherein the first mixer output drives an output connector on the mixer and the instrument is out of the circuit. When you connect an M1971 Mixer to USB, the instrument will pull the IF and RF flatness data from the USB mixer and write this data to a user-accessible file in CSV format for your use when Aux Equipment is selected

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:MIXer:MPATh NORMa1   DUAL   AUX</code><br><code>[ :SENSe]:MIXer:MPATh?</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Example        | <code>:MIX:MPAT NORM</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Dependencies   | <p>Only appears when an M1971 series Mixer is connected to the USB port of the instrument</p> <p>When <b>AUX</b> Equipment is the selection, Sig Id is turned off to avoid shifting the LO. It is <i>not</i> turned back on when a different path is selected</p> <p>When <b>AUX</b> Equipment is the selection, there is no valid result, so the instrument displays a “No Result; Meas invalid with Aux Equip” error condition message (error 135)</p> <p><b>DUAL</b> Conversion is grayed-out unless in the Swept SA measurement. If grayed-out and the command is sent, generates error: “-221, Settings Conflict; Dual Conversion mixer path is only available in Swept SA”</p> <p>If in <b>DUAL</b> Conversion and you exit Swept SA, reverts to <b>NORMa1</b> setting. If you subsequently return to Swept SA, does <i>not</i> automatically return to <b>DUAL</b> Conversion</p> <p>When <b>DUAL</b> Conversion is selected, if no signal is sensed at the 10 MHz input port, an error condition is generated, “Ref missing or out of range; M1971” (error 521). This also lights the Error LED on the mixer itself</p> |
| Couplings      | When <b>AUX</b> path is selected, the instrument switches to Zero Span                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Preset         | <b>NORMa1</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| State Saved    | Saved in instrument state                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |



|            |                                                                                                                                                                                                                                                                           |
|------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Annotation | In the Meas Bar, if an M1971 series Mixer is connected to the USB port of the instrument, the field Mixer Path appears and says: <ul style="list-style-type: none"><li>– Normal for Normal</li><li>– 2xConv for Dual Conversion</li><li>– Aux for Aux Equipment</li></ul> |
|------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

### 6.2.15 User IF Freq

Specifies the desired IF frequency when using the Aux Equipment path. This setting determines the LO frequency that the instrument will drive into the mixer to correspond to the specified center frequency. Note that the Aux Equipment path always uses “Negative Mixing”, that is, the LO frequency is always higher than the RF frequency.

|                |                                                                                            |
|----------------|--------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:MIXer:UIFFreq &lt;real&gt;</code><br><code>[ :SENSe]:MIXer:UIFFreq?</code> |
| Example        | <code>:MIX:UIFF 300 MHz</code>                                                             |
| Dependencies   | Only appears if an M1971 mixer is connected to USB and the Mixer Path is Aux Equipment     |
| Preset         | 1.2 GHz                                                                                    |
| State Saved    | Saved in Input/Output state                                                                |
| Min            | 0 GHz                                                                                      |
| Max            | 4 GHz                                                                                      |

### 6.2.16 Signal ID On/Off

Toggles the Signal ID (signal identification) function On or Off. This function lets you identify multiple responses of a single input signal that are generated when using un-preselected external mixers. The use of mixers without pre-selecting filters offers the advantage of improved receiver sensitivity because of the absence of the filter insertion loss, but results in multiple responses due to images and undesired harmonic mixing products.

While in **Signal ID**, basic spectrum analyzer functions work normally (for example, you can change Span normally), but some functions are disabled (for example, some traces are unavailable).

There are two forms of **Signal ID**, Image Suppress and Image Shift. Choose the one most appropriate for your application. For Image Shift, an LO-shifted and an unshifted trace are taken in Trace 1 and Trace 2 and displayed together. Any peaks that are not the same in both traces are images. For Image Suppress, image

cancellation is performed in the background using two hidden traces, and the result displayed in Trace 1, which shows only the valid signals.

When **Signal ID** is **ON**, this is indicated in the Meas Bar as Signal ID: On. The annotation is displayed in amber to alert you, because it can cause unexpected behavior if you are not aware that it is on.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:SIDentify[:STATe] OFF   ON   0   1</code><br><code>[ :SENSe]:SIDentify[:STATe]?</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Example        | <code>:SID 0</code><br><code>:SID?</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Notes          | <p><b>Signal ID</b> uses data from two successive sweeps. Therefore, if the instrument is in single sweep mode, two sweep triggers are used to generate the data needed for signal identification</p> <p>For the Log Plot measurement in the Phase Noise Mode, <b>Signal ID</b> works only in the segment of LO sweeping where the offsets are greater than the Rejection Offset setting. When turning it on, you may notice a discontinuity in the Phase Noise trace at the Rejection Offset setting frequency by a few dB due to the under response inherent to <b>Signal ID</b></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Dependencies   | <p>Only appears when External Mixer is selected as the Input</p> <p>Not available in some measurements. If <b>Signal ID</b> does not appear or is grayed-out while in your measurement, then it is not available</p> <p>Because <b>Signal ID</b> uses data from two successive sweeps, several trace and sweep functions are grayed-out in <b>Signal ID</b>. See the documentation for your measurement for details on which trace functions are grayed-out</p> <p>Not available with Signal Track, in which case <b>Signal ID</b> is grayed-out</p> <p>Turned off when External Mixer is turned off. <b>Signal ID</b> cannot be turned on when using internal mixing</p> <p>Rules for auto coupling of the Sweep and FFT controls are changed with <b>Signal ID ON</b>. For both the dynamic range case and the speed case, swept is chosen whenever any form of <b>Signal ID</b> is on. If Manual FFT is selected, <b>Signal ID</b> is grayed-out</p> <p>If <b>Signal ID</b> is selected in a measurement that does not support it, a warning message is generated</p> |
| Couplings      | The Auto Rules for detector selection select Normal for all active traces when <b>Signal ID</b> is turned <b>ON</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Preset         | Unaffected by Preset, but set to <b>OFF</b> by <b>Restore Input/Output Defaults</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Annunciation   | When Signal ID is on this is indicated in the Meas Bar as Signal ID: On. The annotation is displayed in amber color to alert you to the fact that Signal ID is on, as it can cause unexpected behavior if you are not aware that it is on                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |

### 6.2.17 Signal ID Mode

Determines the **Signal ID** mode to use, either Image Suppress or Image Shift.

#### Image Suppress

Mathematically removes all image and multiple responses of signals present at the mixer input. Two hidden sweeps are taken in succession. The second sweep is offset in LO frequency by  $2 * IF / N$ . For each point in each trace, the smaller amplitude

from the two traces is taken and placed in that point in the selected trace. The Peak detector is auto-selected to improve the image suppression effectiveness. Responses of each trace that lie on top of one another will remain and are valid signals, others are images and are suppressed. The action of taking the smaller of the two traces will make the average noise level lower in all points that do not have an image, thus reducing the accuracy of the measurement of noise and noise-like signals.

NOTE

When changing from Image Shift to Image Suppress mode, Trace 2 is blanked, as it was used for Image Shift and contains data that you will probably not want to see in Image Suppress

Image Shift

Like the Image Suppress mode, Image Shift is a two-sweep sequence. The data from the first sweep is placed in Trace 1 and the data from the second (LO frequency shifted by  $2 * IF / N$ ) sweep is placed in Trace 2. On alternate sweeps, the alternate trace (trace 2) is placed in front of trace 1. This way, you can see a signal at the same place on alternate sweeps, showing in yellow (trace1) and blue (trace2). Signal responses of Trace 1 and Trace 2 that have the same horizontal position are considered to be in the current band and therefore can be analyzed with the amplitude and frequency measurement systems of the SA. All other responses are invalid and should be ignored.

NOTE

This function takes control of and uses Trace 1 and Trace 2. Any data in these traces prior to activating Image Shift will be lost.

|                |                                                                                                       |
|----------------|-------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:SIdentify:MODE ISUPpress   IShift</code><br><code>[ :SENSe]:SIdentify:MODE?</code>    |
| Example        | <code>:SID:MODE ISUP</code><br><code>:SID:MODE ISH</code><br><code>:SID:MODE?</code>                  |
| Dependencies   | Only appears when External Mixer is selected as the Input                                             |
| Preset         | Unaffected by Preset, but set to <code>ISUPpress</code> by <code>Restore Input/Output Defaults</code> |
| State Saved    | Saved in instrument state                                                                             |

6.2.18 Cable IF Loss

The loss at the IF in the IF/LO cable can be compensated for with this function, by entering the loss in dB for your cable.

The cable loss will depend on the IF frequency. The IF frequency varies depending on which IF path your measurement is using. For best accuracy, characterize your cable's loss for the IF frequency or frequencies you will be using.

## IF Frequencies

|                |                                                              |           |
|----------------|--------------------------------------------------------------|-----------|
|                | 10 MHz path                                                  | 322.5 MHz |
|                | 25 MHz path                                                  | 322.5 MHz |
|                | 40 MHz path                                                  | 250 MHz   |
|                | 140 MHz path                                                 | 300 MHz   |
| Remote Command | [:SENSe]:MIXer:CIFLoss <rel_amp1><br>[:SENSe]:MIXer:CIFLoss? |           |
| Example        | :MIX:CIFL 0.23 DB<br>:MIX:CIFL?                              |           |
| Dependencies   | Only appears when External Mixer is selected as the Input    |           |
| Preset         | 0.26 dB                                                      |           |
| State Saved    | Saved in instrument state                                    |           |
| Min            | -100                                                         |           |
| Max            | 100                                                          |           |

### 6.2.19 I/Q Path

Selects which I/Q input channels are active. The LED next to each I/Q input port will be on when that port is active.

The analysis bandwidth for each channel is the same as that of the instrument. For example, the base N9020A has a bandwidth of 10 MHz. With I/Q input the I and Q channels would each have an analysis bandwidth of 10 MHz, giving 20 MHz of bandwidth when the I/Q Path is I+jQ. With option B25, the available bandwidth becomes 25 MHz, giving 25 MHz each to I and Q and 50 MHz to I+jQ.

I/Q voltage to power conversion processing is dependent on the I/Q Path selected:

- With I+jQ input, we know that the input signal may not be symmetrical about 0 Hz, because it has a complex component. Therefore, above 0 Hz only the positive frequency information is displayed, and below 0 Hz only the negative frequency information is displayed
- With all other Input Path selections, the input signal has no complex component and therefore is always symmetrical about 0 Hz. In this case, by convention, the power conversion shows the combined voltage for both the positive and negative frequencies. The information displayed below 0 Hz is the mirror of the

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information displayed above 0 Hz. This results in a power reading 6.02 dB higher (for both) than would be seen with only the positive frequency voltage. Note also that, in this case the real signal may have complex modulation embedded in it, but that must be recovered by further signal processing

|                              |                                                                                                                                                                                                                                                                                                                                                                                                   |
|------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command               | <code>[ :SENSe]:FEED:IQ:TYPE IQ   IONLy   QONLy!</code> <a href="#">For option details, see More Information</a><br><code>[ :SENSe]:FEED:IQ:TYPE?</code>                                                                                                                                                                                                                                          |
| Example                      | Set the input to be both the I and Q channels, combined as $I + j * Q$ :<br><code>:FEED:IQ:TYPE IQ</code><br><br>Set the input to be only the I channel:<br><code>:FEED:IQ:TYPE IONL</code><br><br>Set the input to be only the Q channel:<br><code>:FEED:IQ:TYPE QONL</code><br><br>Turn on both I and Q channels and treat I as channel 1 and Q as channel 2:<br><code>:FEED:IQ:TYPE IND</code> |
| Dependencies                 | Only appears when I/Q is the selected input                                                                                                                                                                                                                                                                                                                                                       |
| Preset                       | <code>IQ</code>                                                                                                                                                                                                                                                                                                                                                                                   |
| State Saved                  | Yes<br><br>Unaffected by Preset, but set to the default value by <b>Restore Input/Output Defaults</b> or <b>Restore System Defaults-&gt;All</b><br><br>Backwards Compatibility SCPI                                                                                                                                                                                                               |
| Notes                        | For R&S FSQ-B71 compatibility                                                                                                                                                                                                                                                                                                                                                                     |
| Preset                       | <code>IQ</code>                                                                                                                                                                                                                                                                                                                                                                                   |
| Backwards Compatibility SCPI | <code>:INPut[1]:IQ:TYPE IQ   I   Q</code><br><code>:INPut[1]:IQ:TYPE?</code>                                                                                                                                                                                                                                                                                                                      |

More Information

I+jQ

Sets the signal input to be both the I and Q channels. The I and Q channel data will be combined as  $I + j * Q$ .

I Only

Sets the signal input to be only the I channel. The Q channel will be ignored. The data collected is still complex. When the center frequency is 0 the imaginary part will always be zero, but for any other center frequency both the real and imaginary parts will be significant.

Q Only

Sets the signal input to be only the Q channel. The I channel will be ignored. The Q channel will be sent to the digital receiver block as  $Q+j0$ . The receiver's output is still complex. When the center frequency is 0 the imaginary part will always be zero, but for any other center frequency both the real and imaginary parts will be significant. Note that since the receiver's real output is displayed as the "I" data, when the center frequency is 0, the Q Only input appears as the "I" data.

6.2.20 Reference Z

Sets the value of the impedance to be used in converting voltage to power for the I and Q channels. This does not change the hardware's path impedance (see "Input Z" on page 723).

|                |                                                                                                                                               |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:INPut:IMPedance:REference &lt;integer&gt;</code><br><code>:INPut:IMPedance:REference?</code>                                           |
| Example        | Set the I/Q reference impedance to 50 $\Omega$<br><code>:INP:IMP:REF 50</code>                                                                |
| Dependencies   | Only appears when I/Q is the selected input                                                                                                   |
| Preset         | 50 $\Omega$                                                                                                                                   |
| State Saved    | Yes<br>Unaffected by a Preset, but set to the default value by <b>Restore Input/Output Defaults</b> or <b>Restore System Defaults-&gt;All</b> |
| Min/Max        | 1 $\Omega$ - 1 M $\Omega$                                                                                                                     |

6.2.21 I/Q Setup

Lets you set up and calibrate various parameters for the I/Q inputs.

|              |                                             |
|--------------|---------------------------------------------|
| Dependencies | Only appears when I/Q is the selected input |
|--------------|---------------------------------------------|

6.2.21.1 I Setup

Accesses the channel setup parameters for the I channel.

Differential

Selects differential input on or off for the I channel. For differential input (also called balanced input), the instrument uses both main and complementary ports. When differential input is off (also called single-ended or unbalanced input), the instrument uses only the main port.

|        |                                                          |
|--------|----------------------------------------------------------|
| Remote | <code>:INPut:IQ[:I]:DIFFerential OFF   ON   0   1</code> |
|--------|----------------------------------------------------------|

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|                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Command                      | <code>:INPut:IQ[:I]:DIFFerential?</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Example                      | <p>Put the I channel in Differential mode:<br/><code>:INP:IQ:DIFF ON</code></p> <p>Put the I channel in Single Ended mode:<br/><code>:INP:IQ:DIFF OFF</code></p>                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Notes                        | <p>When I Differential Input = On, the instrument checks for attenuation mismatches between the I and I-bar ports. If the difference in attenuation values exceeds 0.5 dB, a Settings Alert error condition, error 159 is set</p> <p>When I Differential Input = On, and IQ Path is I+jQ, the Q Differential input must also be On. Similarly, when I Differential Input = Off, and IQ Path is I+jQ, the Q Differential input must also be Off. If the states of the two inputs do not match, an error condition message is generated, 159, Settings Alert; I/Q mismatch: Differential</p> |
| Couplings                    | <p>Some active probes include built-in differential capability. When one of these probes is sensed, this key is disabled. Since the differential capability is handled in the probe, the Instrument will use only the main port and the key will show that the Instrument's Differential Input mode is Off (indicating that the complementary port is not in use)</p> <p>When Q Same as I is On, the value set for I will also be copied to Q</p>                                                                                                                                          |
| Preset                       | <p><b>OFF</b> (Single Ended)</p> <p>Unaffected by Mode Preset, but set to the default value by <b>Restore Input/Output Defaults</b> or <b>Restore System Defaults-&gt;All</b></p>                                                                                                                                                                                                                                                                                                                                                                                                          |
| State Saved                  | Yes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Annotation                   | <p>The LED on the I-bar port indicates the Differential Input setting</p> <p>Backwards Compatibility Command</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Notes                        | <p>For R&amp;S FSQ-B71 compatibility, with no independent settings for the I and Q channels. Therefore, it is tied only to the I channel and does not provide an equivalent for the Q channel. For proper operation of the backwards compatibility command, Q Same as I should be <b>ON</b></p>                                                                                                                                                                                                                                                                                            |
| Preset                       | <b>OFF</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Backwards Compatibility SCPI | <p><code>:INPut[1]:IQ:BALanced[:STATe] OFF   ON   0   1</code></p> <p><code>:INPut[1]:IQ:BALanced[:STATe]?</code></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |

## Input Z

Selects the input impedance for the I channel. The impedance applies to both the I and I-bar ports.

The input impedance controls the hardware signal path impedance match. It is not used for converting voltage to power. The voltage to power conversion always uses the Reference Z parameter. The Reference Z parameter applies to both I and Q channels.

|                |                                                                                                                                                                                                                                                                                                     |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:INPut[1]:IQ[:I]:IMPedance LOW   HIGH</code><br><code>:INPut[1]:IQ[:I]:IMPedance?</code>                                                                                                                                                                                                      |
| Example        | Set the I channel input impedance to 1 M $\Omega$ :<br><code>:INP:IQ:IMP HIGH</code><br><br>Set the I channel input impedance to 50 $\Omega$ :<br><code>:INP:IQ:IMP LOW</code>                                                                                                                      |
| Notes          | <code>LOW</code> = 50 $\Omega$ , <code>HIGH</code> = 1 M $\Omega$<br><br>When IQ Path is I+jQ, the I Input Z setting must be the same as the Q Input Z setting. If the settings of the two inputs do not match, an error condition message is generated, 159; Settings Alert; I/Q mismatch: Input Z |
| Couplings      | Input impedance is a built-in characteristic of a probe. Therefore, whenever a probe is sensed, this key is disabled, and the value is set to match the probe<br><br>When no probe is sensed on Q and Q Same as I is On, the value set for I will also be copied to Q                               |
| Preset         | <code>LOW</code><br><br>Unaffected by Mode Preset, but set to the default value by <b>Restore Input/Output Defaults</b> or <b>Restore System Defaults-&gt;All</b>                                                                                                                                   |
| State Saved    | Yes                                                                                                                                                                                                                                                                                                 |
| Annotation     | "I:<I Input Z>" (examples, "I:50 $\Omega$ " or "I:1M $\Omega$ ") in the Measurement Bar. The annotation shows both the I and Q Input Z values                                                                                                                                                       |

## Skew

Sets the skew factor for the I channel. The skew will shift the channel's data in time. Use this to compensate for differences in the electrical lengths of the input paths due to cabling.

|                |                                                                                                                                                      |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[[:SENSe]:CORRection:IQ[:I]:SKEW &lt;seconds&gt;</code><br><code>[[:SENSe]:CORRection:IQ[:I]:SKEW?</code>                                      |
| Example        | Delay the data for the I channel by 10 ns:<br><code>:CORR:IQ:SKEW 10 ns</code>                                                                       |
| Preset         | 0                                                                                                                                                    |
| State Saved    | Yes<br><br>Unaffected by Mode Preset, but set to the default value by <b>Restore Input/Output Defaults</b> or <b>Restore System Defaults-&gt;All</b> |
| Range          | 0 s to 100 ns                                                                                                                                        |
| Min            | 0 s                                                                                                                                                  |
| Max            | +100 ns                                                                                                                                              |



### Combined Differential/Input Z (Remote Command Only)

For backwards compatibility only. It combines the Differential Input and Input Z selections into a single command.

|                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |            |                                                 |            |                                                |            |                                                  |            |                                                 |
|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|-------------------------------------------------|------------|------------------------------------------------|------------|--------------------------------------------------|------------|-------------------------------------------------|
| Notes                        | <p>Provided for E4406A code compatibility</p> <p>The enum values translate as follows:</p> <table> <tr> <td><b>U50</b></td><td>Differential Input = Off, Input Z = 50 <math>\Omega</math></td></tr> <tr> <td><b>B50</b></td><td>Differential Input = On, Input Z = 50 <math>\Omega</math></td></tr> <tr> <td><b>U1M</b></td><td>Differential Input = Off, Input Z = 1 M<math>\Omega</math></td></tr> <tr> <td><b>B1M</b></td><td>Differential Input = On, Input Z = 1 M<math>\Omega</math></td></tr> </table> <p>Combines the Input Z (50 <math>\Omega</math> or 1 M <math>\Omega</math>) parameter with the Differential Input (Off = "Unbalanced", On = "Balanced") parameter into a single enumeration</p> <p>This backwards-compatibility command was for an instrument without independent settings for the I and Q channels. Therefore, it is tied only to the I channel and does not provide an equivalent for the Q channel. For proper operation of the backwards-compatibility command, Q Same as I should be set to <b>ON</b></p> <p>Note also the subtle difference between this command and the backwards-compatibility command for Input Z. The Input Z SCPI has "<b>IQ</b>" before "<b>IMP</b>", while this command has that order reversed</p> | <b>U50</b> | Differential Input = Off, Input Z = 50 $\Omega$ | <b>B50</b> | Differential Input = On, Input Z = 50 $\Omega$ | <b>U1M</b> | Differential Input = Off, Input Z = 1 M $\Omega$ | <b>B1M</b> | Differential Input = On, Input Z = 1 M $\Omega$ |
| <b>U50</b>                   | Differential Input = Off, Input Z = 50 $\Omega$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |            |                                                 |            |                                                |            |                                                  |            |                                                 |
| <b>B50</b>                   | Differential Input = On, Input Z = 50 $\Omega$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |            |                                                 |            |                                                |            |                                                  |            |                                                 |
| <b>U1M</b>                   | Differential Input = Off, Input Z = 1 M $\Omega$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |            |                                                 |            |                                                |            |                                                  |            |                                                 |
| <b>B1M</b>                   | Differential Input = On, Input Z = 1 M $\Omega$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |            |                                                 |            |                                                |            |                                                  |            |                                                 |
| Couplings                    | Does not have an independent parameter, but instead is tied to the Differential Input and Input Z parameters. The coupling for those parameters apply to this command too                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |            |                                                 |            |                                                |            |                                                  |            |                                                 |
| Preset                       | <b>U50</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |            |                                                 |            |                                                |            |                                                  |            |                                                 |
| Backwards Compatibility SCPI | <p><b>:INPut:IMPedance:IQ U50   B50   U1M   B1M</b></p> <p><b>:INPut:IMPedance:IQ?</b></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |            |                                                 |            |                                                |            |                                                  |            |                                                 |

#### 6.2.21.2 I Probe

Access the probe setup parameters for the I channel.

|              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|--------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Dependencies | <p>Only appears when I/Q is the selected input</p> <p>The set of I/Q probe setup parameters will change based on the type of probe that is sensed. All probe types have the Attenuation parameter, and all probe types can be calibrated. The remaining parameters are only available for some probe types and will not be shown when not available. The probe type is determined by and reported for only for the I and Q ports, never the I-bar or Q-bar ports. The menu title will be "&lt;ch&gt;: &lt;probe id&gt;", where "&lt;ch&gt;" is either "I" or "Q" and "&lt;probe id&gt;" is the type of probe. For example, for the I Probe setup with an Keysight 1130A probe connected to the I port, the title will be "I: 1130A".</p> |
|--------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Probe calibration data is stored for each probe type for each channel. When no probe is sensed, the probe type "Unknown" is used, and this is also treated like a probe type with its own calibration data. When a probe is changed, the calibration data for that probe type for that port is restored. An advisory message will be displayed showing the new probe type and the calibration status. The calibration data is stored permanently (survives a power cycle) and is not affected by a Preset or any of the Restore commands. When the probe has EEPROM identification (most newer Keysight probes have this), the calibration data is stored by probe serial number and port, so if you have two probes of the same type, the correct calibration data will be used for each. For probes that do not have EEPROM identification, the calibration data is stored by probe type and port and the instrument cannot distinguish between different probes of the same type. In all cases (with or without EEPROM identification), the calibration data is port specific, so it will not follow a specific probe from port to port if the probe is moved.

The "Unknown" probe type is used whenever no probe is sensed. When no calibration data exists for "Unknown" the latest cable calibration data is used.

## Attenuation

The attenuation is part of the calibration data stored with the probe type and is initially the value that was returned by the last calibration. You can modify this value and any changes will be stored with the calibration data and will survive power cycles and presets. When a probe calibration is performed the attenuation value will be overwritten by the calibration.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:CORRection:IQ:I:ATTenuation:RATio &lt;real&gt;</code><br><code>[ :SENSe]:CORRection:IQ:I:ATTenuation:RATio?</code>                                                                                                                                                                                                                                                                                                                                                  |
| Example        | Set the attenuation for the current I probe to 100.00:1:<br><code>:CORR:IQ:I:ATT:RAT 100</code>                                                                                                                                                                                                                                                                                                                                                                                     |
| Notes          | Each probe type has its own attenuation setting. As probes are changed the attenuation value will reflect the new probe's setting. Changing the attenuation affects only the current probe type's setting and leaves all others unchanged<br><br>When the IQ Path is I+jQ, the Q probe attenuation setting must match the I Probe attenuation setting within 1 dB. If this is not the case, an error condition message is generated, 159; Settings Alert; I/Q mismatch: Attenuation |
| Preset         | 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| State Saved    | Saved with probe calibration data. Survives a power cycle and is not affected by Preset or Restore                                                                                                                                                                                                                                                                                                                                                                                  |
| Min/Max        | 0.001/10000<br><br>This is an alternate form of the SCPI command that allows input as a power instead of a ratio.                                                                                                                                                                                                                                                                                                                                                                   |
| Remote Command | <code>[ :SENSe]:CORRection:IQ:I:ATTenuation &lt;rel_amp1&gt;</code><br><code>[ :SENSe]:CORRection:IQ:I:ATTenuation?</code>                                                                                                                                                                                                                                                                                                                                                          |

## 6 Input/Output

### 6.2 Input

|         |                                                                                                    |
|---------|----------------------------------------------------------------------------------------------------|
| Example | Set the attenuation for the current I probe type to 100.00:1:<br><code>:CORR:IQ:I:ATT 20 dB</code> |
| Min/Max | -60 dB /+80 dB                                                                                     |

## Offset

Some active probes have DC offset capability. When one of these probes is connected, this control will be visible. The signal is adjusted for the DC offset before entering the instrument's port. This allows for removal of a DC offset before reaching the instrument's input port voltage limits. For example, a signal that varies 1 V peak-to-peak with a DC offset equal to the instrument's max input voltage would exceed the input limits of the instrument for half its cycle. Removing the DC offset allows the instrument to correctly process the entire signal.

|                |                                                                                                                                                                                                                                                                                                               |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:INPut:OFFSet:I &lt;voltage&gt;</code><br><code>:INPut:OFFSet:I?</code>                                                                                                                                                                                                                                 |
| Example        | Remove a DC offset of -0.5 V from the I channel input:<br><code>:INP:OFFS:I -0.5</code>                                                                                                                                                                                                                       |
| Notes          | Only some probe types support <b>Offset</b> . For those that do, each probe type has its own <b>Offset</b> setting. As probes are changed, the <b>Offset</b> value will reflect the new probe's setting. Changing <b>Offset</b> affects only the current probe type's setting and leaves all others unchanged |
| Preset         | 0 V                                                                                                                                                                                                                                                                                                           |
| State Saved    | Saved with probe calibration data. Survives power cycle and is not affected by Preset or Restore                                                                                                                                                                                                              |
| Min/Max        | -18 V/+18 V                                                                                                                                                                                                                                                                                                   |

## Coupling

Some probe types allow coupling to reject low frequencies. This filters out the DC component of a signal that is composed of a DC bias plus some AC signal. This control is visible only for probe types that have this capability.

|                |                                                                                                                                                                                                                                                                                                                                                                         |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:INPut:COUPling:I DC   LFR1   LFR2</code><br><code>:INPut:COUPling:I?</code>                                                                                                                                                                                                                                                                                      |
| Example        | Turn off low frequency rejection on the I channel, allowing signals down to DC:<br><code>:INP:COUP:I DC</code><br><br>Turn on low frequency rejection on the I channel for frequencies lower than 1.7 Hz:<br><code>:INP:COUP:I LFR1</code><br><br>Turn on low frequency rejection on the I channel for frequencies lower than 0.14 Hz:<br><code>:INP:COUP:I LFR2</code> |
| Notes          | Only some probe types support <b>Coupling</b> . For those that do, each probe type has its own <b>Coupling</b> setting. As probes are changed, the <b>Coupling</b> value will reflect the new probe's setting. Changing                                                                                                                                                 |

|             |                                                                                                      |
|-------------|------------------------------------------------------------------------------------------------------|
|             | <b>Coupling</b> affects only the current probe type's setting and leaves all others unchanged        |
| Preset      | DC                                                                                                   |
| State Saved | Saved with probe calibration data. Survives a power cycle and is not affected by a Preset or Restore |
| Range       | DC   AC 1.7 Hz LFR1   AC 0.14 Hz LFR2                                                                |

## Clear Calibration

Clears the calibration data for the current port and probe. It does not clear the data for other probe types or other ports. If the sensed probe has EEPROM identification, only the data for that specific probe is cleared. After this command has completed, the probe calibration state will be the same as if no probe calibration had ever been performed for the specified channel and probe. The probe attenuation will be the default value for that probe type and the Cable Calibration frequency response corrections will be used. This command is dependent on the Differential Input state. When Differential Input is on, both the data for the probe attached to the main port and the data for the probe attached to the complementary port are cleared. When Differential Input is off, only data for the probe attached to the main port is cleared.

|                |                                                                                                                                                                              |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <b>:CALibration:IQ:PROBe:I:CLEar</b>                                                                                                                                         |
| Example        | Clear the calibration data for the I channel and the current probe (with EEPROM identification) or probe type (without EEPROM identification):<br><b>:CAL:IQ:PROBe:I:CLE</b> |

### 6.2.21.3 Calibrate

Invokes the guided probe calibration. The guided probe calibration is context sensitive and depends on the channel (I or Q) and the Differential Input state. The calibration is only performed on the selected channel. When the Differential control is switched to Differential, both the probe attached to the main port and the probe attached to the complementary port are calibrated. When the Differential control is switched to Single Ended, only the probe attached to the main port is calibrated.

Calibrating the Baseband I/Q ports requires several steps and manual connections. The Guided Calibration will interactively step you through the required steps, displaying diagrams to help with the connections. The steps will vary depending on the setup.

In the Guided Calibration windows, the date and time of the last calibration are displayed. If any of the items listed are displayed in yellow, this indicates that the calibration for that item is inconsistent with the latest calibration, and you should complete the entire calibration process before you exit the calibration. For passive probes with Differential On, any calibration that is more than a day older than the most recent calibration will be displayed with the color amber.

The I/Q probe calibration creates correction data for one of the front panel I/Q channels. When the probe has EEPROM identification, the data is unique to that specific probe. When the probe does not have EEPROM identification, the data will be used for all probes of the same type. The data is also unique to the channel, so calibration data for the I channel will not be used for the Q channel and vice versa.

The guided calibration (front panel only) will show connection diagrams and guide you through the I/Q Isolation Calibration and through calibrating each port. The calibration data for each port is stored separately, so as soon as a port is calibrated that data is saved and will be used. If a user presses "Exit" to exit the calibration process, the data for the port already completed will still be used. It is recommended that a calibration be completed once started, or if exited, that it be properly done before the next use of the probe. The "Next" button will perform the calibration for the current port and then proceed to the next step in the calibration procedure. The "Back" button will return to the prior port in the procedure. Both softkeys and dialog buttons are supplied for ease of use. The dialog buttons are for mouse use and the softkeys for front panel use.

The calibration can also be done via SCPI, but no connection diagrams will be shown. You will need to make the correct connections before issuing each port calibration command. Again, it is recommended that all ports be calibrated at the same time.

For Active probes or when Differential is Off, only the main port is calibrated, otherwise both the main and complementary ports are calibrated.

The instrument state remains as it was prior to entering the calibration procedure except while a port is actually being calibrated. Once a port is calibrated it returns to the prior state. A port calibration is in process only from the time the "Next" button is pressed until the next screen is shown. For SCPI, this corresponds to the time from issuing the CAL:IQ:PROB:I|B|Q|QB command until the operation is complete.

For example, if the prior instrument state is Cal Out = Off, Input = I+jQ, and Differential = Off, then up until the time the "Next" button is pressed the I Input and Q Input LEDs are on and the Cal Out, I-bar Input and Q-bar Input LEDs are off. Once the "Next" button is pressed for the I port calibration, only the Cal Out and I Input LEDs will be on, and the others will be off. When the screen progresses to the next step ("Next" button again enabled), the prior state is restored and only the I Input and Q Input LEDs are on (Cal Out is off again).

## I/Q Isolation Calibration

I/Q Isolation Calibration must be run before calibrating any port with either the I/Q Cable Calibration or I/Q Probe Calibration. This calibration is performed with nothing connected to any of the front panel I/Q ports. This is the first step in both the I/Q Cable Calibration and the I/Q Probe Calibration. This dialog appears if the Calibration is being run for the first time. It can also be accessed by pressing Back

from the I Input Cal, the Q Input Cal, or the I/Q Cable Cal. Pressing Next from this dialog runs the calibration

|                |                                               |
|----------------|-----------------------------------------------|
| Remote Command | <code>:CALibration:IQ:ISOLation</code>        |
| Example        | <code>:CAL:IQ:ISOL</code>                     |
| Notes          | All front panel I/Q ports must be unconnected |
| State Saved    | No                                            |

### I/Q Isolation Calibration Time (Remote Query Only)

Returns the last date and time that the I/Q Isolation Calibration was performed.

|                |                                                                                                                            |
|----------------|----------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALibration:IQ:ISOLation:TIME?</code>                                                                               |
| Example        | <code>:CAL:IQ:ISOL:TIME?</code>                                                                                            |
| Notes          | Returns 6 integer values: year, month, day, hour, minute, second. When no calibration has been performed, all values are 0 |
| Annunciation   | Guided Calibration, Isolation Calibration, Last Calibration                                                                |

### I Port

The I port calibration is performed with the probe body attached to the front panel's I port, and the probe tip connected via an adapter to the Cal Out port. The guided calibration will show a diagram of the required connections.

|                |                                                                                                                                                                                                                                      |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALibration:IQ:PROBe:I</code>                                                                                                                                                                                                 |
| Example        | <code>:CAL:IQ:PROB:I</code>                                                                                                                                                                                                          |
| Notes          | The I port must be connected to the Cal Out port before issuing the command<br>The calibration data is saved as soon as the port is calibrated and will survive power cycles. It is not reset by any preset or restore data commands |
| State Saved    | No                                                                                                                                                                                                                                   |

### I Port Probe Calibration Time (Remote Query Only)

Return the last date and time that the I/Q Probe Calibration was performed for a specific port.

|                |                                                                                                     |
|----------------|-----------------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALibration:IQ:PROBe:I :TIME?</code>                                                         |
| Example        | <code>:CAL:IQ:PROB:I:TIME?</code>                                                                   |
| Notes          | This returns 6 integer values: year, month, day, hour, minute, second. When no calibration has been |

performed, all values are 0. The value is specific to both the port and probe, so the value will change as probes are connected or disconnected

I-bar Port

The I-bar port calibration is performed with the probe body attached to the front panel's I-bar port and the probe tip connected via an adapter to the Cal Out port. The I-bar probe calibration is only available for passive probes with Differential On. The guided calibration will show a diagram of the required connections.

|                |                                                                                                                                                                                                                                          |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | :CALibration:IQ:PROBe:IBar                                                                                                                                                                                                               |
| Example        | :CAL:IQ:PROB:IB                                                                                                                                                                                                                          |
| Notes          | The I-bar port must be connected to the Cal Out port before issuing the command<br>The calibration data is saved as soon as the port is calibrated and will survive power cycles. It is not reset by any preset or restore data commands |
| State Saved    | No                                                                                                                                                                                                                                       |

I-bar Port Probe Calibration Time (Remote Query Only)

Return the last date and time that the I/Q Probe Calibration was performed for a specific port.

|                |                                                                                                                                                                                                                                                |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | :CALibration:IQ:PROBe:IBAR:TIME?                                                                                                                                                                                                               |
| Example        | :CAL:IQ:PROB:IBAR:TIME?                                                                                                                                                                                                                        |
| Notes          | Returns 6 integer values: year, month, day, hour, minute, second. When no calibration has been performed, all values are 0. The value is specific to both the port and probe, so the value will change as probes are connected or disconnected |
| Annunciation   | Guided Calibration, Probe Calibration, Last Calibration                                                                                                                                                                                        |

6.2.21.4 Q Setup

Access the channel setup parameters for the Q channel.

|              |                                             |
|--------------|---------------------------------------------|
| Dependencies | Only appears when I/Q is the selected input |
|--------------|---------------------------------------------|

Q Same as I

Many, but not all, usages require the I and Q channels have an identical setup. To simplify channel setup, the Q Same as I will cause the Q channel parameters to be

mirrored from the I channel. That way you only need to set up one channel (the I channel). The I channel values are copied to the Q channel, so at the time Q Same as I is turned off the I and Q channel setups will be identical. This does not apply to Probe settings or to parameters that are determined by the probe.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                               |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:INPut:IQ:MIRROred OFF   ON   0   1</code><br><code>:INPut:IQ:MIRROred?</code>                                                                                                                                                                                                                                                                                                                                          |
| Example        | Turn off the mirroring of parameters from I to Q:<br><code>:INP:IQ:MIRR OFF</code>                                                                                                                                                                                                                                                                                                                                            |
| Couplings      | Only displayed for the Q channel. When Yes, the I channel values for some parameters are mirrored (copied) to the Q channel. However, when a parameter is determined by the type of probe and a probe is sensed, the probe setting is always used and the I channel setting is ignored. The following parameters are mirrored:<br>Differential Input (when not determined by probe)<br>Input Z (when not determined by probe) |
| Preset         | Unaffected by Preset, but set to the default value (Q Same as I set to <b>ON</b> ) by <b>Restore Input/Output Defaults</b> or <b>Restore System Defaults-&gt;All</b>                                                                                                                                                                                                                                                          |
| State Saved    | Saved in instrument state                                                                                                                                                                                                                                                                                                                                                                                                     |
| Range          | <b>OFF   ON</b>                                                                                                                                                                                                                                                                                                                                                                                                               |

## Differential

Selects differential input on or off for the Q channel. For differential input (also called balanced input), the instrument uses both the Q and Q-bar ports. When differential input is off (also called single-ended or unbalanced input), the instrument uses only the Q port.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:INPut:IQ:Q:DIFFerential OFF   ON   0   1</code><br><code>:INPut:IQ:Q:DIFFerential?</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Example        | Put the Q channel in Differential mode:<br><code>:INP:IQ:Q:DIFF ON</code><br><br>Put the Q channel in Single Ended mode:<br><code>:INP:IQ:Q:DIFF OFF</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Notes          | When Differential Input = <b>ON</b> , the instrument checks for attenuation mismatches between the Q and Q-bar ports. If the difference in attenuation values exceeds 0.5 dB a Settings Alert error condition, error 159 will be set<br><br>When Q Differential Input = <b>ON</b> , and IQ Path is I+jQ, the I Differential input must also be <b>ON</b> . Similarly, when Q Differential Input = <b>OFF</b> , and IQ Path is I+jQ, the I Differential input must also be <b>OFF</b> . If the states of the two inputs do not match, an error condition message is generated, 159; Settings Alert; I/Q mismatch: Differential |
| Couplings      | Some active probes include built-in differential capability. When one of these probes is sensed, this key is disabled. Since the differential capability is handled in the probe, the Instrument will use only the main port and the key will show that the Instrument's Differential Input mode is Off (indicating that the                                                                                                                                                                                                                                                                                                  |



## 6 Input/Output

### 6.2 Input

|             |                                                                                                                                                                                       |
|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|             | complementary port not in use)<br>When a differential probe is not sensed and Q Same as I is On, the value set for I will be copied to Q. This key is disabled when Q Same as I is On |
| Preset      | OFF                                                                                                                                                                                   |
| State Saved | Yes<br>Unaffected by a Preset, but set to the default value by <b>Restore Input/Output Defaults</b> or <b>Restore System Defaults-&gt;All</b>                                         |
| Range       | OFF   ON                                                                                                                                                                              |
| Annotation  | The LED on the Q-bar port indicates the Differential Input setting                                                                                                                    |

## Input Z

Selects the input impedance for the Q channel. The impedance applies to both the Q and Q-bar ports.

The input impedance controls the hardware signal path impedance match. It is not used for converting voltage to power. The voltage to power conversion always uses the Reference Z parameter. The Reference Z parameter applies to both I and Q channels.

|                |                                                                                                                                                                                                                                                                                                               |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | :INPut[1]:IQ:Q:IMPedance LOW   HIGH<br>:INPut[1]:IQ:Q:IMPedance?                                                                                                                                                                                                                                              |
| Example        | Set the Q channel input impedance to 1 M $\Omega$ :<br>:INP:IQ:Q:IMP HIGH<br><br>Set the Q channel input impedance to 50 $\Omega$ :<br>:INP:IQ:Q:IMP LOW                                                                                                                                                      |
| Notes          | LOW = 50 $\Omega$ , HIGH = 1 M $\Omega$<br>When IQ Path is I+jQ, the I Input Z setting must be the same as the Q Input Z setting. If the settings of the two inputs do not match, an error condition message is generated, 159; Settings Alert; I/Q mismatch: Input Z                                         |
| Couplings      | Input impedance is a built-in characteristic of a probe. Therefore, whenever a probe is sensed, this key is disabled, and the value is set to match the probe<br><br>When no probe is sensed and Q Same as I is On, the value set for I will also be copied to Q. This key is disabled when Q Same as I is On |
| Preset         | LOW                                                                                                                                                                                                                                                                                                           |
| State Saved    | Yes<br>Unaffected by a Preset, but set to the default value by <b>Restore Input/Output Defaults</b> or <b>Restore System Defaults-&gt;All</b>                                                                                                                                                                 |
| Range          | 50 $\Omega$   1 M $\Omega$                                                                                                                                                                                                                                                                                    |
| Annotation     | "Q:<Q Input Z>" (examples, "Q:50 $\Omega$ " or "Q:1M $\Omega$ ") in the Measurement Bar. The annotation shows both the I and Q Input Z values                                                                                                                                                                 |

## Skew

Sets the skew factor for the Q channel. The skew will shift the channel's data in time. Use this to compensate for differences in the electrical lengths of the input paths due to cabling and probes.

|                |                                                                                                                                               |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:CORRection:IQ:Q:SKEW &lt;seconds&gt;</code><br><code>[ :SENSe]:CORRection:IQ:Q:SKEW?</code>                                   |
| Example        | Delay the data for the Q channel by 10 ns<br><code>:CORR:IQ:Q:SKEW 10 ns</code>                                                               |
| Preset         | 0                                                                                                                                             |
| State Saved    | Yes<br>Unaffected by a Preset, but set to the default value by <b>Restore Input/Output Defaults</b> or <b>Restore System Defaults-&gt;All</b> |
| Min/Max        | 0 s/ 100 ns                                                                                                                                   |

### 6.2.21.5 Q Probe

Accesses the probe setup parameters for the Q channel. See "[Combined Differential/Input Z \(Remote Command Only\)](#)" on page 725.

|              |                                             |
|--------------|---------------------------------------------|
| Dependencies | Only appears when I/Q is the selected input |
|--------------|---------------------------------------------|

## Attenuation

The attenuation is part of the calibration data stored with the probe type and is initially the value that was returned by the last calibration. You can modify this value and any changes will be stored with the calibration data and will survive power cycles and presets. When a probe calibration is performed the attenuation value will be overwritten by the calibration.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:CORRection:IQ:Q:ATTenuation:RATio &lt;real&gt;</code><br><code>[ :SENSe]:CORRection:IQ:Q:ATTenuation:RATio?</code>                                                                                                                                                                                                                                                                                                                                                  |
| Example        | Set the attenuation for the current Q probe to 100.00:1:<br><code>:CORR:IQ:Q:ATT:RAT 100</code>                                                                                                                                                                                                                                                                                                                                                                                     |
| Notes          | Each probe type has its own attenuation setting. As probes are changed the attenuation value will reflect the new probe's setting. Changing the attenuation affects only the current probe type's setting and leaves all others unchanged<br><br>When the IQ Path is I+jQ, the Q probe attenuation setting must match the I Probe attenuation setting within 1 dB. If this is not the case, an error condition message is generated, 159; Settings Alert; I/Q mismatch: Attenuation |

## 6 Input/Output

### 6.2 Input

|                |                                                                                                                            |
|----------------|----------------------------------------------------------------------------------------------------------------------------|
| Preset         | Each probe type has its own default. The default for the "Unknown" probe type is 1:1                                       |
| State Saved    | Saved with probe calibration data. Survives a power cycle and is not affected by Preset or Restore                         |
| Min/Max        | 0.001/10000<br><br>This is an alternate form of the SCPI command that allows input as a power instead of a ratio.          |
| Remote Command | <code>[ :SENSe]:CORRection:IQ:Q:ATTenuation &lt;rel_ampl&gt;</code><br><code>[ :SENSe]:CORRection:IQ:Q:ATTenuation?</code> |
| Example        | Set the attenuation for the current Q probe type to 100.00:1:<br><code>:CORR:IQ:Q:ATT 20 dB</code>                         |
| Min/Max        | -60 dB /+80 dB                                                                                                             |

### Offset

Some active probes have DC offset capability. When one of these probes is connected this control will be visible. The signal is adjusted for the DC offset before entering the instrument's port. This allows for removal of a DC offset before reaching the instrument's input port voltage limits. For example, a signal that varies 1 V peak-to-peak with a DC offset equal to the instrument's max input voltage would exceed the input limits of the instrument for half its cycle. Removing the DC offset allows the instrument to correctly process the entire signal.

|                |                                                                                                                                                                                                                                                                                                               |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:INPut:OFFSet:Q &lt;voltage&gt;</code><br><code>:INPut:OFFSet:Q?</code>                                                                                                                                                                                                                                 |
| Example        | Remove a DC offset of -0.5 V from the Q channel input:<br><code>:INP:OFFS:Q -0.5</code>                                                                                                                                                                                                                       |
| Notes          | Only some probe types support <b>Offset</b> . For those that do, each probe type has its own <b>Offset</b> setting. As probes are changed, the <b>Offset</b> value will reflect the new probe's setting. Changing <b>Offset</b> affects only the current probe type's setting and leaves all others unchanged |
| Preset         | 0 V                                                                                                                                                                                                                                                                                                           |
| State Saved    | Saved with probe calibration data. Survives power cycle and is not affected by Preset or Restore                                                                                                                                                                                                              |
| Min/Max        | -18 V/+18 V                                                                                                                                                                                                                                                                                                   |

### Coupling

Some probe types allow coupling to reject low frequencies. This filters out the DC component of a signal that is composed of a DC bias plus some AC signal. This control is visible only for probe types that have this capability.

|                |                                                                                    |
|----------------|------------------------------------------------------------------------------------|
| Remote Command | <code>:INPut:COUPling:Q DC   LFR1   LFR2</code><br><code>:INPut:COUPling:Q?</code> |
|----------------|------------------------------------------------------------------------------------|

|             |                                                                                                                                                                                                                                                                                                                                                                                      |
|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Example     | <p>Turn off low frequency rejection on the Q channel, allowing signals down to DC:<br/> <code>:INP:COUP:Q DC</code></p> <p>Turn on low frequency rejection on the Q channel for frequencies lower than 1.7 Hz:<br/> <code>:INP:COUP:Q LFR1</code></p> <p>Turn on low frequency rejection on the Q channel for frequencies lower than 0.14 Hz:<br/> <code>:INP:COUP:Q LFR2</code></p> |
| Notes       | Only some probe types support <b>Coupling</b> . For those that do, each probe type has its own <b>Coupling</b> setting. As probes are changed, the <b>Coupling</b> value will reflect the new probe's setting. Changing <b>Coupling</b> affects only the current probe type's setting and leaves all others unchanged                                                                |
| Preset      | <code>DC</code>                                                                                                                                                                                                                                                                                                                                                                      |
| State Saved | Saved with probe calibration data. Survives a power cycle and is not affected by a Preset or Restore                                                                                                                                                                                                                                                                                 |
| Range       | DC   AC 1.7 Hz LFR1   AC 0.14 Hz LFR2                                                                                                                                                                                                                                                                                                                                                |

## Clear Calibration

Clears the calibration data for the current port and probe. It does not clear the data for other probe types or other ports. If the sensed probe has EEPROM identification, only the data for that specific probe is cleared. After this command has completed, the probe calibration state will be the same as if no probe calibration had ever been performed for the specified channel and probe. The probe attenuation will be the default value for that probe type and the Cable Calibration frequency response corrections will be used. This command is dependent on the Differential Input state. When Differential Input is on, both the data for the probe attached to the main port and the data for the probe attached to the complementary port are cleared. When Differential Input is off, only data for the probe attached to the main port is cleared.

|                |                                                                                                                                                                                             |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALibration:IQ:PROBe:Q:CLEar</code>                                                                                                                                                  |
| Example        | <p>Clear the calibration data for the Q channel and the current probe (with EEPROM identification) or probe type (without EEPROM identification):<br/> <code>:CAL:IQ:PROBe:I:CLE</code></p> |

### 6.2.21.6 Calibrate

Invokes the guided probe calibration. The guided probe calibration is context sensitive and depends on the channel (I or Q) and the Differential Input state. The calibration is only performed on the selected channel. When the Differential control is switched to Differential, both the probe attached to the main port and the probe attached to the complementary port are calibrated. When the Differential control is switched to Single Ended, only the probe attached to the main port is calibrated.

## 6 Input/Output

### 6.2 Input

The I/Q Isolation Calibration must be run before calibrating any port with either the I/Q Cable Calibration or I/Q Probe Calibration. See "[I/Q Isolation Calibration](#)" on [page 729](#)

## Q Port

The Q port calibration is performed with the probe body attached to the front panel's Q port and the probe tip connected via an adapter to the Cal Out port. The guided calibration will show a diagram of the required connections.

|                |                                                                                                                                                                                                                                  |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALibration:IQ:PROBe:Q</code>                                                                                                                                                                                             |
| Example        | <code>:CAL:IQ:PROB:Q</code>                                                                                                                                                                                                      |
| Notes          | The Q port must be connected to the Cal Out port before issuing the command<br>The calibration data is saved as soon as the port is calibrated and survives power cycles. It is not reset by any preset or restore data commands |
| State Saved    | No                                                                                                                                                                                                                               |

## Q Port Probe Calibration Time (Remote Query Only)

Return the last date and time that the I/Q Probe Calibration was performed for a specific port.

|                |                                                                                                                                                                                                                                                |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALibration:IQ:PROBe:Q:TIME?</code>                                                                                                                                                                                                     |
| Example        | <code>:CAL:IQ:PROB:Q:TIME?</code>                                                                                                                                                                                                              |
| Notes          | Returns 6 integer values: year, month, day, hour, minute, second. When no calibration has been performed, all values are 0. The value is specific to both the port and probe, so the value will change as probes are connected or disconnected |
| Annunciation   | Guided Calibration, Probe Calibration, Last Calibration                                                                                                                                                                                        |

## Q-bar Port

The Q-bar port calibration is performed with the probe body attached to the front panel's Q-bar port and the probe tip connected via an adapter to the Cal Out port. The Q-bar probe calibration is only available for passive probes with Differential On. The guided calibration will show a diagram of the required connections.

|                |                                                                                 |
|----------------|---------------------------------------------------------------------------------|
| Remote Command | <code>:CALibration:IQ:PROBe:QBar</code>                                         |
| Example        | <code>:CAL:IQ:PROB:QB</code>                                                    |
| Notes          | The Q-bar port must be connected to the Cal Out port before issuing the command |

|             |                                                                                                                                                       |
|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|
|             | The calibration data is saved as soon as the port is calibrated and will survive power cycles. It is not reset by any preset or restore data commands |
| State Saved | No                                                                                                                                                    |

### Q-bar Probe Calibration Time (Remote Query Only)

Return the last date and time that the I/Q Probe Calibration was performed for a specific port.

|                |                                                                                                                                                                                                                                                |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALibration:IQ:PROBe:QBAR:TIME?</code>                                                                                                                                                                                                  |
| Example        | <code>:CAL:IQ:PROB:QBAR:TIME?</code>                                                                                                                                                                                                           |
| Notes          | Returns 6 integer values: year, month, day, hour, minute, second. When no calibration has been performed, all values are 0. The value is specific to both the port and probe, so the value will change as probes are connected or disconnected |
| Annunciation   | Guided Calibration, Probe Calibration, Last Calibration                                                                                                                                                                                        |

## 6.2.22 I/Q Cable Calibrate

The I/Q cable calibration creates correction data for each of the front panel I/Q ports. This calibration data is used whenever no probe specific calibration data is available. It is important that all ports are calibrated using the same short BNC cable so that the data is comparable from port to port.

The guided calibration (front panel only) will show connection diagrams and guide you through the isolation calibration and calibrating each port. The calibration data for each port is stored separately, so as soon as a port is calibrated that data is saved and will be used. If you press "Exit" to exit the calibration process, the data for the ports already completed will still be used. It is recommended that a calibration be completed once started, or if exited, that it be properly done before the next use of the I/Q ports. The "Next" button will perform the calibration for the current port and then proceed to the next step in the calibration procedure. The "Back" button will return to the prior port in the procedure. Both keys and dialog buttons are supplied for ease of use. The dialog buttons are for mouse use and the softkeys for front panel use.

The calibration can also be done via SCPI, but no connection diagrams will be shown. You will have to make the correct connections before issuing each port calibration command. Again, it is recommended that all ports be calibrated at the same time.

The instrument state remains as it was prior to entering the calibration procedure except while a port is actually being calibrated. Once a port is calibrated it returns to the prior state. A port calibration is in process only from the time the "Next" button is

pressed until the next screen is shown. For SCPI, this corresponds to the time from issuing the CAL:IQ:FLAT:I|IB|Q|QB command until the operation is complete.

For example, if the prior instrument state is Cal Out = Off, Input = I+jQ, and Differential = Off, then up until the time the "Next" button is pressed the I Input and Q Input LEDs are on and the Cal Out, I-bar Input and Q-bar Input LEDs are off. Once the "Next" button is pressed for the I port calibration, only the Cal Out and I Input LEDs will be on and the others will be off. When the screen progresses to the next step ("Next" button again enabled), the prior state is restored and only the I Input and Q Input LEDs are on (Cal Out is off again).

The last calibration date and time for each port will be displayed. Any calibrations that are more than a day older than the most recent calibration will be displayed with the color amber.

The I/Q Isolation Calibration must be run before calibrating any port with either the I/Q Cable Calibration or I/Q Probe Calibration. See ["I/Q Isolation Calibration" on page 729](#)

|              |                                             |
|--------------|---------------------------------------------|
| Dependencies | Only appears when I/Q is the selected input |
|--------------|---------------------------------------------|

6.2.22.1 I Port

The I port calibration is performed with the front panel's I port connected via a short BNC cable to the Cal Out port. The guided calibration will show a diagram of the required connections.

|                |                                                                                                                                                                                                                                                                                                                                                                                                 |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | :CALibration:IQ:FLATness:I                                                                                                                                                                                                                                                                                                                                                                      |
| Example        | :CAL:IQ:FLAT:I                                                                                                                                                                                                                                                                                                                                                                                  |
| Notes          | The recommended procedure is to use the same BNC cable to calibrate all I/Q ports. All I/Q ports should be calibrated sequentially during the procedure<br>The calibration data is saved as soon as the port is calibrated and will survive power cycles. It is not reset by any preset or restore data commands<br>The I port must be connected to the Cal Out port before issuing the command |
| State Saved    | No                                                                                                                                                                                                                                                                                                                                                                                              |

6.2.22.2 I-bar Port

The I-bar port calibration is performed with the front panel's I-bar port connected via a short BNC cable to the Cal Out port. The guided calibration will show a diagram of the required connections.

|                |                               |
|----------------|-------------------------------|
| Remote Command | :CALibration:IQ:FLATness:IBAR |
|----------------|-------------------------------|

|             |                                                                                                                                                                                                                                                                                                                                                                                                                    |
|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Example     | <code>:CAL:IQ:FLAT:IBAR</code>                                                                                                                                                                                                                                                                                                                                                                                     |
| Notes       | <p>The recommended procedure is to use the same BNC cable to calibrate all I/Q ports. All I/Q ports should be calibrated sequentially during the procedure</p> <p>The calibration data is saved as soon as the port is calibrated and will survive power cycles. It is not reset by any preset or restore data commands</p> <p>The I-bar port must be connected to the Cal Out port before issuing the command</p> |
| State Saved | No                                                                                                                                                                                                                                                                                                                                                                                                                 |

### 6.2.22.3 Q Port

The Q port calibration is performed with the front panel's Q port connected via a short BNC cable to the Cal Out port. The guided calibration will show a diagram of the required connections.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALibration:IQ:FLATness:Q</code>                                                                                                                                                                                                                                                                                                                                                                        |
| Example        | <code>:CAL:IQ:FLAT:Q</code>                                                                                                                                                                                                                                                                                                                                                                                    |
| Notes          | <p>The recommended procedure is to use the same BNC cable to calibrate all I/Q ports. All I/Q ports should be calibrated sequentially during the procedure</p> <p>The calibration data is saved as soon as the port is calibrated and will survive power cycles. It is not reset by any preset or restore data commands</p> <p>The Q port must be connected to the Cal Out port before issuing the command</p> |
| State Saved    | No                                                                                                                                                                                                                                                                                                                                                                                                             |

### 6.2.22.4 Q-bar Port

The Q-bar port calibration is performed with the front panel's Q-bar port connected via a short BNC cable to the Cal Out port. The guided calibration will show a diagram of the required connections.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                    |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALibration:IQ:FLATness:QBAR</code>                                                                                                                                                                                                                                                                                                                                                                         |
| Example        | <code>:CAL:IQ:FLAT:QBAR</code>                                                                                                                                                                                                                                                                                                                                                                                     |
| Notes          | <p>The recommended procedure is to use the same BNC cable to calibrate all I/Q ports. All I/Q ports should be calibrated sequentially during the procedure</p> <p>The calibration data is saved as soon as the port is calibrated and will survive power cycles. It is not reset by any preset or restore data commands</p> <p>The Q-bar port must be connected to the Cal Out port before issuing the command</p> |
| State Saved    | No                                                                                                                                                                                                                                                                                                                                                                                                                 |



#### 6.2.22.5 I/Q Cable Calibration Time (Remote Query Only)

Returns the last date and time that the I/Q Cable Calibration was performed for a specific port.

|                |                                                                                                                            |
|----------------|----------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALibration:IQ:FLATness:I IBAR Q QBAR:TIME?</code>                                                                  |
| Example        | <code>:CAL:IQ:FLAT:I:TIME?</code>                                                                                          |
| Notes          | Returns 6 integer values: year, month, day, hour, minute, second. When no calibration has been performed, all values are 0 |
| Annunciation   | Guided Calibration, Cable Calibration, Last Calibration                                                                    |

### 6.2.23 Audio Input Channel

Determines which Audio Input to be used for audio measurements.

|                |                                                                                                                               |
|----------------|-------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:FEED:AFINput:PORT CH1   CH2</code><br><code>[ :SENSe]:FEED:AFINput:PORT?</code>                               |
| Example        | <code>:FEED:AFIN CH1</code>                                                                                                   |
| Dependencies   | Only appears in Radio Test Mode<br>Only appears in modular products, and only if an M9260A Audio Analyzer module is installed |
| Preset         | Unaffected by Mode Preset, but set to Channel 1 by <b>Input/Output Preset</b>                                                 |

### 6.2.24 Audio Calibrator

Lets you turn on the internal calibrator in the X-Series Audio board.

|                |                                                                                         |
|----------------|-----------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:FEED:AFALign OFF   REF10</code><br><code>[ :SENSe]:FEED:AFALign?</code> |
| Example        | <code>:FEED:AFAL REF10</code>                                                           |
| Dependencies   | Only appears in Measuring Receiver Mode's Audio Measurements when Option 107 is present |
| Preset         | <b>OFF</b>                                                                              |

### 6.2.25 Audio Coupling

Lets you set AC or DC coupling for the currently selected audio input.

|                |                                                                                                       |
|----------------|-------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:AFINput[1] 2:COUPling AC   DC</code><br><code>[ :SENSe]:AFINput[1] 2:COUPling?</code> |
|----------------|-------------------------------------------------------------------------------------------------------|

|              |                                                                                                                                                                                                                                                                                   |
|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Example      | <code>:AFIN:COUP AC</code>                                                                                                                                                                                                                                                        |
| Dependencies | Only appears in Measuring Receiver Mode and Radio Test Mode<br>In Measuring Receiver Mode, only appear in Audio Measurements, and only if Option 107 is present<br>In Radio Test Mode, only appears in modular products, and only if an M9260A Audio Analyzer module is installed |
| Preset       | <code>AC</code>                                                                                                                                                                                                                                                                   |

### 6.2.26 Audio Input Ground

Lets you float or ground the low side of the currently selected audio input channel. When you choose `FLOat`, the low side of the input is disconnected from ground.

|                |                                                                                                                               |
|----------------|-------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[[:SENSe]:AFINput[1] 2:LOW FLOat   GRound<br/>[:SENSe]:AFINput[1] 2:LOW?</code>                                         |
| Example        | <code>:AFIN2:LOW FLO</code>                                                                                                   |
| Dependencies   | Only appears in Radio Test Mode<br>Only appears in modular products, and only if an M9260A Audio Analyzer module is installed |
| Preset         | Unaffected by Mode Preset, but set to <code>GRound</code> by <b>Input/Output Preset</b>                                       |

### 6.2.27 Audio In Impedance

Lets you set the Impedance of the currently selected audio input channel. The value you enter is rounded up to the nearest allowed value.

|                |                                                                                                                               |
|----------------|-------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[[:SENSe]:AFINput[1] 2:IMPedance 50   600   1000000<br/>[:SENSe]:AFINput[1] 2:IMPedance?</code>                         |
| Example        | <code>:AFIN:IMP 50</code>                                                                                                     |
| Dependencies   | Only appears in Radio Test Mode<br>Only appears in modular products, and only if an M9260A Audio Analyzer module is installed |
| Preset         | Unaffected by Mode Preset, but set to 600 by <b>Input/Output Preset</b>                                                       |

### 6.2.28 Input/Output Preset

Resets the group of settings and data associated with the **Input/Output** front-panel key to their default values. These settings are not affected by **Mode Preset** because they are generally associated with connections to the instrument, which you generally would not want to reset every time you press **Mode Preset**.

## 6 Input/Output

### 6.2 Input

This is the same as the control in the **Preset** dropdown, and also the same as **Input/Output** button in the **Restore Defaults** menu under **System**.

All the variables set under the **Input/Output** front panel key are reset by **Input/Output Preset**, including Amplitude Corrections and Data (described in the **Corrections** section), with the exception of RF Source settings, which are unaffected.

By using **Input/Output Preset** and **Restore Mode Defaults**, a full preset of the current mode will be performed, with the caveat that since **Input/Output Preset** is a global function it will affect *all* Modes.

When **Input/Output Preset** is selected, a message appears saying:

“This will reset all of the Input/Output variables to their default state, including which input is selected, all Amplitude Correction settings and data, all External Mixing settings, all Frequency Reference settings and all Output settings.

It will not affect Alignment data or settings.

It will not affect RF Source settings.

This action cannot be undone. Do you want to proceed?”

Use the **OK** or **Cancel** buttons to affirm or cancel the operation.

---

Example

**:SYST:DEF INP**

presets all Input/Output variables to their factory default values

## 6.3 External Gain

Contains controls that allow you to compensate for gain or loss in the measurement system outside the instrument. The External Gain is subtracted from the amplitude readout (or the loss is added to the amplitude readout). So, the displayed signal level represents the signal level at the output of the device-under-test, which can be the input of an external device that provides gain or loss.

Entering an External Gain value does not affect the Reference Level, therefore the trace position on screen changes, as do all of the values represented by the trace data. Thus, the values of exported trace data, queried trace data, marker amplitudes, trace data used in calculations such as N dB points, trace math, peak threshold, etc., are all affected by External Gain. Changing the External Gain, even on a trace that is not updating, immediately changes all of the above, without new data needing to be taken.

**NOTE**

**Changing the External Gain causes the instrument to immediately stop the current sweep and prepare to begin a new sweep. The data will not change until the trace data updates because the offset is applied to the data as it is taken. If a trace is exported with a nonzero External Gain, the exported data will contain the trace data with the offset applied.**

---

In Spectrum Analyzer Mode, a Preamp is the common external device providing gain or loss. In a measurement application mode like GSM or W-CDMA, the gain or loss could be from a BTS (Base Transceiver Station) or an MS (Mobile Station). So, in the Spectrum Analyzer mode MS and BTS would be grayed out and the only choice would be Ext Preamp. Similarly, in some of the digital communications applications, Ext Preamp will be grayed out and you would have a choice of MS or BTS.

The Ext Preamp, MS, and BS controls may be grayed-out depending on which measurement is currently selected. If any of the grayed-out controls are pressed, or the equivalent SCPI command is sent, an advisory message is generated.

### 6.3.1 External Preamp

This function is similar to the reference level offset function. Both affect the displayed signal level. Ref Lvl Offset is a mathematical offset only, no instrument configuration is affected. Ext Preamp gain is used when determining the auto-coupled value of the Attenuator. The External Gain value and the Maximum Mixer Level settings are both part of the automatic setting equation for the RF attenuation setting. (10 dB of Attenuation is added for every 10 dB of External Gain.)

Note that the Ref Lvl Offset and Maximum Mixer Level are described in the Amplitude section. They are reset by Mode Preset. The External Preamp Gain is

## 6 Input/Output

### 6.3 External Gain

reset by the "Restore Input/Output Defaults" or "Restore System Defaults->All functions.

The Swept SA Measurement in SA Mode only supports the "Ext Preamp" function under External Gain. The other External Gain functions are grayed-out, and generate a settings conflict, if the SCPI for them is sent.

See ["More Information" on page 745](#)

|                              |                                                                                                                                                                                                                                                                                                                                      |
|------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command               | <code>[ :SENSe]:CORRection:SA[:RF]:GAIN &lt;rel_amp1&gt;</code><br><code>[ :SENSe]:CORRection:SA[:RF]:GAIN?</code>                                                                                                                                                                                                                   |
| Example                      | Set the Ext Gain value to 10 dB:<br><code>:CORR:SA:GAIN 10</code><br><br>Set the Ext Gain value to -10 dB (that is, an attenuation of 10 dB):<br><code>:CORR:SA:GAIN -10</code>                                                                                                                                                      |
| Notes                        | Does not auto return<br>This command is new in X-Series                                                                                                                                                                                                                                                                              |
| Dependencies                 | The reference level limits are determined in part by the External Gain/Atten, Max Mixer Level, and RF Atten<br>Grayed-out in Modes that do not support External Gain                                                                                                                                                                 |
| Preset                       | Unaffected by Preset, but set to 0 dB by <b>Restore Input/Output Defaults</b> or <b>Restore System Defaults-&gt;All</b><br>0.00 dB, Gain                                                                                                                                                                                             |
| State Saved                  | Saved in instrument state                                                                                                                                                                                                                                                                                                            |
| Min                          | -120 dB                                                                                                                                                                                                                                                                                                                              |
| Max                          | 120 dB                                                                                                                                                                                                                                                                                                                               |
| Annotation                   | Displayed in the Meas Bar as "Ext Gain <value>". When the gain is zero, no annotation is shown                                                                                                                                                                                                                                       |
| Backwards Compatibility SCPI | <code>[ :SENSe]:CORRection:OFFSet[:MAGNitude]</code><br>The legacy <b>Ext Preamp Gain</b> key is now called <b>Ext Gain</b> and the sub-menu has choices of Ext Preamp   MS   BTS for backwards compatibility<br>The MS and BTS choices are unavailable in Swept SA and the Ext Preamp is unavailable in the cell comms measurements |

## More Information

The U7227A USB Preamplifier is an accessory for the X-Series Signal Analyzer that provides gain externally, and whose gain settings are automatically loaded into the instrument over USB whenever it is connected to one of the instrument's USB ports.

While the USB Preamplifier is plugged into one of the instrument's USB ports, the instrument will consider it to be in the signal path of the RF Input and will apply the calibration data from the USB Preamp to measurements taken at the RF Input (on 2

input boxes, it will be considered to be in the signal path of RF Input 1; it is not supported for RF Input 2).

The USB Preamplifier contains its own cal data. This includes a noise trace suitable for use with NFE, for those models which support NFE. The act of connecting the Preamp to USB will cause the cal data to be downloaded from the preamp. When this happens, an informational message is provided saying "Cal data loaded from USB Preamp". The instrument will then automatically apply the calibration factors loaded from the Preamp in any measurement that supports the USB Preamp.

The External Preamp Gain setting may still be used, even though it is not required for the USB Preamp (since the USB Preamp supplies its own gain data to the instrument which is applied automatically). Connecting the USB Preamp does not change the External Preamp Gain setting, however unless you have another gain or attenuation element in the signal path, the appropriate setting for External Preamp Gain is 0 dB.

Overload detection and reporting will apply when the USB preamplifier is connected to USB. The USB Preamplifier has its own overload detector which reports overloads to the instrument over USB. This generates an error condition, "Input Overload; USB Preamp."

If, while the USB Preamp is connected to USB, a measurement is selected that does not support the USB preamplifier, the "No result; Meas invalid with Preamp" error condition is generated.

## 6.3.2 External Gain - MS

Sets an external gain/attenuation value for MS (Mobile Station) tests.

|                |                                                                                                                                                                         |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:CORRection:MS[:RF]:GAIN &lt;rel_ampl&gt;</code><br><code>[ :SENSe]:CORRection:MS[:RF]:GAIN?</code>                                                      |
| Example        | Set the Ext Gain value to 10 dB:<br><code>:CORR:MS:GAIN 10</code><br><br>Set the Ext Gain value to -10 dB (that is, a loss of 10 dB):<br><code>:CORR:MS:GAIN -10</code> |
| Notes          | Does not auto return                                                                                                                                                    |
| Dependencies   | The reference level limits are determined in part by the External Gain, Max Mixer Level, RF Atten<br>Grayed-out in modes that do not support MS                         |
| Preset         | Unaffected by Preset, but set to 0 dB by <b>Restore Input/Output Defaults</b> or <b>Restore System Defaults-&gt;All</b><br>0.00 dB, Gain                                |
| State Saved    | Saved in instrument state                                                                                                                                               |
| Min            | -100 dB                                                                                                                                                                 |
| Max            | 100 dB                                                                                                                                                                  |

## 6 Input/Output

### 6.3 External Gain

#### Backwards Compatibility SCPI

|                              |                                                                                                                                                                                                                                                                                |
|------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Example                      | <p>Set the Ext Gain value to -10 dB, and subsequently querying :LOSS will give 10 dB:<br/> <code>:CORR:MS:LOSS 10</code></p> <p>Set the Ext Gain value to 10 dB. Subsequently querying :LOSS will return -10 dB:<br/> <code>:CORR:MS:LOSS -10</code></p>                       |
| Notes                        | <p>A positive value of <code>&lt;rel_amp1&gt;</code> in the above command means a loss and a negative value indicates a gain</p> <p>If :LOSS is set, :GAIN is set to the negative value of the parameter sent</p> <p>If :LOSS is queried, it returns the negative of :GAIN</p> |
| Preset                       | Unaffected by Preset, but set to 0 dB by <b>Restore Input/Output Defaults</b> or <b>Restore System Defaults-&gt;All</b>                                                                                                                                                        |
| Min/Max                      | -/+100 dB                                                                                                                                                                                                                                                                      |
| Backwards Compatibility SCPI | <code>[ :SENSe]:CORRection:MS[:RF]:LOSS &lt;rel_amp1&gt;</code><br><code>[ :SENSe]:CORRection:MS[:RF]:LOSS?</code>                                                                                                                                                             |

### 6.3.3 External Gain - BTS

Sets an external attenuation value for BTS (Base Transceiver Station) tests.

|                |                                                                                                                                                                                      |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:CORRection:BTS[:RF]:GAIN &lt;rel_amp1&gt;</code><br><code>[ :SENSe]:CORRection:BTS[:RF]:GAIN?</code>                                                                 |
| Example        | <p>Set the Ext Gain value to 10 dB:<br/> <code>:CORR:BTS:GAIN 10</code></p> <p>Set the Ext Gain value to -10 dB (that is, a loss of 10 dB):<br/> <code>:CORR:BTS:GAIN -10</code></p> |
| Notes          | Does not auto return                                                                                                                                                                 |
| Dependencies   | The reference level limits are determined in part by the External Gain, Max Mixer Level, RF Atten<br>Grayed-out in modes that do not support BTS                                     |
| Preset         | Unaffected by Preset, but set to 0 dB by <b>Restore Input/Output Defaults</b> or <b>Restore System Defaults-&gt;All</b><br>0.00 dB, Gain                                             |
| State Saved    | Saved in instrument state                                                                                                                                                            |
| Min            | -100 dB                                                                                                                                                                              |
| Max            | 100 dB                                                                                                                                                                               |

#### Backwards Compatibility SCPI

|         |                                                                                                                               |
|---------|-------------------------------------------------------------------------------------------------------------------------------|
| Example | <p>Set the Ext Gain value to -10 dB, and subsequently querying :LOSS will give 10 dB:<br/> <code>:CORR:BTS:LOSS 10</code></p> |
|---------|-------------------------------------------------------------------------------------------------------------------------------|

|                                 |                                                                                                                                                                                                                                                                                       |
|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                 | Set the Ext Gain value to 10 dB. Subsequently querying <b>:LOSS</b> will return -10 dB:<br><b>:CORR:BTS:LOSS -10</b>                                                                                                                                                                  |
| Notes                           | A positive value of <b>&lt;rel_amp1&gt;</b> in the above command means a loss and a negative value indicates a gain<br>If <b>:LOSS</b> is set, <b>:GAIN</b> is set to the negative value of the parameter sent<br>If <b>:LOSS</b> is queried, it returns the negative of <b>:GAIN</b> |
| Preset                          | Unaffected by Preset, but set to 0 dB by <b>Restore Input/Output Defaults</b> or <b>Restore System Defaults-&gt;All</b>                                                                                                                                                               |
| Min/Max                         | -/+100 dB                                                                                                                                                                                                                                                                             |
| Backwards Compatibility<br>SCPI | <b>[ :SENSe]:CORRection:BTS[:RF]:LOSS &lt;rel_amp1&gt;</b><br><b>[ :SENSe]:CORRection:BTS[:RF]:LOSS?</b>                                                                                                                                                                              |

### 6.3.4 I Ext Gain

Affects the I channel input. However, when Q Gain in I+jQ is set to Same as I Gain, this value is applied to both I and Q channel inputs.

|                |                                                                                                                                                                                                                                                                                                                                |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <b>[ :SENSe]:CORRection:IQ:I:GAIN &lt;rel_amp1&gt;</b><br><b>[ :SENSe]:CORRection:IQ:I:GAIN?</b>                                                                                                                                                                                                                               |
| Example        | Set the I Ext Gain to 10 dB:<br><b>:CORR:IQ:I:GAIN 10</b><br><br>Set the I Ext Gain to -10 dB (that is, a loss of 10 dB):<br><b>:CORR:IQ:I:GAIN -10</b>                                                                                                                                                                        |
| Dependencies   | Not available unless option BBA is installed<br>Grayed-out when I/Q Path is Q Only                                                                                                                                                                                                                                             |
| Preset         | 0 dB<br>Unaffected by Preset, but set to 0 dB by <b>Restore Input/Output Defaults</b> or <b>Restore System Defaults-&gt;All</b>                                                                                                                                                                                                |
| State Saved    | Yes                                                                                                                                                                                                                                                                                                                            |
| Min/Max        | -/+100 dB                                                                                                                                                                                                                                                                                                                      |
| Annotation     | Ext Gain: <I Ext Gain> dB<br><br>No annotation is shown when Input is not I/Q. Also not shown when I Ext Gain is 0.00 dB. I Ext Gain is not shown for Input Path Q Only. When the Input Path is Independent I and Q and I Ext Gain is not the same as Q Ext Gain, both are shown. "Ext Gain: <I Ext Gain> dB, <Q Ext Gain> dB" |

### 6.3.5 Q Ext Gain

Affects the Q channel input.



## 6 Input/Output

### 6.3 External Gain

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:CORRection:IQ:Q:GAIN &lt;rel_amp1&gt;</code><br><code>[ :SENSe]:CORRection:IQ:Q:GAIN?</code>                                                                                                                                                                                                                                                                                                                                          |
| Example        | Set the Q Ext Gain to 10 dB:<br><code>:CORR:IQ:Q:GAIN 10</code><br><br>Set the Q Ext Gain to -10 dB (that is, a loss of 10 dB):<br><code>:CORR:IQ:Q:GAIN -10</code>                                                                                                                                                                                                                                                                                   |
| Dependencies   | Not available unless option BBA is installed<br>Grayed-out when Q gain in I+jQ is set to Same as I Gain                                                                                                                                                                                                                                                                                                                                               |
| Preset         | 0 dB<br>Unaffected by Preset, but set to 0 dB by <b>Restore Input/Output Defaults</b> or <b>Restore System Defaults-&gt;All</b>                                                                                                                                                                                                                                                                                                                       |
| State Saved    | Saved in instrument state                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Min/Max        | -/+100 dB                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Annotation     | Ext Gain: <Q Ext Gain> dB<br><br>No annotation is shown when Input is not I/Q. Also not shown when Q Ext Gain is 0.00 dB. Q Ext Gain is not shown for Input Path I Only or I+jQ. When Input Path is Independent I and Q and when I and Q Ext Gain are both non-zero but are the same the annotation will be "Ext Gain: <Ext Gain> dB" and when I Ext Gain is not the same as Q Ext Gain, both are shown. "Ext Gain: <I Ext Gain> dB, <Q Ext Gain> dB" |

#### 6.3.6 Q Gain in I+jQ

When Same as I Gain (**ON**) is selected, I Ext Gain value is applied to both I and Q channel input if the Input Path is I+jQ.

When Independent (**OFF**) is selected, I and Q Ext Gain values are applied to I and Q channel input independently.

|                |                                                                                                                            |
|----------------|----------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:CORRection:IQ:Q:GAIN:COUPle ON   OFF   0   1</code><br><code>[ :SENSe]:CORRection:IQ:Q:GAIN:COUPle?</code> |
| Example        | <code>:CORR:IQ:Q:GAIN:COUP ON</code><br><code>:CORR:IQ:Q:GAIN:COUP?</code>                                                 |
| Preset         | <b>ON</b>                                                                                                                  |
| State Saved    | Yes                                                                                                                        |
| Range          | Same as I Gain   Independent                                                                                               |

## 6.4 Data Source

Contains controls that let you select the source of the data being fed to the instrument analysis engine.

The ability to Save and Record files of I/Q data is an important feature of some X-Series applications, and the Data Source controls allow you to switch back and forth from actual data at the instrument input and recorded data from a File.

In addition, some measurements allow you to retain a single measurement record in a Capture Buffer, and some measurements allow you to retain a specified length data record internally in a Recorded data area.

So, for measurements that support it, the controls on this tab allow you to select data from the instrument inputs, a recalled recording File, the Capture Buffer, or the Recorded data area. For measurements that do not support these features, the **Data Source** tab does not appear, and if **:FEED:DATA SCPI** is sent, an Undefined Header error is generated.

The available choices depend on which measurement you are running. All measurements support Input; Capture Buffer and File are only available in certain measurements, as shown in the table below. The choice of the internal Recorded data area is only available in Pulse Mode.

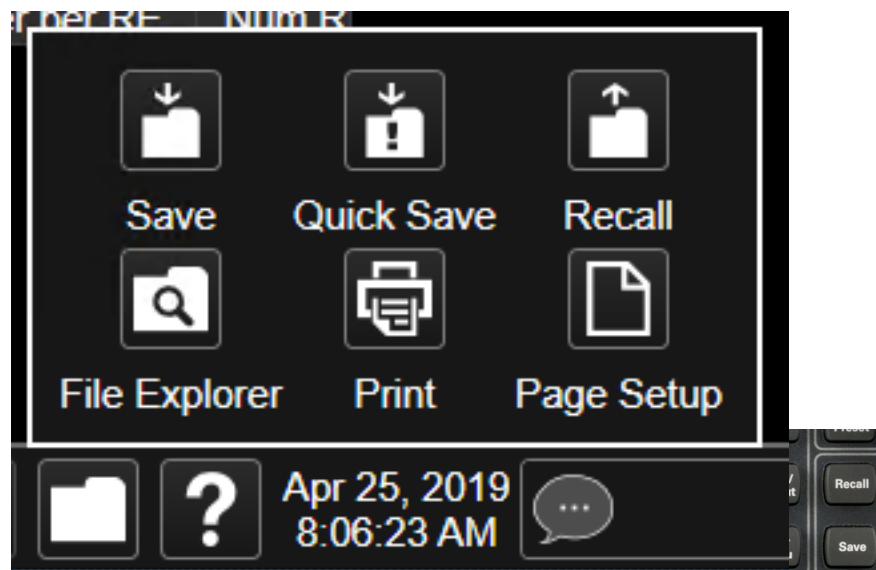
| Measurement                   | Capture Buffer | File |
|-------------------------------|----------------|------|
| WCDMA Code Domain             | x              |      |
| WCDMA Mod Accuracy            | x              |      |
| VMA Digital Demod             |                | x    |
| VMA Custom OFDM               |                | x    |
| 5G NR Modulation Analysis     |                | x    |
| FDD LTE-A Modulation Analysis |                | x    |
| TDD LTE-A Modulation Analysis |                | x    |
| WLAN Modulation Analysis      | x              | x    |
| WLAN Spectral Flatness        |                | x    |
| WLAN MIMO Modulation Analysis |                | x    |
| Analog Demod AM               |                | x    |
| Analog Demod PM               |                | x    |
| Analog Demod FM               |                | x    |
| Analog Demod FM Stereo        |                | x    |
| Bluetooth Transmit Analysis   | x              | x    |
| IoT & SRComms LoRa CSS Demod  |                | x    |

### How to Record and Playback I/Q Data

In several Demod measurements (and certain other measurements), it is possible to record I/Q data to files on your hard drive or network, and then recall these files for subsequent playback. These are the measurements shown in the table above with an “x” in the **File** column.

The Recording and Playback of signal data files is a multi-step process which involves controls in several menus (listed below).

#### Menus involved in Record/Playback:



- **Save, Recording** (under the **Save** hardkey or the **Save** icon in the **File** panel)
- **Recall, Recording** (under the **Recall** hardkey or the **Recall** icon in the **File** panel)
- **Sweep, Recording** tab
- **Sweep, Playback** tab
- **Input/Output, Data Source** tab (this tab)

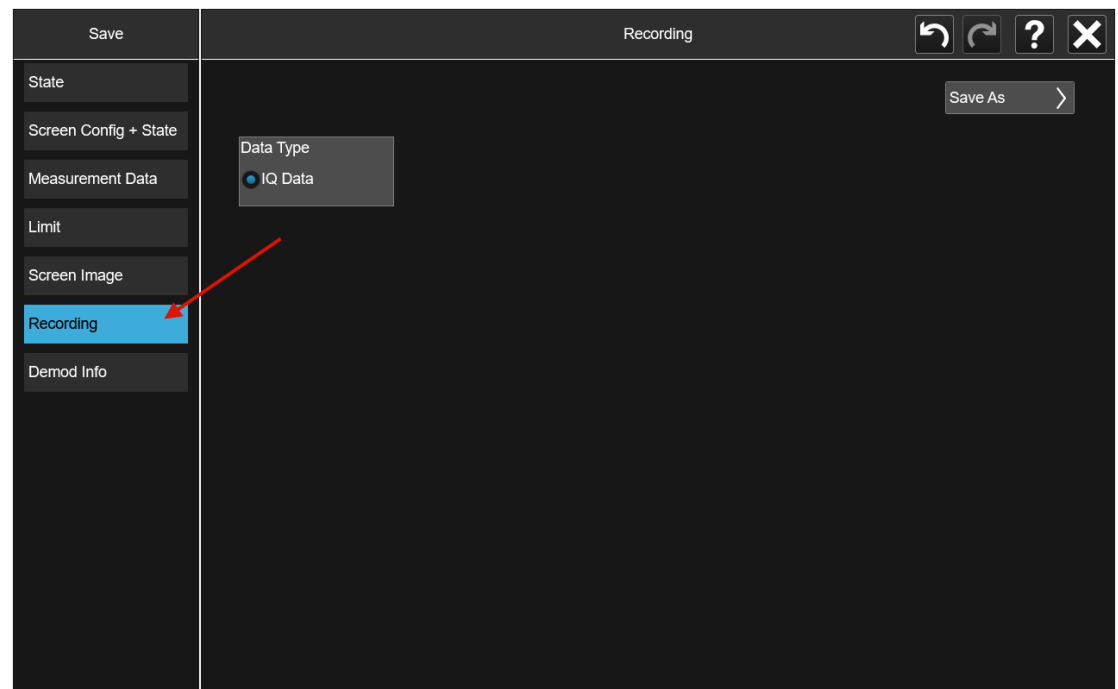
#### Saving a Recording

When you save a recording, a certain number of measurement records are saved to a Recording file. The amount of data that is saved varies depending on the measurement and measurement settings. The following example uses VMA Digital Demod to illustrate the process.

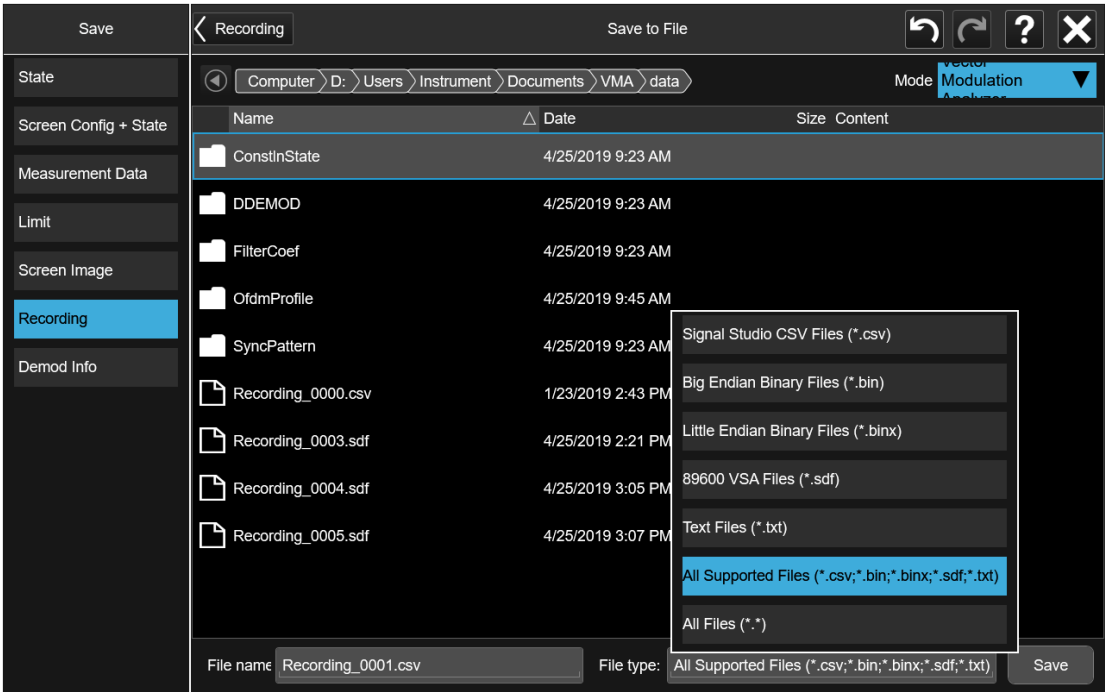
If you press the **Recording** tab in the **Sweep** menu, you will see a certain number of parameters displayed on the menu panel. Before you save a Recording, these parameters are all 0, as shown below:



To save the data for the current measurement, press the **Save** hardkey (or the **Save** icon in the **File** panel) and press the **Recording** tab on the left side of the **Save** panel:



Then press **Save As** and choose the file type you would like to use for the Save (**CSV**, **SDF**, **TXT**, **BIN**, **BINX**). You can find details of the file formats in **Save > Recording**.



Then press **Save** to save the raw I/Q data of the current measurement.

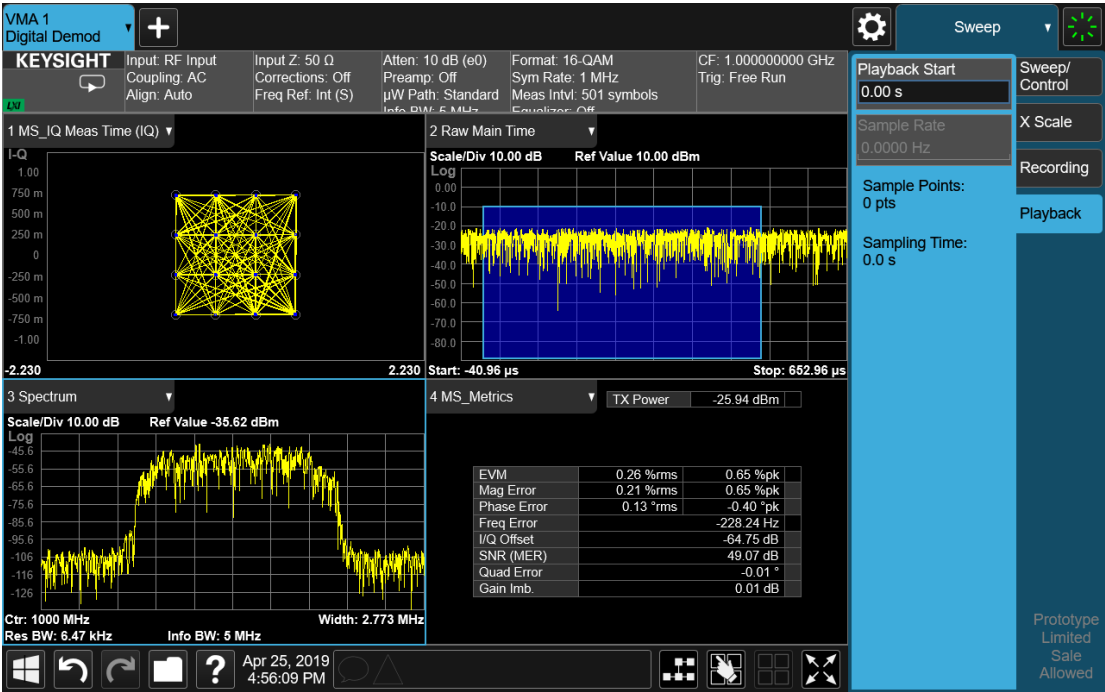
After the Save, you will see that the data on the Recording panel has changed to describe the data in the file you just saved. You should note this data in case you need to refer to it when you recall the file, particularly as not all file formats include the Sample Rate that was used to save the data. In particular, **BIN** and **BINX** files do not include sampling rate information inside the file, so after recalling one of these file types, you will need to set the Sample Rate manually in the **Sweep, Playback** menu.



Step 2: Recalling a Recording

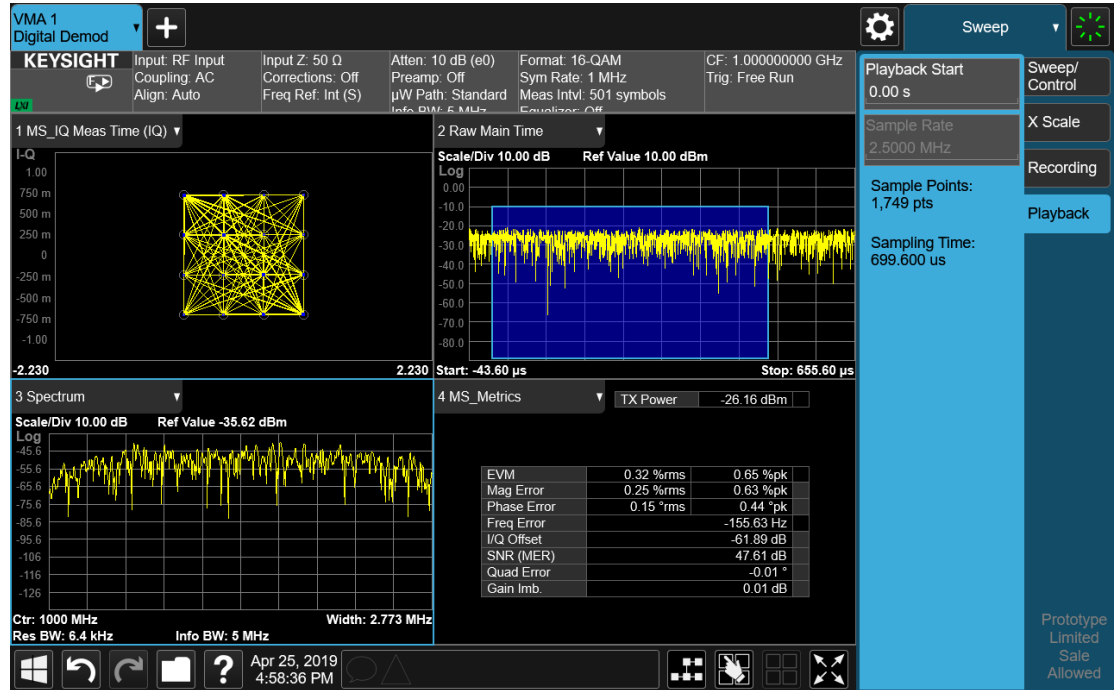
If you press the **Playback** tab in the **Sweep** menu, you will see a certain number of parameters displayed on the menu panel. Before you recall a Recording, these parameters are all 0, as shown below:

6 Input/Output  
6.4 Data Source



To recall a Recording, press the **Recall** hardkey (or the **Recall** icon in the **File** panel) and press the **Recording** tab on the left side of the **Recall** panel. Then press **Recall From** and choose the file you would like to recall. This will read the raw I/Q data from the specified file and feed it to the current measurement.

After the Recall, you will see that the data on the Recording panel has changed to describe the data in the file you just recalled:



Note that the **Sample Rate** key is grayed out if the file type you loaded contains Sample Rate information. **BIN** and **BINX** files do not include sampling rate information inside the file, so after recalling one of these file types, you will need to set the Sample Rate. You should have noted the Sample Rate that was displayed on the **Sweep, Recording** menu panel after you saved the file.

After the recall is performed, you will also see that the **Data Source** control has switched to **File**. You can see this on the **Data Source** menu panel, and also on the dropdown from the Measurement Bar on the far-left side of the instrument:



6 Input/Output  
6.4 Data Source

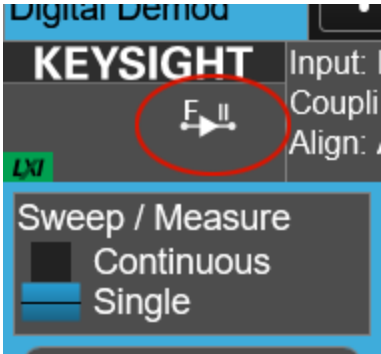


You can also see that the control indicator on the measurement bar has an “F” in it and the playback symbol (right facing triangle) displayed:



This indicates that the instrument is in **Continuous Playback** mode and is using data from a File.

If you select **Single** in the control dropdown, the indicator will change to show that it is in **Single Pause** mode as below:



You can now examine data in the recorded file which you loaded. How you do this depends on whether you are in **Continuous Playback** mode or **Single Pause** mode.

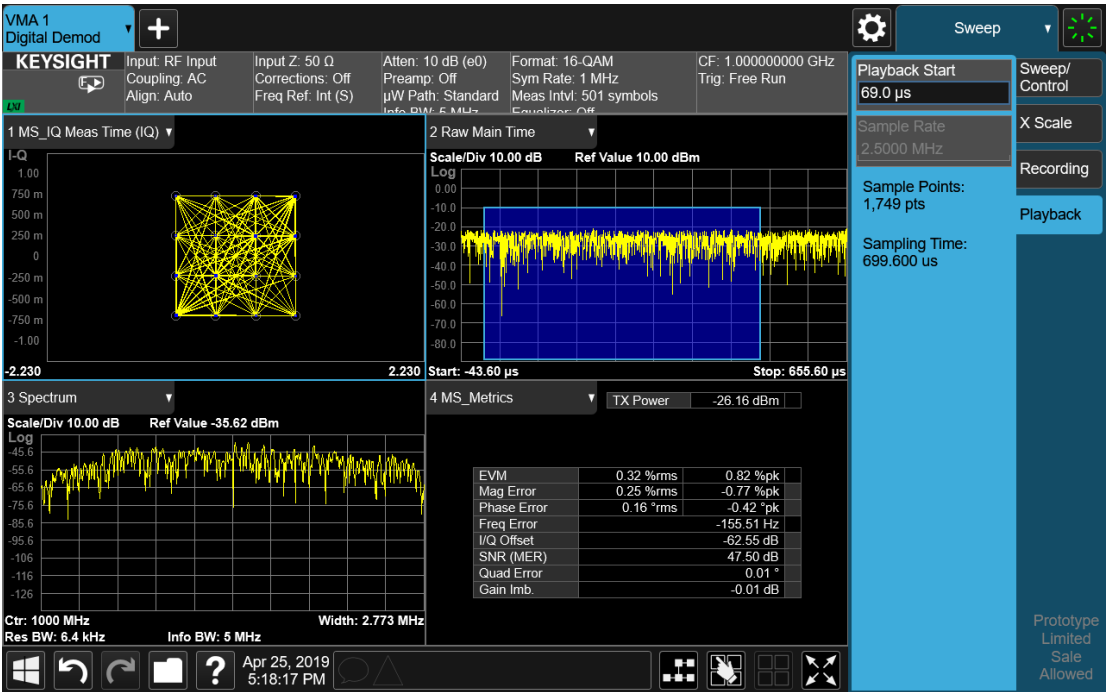
If you wish to return to looking at data at the instrument input, simply change the **Data Source** control from **File** back to **Input**.

Looking at your Recorded data

To examine the data you loaded, go to the **Playback** menu panel under **Sweep**. How you proceed from here depends on whether you are in **Continuous Playback** mode or **Single Pause** mode.

Continuous Playback mode

In this mode, turn the knob clockwise or use the **Up** key on the front panel to move through successive records in the recording. You will see the Playback Start control change from 0 to successively higher values as you move through the records.

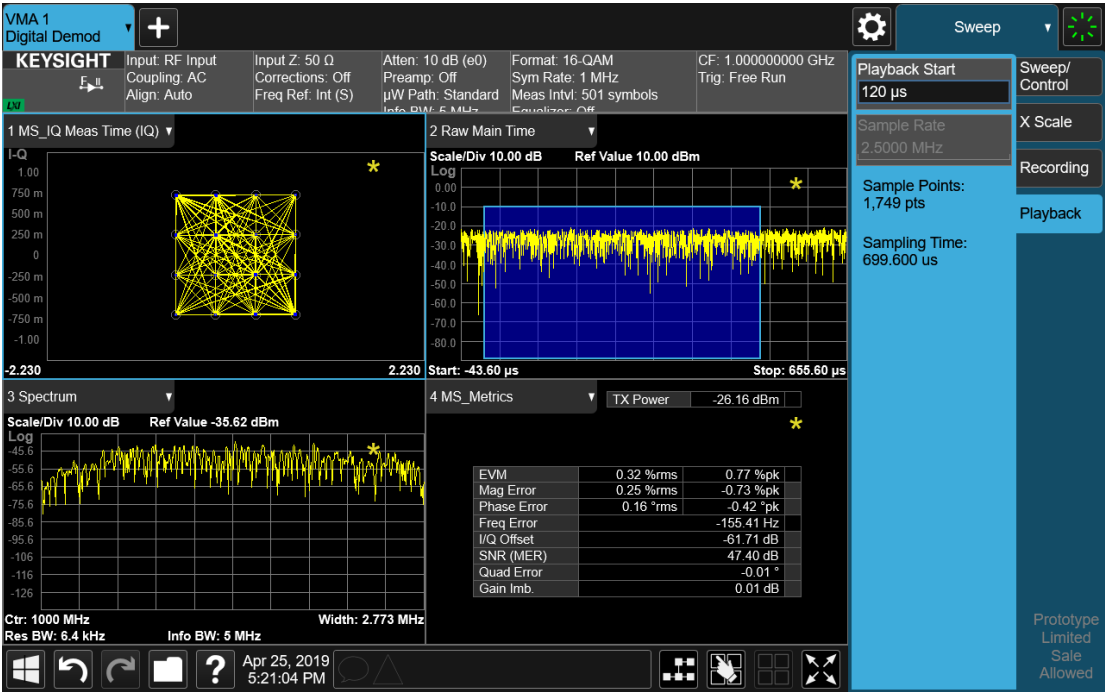


Single Pause mode

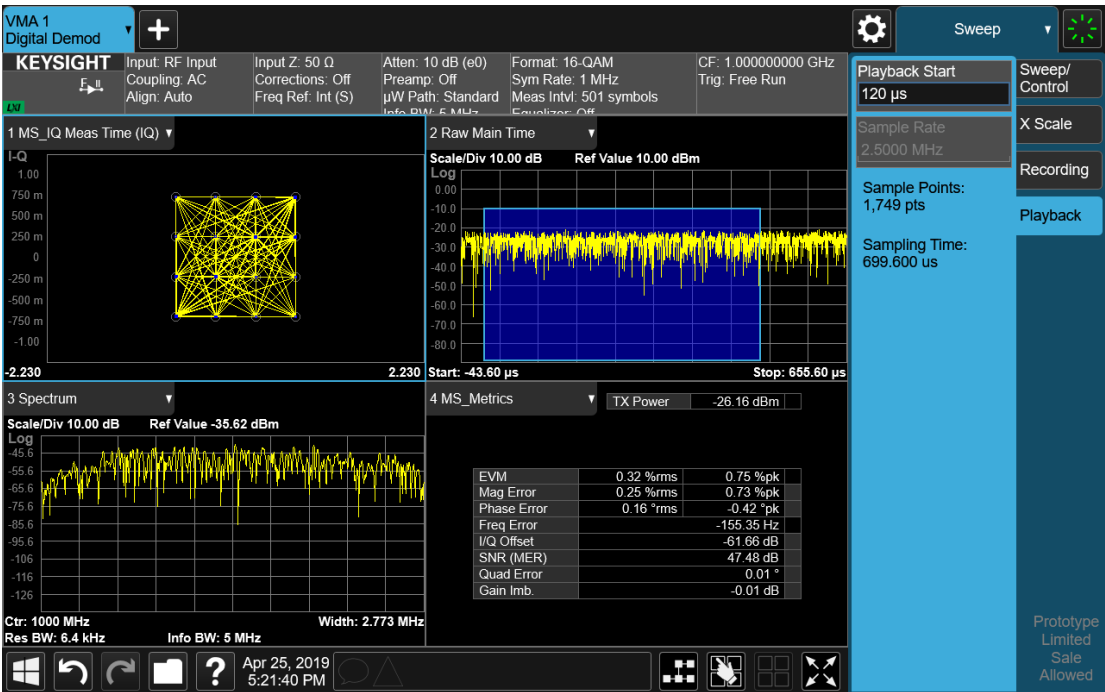
In this mode, you can only look at one record. Set the Playback Start time to the desired offset from zero and press **Restart**. A single record will be displayed.

Note that until you press **Restart**, the “invalid data” indicator (yellow asterisk) will be displayed in each window as below:

6 Input/Output  
6.4 Data Source



Once you press **Restart**, the invalid data indicator will disappear, as below:



## 6.4.1 Data Source

Lets you select the input to the analysis engine. The following options are available:

|                |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|----------------|-----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Input          | <b>INPut</b>    | A hardware input signal (the default). This causes the measurement to take its input data from the hardware input (for example RF, I/Q, or EXTMixer) currently selected on the Input tab under Input/Output                                                                                                                                                                                                                                                                                                                                                                                             |
| Capture Buffer | <b>STORed</b>   | Data stored in a storage buffer from a single earlier acquisition. Selecting "Capture Buffer" allows you to use data that has been previously stored using the "Current Meas -> Capture Buffer" control. You can make a measurement and then, if you want to make a different measurement using the exact same data, store the raw data using the "Current Meas -> Capture Buffer" control and select "Capture Buffer" as the Data Source, then switch to the other measurement. You must have previously done a "Current Meas -> Capture Buffer" before the Capture Buffer choice is available for use |
| Recorded       | <b>RECORded</b> | Data recorded to memory from a set of earlier acquisitions. Selecting "Recorded" lets you use the record buffer, previously filled by using the "Recording" tab in the Sweep menu, as the input (only available in the Pulse measurement)                                                                                                                                                                                                                                                                                                                                                               |
| File           | <b>FILE</b>     | Data recorded on a storage device from a set of earlier acquisitions. If you load a Recording using Recording under the Recall key, "File" is automatically selected, which lets you use the recorded data as though it were coming from the Input                                                                                                                                                                                                                                                                                                                                                      |

See ["Data Source" on page 750](#) for a table of available choices on a per-measurement basis.

|                              |                                                                                                                                                                                                                                                                                                                                   |
|------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command               | <code>[ :SENSe]:FEED:DATA INPut   STORed   RECORded   FILE</code><br><code>[ :SENSe]:FEED:DATA?</code>                                                                                                                                                                                                                            |
| Example                      | Cause the measurement to look at the input selection:<br><code>:FEED:DATA INP</code><br><br>Cause stored measurement data to be used with a different measurement that supports this:<br><code>:FEED:DATA STOR</code>                                                                                                             |
| Dependencies                 | If you switch to a measurement that does not support the currently selected Data Source, the instrument switches Data Source to "Input". Attempting to select an unavailable Data Source via SCPI generates an error<br><br>The Data Source setting is independent for each mode. Not all Data Sources are available in all modes |
| Preset                       | Unaffected by Preset, but set to <b>INPut</b> by <b>Restore Input/Output Defaults</b> or <b>Restore System Defaults-&gt;All</b>                                                                                                                                                                                                   |
| State Saved                  | Saved in instrument state                                                                                                                                                                                                                                                                                                         |
| Backwards Compatibility SCPI | <code>[ :SENSe]:FEED:SOURce INPut   STORed</code><br><code>[ :SENSe]:FEED:SOURce?</code>                                                                                                                                                                                                                                          |

6.4.2 Current Meas -> Capture Buffer

Stores the raw data of one measurement in the internal memory of the instrument where it can then be used by a different measurement by pressing **Stored Data**. When raw data is stored, then the data source selection switch automatically changes to **Stored Data**. Stored raw data cannot be directly accessed. There is no save/recall function to save the raw data in an external media. If you want to get the stored raw data, you must first perform a measurement using the stored raw data. Now you can access the used raw data, which is the same as stored raw data, using the **:FETch** or **:READ** commands.

|                                 |                                         |
|---------------------------------|-----------------------------------------|
| Remote Command                  | [ :SENSe ] :FEED:DATA:STORe             |
| Example                         | :FEED:DATA:STOR<br>stores recorded data |
| Notes                           | Command only; no query                  |
| Dependencies                    | Grayed-out in the SA measurement        |
| Backwards Compatibility<br>SCPI | [ :SENSe ] :FEED:SOURce:STORe           |

## 6.5 Corrections

Accesses the **Corrections** menu, which lets you select, turn on and off, and configure and edit Corrections. You can also select, turn on and off and configure Complex Corrections and Corrections Groups.

Corrections arrays provide Amplitude Corrections, and can be entered by the user, sent over SCPI, or loaded from a file. They allow you to correct the response of the instrument for various use cases. X-Series supports eight separate Corrections arrays, each of which can contain up to 2000 points. They can be turned on and off individually and any or all can be on at the same time. Corrections Groups let you load several (Amplitude) Corrections at a time into a Correction Group.

Complex Correction arrays provide both Amplitude and Phase Corrections, and can be loaded from a file. Currently the file type supported has the extension .s2p. Complex Corrections operate in much the same manner as Corrections - the X-series supports eight separate Complex Corrections arrays, each of which can contain up to 30000 points, and each Complex Correction can be turned on and off individually and any or all can be on at the same time. Some Modes, such as Spectrum Analyzer Mode, only support only the Amplitude (Magnitude) element of Complex Corrections. Other Modes, such as IQ Analyzer Mode and VMA, support both the Amplitude and Phase elements of Complex Corrections. If a Complex Correction is turned on in a Measurement that does not support Phase, only the Magnitude information will be used for the Correction.

Trace data is in absolute units and corrections data is in relative units. You can edit the Corrections arrays in the Corrections editor using the “Edit Correction” dialog (you cannot edit the Complex Corrections arrays; they can only be loaded from a file).

In zero span measurements (such as Zero Span in the Swept SA measurement), where the frequency is always the center frequency of the instrument, we apply the (interpolated) correction for the center frequency to all points in the trace. In the event where there are two correction amplitudes at the center frequency, we apply the first one in the table.

Note that the corrections are applied as the data is taken; therefore, a trace in **View** (Update Off) will not be affected by changes made to the corrections after the trace is put in **View**.

The **Corrections** tab only appears in Modes and Measurements that support Corrections and/or Complex Corrections. In other Modes, sending SCPI for Corrections and/or Complex Corrections will generate a Settings Conflict message

Corrections and Complex Corrections arrays are not affected by a Preset, because they are in the Input/Output system. They also survive shutdown and restarting of the instrument application, which means they will survive a power cycle. Corrections

and Complex Corrections arrays are reset (deleted) by Restore Input/Output Defaults. The following commands delete the correction registers:

- User Preset the current mode **:SYST:PRES:USER**
- User Preset all modes **:SYST:PRES:USER ALL**
- Full mode preset **:SYST:PRES:FULL**
- Restore power on default **:SYST:DEF PON**
- Restore all defaults **:SYST:DEF; :SYST:DEF ALL**
- Preset Input/Output variables **:SYST:DEF INP**
- Delete all corrections **:CORR:CSET:ALL:DEL**

The instrument Save State and Save Screen Config + State includes the data in the correction registers. If a measurement setup is saved and then recalled at a later time, the correction data will be recalled as well. This feature is useful for recreating the full instrument condition, but the user has to be careful that the recalled correction data is the desired data. For example, if the state is recalled on a different instrument different correction data might be needed. Or if the system is recalibrated, the correction data in the save state would then be stale. Applications that use measured data for corrections will generally need to reload the correction data from file whenever a state is recalled; this ensures that the correction data is current and applies to hardware in use.

In the EXM and EXF, on the RF Input/Output panel, there are two full-duplex RF ports (RFIO1 and RFIO2), RF Input and RF Output. When RF Input is selected, it will correspond to one input port from two half-duplex RF ports (RFIO3 and RFIO4), and when RF Output is selected, it will correspond to one output port from two half-duplex RF ports (RFIO3 and RFIO4). So, there are 8 sets of corrections in all that can be applied to the RF ports. Ports cannot share the same set of corrections, but a single port can have multiple corrections applied to it. The correction data is applied to incoming signals as well as transmitted signals and is in the form of a list of spot frequencies and amplitude correction levels.

|            |                                                                                                                                          |
|------------|------------------------------------------------------------------------------------------------------------------------------------------|
| Annotation | In EMI Mode, you can choose to display the correction details in the graph area by turning on Display, Annotation, Correction Annotation |
|------------|------------------------------------------------------------------------------------------------------------------------------------------|

### 6.5.1 Select Correction

Specifies the selected correction. The term "selected correction" is used throughout this document to specify which correction will be affected by the functions.

|        |                                                                            |
|--------|----------------------------------------------------------------------------|
| Notes  | The selected correction is remembered even when not in the correction menu |
| Preset | Set to Correction 1 by Restore Input/Output Defaults                       |

## 6.5.2 Correction On/Off

Turning the Selected Correction from **OFF** to **ON** allows the values in it to be applied to the data. This state transition also automatically turns on "Apply Corrections" (sets it to **ON**), otherwise the correction would not take effect.

A new sweep is initiated if an amplitude correction is switched on or off. Note that changing, sending or loading corrections data does *not* directly initiate a sweep, however in general these operations will turn corrections on, which *does* initiate a sweep.

|                               |                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|-------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command                | <code>[ :SENSe]:CORRection:CSET[1] 2 ... 16[:STATe] ON   OFF   1   0</code><br><code>[ :SENSe]:CORRection:CSET[1] 2 ... 16[:STATe]?</code>                                                                                                                                                                                                                                                                                       |
| Example                       | <code>:SENS:CORR:CSET1 ON</code>                                                                                                                                                                                                                                                                                                                                                                                                 |
| Dependencies                  | Changing this from <b>OFF</b> to <b>ON</b> automatically turns on "Apply Corrections"<br>Note that if any Correction is turned on that has a transducer unit set (other than "None"), the Y-Axis Unit of the instrument is forced to that Transducer Unit. All other Y-Axis Unit choices are grayed-out<br>This command generates an "Option not available" error unless you have the proper option installed in your instrument |
| Preset                        | Not affected by Preset. Set to <b>OFF</b> by <b>Restore Input/Output Defaults</b>                                                                                                                                                                                                                                                                                                                                                |
| State Saved                   | Saved in instrument state                                                                                                                                                                                                                                                                                                                                                                                                        |
| Annotation                    | If <i>any</i> Correction is turned on, Corr in the Meas Bar displays in amber to indicate Corrections are in use                                                                                                                                                                                                                                                                                                                 |
| Backwards Compatibility Notes | Unlike legacy instruments, Preset does not turn Corrections off ( <b>Restore Input/Output Defaults</b> does)                                                                                                                                                                                                                                                                                                                     |

## 6.5.3 Correction Port

Maps one of the sets of corrections to a particular I/O port. This control allows any Input port (including External Mixing, BBIQ, the RF2 input, etc.) to be mapped to a specific Correction, so that the Correction is only applied when that Port is being used by the current Screen. You can also map any internal source Output port to a specific Correction.

When Current Input (CINPut) is selected for **Correction Port**, it chooses the current input port of the current Screen for the selected Correction. In other words, the Correction applies to whichever input is selected. If the input changes, the correction applies to the new input.

When using the VXT M9410A/11A with Remote Radio Heads (such as the Keysight M1740A mmWave Transceiver for 5G), the choices in the dropdown menu appear as :



## 6 Input/Output

### 6.5 Corrections

#### Head h RFHD p

For example, if you have two Radio Heads (numbered 1 and 2), each of which have two RF half duplex ports, the choices for these ports appear as below:

| Head and Port           | Choice in dropdown | SCPI parameter            |
|-------------------------|--------------------|---------------------------|
| Head 1, port RF Tx/Rx 1 | Head 1 RFHD 1      | <a href="#">RRH1RFHD1</a> |
| Head 1, port RF Tx/Rx 2 | Head 1 RFHD 2      | <a href="#">RRH1RFHD2</a> |
| Head 2, port RF Tx/Rx 1 | Head 2 RFHD 1      | <a href="#">RRH2RFHD1</a> |
| Head 2, port RF Tx/Rx 2 | Head 2 RFHD 2      | <a href="#">RRH2RFHD2</a> |

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <pre>[ :SENSe]:CORRection:CSET[1] 2 ... 16:RF:PORT CINPut   RFIN   RFIN2   AIQ   EMIXer   RFIO1   RFIO2   RFIO3   RFIO4   RFOut   RFHD   RFFD   ANT   GEN   TR   A1   A2   A3   B1   B2   B3   IFIO1   IFIO2   RRHnRFHDp   ERFIN</pre> <p>See <a href="#">"Parameter Options" on page 765</a></p> <pre>[ :SENSe]:CORRection:CSET[1] 2 ... 16:RF:PORT?</pre>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Example        | <p>Set Correction Port for Correction 1 to apply to the currently selected input:</p> <pre>:CORR:CSET:RF:PORT CINP</pre> <p>Set Correction Port for Correction 4 to apply to Radio Head 1, RF Tx/Rx Port 2:</p> <pre>:CORR:CSET4:RF:PORT RRH1RFHD2</pre>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Notes          | <p>The <b>RF</b> node in this command is retained for backwards compatibility, even though the scope of the Correction Port command goes beyond the RF ports and includes BBIQ and External Mixing</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Dependencies   | <p><a href="#">RFIN2</a>   <a href="#">AIQ</a>   <a href="#">EMIXer</a> are only available on C/E/M/P/UXA analyzers with the appropriate options loaded</p> <p><a href="#">RFOut</a> is only available on modular products such as VXT</p> <p><a href="#">ANT</a>, <a href="#">GEN</a> and <a href="#">TR</a> are only available in VXT and only when the M9470A module is installed, such as in the M8920A. Option "HDX" is required to enable the TR port</p> <p><a href="#">RFHD</a> and <a href="#">RFFD</a> are only available on VXT. Option HDX is required to enable RFHD port and option FDX is required to enable RFFD port</p> <p><a href="#">RFIO3</a> and <a href="#">RFIO4</a> are only available on EXM with hardware M9431A</p> <p><a href="#">RFIN</a> and <a href="#">RFOut</a> are not available on EXM with hardware M9431A</p> <p><a href="#">ERFIN</a> requires option "EXW"</p> |
| Preset         | <p>Unaffected by Preset. Set as below by <b>Restore Input/Output Defaults</b>:</p> <p>For VXT: <a href="#">RFIN</a></p> <p>For EXM, EXF: <a href="#">RFIO1</a></p> <p>For all other models: <a href="#">CINPut</a> (the currently selected input)</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| State Saved    | Saved in State                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |

## Parameter Options

Note that the presence of these ports is highly hardware dependent.

| Correction Port | SCPI          | Note                                                                                                                     |
|-----------------|---------------|--------------------------------------------------------------------------------------------------------------------------|
| Current Input   | <b>CINPut</b> | The correction will be applied to whichever input is currently selected in the Input menu                                |
| RF Input        | <b>RFIN</b>   | Main RF Port<br>Not available on EXM with hardware M9431A                                                                |
| RF Input 2      | <b>RFIN2</b>  | Second RF Port, labeled <b>RF Input 2</b><br>Only available on certain instruments. Not available on modular instruments |
| BBIQ input      | <b>AIQ</b>    | Requires option BBA<br>Not available on modular instruments                                                              |
| External Mixer  | <b>EMIXer</b> | Requires option EXM<br>Not available on modular instruments                                                              |
| Antenna         | <b>ANT</b>    | Antenna input port on M9470A, labeled <b>Ant</b>                                                                         |
| Generator       | <b>GEN</b>    | Generator output port on M9470A, labeled <b>Gen</b>                                                                      |
| T/R             | <b>TR</b>     | T/R port on M9470A, labeled <b>T/R</b>                                                                                   |
| RF Full Duplex  | <b>RFFD</b>   | On modular instruments, labeled <b>RFFD</b> . Option “FDX” is required to enable RFFD port                               |
| RF Half Duplex  | <b>RFHD</b>   | On modular instruments, labeled <b>RFHD</b> . Option “HDX” is required to enable RFHD port                               |
| A1              | <b>A1</b>     | On E7760B                                                                                                                |
| A2              | <b>A2</b>     | On E7760B                                                                                                                |
| A3              | <b>A3</b>     | On E7760B                                                                                                                |
| B1              | <b>B1</b>     | On E7760B                                                                                                                |
| B2              | <b>B2</b>     | On E7760B                                                                                                                |
| B3              | <b>B3</b>     | On E7760B                                                                                                                |
| IFIO1           | <b>IFIO1</b>  | On E7760B                                                                                                                |
| IFIO2           | <b>IFIO2</b>  | On E7760B                                                                                                                |
| RF Output       | <b>RFOut</b>  | Appears on some modular instruments<br>Not available on EXM with hardware M9431A                                         |
| RFIO1           | <b>RFIO1</b>  | Appears on some modular instruments                                                                                      |
| RFIO2           | <b>RFIO2</b>  | Appears on some modular instruments                                                                                      |
| RFIO3           | <b>RFIO3</b>  | Only available in EXM with hardware M9431A                                                                               |
| RFIO4           | <b>RFIO4</b>  | Only available in EXM with hardware M9431A                                                                               |
| GPS out         | <b>GPS</b>    | Appears on some modular instruments                                                                                      |
| GNSS out        | <b>GNSS</b>   | Appears on some modular instruments                                                                                      |

### 6.5.4 Correction Direction

Selects whether corrections will be applied when the device associated with the specified correction is being used as an input, an output or in both directions. The choices are:

## 6 Input/Output

### 6.5 Corrections

|               |                                                                                  |
|---------------|----------------------------------------------------------------------------------|
| <b>INPut</b>  | Correct the port only when the port is used as an Input                          |
| <b>OUTPut</b> | Correct the port only when the port is used as an Output                         |
| <b>BOTH</b>   | Correct the port when the port is used as either an Input or an Output (or both) |

A port that is only an Output is always corrected as an output if the Correction is On. A port that is only an Input is always corrected as an Input if the Correction is On. For a port that can be either an Input or an Output (or both), the Correction is determined by the Correction Direction setting. The default is **BOTH**, which means that by default a port that can be either an Input or an Output (or both) is corrected in both directions if the Correction is On.

|                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command               | <code>[ :SENSe]:CORRection:CSET[1] 2 ... 16:DIRection INPut   OUTPut   BOTH</code><br><code>[ :SENSe]:CORRection:CSET[1] 2 ... 16:DIRection?</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Example                      | <code>:CORR:CSET2:DIR INP</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Dependencies                 | The Correction Direction control only appears when Correction Port selects a port that can either function as an input or an output (or both simultaneously), such as RFIO HD, RFFD or T/R. If the SCPI command is sent to any other port, it is accepted but ignored                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Preset                       | Not affected by a Preset. Set to <b>BOTH</b> by <b>Restore Input/Output Defaults</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| State Saved                  | Saved in State                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Backwards Compatibility SCPI | The following SCPI results in the selection of <b>BOTH</b> (included for compatibility with early Multitouch implementations):<br><code>[ :SENSe]:CORRection:CSET[1] 2 ... 8:DIRection BIDIRectiona</code><br>included for compatibility with A-models modular products:<br><code>[ :SENSe]:CORRection:CSET[1] 2 ... 8:RF:PORT:RFFD SOURce   ANALyzer   BOTH</code><br><code>[ :SENSe]:CORRection:CSET[1] 2 ... 8:RF:PORT:RFIO1 SOURce   ANALyzer   BOTH</code><br><code>[ :SENSe]:CORRection:CSET[1] 2 ... 8:RF:PORT:RFIO2 SOURce   ANALyzer   BOTH</code><br><code>[ :SENSe]:CORRection:CSET[1] 2 ... 8:RF:PORT:RFIO3 SOURce   ANALyzer   BOTH</code><br><code>[ :SENSe]:CORRection:CSET[1] 2 ... 8:RF:PORT:RFIO4 SOURce   ANALyzer   BOTH</code> |

### 6.5.5 Edit Correction

Invokes the integrated editing facility for this correction set. When entering the menu, the editor window turns on, the selected correction is turned **On**, **Apply Corrections** is set to **On**, the amplitude scale is set to **Log**, and the Amplitude Correction (“Ampcor”) trace is displayed. The actual, interpolated correction trace is shown in green for the selected correction. Note that since the actual interpolated correction is shown, the correction trace may have some curvature to it. This trace represents only the correction currently being edited, rather than the total, accumulated amplitude correction for all amplitude corrections which are currently on, although the total, accumulated correction for all corrections which are turned on is still applied to the data traces.

Because corrections data is always in dB, but the Y-axis of the instrument is in absolute units, it is necessary to establish a reference line for display of the Corrections data. The reference line is halfway up the display and represents 0 dB of correction. It is labeled "0 dB CORREC". It is drawn in blue. Corrections data is always in dB. Whatever dB value appears in the correction table represents the correction to be applied to that trace at that frequency. So, if a table entry shows 30 dB that means we ADD 30 dB to each trace to correct it before displaying it. By definition all points are connected. If a gap is desired for corrections data, enter 0 dB.

Note that a well-designed Corrections array should start at 0 dB and end at 0 dB. This is because whatever the high-end point is will be extended to the top frequency of the instrument, and whatever the low-end point is will be extended down to 0 Hz. So, for a Corrections array to have no effect outside its range, you should start and end the array at 0 dB.

**NOTE**

**The table editor only operates properly if the instrument is sweeping, because its updates are tied to the sweep system. Thus, you should not try to use the editor in single sweep, and its response will be sluggish during compute-intensive operations like narrow-span FFT sweeps.**

When exiting the edit menu (by using the **Return** key or by pressing an instrument front-panel key), the editor window turns off and the Ampcor trace is no longer displayed; however, **Apply Corrections** remains **On**, any correction that was on while in the editor remains on, and the amplitude scale returns to its previous setting.

Corrections arrays are not affected by a Preset, because they are in the Input/Output system. They also survive shutdown and restarting of the instrument application, which means they will survive a power cycle.

When editing a correction, the editor remembers which correction and which element in the correction array you were editing, and returns you to that correction and that element when you return to the editor after leaving it.

### 6.5.5.1 Select Correction

Specifies the selected correction. The term "selected correction" is used throughout this document to specify which correction will be affected by the functions.

|        |                                                                            |
|--------|----------------------------------------------------------------------------|
| Notes  | The selected correction is remembered even when not in the correction menu |
| Preset | Set to Correction 1 by Restore Input/Output Defaults                       |

### 6.5.5.2 Frequency

Touching a frequency value makes the touched row the current row and lets you edit the frequency.

|     |       |
|-----|-------|
| Min | 0     |
| Max | 1 THz |

### 6.5.5.3 Amplitude

Touching an amplitude value makes the touched row the current row and lets you edit the amplitude.

|     |          |
|-----|----------|
| Min | -1000 dB |
| Max | 1000 dB  |

### 6.5.5.4 Go to Row

Lets you move through the table to edit the desired point.

|     |      |
|-----|------|
| Min | 1    |
| Max | 2000 |

### 6.5.5.5 Insert Row Below

Inserts a point below the current point. The new point is a copy of the current point and becomes the current point. The new point is not yet entered into the underlying table, and the data in the row is displayed in light gray. To enter the row into the table, press the **Enter** key, or tap either value and edit it.

### 6.5.5.6 Delete Row

Deletes the currently-selected point, whether or not that point is being edited, and selects the Navigate functionality. The point following the currently-selected point (or the point preceding if there is none) will be selected.

### 6.5.5.7 Scale X Axis

Matches the X-Axis to the selected Correction, as well as possible. Sets the Start and Stop Frequency to contain the minimum and maximum Frequency of the selected Correction. The range between Start Frequency and Stop Frequency is 12.5% above the range between the minimum and maximum Frequency, so that span exceeds this range by one graticule division on either side. If in zero-span, or there is no data in the Ampcor table, or the frequency range represented by the table is zero, no action is taken. Standard clipping rules apply if the value in the table is outside the allowable range for the X-Axis.

|              |                                                                                                                                                                                                                             |
|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Dependencies | If either the first or last point in the array is outside the frequency range of the current input, an error message is generated:<br>“-221. Settings conflict; Start or Stop Freq out of range for current input settings” |
|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

### 6.5.5.8 Delete Correction

Deletes the correction values for this set. When this key is pressed, a prompt appears on the screen saying “Please press **Enter** or **OK** key to delete correction. Press **ESC** or **Cancel** to close this dialog.” The deletion is only performed if you press **OK** or **Enter**.

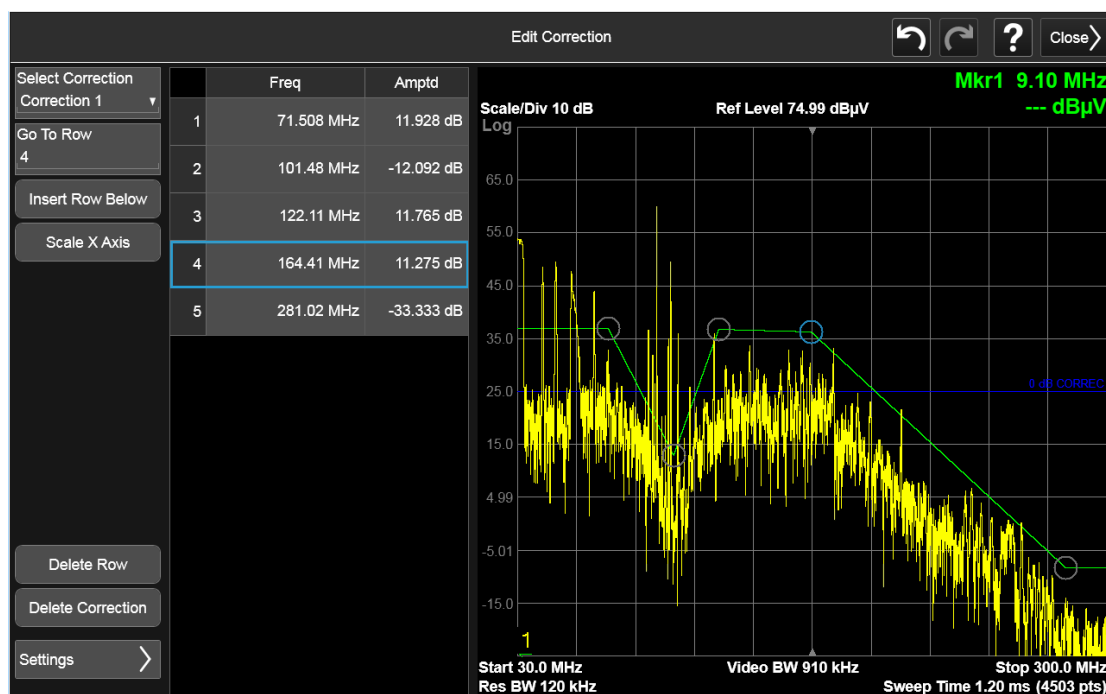
|                |                                                           |
|----------------|-----------------------------------------------------------|
| Remote Command | <code>[[:SENSe]:CORRection:CSET[1] 2 ... 16:DELeTe</code> |
|----------------|-----------------------------------------------------------|

|         |                                                                                             |
|---------|---------------------------------------------------------------------------------------------|
| Example | <code>:CORR:CSET:DEL</code><br><code>:CORR:CSET1:DEL</code><br><code>:CORR:CSET4:DEL</code> |
|---------|---------------------------------------------------------------------------------------------|

|       |                                                                             |
|-------|-----------------------------------------------------------------------------|
| Notes | Pressing this key when no corrections are present is accepted without error |
|-------|-----------------------------------------------------------------------------|

### 6.5.5.9 Correction Graph

The **Correction Graph** embedded in the Edit Correction dialog lets you edit the Amplitude Correction visually. Each node in the Correction is represented by a gray circle. The current node has a blue outline in the table and a blue circle in the graph. Touch any circle and drag it where you want it to go.



6.5.6 Edit Correction Settings

Opens another menu page that lets you set certain properties of the selected correction, such as Interpolation, Transducer Unit, Description and Comment.

6.5.6.1 Select Correction

Specifies the selected correction. The term "selected correction" is used throughout this document to specify which correction will be affected by the functions.

|        |                                                                            |
|--------|----------------------------------------------------------------------------|
| Notes  | The selected correction is remembered even when not in the correction menu |
| Preset | Set to Correction 1 by Restore Input/Output Defaults                       |

6.5.6.2 Freq Interpolation

Controls how the correction values per-bucket are calculated. We interpolate between frequencies in either the logarithmic or linear scale.

This setting is handled and stored individually per correction set.

VXT models M9410A/11A/15A/16A only support Linear Interpolation. For more details, see ["Interpolation" on page 771](#)

|                |                                                                                                                                       |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[[:SENSe]:CORRection:CSET[1] 2 ... 16:X:SPACing LINear   LOGarithmic<br/>[:SENSe]:CORRection:CSET[1] 2 ... 16:X:SPACing?</code> |
| Example        | <code>:CORR:CSET:X:SPAC LIN</code>                                                                                                    |
| Preset         | Unaffected by Preset. Set to Linear by <b>Restore Input/Output Defaults</b>                                                           |
| State Saved    | Saved in instrument state                                                                                                             |

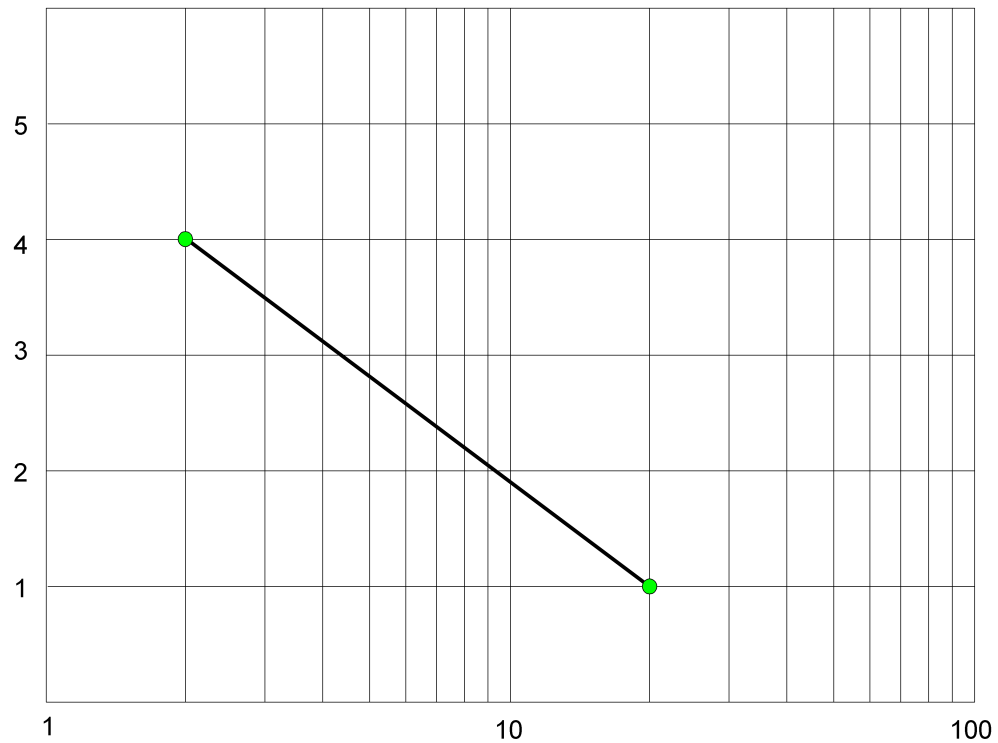
Interpolation

For each bucket processed by the application, all of the correction factors at the frequency of interest (center frequency of each bucket) are summed and added to the amplitude. All trace operations and post processing treat this post-summation value as the true signal to use.

To effect this correction, the goal, for any particular start and stop frequency, is to build a correction trace, whose number of points matches the current Sweep Points setting of the instrument, which will be used to apply corrections on a bucket-by-bucket basis to the data traces.

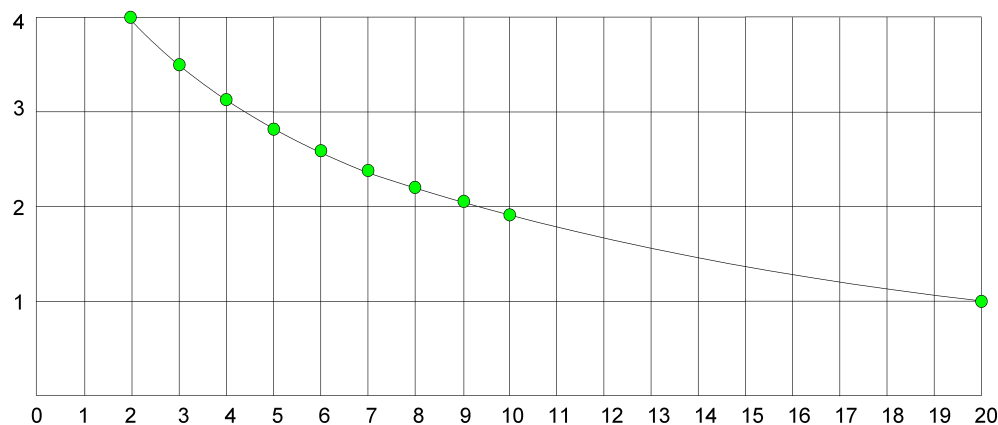
For amplitudes that lie between two user specified frequency points, we interpolate to determine the amplitude value. You may select either linear or logarithmic interpolation between the frequencies.

If we interpolate on a log scale, we assume that the line between the two points is a straight line on the log scale. For example, let's say the two points are (2,4) and (20,1). A straight line between them on a log scale looks like:



vsd17

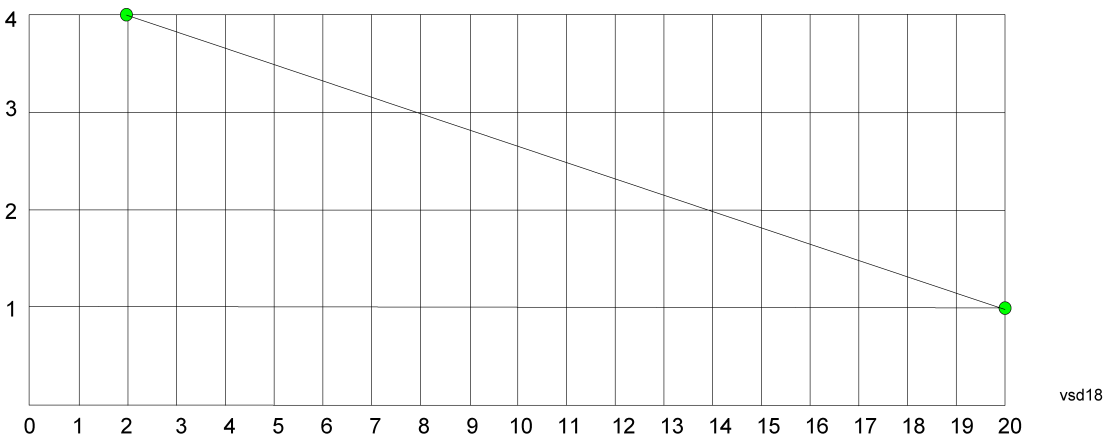
On a linear scale (like that of the spectrum analyzer), this translates to:



vsd19

If we interpolate on a linear scale, we assume that the two points are connected by a straight line on the linear scale, as below:





The correction to be used for each bucket is taken from the interpolated correction curve at the center of the bucket.

6.5.6.3 Transducer Unit

For devices (like antennas) that make measurements of field strength or flux density, the correction array should contain within its values the appropriate conversion factors such that, when the data on the instrument is presented in dBμV, the display is calibrated in the appropriate units. The "Transducer Unit" used for the conversion is contained within the corrections array database. It may be specified or loaded in from an external file or SCPI.

When an array with a Transducer Unit other than "None" is turned on, the Y Axis Unit of the instrument is forced to that unit. When this array is turned on, and it contains a Transducer Unit other than "None", the Y Axis Unit of the instrument is forced to that Transducer Unit., and all other Y Axis Unit choices are grayed out.

Transducer Unit only appears in certain Modes, it does not appear in all Modes that support Corrections.

See "Examples" on page 774

|                |                                                                                                                                                                                                                                                                                                                                                           |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:CORRection:CSET[1] 2 ... 16:ANTenna[:UNIT] GAUSS   PTES1a   UVM   UAM   UA   NOConversion</code><br><code>[ :SENSe]:CORRection:CSET[1] 2 ... 16:ANTenna[:UNIT]?</code>                                                                                                                                                                    |
| Example        | <code>:CORR:CSET:ANT GAUS</code>                                                                                                                                                                                                                                                                                                                          |
| Dependencies   | Only one Transducer units can be on at any given time. Note that this means that if a correction file with a Transducer Unit is loaded into a particular Correction, all other Corrections are set to that same Transducer unit<br><br>When <b>Normalize</b> is On (in the <b>Trace, Normalize</b> menu) Transducer Unit is grayed-out and forced to None |
| Preset         | Unaffected by Preset. Set to NOC by <b>Restore Input/Output Defaults</b>                                                                                                                                                                                                                                                                                  |
| State Saved    | Saved in instrument state                                                                                                                                                                                                                                                                                                                                 |

## Examples

The units that may be specified and what appears in the file and on the screen are shown below:

| Transducer Unit | SCPI Example                     | In the Correction file               | On the screen (also Y Axis Unit forced to) |
|-----------------|----------------------------------|--------------------------------------|--------------------------------------------|
| dB $\mu$ V/m    | <code>:CORR:CSET:ANT UVM</code>  | Antenna<br>Unit= $\mu$ V/m           | dB $\mu$ V/m                               |
| dB $\mu$ A/m    | <code>:CORR:CSET:ANT UVA</code>  | Antenna<br>Unit= $\mu$ A/m           | dB $\mu$ A/m                               |
| dB $\mu$ A      | <code>:CORR:CSET:ANT UA</code>   | Antenna<br>Unit= $\mu$ A             | dB $\mu$ A                                 |
| dBpT            | <code>:CORR:CSET:ANT PTES</code> | Antenna<br>Unit=pTesla               | dBpT                                       |
| dBG             | <code>:CORR:CSET:ANT GAUS</code> | Antenna<br>Unit=Gauss                | dBG                                        |
| None            | <code>:CORR:CSET:ANT NOC</code>  | Antenna Unit=<br>(or no line at all) | none (not forced)                          |

### 6.5.6.4 Description

Sets an ASCII description field which will be stored in an exported file. Can be displayed in the active function area by selecting as the active function, if desired to appear in a screen capture.

|                |                                                                                                                                           |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[[:SENSe]:CORRection:CSET[1] 2 ... 16:DESCription "text"]</code><br><code>[[:SENSe]:CORRection:CSET[1] 2 ... 16:DESCription?</code> |
| Example        | <code>:CORR:CSET1:DESC "11941A Antenna correction"</code>                                                                                 |
| Notes          | 45 chars max; may not fit on display if max chars used                                                                                    |
| Preset         | Unaffected by a Preset. Set to empty by Restore Input/Output Defaults                                                                     |
| State Saved    | Saved in instrument state                                                                                                                 |

### 6.5.6.5 Comment

Sets an ASCII comment field which will be stored in an exported file. Can be displayed in the active function area by selecting as the active function, if desired to appear in a screen capture.

|                |                                                                                                                                   |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[[:SENSe]:CORRection:CSET[1] 2 ... 16:COMMeNt "text"]</code><br><code>[[:SENSe]:CORRection:CSET[1] 2 ... 16:COMMeNt?</code> |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------|

|             |                                                                            |
|-------------|----------------------------------------------------------------------------|
| Example     | <code>:CORR:CSET1:COMM "this is a comment"</code>                          |
| Notes       | 60 chars max; may not fit on display if max chars used                     |
| Preset      | Unaffected by Preset. Set to empty by <b>Restore Input/Output Defaults</b> |
| State Saved | Saved in instrument state                                                  |

### 6.5.7 Complex Corrections

This dialog is used to set up and display information about the **Complex Corrections** set. It also lets you view and edit certain information such as the Description and Comment for the selected Complex Correction.

Complex Corrections (loaded from **.s2p** files) support both magnitude and phase corrections, whereas standard corrections (loaded from standard Ampcor **.csv** files) support only magnitude corrections.

When loading an **.s2p** file, the component representing S21 is the one that is used to generate the complex correction. If no S21 component is present, a Mass Storage error is reported.

#### NOTE

**Data types RI, MA, and DB are supported.**

The phase components of the S2P file are taken to be in degrees, not in radians. You must provide the phase correction in degrees.

Unlike Correction files, S2P files describe device characteristics, rather than the correction required to compensate for those characteristics; so, when an S2P file is loaded, both the magnitude and phase are negated to turn it into a correction

Complex Corrections and standard corrections can be turned on at the same time. For example, you could turn on Correction 2, Correction 4, and Complex Correction 1 and 2, all at the same time. The magnitude part of all the corrections would add, and the phase part of the complex corrections would add.

You can have up to 64 Complex Corrections loaded simultaneously. Each Complex Correction can hold up to 30,000 points.

You can load a standard correction into Complex Corrections, but it will only provide a magnitude correction, not a phase correction.

#### NOTE

**A standard correction (from a CSV file) can be loaded into a Complex Correction, but when it is loaded the Phase correction is set to 0 for all points.**

Some measurements, like Swept SA, have no phase component to the measurement, but nonetheless support Complex Corrections. For such measurements, only the Magnitude part of the Complex Correction is applied.

### 6.5.7.1 Go To Row (Select Correction)

Specifies the selected complex correction. The selected correction will be identified by the blue outlined row in the dialog.

The "selected complex correction" is an important concept when sending SCPI commands to the Complex Corrections system, because in each case the SCPI command is directed to the currently selected Complex Correction and that will be the Correction which is modified by the SCPI command.

|                |                                                                                                                   |
|----------------|-------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:CCORrection:CSET:SElect &lt;integer&gt;</code><br><code>[ :SENSe]:CCORrection:CSET:SElect?</code> |
| Example        | <code>:CCOR:CSET:SEL 3</code><br><code>:CCOR:CSET:SEL?</code>                                                     |
| Notes          | The selected correction is remembered even when not in the correction menu                                        |
| Preset         | Set to Correction 1 by Restore Input/Output Defaults                                                              |
| Min            | 1                                                                                                                 |
| Max            | 64                                                                                                                |

### 6.5.7.2 Delete Row

Deletes the currently-selected Complex Correction and clears all entries in that row to the default.

|                |                                                                                                                  |
|----------------|------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:CCORrection:CSET:DELeTe</code>                                                                   |
| Example        | Select correction 3:<br><code>:CCOR:CSET:SEL 3</code><br><br>Delete correction 3:<br><code>:CCOR:CSET:DEL</code> |

### 6.5.7.3 Delete All

Deletes all complex corrections and clears all entries in all rows to the default.

When this key is pressed a prompt is placed on the screen that says "Please press Enter or OK key to delete all complex corrections. Press ESC or Cancel to close this dialog." The deletion is only performed if you press **OK** or **Enter**.

|                |                                                    |
|----------------|----------------------------------------------------|
| Remote Command | <code>[ :SENSe]:CCORrection:CSET:ALL:DELeTe</code> |
| Example        | <code>:CCOR:CSET:ALL:DEL</code>                    |

#### 6.5.7.4 Correction On

Checking or unchecking this box turns the Selected Complex Correction **ON** or **OFF**. Turning it **ON** causes the values in it to be applied to the data. This state transition also automatically turns on "Apply Corrections" (sets it to **ON**), otherwise the correction would not take effect.

A new sweep/acquisition is initiated if a complex correction is switched on or off. Note that changing, sending or loading corrections data does *not* directly initiate a sweep, however in general these operations will turn corrections on, which *does* initiate a sweep.

|                |                                                                                                                                                                                                                                                                                                                   |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:CCORrection:CSET[:STATe] ON   OFF   1   0</code><br><code>[ :SENSe]:CCORrection:CSET[:STATe]?</code>                                                                                                                                                                                              |
| Example        | Select correction 3:<br><code>:CCOR:CSET:SEL 3</code><br><br>Turn correction 3 on:<br><code>:CCOR:CSET ON</code>                                                                                                                                                                                                  |
| Dependencies   | Changing this from <b>OFF</b> to <b>ON</b> automatically turns on "Apply Corrections"<br><br>Grayed-out if Complex Corrections is not supported by the current measurement. A warning or SCPI error is generated if you try to turn it on under these circumstances: "Feature not supported for this measurement" |
| Preset         | Not affected by Preset. Set to <b>OFF</b> by <b>Restore Input/Output Defaults</b>                                                                                                                                                                                                                                 |
| State Saved    | Saved in instrument state                                                                                                                                                                                                                                                                                         |
| Annotation     | If <i>any</i> Complex Correction is turned on, CC in the Meas Bar will display in amber to indicate Complex Corrections are in use                                                                                                                                                                                |

#### 6.5.7.5 Correction Port

Maps one of the sets of corrections to a particular I/O port. This control allows any Input port (including External Mixing, BBIQ, the RF2 input, etc.) to be mapped to a specific Correction, so that the Correction is only applied when that Port is being used by the current Screen. You can also map any internal source Output port to a specific Correction.

When Current Input (CINPut) is selected for **Correction Port**, it chooses the current input port of the current Screen for the selected Correction. In other words, the Correction applies to whichever input is selected. If the input changes, the correction applies to the new input.

When using the VXT M9410A/11A with Remote Radio Heads (such as the Keysight M1740A mmWave Transceiver for 5G), the choices in the dropdown menu will appear as

Head h RFHD p

For example, if you have two Radio Heads (numbered 1 and 2), each of which have two RF half duplex ports, the choices for these ports will appear as below:

| Head and Port           | Choice in dropdown | SCPI parameter |
|-------------------------|--------------------|----------------|
| Head 1, port RF Tx/Rx 1 | Head 1 RFHD 1      | RRH1RFHD1      |
| Head 1, port RF Tx/Rx 2 | Head 1 RFHD 2      | RRH1RFHD2      |
| Head 2, port RF Tx/Rx 1 | Head 2 RFHD 1      | RRH2RFHD1      |
| Head 2, port RF Tx/Rx 2 | Head 2 RFHD 2      | RRH2RFHD2      |

See also the parameters, notes and examples table under ["Correction Port" on page 764](#).

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <pre>[ :SENSe]:CCORrection:CSET:PORT CINPut   RFIN   RFIN2   AIQ   EMIXer   RFOut   RFIO1   RFIO2   RFIO3   RFIO4   RFHD   RFFD   ANT   GEN   TR   A1   A2   A3   B1   B2   B3   IFIO1   IFIO2   RRHnRFHD   ERFIN  [:SENSe]:CCORrection:CSET:PORT?</pre>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Example        | <p>Select correction 2:</p> <pre>:CCOR:CSET:SEL 2</pre> <p>Set correction 2 to RFIN:</p> <pre>:CCOR:CSET:PORT RFIN</pre> <p>Set Correction 2 to Radio Head 1, RF Tx/Rx Port 2:</p> <pre>:CCOR:CSET:PORT RRH1RFHD2</pre>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Dependencies   | <p><a href="#">RFIN2</a>   <a href="#">AIQ</a>   <a href="#">EMIXer</a> are only available on C/E/M/P/UXA analyzers with the appropriate options loaded</p> <p><a href="#">RFOut</a> is only available on modular products such as VXT</p> <p><a href="#">ANT</a>, <a href="#">GEN</a> and <a href="#">TR</a> are only available in VXT and only when the M9470A module is installed, such as in the M8920A. Option "HDX" is required to enable the TR port</p> <p><a href="#">RFHD</a> and <a href="#">RFFD</a> are only available on VXT. Option HDX is required to enable RFHD port and Option FDX is required to enable RFFD port</p> <p><a href="#">RFIO3</a> and <a href="#">RFIO4</a> are only available on EXM with hardware M9431A</p> <p><a href="#">RFIN</a> and <a href="#">RFOut</a> are not available on EXM with hardware M9431A</p> <p><a href="#">ERFIN</a> requires option "EXW"</p> |
| Preset         | Not affected by Preset. Set to <a href="#">CINPut</a> by <b>Restore Input/Output Defaults</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| State Saved    | Saved in State                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |

### 6.5.7.6 Direction

Selects whether corrections will be applied when the device associated with the specified correction is being used as an input, an output or in both directions. The choices are:

[INPut](#)      Correct the port only when the port is used as an Input

## 6 Input/Output

### 6.5 Corrections

|               |                                                                                  |
|---------------|----------------------------------------------------------------------------------|
| <b>OUTPut</b> | Correct the port only when the port is used as an Output                         |
| <b>BOTH</b>   | Correct the port when the port is used as either an Input or an Output (or both) |

|                              |                                                                                                                                                                                                                                                                                                                                                                                                       |
|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command               | <code>[ :SENSe]:CCORrection:CSET:DIRection INPut   OUTPut   BOTH</code><br><code>[ :SENSe]:CCORrection:CSET:DIRection?</code>                                                                                                                                                                                                                                                                         |
| Example                      | Firstly, select correction 4:<br><code>:CCOR:CSET:SEL 4</code><br><br>Set correction 4 to Input:<br><code>:CCOR:CSET:DIR INP</code>                                                                                                                                                                                                                                                                   |
| Dependencies                 | For Inputs, the only choice is <b>INPut</b> , so an empty table cell is displayed. For Outputs, the only choice is <b>OUTPut</b> , so an empty table cell is displayed. If the SCPI command is sent while one of these ports is selected, it is accepted but ignored<br><br>For a port that can be either an Input or an Output (or both), such as RFHD, RFFD or T/R, all three choices are available |
| Preset                       | Not affected by Preset. Set to <b>BOTH</b> by <b>Restore Input/Output Defaults</b>                                                                                                                                                                                                                                                                                                                    |
| State Saved                  | Saved in State                                                                                                                                                                                                                                                                                                                                                                                        |
| Backwards Compatibility SCPI | The following SCPI will result in the selection of <b>BOTH</b> (included for compatibility with early Multitouch implementations):<br><code>[ :SENSe]:CCORrection:CSET:DIRection BIDIrectiona</code>                                                                                                                                                                                                  |

#### 6.5.7.7 Description

Shows the Description field for the selected Complex Correction. The Description field is loaded from the second line of the `.s2p` file. (Note that, if line 2 begins with “!”, the ! is not displayed in the Description field.)

|                |                                                                                                                             |
|----------------|-----------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:CCORrection:CSET:DESCription "text"</code><br><code>[ :SENSe]:CCORrection:CSET:DESCription?</code>          |
| Example        | Firstly, select correction 4:<br><code>:CCOR:CSET:SEL 4</code><br><br><code>:CCOR:CSET:DESC "PNA data import 1-1-18"</code> |
| Notes          | 45 chars max; may not fit on display if max chars used                                                                      |
| Preset         | Unaffected by Preset. Set to empty by <b>Restore Input/Output Defaults</b>                                                  |
| State Saved    | Saved in instrument state                                                                                                   |

#### 6.5.7.8 Comment

Shows the Comment field for the selected Complex Correction. The Comment field is loaded from the third line of the `.s2p` file. (Note that, if line 3 begins with “!”, the ! is not displayed in the Comment field.)

|                |                                                                                                                    |
|----------------|--------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:CCORrection:CSET:COMMeNt "text"</code><br><code>[ :SENSe]:CCORrection:CSET:COMMeNt?</code>         |
| Example        | Firstly, select correction 4:<br><code>:CCOR:CSET:SEL 4</code><br><code>:CCOR:CSET:COMM "this is a comment"</code> |
| Notes          | 60 chars max; may not fit on display if max chars used                                                             |
| Preset         | Unaffected by Preset. Set to empty by <b>Restore Input/Output Defaults</b>                                         |
| State Saved    | Saved in instrument state                                                                                          |

### 6.5.7.9 File

Shows the file from which the selected correction was loaded. If correction was loaded with a SCPI command (see **"Set Data (Remote Command Only)" on page 781**) displays "(SCPI)". If no correction is loaded, displays "(No correction loaded)"

|             |                                                        |
|-------------|--------------------------------------------------------|
| Notes       | 60 chars max; may not fit on display if max chars used |
| State Saved | Saved in instrument state                              |

### 6.5.7.10 Freq Interpolation (Remote Command Only)

Controls how the correction values per-bucket are calculated. We interpolate between frequencies in either the logarithmic or linear scale.

This setting is handled and stored individually per correction set.

VXT models M9410A/11A/15A/16A and M9410E/11E/15E/16E only support Linear Interpolation.

See **"Interpolation" on page 771** under Corrections.

|                |                                                                                                                                       |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:CCORrection:CSET:X:SPACing LINear   LOGarithmic</code><br><code>[ :SENSe]:CCORrection:CSET:X:SPACing?</code>          |
| Example        | Firstly, select correction 4:<br><code>:CCOR:CSET:SEL 4</code><br><br>Set linear interpolation:<br><code>:CCOR:CSET:X:SPAC LIN</code> |
| Preset         | Unaffected by Preset. Set to <b>LINear</b> by <b>Restore Input/Output Defaults</b>                                                    |
| State Saved    | Saved in instrument state                                                                                                             |



6.5.7.11 Set Data (Remote Command Only)

Lets you set the magnitude part of a complex correction’s data via a SCPI command. This is provided for compatibility with the similar command for standard corrections, to allow you to use Complex Corrections as an extension to standard corrections.

Sending this command sets the phase part of the selected correction to 0 for all points.

The command takes an ASCII series of alternating frequency and amplitude points, each value separated by commas.

The values sent in the command will totally replace all existing correction points in the specified set.

A Complex Correction array can contain 30000 points maximum.

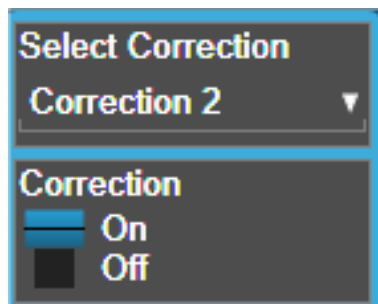
| Remote Command | <code>[ :SENSe]:CCORrection:CSET:DATA &lt;freq&gt;, &lt;ampl&gt;, ...</code><br><code>[ :SENSe]:CCORrection:DATA?</code>                                                                                                            |           |     |     |      |      |       |       |           |           |  |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|-----|-----|------|------|-------|-------|-----------|-----------|--|
| Example        | Firstly, select correction 4:<br><code>:CCOR:CSET:SEL 4</code><br><br>This defines two correction points at (10 MHz, -1.0 dB) and (20 MHz, 1.0 dB) for correction set 4:<br><code>:CCOR:CSET:DATA 10000000,-1.0,20000000,1.0</code> |           |     |     |      |      |       |       |           |           |  |
| Preset         | Empty after <b>Restore Input/Output Defaults</b> . Survives a shutdown or restart of instrument application (including a power cycle)                                                                                               |           |     |     |      |      |       |       |           |           |  |
| State Saved    | Saved in instrument state                                                                                                                                                                                                           |           |     |     |      |      |       |       |           |           |  |
| Min/Max        | <table><tr><th></th><th>Min</th><th>Max</th></tr><tr><td>Freq</td><td>0 Hz</td><td>1 THz</td></tr><tr><td>Amptd</td><td>-1000 dBm</td><td>+1000 dBm</td></tr></table>                                                               |           | Min | Max | Freq | 0 Hz | 1 THz | Amptd | -1000 dBm | +1000 dBm |  |
|                | Min                                                                                                                                                                                                                                 | Max       |     |     |      |      |       |       |           |           |  |
| Freq           | 0 Hz                                                                                                                                                                                                                                | 1 THz     |     |     |      |      |       |       |           |           |  |
| Amptd          | -1000 dBm                                                                                                                                                                                                                           | +1000 dBm |     |     |      |      |       |       |           |           |  |

6.5.8 Apply Corrections

When you turn on Apply Corrections, all of the Corrections that are turned On are applied to the measured data. When you turn off Apply Corrections, no Corrections are applied, even if they are turned On.

With this switch you can turn the entire Corrections system on and off without affecting the settings of any individual Corrections. Turning Apply Corrections On and Off has no effect on the On/Off switches under the individual Corrections.

Apply Corrections affects both normal Corrections and Complex Corrections. Normal Corrections are turned On and Off using the Correction switch under Select Correction:



Complex Corrections are turned On and Off using the checkboxes in the Complex Corrections dialog:

| Correction | On                                  | Port          | Direction |   |
|------------|-------------------------------------|---------------|-----------|---|
| 1          | <input checked="" type="checkbox"/> | Current Input | Input     | D |
| 2          | <input type="checkbox"/>            | Current Input | Input     |   |

See ["Correction On/Off" on page 764](#)) and ["Complex Corrections" on page 775](#).

|                |                                                                                                                                                               |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:CORRection:CSET:ALL[:STATe] ON   OFF   1   0</code><br><code>[ :SENSe]:CORRection:CSET:ALL[:STATe]?</code>                                    |
| Example        | <code>:SENS:CORR:CSET:ALL OFF</code><br><br>This command makes sure that no amplitude corrections are applied, regardless of their individual on/off settings |
| Couplings      | Whenever you turn on any Correction or Complex Correction, <b>Apply Corrections</b> is automatically set to <b>ON</b>                                         |
| Preset         | Not affected by Preset. Set to <b>OFF</b> by <b>Restore Input/Output Defaults</b>                                                                             |
| State Saved    | Saved in instrument state                                                                                                                                     |
| Annunciation   | When <b>ON</b> , 'CORREC' appears in the Meas Bar as long as at least one of the individual corrections is enabled                                            |

## 6.5.9 Delete All Corrections

Erases all correction values for all Amplitude Correction sets and Complex Corrections.

When this key is pressed a prompt is placed on the screen that says “Please press Enter or OK key to delete all corrections. Press ESC or Cancel to close this dialog.” The deletion is only performed if you press **OK** or **Enter**.

|                |                                                   |
|----------------|---------------------------------------------------|
| Remote Command | <code>[ :SENSe]:CORRection:CSET:ALL:DELeTe</code> |
| Example        | <code>:CORR:CSET:ALL:DEL</code>                   |

### 6.5.10 Correction Group On/Off

Turns the Correction Group on and off. The Correction Group allow you to preload Correction files and associate them with specific frequency ranges, so that they can be switched in and out during a sweep at the appropriate frequencies. Use the control “Edit Correction Group” below to set up your Correction Group.

The state of each Correction will be set dynamically depending on the active measurement frequency. Only the correction selected for the range that matches the active measurement frequency will be turned on, and vice versa.

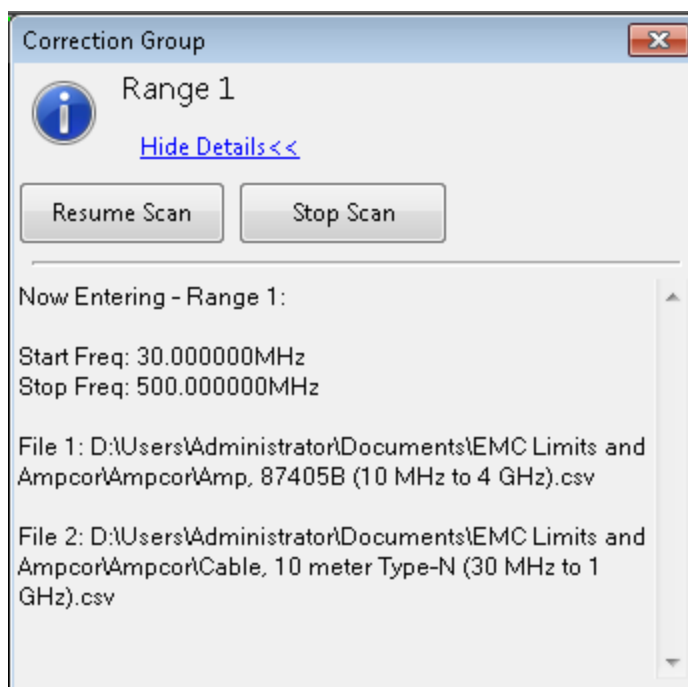
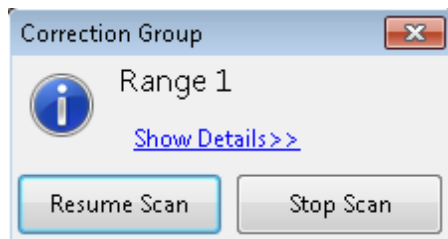
Note that the Corrections in the Correction Group, although they are loaded into memory, are independent of the main Correction registers at the top of the Corrections menu, and will not display under the Select Correction, Correction On/Off or Edit Correction functions.

|                |                                                                                                                                                                                                                                                                              |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:CORRection:CSET:GRoup[:STATe] ON   OFF   1   0</code><br><code>[ :SENSe]:CORRection:CSET:GRoup[:STATe]?</code>                                                                                                                                               |
| Example        | <code>:SENS:CORR:CSET:GRO ON</code>                                                                                                                                                                                                                                          |
| Dependencies   | Correction group is supported in EMI Receiver Mode, and in Spectrum Analyzer Mode if option EMC or EMI Receiver Mode is present. If you switch to other measurements or modes, correction group is turned off and the Correction Group functions are not visible             |
| Couplings      | When on, Correction 1 through 8 is set to <b>OFF</b> and the correction on/off state keys are grayed out. If the grayed-out key is pressed, it generates an advisory message. If sending the SCPI to turn it on, this same message is generated as part of Settings conflict |
| Preset         | Not affected by Preset. Set to <b>OFF</b> by <b>Restore Input/Output Defaults</b>                                                                                                                                                                                            |
| State Saved    | Saved in instrument state                                                                                                                                                                                                                                                    |

### 6.5.11 Break

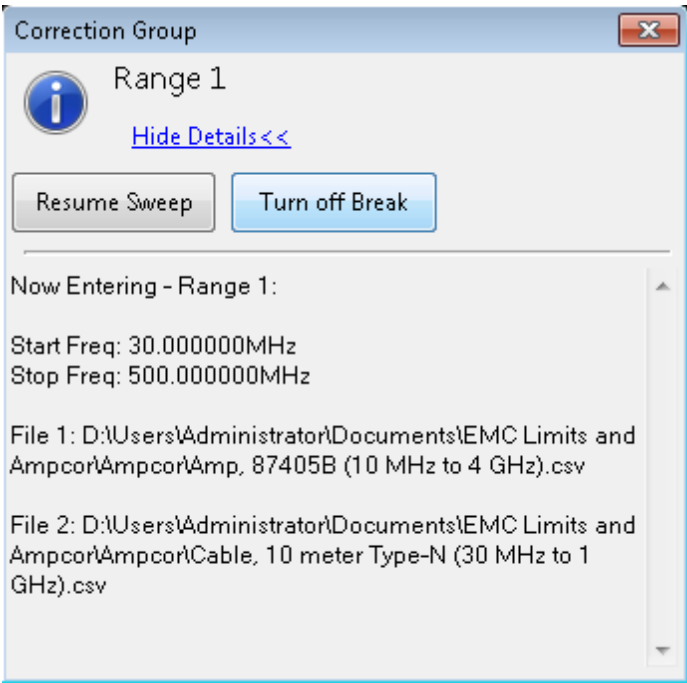
If break is turned on, the scan or sweep will be paused when it reaches the boundary of correction group ranges. At the same time, a window at the size of ~ 6.5cm x 3.5 cm is prompt at the upper right-hand corner of the graticule.

When running Frequency Scan measurement of Emi Receiver application, the message prompt is like below. You are given the option to resume the scan or stop the scan.



When running the Swept SA measurement in Spectrum Analyzer Mode, the message prompt is as below. You are given the option to resume the sweep or turn off the break. If in Continuous sweep, the sweep will resume after the break is turned off.





|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:CORRection:CSET:GROup:BRak ON   OFF   1   0</code><br><code>[ :SENSe]:CORRection:CSET:GROup:BRak?</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Example        | <code>:SENS:CORR:CSET:GRO:BR ON</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Notes          | <p>When running the Frequency Scan measurement in EMI Receiver Mode, if break is turned on when a SCPI is sent to start the scan, the scan pauses when it reaches the boundary of correction group ranges. Bit 8 (Paused) of status operation register is set to true. To resume, send <code>:INITiate2:RESume</code>. To stop the scan, send <code>:ABORt</code></p> <p>When running the Swept SA measurement in Spectrum Analyzer Mode, the break state does not affect the operation of sweep when SCPI to control the sweep is sent. Instead, the SCPI commands close the message prompt if it is showing at the point the commands are sent, and the break is turned off. The SCPI includes:</p> <p><code>:INITitate:IMMEdiate</code><br/><code>:INITitate:REStart</code><br/><code>:INITitate:CONTinuous ON   OFF   1   0</code><br/><code>:ABORt</code></p> |
| Dependencies   | Correction group is supported in EMI Receiver Mode, and in Spectrum Analyzer Mode if option EMC or EMI Receiver mode is present. If you switch to other measurements or modes, correction group is turned off and the Correction Group functions (like Break) are not visible                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Preset         | Not affected by Preset. Set to <b>OFF</b> by <b>Restore Input/Output Defaults</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| State Saved    | Saved in instrument state                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |

### 6.5.12 Reload Corrections From Files

Because the Correction data for the Correction Group is loaded into memory from Correction files at the time the Group is defined, it will be necessary to reload some or all of the data if any of the files changes. This function reloads all of the correction data from all of the correction files defined in all of the ranges in the Correction Group.

|                |                                                                                                                                                                                                                                                                                                     |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe ] :CORRection :CSEt :GRoup :RELoad</code>                                                                                                                                                                                                                                            |
| Example        | <code>:MMEM :STOR :CORR :GRO :REL</code>                                                                                                                                                                                                                                                            |
| Notes          | If invalid data is found in the files, the correction group will be set to off, and an Execution error is generated. Error icon appears on the status column correction group table                                                                                                                 |
| Dependencies   | Correction group is supported in EMI Receiver Mode, and in Spectrum Analyzer mode if option EMC or EMI Receiver Mode is present. If you switch to other measurements or modes, correction group is turned off and the Correction Group functions (like Reload Correction From File) are not visible |
| Annotation     | If reload fails, error icons appear in the status column of correction group editor for the range that has the error                                                                                                                                                                                |

### 6.5.13 Edit Correction Group

Opens the Table Editor for the correction group. The content of correction group table including the correction data loaded from the files is not affected by Preset, and it survives power cycle. You can set it to empty with **Restore Input/Output Defaults**.

|              |                                                                                                                                                                                                                                                                                               |
|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Dependencies | Correction group is supported in EMI Receiver Mode, and in Spectrum Analyzer Mode if option EMC or EMI Receiver Mode is present. If you switch to other measurements or modes, correction group is turned off and the Correction Group functions (like Edit Correction Group) are not visible |
|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

#### 6.5.13.1 Go to Row

Lets you move through the table to edit the desired point.

|     |      |
|-----|------|
| Min | 1    |
| Max | 2000 |

#### 6.5.13.2 Insert Row Below

Inserts a point below the current point. The new point starts from the current range stop frequency and becomes the current point. The new point is not yet entered into the underlying table, and the data in the row is displayed in light gray.

6.5.13.3 Delete Row

Deletes the currently-selected point, whether or not that point is being edited, and selects the Navigate functionality. The point following the currently-selected point (or the point preceding if there is none) will be selected.

6.5.13.4 Select File

Indicate the correction files in which the specify file and remove file operations will take effect.

---

|        |                                                                              |
|--------|------------------------------------------------------------------------------|
| Preset | Unaffected by a Preset. Set to empty by <b>Restore Input/Output Defaults</b> |
|--------|------------------------------------------------------------------------------|

6.5.13.5 Specify File

Displays the file browsing menu. When a file is selected, correction data will be loaded from the file. The correction data remains until the file is removed or the range is deleted.

---

|       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Notes | <p>If the file is empty, error -250 is reported. If the file does not exist error -256 is reported. If there is a mismatch of data type, error -250 is reported</p> <p>Only one file with antenna unit can be supported per range. If you try to add another file which contains an antenna unit, a Mass Storage error is generated</p> <p>All ranges have to use a common antenna unit. If you try to add a correction file that contains a different antenna unit, a Mass Storage error is generated</p> <p>If you try to add a correction file that contains data that does not cover the range frequency, the file cannot be added, and an Execution error is generated</p> |
|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

6.5.13.6 Remove File

Removes the selected file. When a file is removed, correction data for that file will be removed as well.

---

|              |                                                                                                                                    |
|--------------|------------------------------------------------------------------------------------------------------------------------------------|
| Dependencies | The key is grayed-out if there the file has not been specified. If the grayed-out key is pressed, an advisory message is generated |
|--------------|------------------------------------------------------------------------------------------------------------------------------------|

6.5.13.7 Correction Trace Display

Enables you to view the correction traces of all corrections that are added to the range currently selected. A 2-column table in the function of frequency and the accumulated amplitude correction is displayed at the left pane.

|             |                           |
|-------------|---------------------------|
| Preset      | OFF                       |
| State Saved | Saved in instrument state |

### 6.5.13.8 Description

Provides a description of up to 60 characters by which you can easily identify the correction group. The descriptions will be stored in the exported file and can be displayed in the active function area by selecting them as the active function, if desired to be in a saved screen dump.

|                |                                                                                                                              |
|----------------|------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:CORRection:CSET:GROup:DESCRiption "text"</code><br><code>[ :SENSe]:CORRection:CSET:GROup:DESCRiption?</code> |
| Example        | <code>:CORR:CSET:GRO:DESC "Radiated Setup"</code>                                                                            |
| Notes          | 60 chars max; may not fit on display if max chars used                                                                       |
| Preset         | Unaffected by Preset. Set to empty by <b>Restore Input/Output Defaults</b>                                                   |
| State Saved    | Saved in instrument state                                                                                                    |

### 6.5.13.9 Comment

Provides a comment of up to 60 characters by which you can easily identify the correction group. The comments will be stored in the exported file and can be displayed in the active function area by selecting them as the active function, if desired to be in a saved screen dump.

|                |                                                                                                                      |
|----------------|----------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:CORRection:CSET:GROup:COMMeNt "text"</code><br><code>[ :SENSe]:CORRection:CSET:GROup:COMMeNt?</code> |
| Example        | <code>:CORR:CSET:GRO:COMM "For internal only"</code>                                                                 |
| Notes          | 60 chars max; may not fit on display if max chars used                                                               |
| Preset         | Unaffected by Preset. Set to empty by <b>Restore Input/Output Defaults</b>                                           |
| State Saved    | Saved in instrument state                                                                                            |

### 6.5.13.10 Start Frequency

Touching a **Start Frequency** value makes the touched row the current row and lets you edit the start frequency.

|       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Notes | You cannot set the Start Frequency to a value greater than Stop Frequency or equal to Stop Frequency. You cannot set the Start Frequency to a value that would create a span of less than 10 Hz. If you try to do any of these, the Stop Frequency will change to maintain a minimum span of 10 Hz<br>If you change the Start Frequency of the selected range to a value smaller than the previous range's Stop Frequency, the Stop Frequency of the previous range will be changed to the same value |
|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|



|        |                                                                                                                                                                                               |
|--------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|        | If you change the Start Frequency of the selected range to a value out of the correction data frequency range, an error icon appears on the status column and an Execution error is generated |
| Preset | Unaffected by Preset. Set to empty by <b>Restore Input/Output Defaults</b>                                                                                                                    |
| Min    | 0                                                                                                                                                                                             |
| Max    | 1 THz                                                                                                                                                                                         |

### 6.5.13.11 Stop Frequency

Touching a **Stop Frequency** value makes the touched row the current row and lets you edit the stop frequency.

|        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|--------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Notes  | <p>You cannot set the Stop Frequency to a value greater than Start Frequency or smaller than Start Frequency. You cannot set the Stop Frequency to a value that would create a span of less than 10 Hz. If you try to do any of these, the Start Frequency will change to maintain a minimum span of 10 Hz</p> <p>If you change the Stop Frequency of the selected range to a value greater the next range's Start Frequency, the Start Frequency of the next range will be changed to the same value</p> <p>If you change the Stop Frequency of the selected range to a value out of the correction data frequency range, an error icon appears on the status column and an Execution error is generated</p> |
| Preset | Unaffected by Preset. Set to empty by <b>Restore Input/Output Defaults</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Min    | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Max    | 1 THz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |

### 6.5.14 Merge Correction Data (Remote Command Only)

Accepts an ASCII series of alternating frequency and amplitude points, each value separated by commas. The difference between this command and **Set Data** is that this merges new correction points into an existing set.

If any new point has the same frequency as an existing correction point, the existing point's amplitude is replaced by that of the new point.

An Ampcor array can contain 2000 total points, maximum.

|                |                                                                                                                                                                                                             |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[[:SENSe]:CORRection:CSET[1] 2 ... 16:DATA:MERGe &lt;freq&gt;, &lt;amp1&gt;, ...</code>                                                                                                               |
| Example        | <p><code>:CORR:CSET1:DATA:MERGE 15000000,-5.0,25000000,5.0</code></p> <p>This adds two correction points at (15 MHz, -5.0 dB) and (25 MHz, 5.0 dB) to whatever values already exist in correction set 1</p> |
| Preset         | Empty after <b>Restore Input/Output Defaults</b> . Survives shutdown/restart of instrument application (including power cycle)                                                                              |

| Min/Max | Min       | Max       |
|---------|-----------|-----------|
| Freq    | 0 Hz      | 1 THz     |
| Amptd   | -1000 dBm | +1000 dBm |

### 6.5.15 Set (Replace) Data (Remote Command Only)

Accepts an ASCII series of alternating frequency and amplitude points, each value separated by commas.

The values sent in the command totally replace all existing correction points in the specified set.

An Ampcor array can contain 2000 points maximum.

|                |                                                                                                                                                               |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[[:SENSe]:CORRection:CSET[1] 2 ... 16:DATA &lt;freq&gt;, &lt;ampl&gt;, ...<br/>[:SENSe]:CORRection:CSET[1] 2 ... 16:DATA?</code>                        |
| Example        | <code>:CORR:CSET1:DATA 10000000,-1.0,20000000,1.0</code><br>This defines two correction points at (10 MHz, -1.0 dB) and (20 MHz, 1.0 dB) for correction set 1 |
| Preset         | Empty after <b>Restore Input/Output Defaults</b> . Survives a shutdown or restart of instrument application (including a power cycle)                         |
| State Saved    | Saved in instrument state                                                                                                                                     |
| Min            | Freq: 0 Hz<br>Amptd: -1000 dBm                                                                                                                                |
| Max            | Freq: 1 THz<br>Amptd: +1000 dBm                                                                                                                               |

### 6.5.16 Correction Group Range Data (Remote Command Only)

Accepts an ASCII series of alternating start frequency, stop frequency and file names, each value separated by commas.

The values sent in the command replace the content of correction group.

The default path for CSV files is:

`D:\My Documents\amplitudeCorrections\`

|                |                                                                                                                                                                                                                                                                                       |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[[:SENSe]:CORRection:CSET:GRUp[1] 2 ... 10:DATA &lt;startFreq&gt;,&lt;stopFreq&gt;,&lt;filename1&gt;,&lt;filename2&gt;,...,&lt;filename8&gt;<br/>See Notes below for explanation of the &lt;filenameN&gt; parameters<br/>[:SENSe]:CORRection:CSET:GRUp[1] 2 ... 10:DATA?</code> |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

## 6 Input/Output

### 6.5 Corrections

|             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Example     | <code>:CORR:CSET:GRO:DATA 10000000,20000000,"myAmpcor.csv"</code><br><br><code>myAmpcor.csv</code> refers to the Amplitude Correction data from the file <code>myAmpcor.csv</code> in the default path                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Notes       | <p><code>&lt;filename&gt;</code> is the string containing the path of the correction files</p> <p><code>&lt;filename2&gt;</code>, <code>&lt;filename3&gt;</code>, <code>&lt;filename4&gt;</code>, <code>&lt;filename5&gt;</code>, <code>&lt;filename6&gt;</code>, <code>&lt;filename7&gt;</code>, <code>&lt;filename8&gt;</code> are optional. You can define only <code>&lt;filename1&gt;</code>. The file name defined is added to corresponding File keys based on the sequence sent in the command. File keys with no file name set in the SCPI will be emptied</p> <p>Data for ranges 1 to 10 must be set in ascending order. If you try to set the data for a correction group range that is not connecting to the range currently available, a Data out of range error is generated</p> <p>If the file defined in data is empty, error -250 is reported. If the file does not exist, error -256 is reported. If there is a mismatch of data type, error -250 is reported</p> <p>Only one file with antenna unit can be supported per range. If you try to add another file that contains an antenna unit, a Mass Storage error is generated</p> <p>All ranges have to use a common antenna unit. If you try to add a correction file that contains a different antenna unit, a Mass Storage error is generated</p> |
| Preset      | Reset to Not a Number (9.91e+37) for frequencies and "" for File 1 through File 8 after <b>Restore Input/Output Defaults</b> . Survives a shutdown or restart of instrument application (including a power cycle)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| State Saved | Saved in instrument state                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Min         | Start Freq and Stop Freq: 0 Hz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Max         | Start Freq and Stop Freq: 1 THz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |

#### 6.5.17 Delete Correction Group Range (Remote Command Only)

Deletes all range values of corrections Group.

|                |                                                                                  |
|----------------|----------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe ] :CORRection:CSET:GROup:DELeTe</code>                            |
| Example        | <code>:CORR:CSET:GRO:DEL</code>                                                  |
| Notes          | Sending this command when no range is defined in table is accepted without error |

## 6.6 Freq Ref Input

Lets you configure the External Frequency Reference input on the rear panel.

### 6.6.1 Freq Ref Input

Specifies the frequency reference as being the internal reference, an external reference at the rear panel input labeled EXT REF IN, a 1 pulse per second signal at the EXT REF IN input, or automatically sensing the appropriate reference.

See ["More Information" on page 794](#)

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:ROSCillator:SOURce:TYPE Internal   EXTernal   SENSE   PULSe</code><br><code>[ :SENSe]:ROSCillator:SOURce:TYPE?</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Example        | <code>:ROSC:SOUR:TYPE SENS</code><br><code>:ROSC:SOUR:TYPE INT</code><br><code>:ROSC:SOUR:TYPE EXT</code><br><code>:ROSC:SOUR:TYPE PULS</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Dependencies   | <p>The <b>PULSe</b> parameter, and support of the 1 pps signal at the EXT REF IN input, are not available in some models. If not available, the choice does not appear, and sending the <b>PULSe</b> parameter via SCPI generates an error</p> <p>For VXT models M9420A/10A/11A/15A and M9410E/11E/15E/16E the only available selection is <b>EXTernal</b>, unless M9420A/10A/11A/15A is configured in MIMO mode as Primary module. If configured in MIMO mode as Primary module, the available selection is <b>INTernal   EXTernal   SENSE</b></p> <p>For EXM the only available selections are <b>INTernal   EXTernal   SENSE</b></p> <p>For E7760B and M8920A/20B the only available selections are <b>INTernal   EXTernal</b></p> <p>Not available in UXM</p> |
| Preset         | Unaffected by Preset, but set to <b>EXTernal</b> in VXT models M9420A/10A/11A/15A, <b>INTernal</b> for E7760B, and <b>SENSe</b> for other models, by <b>Restore Input/Output Defaults</b> or <b>Restore System Defaults-&gt;All</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| State Saved    | Saved in instrument state                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Annunciation   | <p>In the Meas Bar:</p> <p>If you set this to Internal and no external reference is plugged in:<br/>Freq Ref: Internal</p> <p>If you set this to Internal and an external reference between 1 and 50 MHz, or a 1 pps signal, IS plugged in:<br/>Freq Ref: Internal (in amber, as a warning sign)</p> <p>If you set this to External and an External Reference between 1 and 50 MHz is plugged in:<br/>Freq Ref: External</p>                                                                                                                                                                                                                                                                                                                                      |

## 6 Input/Output

### 6.6 Freq Ref Input

|                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|-------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                               | <p>If you set this to External and no External Reference is sensed:<br/> Freq Ref: External (in amber, as a warning sign)<br/> When set to Pulse and a 1 pps signal is plugged in:<br/> Freq Ref: Pulse<br/> If you set this to Pulse and no Pulse Reference is sensed:<br/> Freq Ref: Pulse (in amber, as a warning sign)<br/> When set to Sense and neither a signal between 1 and 50 MHz nor a 1 pps signal is detected at the EXT REF IN input, "Sense:Int" is displayed:<br/> Freq Ref: Sense,Int<br/> When set to Sense and a signal within 5 ppm of the External Ref Freq (as set on the Ext Ref Freq control) is detected at the EXT REF IN input:<br/> Freq Ref: Sense,Ext<br/> When set to Sense and a 1 pps signal is detected at the EXT REF IN input, "Sense:Pulse" is displayed:<br/> Freq Ref: Sense,Pls</p>                                                                                                                                     |
| Status Bits/OPC dependencies  | <p><b>STATus:QUESTIONable:FREQuency</b> bit 1 set if unlocked<br/> Note: In EXM, the status bit is not set for non-controlling instances. To determine if the frequency reference is unlocked, the controlling instance must be queried</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Backwards Compatibility Notes | <p>Freq Ref In was not saved in state in the legacy instruments. It is part of state in the X-Series</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Remote Query                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Remote Command                | <p><b>[ :SENSe ]:ROSCillator:SOURce?</b></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Notes                         | <p>Returns the current switch setting. This means:</p> <ol style="list-style-type: none"> <li>1. If it was set to <b>SENSe</b> but there is no external reference nor 1 pps signal, so the instrument is actually using the internal reference, then this query returns <b>INTernal1</b>, not <b>SENSe</b></li> <li>2. If it was set to <b>SENSe</b> and there is an external reference present, the query returns <b>EXTernal1</b>, not <b>SENSe</b></li> <li>3. If it was set to <b>SENSe</b> and there is a 1 pps signal present, the query returns <b>PULSe</b>, not <b>SENSe</b></li> <li>4. If it was set to <b>EXTernal1</b>, then the query returns <b>EXTernal1</b></li> <li>5. If it was set to <b>INTernal1</b>, then the query returns <b>INTernal1</b></li> <li>6. If it was set to <b>PULSe</b>, then the query returns <b>PULSe</b></li> </ol> <p>Note: In EXM, the SCPI query always returns <b>INTernal1</b> for non-controlling instances</p> |
| Preset                        | <p>For VXT models M9420A/10A/11A/15A: <b>EXTernal1</b><br/> For E7760B, M8920A/20B: <b>INTernal1</b><br/> All other models: <b>SENSe</b></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Backwards                     | <p><b>[ :SENSe ]:ROSCillator:SOURce?</b> was query-only in ESA which always returned whichever</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |

|                              |                                                                                                                                                                                                                                                                                                                                                                                     |
|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Compatibility Notes          | <p>reference the instrument was using. The instrument automatically switched to the ext ref if it was present</p> <p>In PSA (which had no sensing), [:SENSe]:ROSCillator:SOURce set the reference (INT or EXT), so again its query returned the actual routing</p> <p>Thus, the query is 100% backwards compatible with both instruments</p> <p>Backwards Compatibility Command</p> |
| Notes                        | <p>For PSA compatibility the command form is provided and is directly mapped to [:SENSe]:ROSCillator:SOURce:TYPE</p> <p>Note: In EXM, the command does nothing for non-controlling instances</p>                                                                                                                                                                                    |
| Backwards Compatibility SCPI | [:SENSe]:ROSCillator:SOURce INTernal   EXTernal                                                                                                                                                                                                                                                                                                                                     |

## More Information

When the frequency reference is set to internal, the internal 10 MHz reference is used even if an external reference is connected.

When the frequency reference is set to external, the instrument will use the external reference. However, if there is no external signal present, or it is not within the proper amplitude range, a condition error message is generated. When the external signal becomes valid, the error is cleared.

When the frequency reference is set to Pulse, the instrument expects a 1 pulse per second signal at the EXT REF IN input. The instrument uses this signal to adjust the frequency of the internal reference.

If Sense is selected, the instrument checks whether a signal is present at the external reference connector. If it senses a signal within 5 ppm of the External Ref Freq (as set on the **External Ref Freq** control), it will automatically switch to the external reference. If it senses a 1 pulse per second signal, it enters Pulse mode, wherein the signal is used to adjust the internal reference. When no signal is present, it automatically switches to the internal reference. No message is generated as the reference switches between pulse, external and internal. The monitoring of the external reference occurs approximately on 1 millisecond intervals, and never occurs in the middle of a measurement acquisition, only at the end of the measurement (end of the request).

If for any reason the instrument's frequency reference is not able to obtain lock, Status bit 1 in the Questionable Frequency register will be true and a condition error message is generated. When lock is regained, Status bit 1 in the Questionable Frequency register will be cleared and the condition error will be cleared.

If an external frequency reference is being used, you must enter the frequency of the external reference if it is not exactly 10 MHz. The **External Ref Freq** key is provided for this purpose.

For VXT models M9420A/10A/11A/15A, there is no internal frequency reference. To work correctly, a 100MHz external frequency reference signal is needed to connect to the front panel of the module. The default Freq Ref In setting is “External” and it cannot be set to any other types.

For VXT models M9410A/11A, External Freq Ref Input controls the “100 MHz In” port on the front panel. For VXT models M9415A/16A, External Freq Ref Input controls the “REF In” port on the front panel. For M941xE, the External Freq Ref Input is the reference in port on M941xA module.

NOTE

In EXM, a common frequency reference module serves all instrument instances, but only one instance of the software application can change the reference input type (INT or EXT or SENSE). The software application allowed to change the reference input is called the primary or controlling instance; by default, the leftmost instrument instance is the controlling instance. This can be changed in the config file “[E66XXModules.config](#)” located in the folder [E:\Keysight\Instrument](#). For the non-controlling instance(s) the reference input types (in SCPI commands, and in the Virtual Front Panel menus) are blanked and unavailable for use.

---

## Sense

If **Sense** is selected, the instrument checks whether a signal is present at the external reference connector. If it senses a signal within 5 ppm of the External Ref Freq (as set by **External Ref Freq**), it uses this signal as an External Reference. If it senses a 1 pulse per second signal, it uses this signal to adjust the internal reference by adjusting the User setting of the Timebase DAC. When no signal is present, it automatically switches to the internal reference.

If set to **SENSe** and the instrument senses a 1 pulse per second signal, it sets the **System, Alignments, Timebase DAC** setting to **User**. This setting survives Preset and Power Cycle but is set to **Calibrated** by **System, Restore Defaults, Align** or **System, Restore Defaults, All**

## Internal

The internal reference is used. A 1 pps signal at the EXT REF IN port, or a signal there between 1 and 50 MHz, causes a warning triangle to appear in the settings panel next to the word “INTERNAL”, but will otherwise be ignored.

## External

The external reference is used.

## Pulse

The internal reference continues to be the frequency reference for the instrument in that it determines the reference contribution to the phase noise, but its average frequency is adjusted to follow the 1 pps signal at the EXT REF IN input. Therefore, the instrument frequency accuracy will be dominated by the aging rate of the 1 pps signal instead of the aging rate of the internal reference, except during the time it takes to lock to a new 1 pps signal, approximately 10 minutes.

Sets the System, Alignments, Timebase DAC setting to “User”. This setting survives Preset and Power Cycle, but it set to “Calibrated” on a System, Restore Defaults, Align or a System, Restore Defaults, All

When a 1 pps signal is present at the EXT REF IN input, and either **Pulse** or **Sense** is selected, the internal reference frequency is affected by this signal; in effect, it “learns” a new accuracy setting. This setting can be seen by going to the **System, Alignments, Timebase Dac** menu, and looking at the **User** key in that menu. You will note that User has become automatically selected, and that the value shown on the **User** key is the updated value of the timebase DAC as “learned” from the 1 pps signal. Note that this replaces any value the user might have previously set on this key.

Once the setting is learned the user may remove the 1 pps signal; the User setting for the Timebase DAC is retained until you manually select “Calibrated” or execute a System, Restore Defaults, Align or a System, Restore Defaults, All. If you want to make the User setting permanent there is information in the Service Guide that tells you how to change the Calibrated setting of the Timebase DAC.

Note also that if the 1 pps signal is removed when Sense is selected, the instrument will simply switch to the normal state of the Internal reference and display SENSE:INT in the Settings Panel. However, if the 1 pps signal is removed when Pulse is selected, the instrument will generate an error

The J7203A Atomic Frequency Reference is an accessory for the X-Series Signal Analyzer that provides a highly accurate 1 pps timebase to use in conjunction with the Pulse setting. With the J7203A, the 1 pps signal is guaranteed to meet the input requirements of the EXT REF IN port, and the improved accuracy of the instrument’s internal frequency reference is specified. This is the only 1 pps signal that is guaranteed to function properly with the X-Series.



## 6.6.2 Ext Ref Freq

This key tells the instrument the frequency of the external reference. When the external reference is in use (either because the reference has been switched to External or because the Reference has been switched to Sense and there is a valid external reference present) this information is used by the instrument to determine the internal settings needed to lock to that particular external reference signal.

For the instrument to stay locked, the value entered must be within 5 ppm of the actual external reference frequency. So, it is important to get it close, or you risk an unlock condition.

Note that this value only affects the instrument's ability to lock. It does not affect any calculations or measurement results. See "Freq Offset" in the Frequency section for information on how to offset frequency values.

|                |                                                                                                                                                                                                                                                                                                                                                                  |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:ROSCillator:EXTernal:FREQuency &lt;freq&gt;</code><br><code>[ :SENSe]:ROSCillator:EXTernal:FREQuency?</code>                                                                                                                                                                                                                                     |
| Example        | Set the external reference frequency to 20 MHz, but does not select the external reference:<br><code>:ROSC:EXT:FREQ 20 MHz</code><br><br>Select the external reference:<br><code>:ROSC:SOUR:TYPE EXT</code>                                                                                                                                                      |
| Dependencies   | Still available with Internal or Pulse selected, to allow setup for when External is in use. However, the setting has no effect if the Internal Reference is in use (Freq Ref In set to Internal, Pulse, or SENSE:INT or SENSE:PULSE)<br><br>Not available in UXM<br><br>For VXT models M9420A/10A/11A/15A/16A and M9410E/11E/15E/16E: only 100 MHz is available |
| Preset         | Unaffected by <b>Mode Preset</b> , <b>Input/Output Preset</b> , or <b>Restore Defaults, Input/Output</b> , but set to 100 MHz for VXT models and 10 MHz for other models, by <b>Restore Defaults, Misc</b> , or <b>Restore Defaults, All</b> , or <b>Default External Ref Freq</b>                                                                               |
| State Saved    | Power On Persistent (survives power cycle)                                                                                                                                                                                                                                                                                                                       |
| Min/Max        | See " <b>Minimum &amp; Maximum Values</b> " on page 797                                                                                                                                                                                                                                                                                                          |

### Minimum & Maximum Values

| Model                                  | Min    | Max    |
|----------------------------------------|--------|--------|
| CXA, N897xB, E7760B, M8920A/20B, CXA-m | 10 MHz | 10 MHz |
| EXA without option R13                 | 10 MHz | 10 MHz |
| EXA with option R13                    | 10 MHz | 20 MHz |
| MXA, PXA, EXM                          | 10 MHz | 50 MHz |

| Model              | Min     | Max     |
|--------------------|---------|---------|
| VXT models         | 100 MHz | 100 MHz |
| M9410E/11E/15E/16E | 100 MHz | 100 MHz |
| All other models   | 1 MHz   | 100 MHz |

### 6.6.3 Default External Ref Freq

Restores the External Ref Freq to its default of 10 MHz.

When you set an External Ref Freq value with the **Ext Ref Freq** control, that Frequency is persistent; is not affected by Mode Preset or Input/Output Preset, and survives shutdown and power cycle. This control allows you to reset the External Ref Freq to its default value.

#### NOTE

The persistence of the External Ref Freq is a new behavior as of firmware version A.18.00, necessitating the addition of this control. In versions before A.18.00, the frequency reset on a power cycle/restart. Thus, you may need to use this command to retain backwards compatibility.

|                |                                                                                                                       |
|----------------|-----------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:ROSCillator:EXTernal:FREQuency:DEFault</code>                                                         |
| Example        | <code>:ROSC:EXT:FREQ:DEF</code><br>resets the external ref frequency                                                  |
| Notes          | Command only; no query                                                                                                |
| Dependencies   | Grayed-out if the Ext Ref Freq is already set to the default<br>Does not appear in EXM, UXM, VXT models or M8920A/20B |

### 6.6.4 LO Ref Input

This parameter sets the LO Reference signal Input to External or Internal.

|                |                                                                                                                                                     |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:ROSCillator:LO:INPut INTernal   EXTernal</code><br>See "Option Details" on page 799<br><code>[ :SENSe]:ROSCillator:LO:INPut?</code> |
| Example        | <code>:ROSC:LO:INP EXT</code><br><code>:ROSC:LO:INP?</code>                                                                                         |
| Dependencies   | Only available in VXT models M9410A/11A/15A/16A when MIMO is on                                                                                     |
| Preset         | <code>INTernal</code>                                                                                                                               |
| State Saved    | Saved in instrument state                                                                                                                           |

### Option Details

| Parameter | SCPI            | Notes                                                                                                                                                                                                                                                                                                    |
|-----------|-----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Internal  | <b>INTernal</b> | When Internal is selected, internal reference signal will be used to synchronize the LO board                                                                                                                                                                                                            |
| External  | <b>EXTernal</b> | When External is selected, external reference signal will be used to synchronize the LO board. Route the correct reference signal to the specified port before changing the LO Ref Input to External<br>For VXT models M9410A/11A, a 4.8 GHz reference signal is required to rout to the 4.8 GHz In port |

### 6.6.5 Ref Lock BW

Lets you adjust the Frequency Reference phase lock bandwidth. This control is available in some models of the X-Series.

It is possible to improve the phase noise of the instrument by several dB, even tens of dB, by using an external reference with excellent phase noise. When an external reference is used the instrument's close-in phase noise improves to match that of the reference.

Normally a narrow loop bandwidth is used to phase lock to the external reference. However, the Ref Lock BW control allows you to choose a wider loop bandwidth to reduce the phase noise at low offset frequencies, especially 4 to 400 Hz offset. The Wide setting represents about a 60 Hz loop bandwidth, the Narrow setting about 15 Hz.

When using an external reference with superior phase noise, Keysight recommends setting the external reference phase-locked-loop bandwidth to Wide to take advantage of that superior performance.

When using an external reference with inferior phase noise performance, Keysight recommends setting the bandwidth to Narrow.

In these relationships, inferior and superior phase noise are with respect to  $-134$  dBc/Hz at 30 Hz offset from a 10 MHz reference. Because most reference sources have phase noise behavior that falls off at a rate of 30 dB/decade, this is usually equivalent to  $-120$  dBc/Hz at 10 Hz offset.

In instruments with EP1 or EP2, this control only affects the external reference loop bandwidth. In instruments with EP0, this control also affects the loop bandwidth used when the Internal reference is selected (reference set manually to Internal or Pulse, or set to Sense and set by sensing to Internal or Pulse).

---

|                |                                                                                                 |
|----------------|-------------------------------------------------------------------------------------------------|
| Remote Command | <b>[ :SENSe]:ROSCillator:BANDwidth WIDE   NARRow</b><br><b>[ :SENSe]:ROSCillator:BANDwidth?</b> |
|----------------|-------------------------------------------------------------------------------------------------|

|              |                                                                                                                                                                                                                                                                                                                                                             |
|--------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Example      | <code>:ROSC:BAND WIDE</code>                                                                                                                                                                                                                                                                                                                                |
| Dependencies | In instruments with EP1 or EP2: the control is available (not grayed-out) even with Internal or Pulse selected, to allow setup for when External is in use. However, the setting has no effect if the Internal Reference is in use<br>Only appears in instruments equipped with the required hardware<br>Does not appear in EXM, UXM, VXT models, or E7760B |
| Preset       | Unaffected by Preset, but set to <code>NARRow</code> by <b>Restore Input/Output Defaults</b> or <b>Restore System Defaults -&gt; All</b>                                                                                                                                                                                                                    |
| State Saved  | Saved in Input/Output state                                                                                                                                                                                                                                                                                                                                 |

## 6.6.6 Reference Oscillator On/Off (Remote Command Only)

Provided for PSA code compatibility.

In PSA it turned the Reference Oscillator on and off, however in the X-Series the reference oscillator cannot be turned off, so no hardware is affected when it is received.

If queried it returns the state you set with the command, but note that this does not necessarily reflect the actual state of the Reference Oscillator, which is always `ON`.

|                              |                                                                                                                                      |
|------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|
| Example                      | <code>:ROSCillator:OUTP ON</code>                                                                                                    |
| Preset                       | Unaffected by Preset, but set to <code>ON</code> by <b>Restore Input/Output Defaults</b> or <b>Restore System Defaults -&gt; All</b> |
| Backwards Compatibility SCPI | <code>[ :SENSe]:ROSCillator:OUTPut[:STATe] ON   OFF   1   0</code><br><code>[ :SENSe]:ROSCillator:OUTPut[:STATe]?</code>             |

### 6.6.6.1 Select Ref

Lets you select the reference model to control.

The reference status is not saved in a state file, because Reference is a standard alone module.

|                |                                                                                                                                 |
|----------------|---------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:ROSCillator:PXIReference:SElect NONE   M9300a</code><br><code>[ :SENSe]:ROSCillator:PXIReference:SElect?</code> |
| Example        | <code>:ROSC:PXIR:SEL M9300</code><br><code>:ROSC:PXIR:SEL?</code>                                                               |
| Dependencies   | Only Keysight M9300A Frequency Reference is supported                                                                           |
| State Saved    | No                                                                                                                              |

### 6.6.6.2 Freq Ref In

Specifies the frequency reference as being the internal reference, an external reference at the front panel input labeled **Ref In**.

|                |                                                                                                                                       |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:ROSCillator:PXIReference:SOURce INTernal   EXTernal</code><br><code>[ :SENSe]:ROSCillator:PXIReference:SOURce?</code> |
| Example        | <code>:ROSC:PXIR:SOUR INT</code><br><code>:ROSC:PXIR:SOUR?</code>                                                                     |
| Dependencies   | Only available when <b>Select Ref</b> is not <b>NONE</b>                                                                              |
| Preset         | <b>INTernal</b>                                                                                                                       |
| State Saved    | Saved in instrument state                                                                                                             |

### 6.6.6.3 External Freq Ref

Tells the PXIe Ref module the frequency of the external reference. When the external reference is in use this information is used by the Ref module to determine the internal settings needed to lock to that particular external reference signal.

For the instrument to stay locked, the value entered must be within 5 ppm of the actual external reference frequency. So, it is important to get it close, or you risk an unlock condition.

|                |                                                                                                                                                                                                                  |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:ROSCillator:PXIReference:EXTernal:FREQuency &lt;freq&gt;</code><br><code>[ :SENSe]:ROSCillator:PXIReference:EXTernal:FREQuency?</code>                                                           |
| Example        | Set the external reference frequency to 20 MHz, but does not select the external reference:<br><code>:ROSC:PXIR:EXT:FREQ 20 MHz</code><br><br>Select the external reference:<br><code>:ROSC:PXIR:SOUR EXT</code> |
| Dependencies   | Only available when <b>Select Ref</b> is not <b>NONE</b>                                                                                                                                                         |
| Preset         | 10 MHz                                                                                                                                                                                                           |
| State Saved    | Yes                                                                                                                                                                                                              |
| Min            | 1 MHz                                                                                                                                                                                                            |
| Max            | 110 MHz                                                                                                                                                                                                          |

### 6.6.6.4 Ext Ref Locked (Remote Query Only)

Returns the External Reference locked status

|                |                                                                                                                                                                                                                                                                                                |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:ROSCillator:PXIReference:EXTernal:LOCK?</code>                                                                                                                                                                                                                                 |
| Example        | <code>:ROSC:PXIR:EXT:LOCK?</code>                                                                                                                                                                                                                                                              |
| Notes          | <p>Returns “1” if the Freq Ref Input is External and Reference is locked. Otherwise returns “0”</p> <p>When the Freq Ref Input is External and Reference is unlocked, the following warning message appears in the status bar:</p> <p><code>Settings Alert; M9300A Ext Ref Unlocked</code></p> |
| Dependencies   | Only available when <b>Select Ref</b> is not <code>NONE</code>                                                                                                                                                                                                                                 |

## 6.7 Output

Accesses controls that configure various output settings, like the frequency reference output, IF outputs and analog output.

Not all measurements support all output functions. For example, the Swept SA Measurement does not support the Digital Bus function or the I/Q Cal Out function under the **Output** tab; although the controls are visible, the outputs do not function in this measurement.

In addition, if the appropriate license is not present, some controls may not appear. In Modes/Measurements that do not support particular controls, the controls may appear, but no output will be generated if they are selected.

This tab does not appear in EXM or VXT model M9420A.

### 6.7.1 Analog Out

Lets you control which signal is fed to the “Analog Out” connector on the instrument rear panel.

In the Auto state, the Analog Output will automatically be set to the most sensible setting for the current mode or measurement.

If you make a selection manually from the **Analog Out** menu, the manually selected choice will remain in force until you change it (or re-select Auto), even if you switch to a mode or measurement for which the selected output does not apply.

|                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|-------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command                | <code>:OUTPut:ANALog OFF</code>   <code>SVIDeo</code>   <code>LOGVideo</code>   <code>LINVideo</code>   <code>DAUDio</code> !See Option Details<br><code>:OUTPut:ANALog?</code>                                                                                                                                                                                                                                                                                                                                                                        |
| Example                       | <code>:OUTP:ANAL SVIDeo</code><br>causes the analog output type to be Screen Video                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Preset                        | Unaffected by Preset, but set to <code>DAUDio</code> by <b>Restore Input/Output Defaults</b> or <b>Restore System Defaults-&gt;All</b>                                                                                                                                                                                                                                                                                                                                                                                                                 |
| State Saved                   | Saved in Input/Output State                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Backwards Compatibility Notes | <p>Prior to A.04.00, <code>OFF</code> was the default functionality except when in the Analog Demod application or with Tune and Listen, in which case it was <code>DAUDio</code>, and there was no selection menu. For backwards compatibility with earlier X-Series firmware versions, Auto (<code>:OUTP:ANAL:AUTO ON</code>) duplicates the prior behavior</p> <p>The <code>DNWB</code> and <code>SANalyzer</code> parameters, which were legal in PSA but perform no function in the X-Series, are accepted without error</p> <p>Auto Function</p> |

|                |                                                                                        |
|----------------|----------------------------------------------------------------------------------------|
| Remote Command | <code>:OUTPut:ANALog:AUTO OFF   ON   0   1</code><br><code>:OUTPut:ANALog:AUTO?</code> |
| Example        | <code>:OUTP:ANAL:AUTO ON</code>                                                        |
| Preset         | ON                                                                                     |

### Option Details

| Source       | SCPI     | Notes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|--------------|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Off          | OFF      | The Analog Output is off                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Screen Video | SVIDeo   | Selects the analog output to be the screen video signal. In this mode, the pre-detector data is output to the Analog Out connector. The output looks very much like the trace displayed on the instrument's screen, and depends on the Log/Lin display Scale, Reference Level, and dB per division, but is not influenced by the selected detector or any digital flatness corrections or trace post-processing (like Trace Averaging)                                                                   |
| Log Video    | LOGVideo | Selects the analog output to be the log of the video signal. In this mode, the pre-detector data is output to the Analog Out connector with a Log scaling. The output is referenced to the current level at the mixer, does not depend on display settings like Reference Level or dB per division, and it is not influenced by the selected detector or any digital flatness corrections or trace post-processing (like Trace Averaging), but does change with input attenuation                        |
| Linear Video | LINVideo | Selects the analog output to be the envelope signal on a linear (voltage) scale. In this mode, the pre-detector data is output to the Analog Out connector with a Linear scaling. The output is based on the current Reference Level, and is not influenced by the selected detector or any digital flatness corrections or trace post-processing (like Trace Averaging)                                                                                                                                 |
| Demod Audio  | DAUDio   | Selects the analog output to be the demodulation of the video signal. When Demod Audio is selected, the demodulated audio signal appears at this output whenever the Analog Demod application is demodulating a signal or when <b>Analog Demod Tune and Listen</b> is operating in the Swept SA measurement<br><br>When Analog Out is in the Auto state, this output is auto-selected when in the Analog Demod mode or when <b>Analog Demod Tune and Listen</b> is operating in the Swept SA measurement |

The table below specifies the range for each output.

| Analog Out   | Nominal Range<br>exc<br>(10% overrange) | Scale Factor    | Notes                                                                    |
|--------------|-----------------------------------------|-----------------|--------------------------------------------------------------------------|
| Off          | 0 V                                     |                 |                                                                          |
| Screen Video | 0 – 1 V open circuit                    | 10%/division    | 8566 compatible                                                          |
| Log Video    | 0 – 1 V terminated                      | 1/(192.66 dB/V) | dB referenced to mixer level, 1V out for –10 dBm at the mixer            |
| Linear Video | 0 – 1 V terminated                      | 100%/V          | Linear referenced to Ref Level, 1 V out for RF envelope at the Ref Level |



| Analog Out     | Nominal Range<br>exc<br>(10% overrange) | Scale Factor | Notes |
|----------------|-----------------------------------------|--------------|-------|
| Demod<br>Audio | (varies with instrument setting)        |              |       |

### Notes about the Analog Outputs

#### Screen Video

This mode is similar to the Analog Output of the HP 8566 family and the Video Out (opt 124) capability of the Keysight PSA analyzer (E444x), although there are differences in the behavior.

Screen Video output changes while in FFT Sweeps, so for measurements that use exclusively FFT Sweeps, or if the user manually chooses FFT Sweeps, the Screen Video output will look different than it does in swept mode

Because the Screen Video output uses one of the two IF processing channels, only one detector is available while Screen Video is selected. All active traces will change to use the same detector as the selected trace when Screen Video is activated.

Screen Video output is not available while any EMI Detector is selected (Quasi Peak, RMS Average or EMI Average), because these detectors use both IF processing channels. Consequently, if the user chooses an EMI Detector, there will be no Screen Video output.

The output holds at its last value during an alignment and during a marker count. After a sweep:

- If a new sweep is to follow (as in Continuous sweep mode), the output holds at its last value during the retrace before the next sweep starts. If the instrument is in zero-span, there is no retrace, as the instrument remains tuned to the Center Frequency and does not sweep. Therefore, in zero-span, the output simply remains live between display updates
- If no new sweep is to follow (as in Single sweep mode), the output remains live, and continues to show the pre-detector data

This function depends on optional capability; the selection is not available, and the command will generate an “Option not available” error unless you have Option YAV or YAS licensed in your instrument.

The Screen Video function is intended to be very similar to the 8566 Video Output and the PSA Option 124. However, unlike the PSA, it is not always on; it must be switched on by the Screen Video key. Also, unlike the PSA, there are certain dependencies (detailed above) – for example, the Quasi Peak Detector is unavailable when Screen Video is on.

Furthermore, the PSA Option 124 hardware was unipolar, and its large range was padded to be exactly right for use as a Screen Video output. In the X-Series, the hardware is bipolar and has a wider range to accommodate the other output choices. Therefore, the outputs won't match up exactly and users may have to modify their setup when applying the X-Series in a PSA application.

### Log Video

Log Video shows the RF Envelope with the Reference equal to the Mixer Level. The output is designed so that full scale (1 V) corresponds to -10 dBm at the mixer. The full range (0-1 V) covers 192.66 dB ; thus, 0 V corresponds to -202.66 dBm at the mixer.

Because the Log Video output uses one of the two IF processing channels, only one detector is available while Screen Video is selected. All active traces will change to use the same detector as the selected trace when Log Video is activated.

Log Video output is not available while any EMI Detector is selected (Quasi Peak, RMS Average or EMI Average), because these detectors use both IF processing channels. Consequently, if the user chooses an EMI Detector, there will be no Log Video output.

The output holds at its last value during an alignment, during a marker count, and during retrace (after a sweep and before the next sweep starts).

This function depends on optional capability. The choice will not appear, and the command will generate an "Option not available" error unless you have Option YAV licensed in your instrument.

Log Video output changes while in FFT Sweeps, so for measurements that use exclusively FFT Sweeps, or if the user manually chooses FFT Sweeps, the Log Video output will look different than it does in swept mode.

### Linear Video

Linear Video shows the RF Envelope with the Reference equal to the Ref Level. The scaling is set so that 1 V output occurs with an instantaneous video level equal to the reference level, and 0 V occurs at the bottom of the graticule. This scaling gives you the ability to control the gain without having another setup control for the key. But it requires you to control the look of the display (the reference level) in order to control the analog output.

This mode is ideal for looking at Amplitude Modulated signals, as the linear envelope effectively demodulates the signal.

Because the Linear Video output uses one of the two IF processing channels, only one detector is available while Linear Video is selected. All active traces will change to use the same detector as the selected trace when Log Video is activated.

Linear Video output is not available while any EMI Detector is selected (Quasi Peak, RMS Average or EMI Average), because these detectors use both IF processing

channels. Consequently, if the user chooses an EMI Detector, there will be no Linear Video output.

The output holds at its last value during an alignment and during a marker count and during retrace (after a sweep and before the next sweep starts).

This function depends on optional capability; the choice will not appear, and the command will generate an “Option not available” error unless you have Option YAV licensed in your instrument.

Linear Video output changes while in FFT Sweeps, so for measurements that use exclusively FFT Sweeps, or if the user manually chooses FFT Sweeps, the Linear Video output will look different than it does in swept mode.

Demod Audio

When Analog Out is in the Auto state, this output is auto-selected when in the Analog Demod mode or when **Analog Demod Tune and Listen** is operating in the Swept SA measurement.

If any other Analog Output is manually selected when in the Analog Demod mode or when **Analog Demod Tune and Listen** is operating in the Swept SA measurement, a condition warning message appears. This choice only appears if the Analog Demod application (N9063A), the N6141A or W6141A application, or Option EMC is installed and licensed, otherwise the choice will not appear, and the command will generate an “Option not available” error.

The output holds at its last value during an alignment and during a marker count. It is not held between sweeps, in order for Tune and Listen to work properly.

When Demod Audio is the selected Analog Output, all active traces are forced to use the same detector, and the CISPR detectors (QPD, EMI Avg, RMS Avg) are unavailable

6.7.2 Screen Video Level

Lets you control the amplitude of the Analog Output when Screen Video is selected.

- The 1V (**NORMal**) setting provides a nominal output of 1 V peak-to-peak into an open circuit. This matches the traditional behavior of X-series instruments
- The 2V (**COMPatible**) setting provides a nominal output of 2 V peak-to-peak into an open circuit. This matches the legacy behavior of PSA and earlier analyzers

|                |                                                                                               |
|----------------|-----------------------------------------------------------------------------------------------|
| Remote Command | <code>:OUTPut:ANALog:SVIDeo NORMal   COMPatible</code><br><code>:OUTPut:ANALog:SVIDeo?</code> |
| Example        | <code>:OUTP:ANAL:SVID COMP</code><br>causes the Screen Video level to be 2 V                  |

|              |                                                                                                                                |
|--------------|--------------------------------------------------------------------------------------------------------------------------------|
| Dependencies | Only appears if Screen Video is the selected Analog Output                                                                     |
| Preset       | Unaffected by Preset, but set to <b>NORM</b> by <b>Restore Input/Output Defaults</b> or <b>Restore System Defaults-&gt;All</b> |
| State Saved  | Saved in Input/Output State                                                                                                    |

### 6.7.3 Digital Bus Out

Turns on the LVDS Digital Output port for outputting digital acquisition data.

- When **ON**, all acquisitions are streamed to the output port including acquisitions for internal purposes such as Alignment. The internal processing and routing of acquisitions continues as usual and is unaffected by the state of Bus Out
- When **OFF**, no signal appears on the LVDS port

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:OUTPut:DBUS[1][:STATe] ON   OFF   1   0</code><br><code>:OUTPut:DBUS[1][:STATe]?</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Example        | <code>:OUTP:DBUS ON</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Dependencies   | Requires option RTL or control is not displayed<br><b>Digital Bus Out</b> and <b>Wideband Digital Bus</b> cannot both be <b>ON</b> at the same time, so: <ul style="list-style-type: none"> <li>– When <b>Wideband Digital Bus</b> is turned <b>ON</b>, if <b>Digital Bus Out</b> is already <b>ON</b>, an advisory message is displayed, “Wideband Digital Bus On, Digital Bus (narrow band) forced to Off”</li> <li>– When <b>Digital Bus Out</b> is turned <b>ON</b>, if <b>Wideband Digital Bus</b> is already <b>ON</b>, an advisory message is displayed, “Digital Bus (narrow band) On, Wideband Digital Bus forced to Off”</li> </ul> |
| Preset         | <b>OFF</b><br>Set by <b>Restore Input/Output Defaults</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| State Saved    | Saved in Input/Output State                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |

### 6.7.4 Wideband Digital Bus

Turns on the LVDS port on the Wideband IF, which causes the I/Q pairs from the current measurement to be sent to this port.

#### NOTE

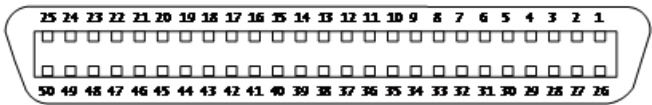
**This control is grayed-out in all Modes except RTSA, which offers the only measurement that supports wideband streaming.**

- When **ON**, the internal processing and routing of acquisitions continues as usual, and the display of measurement data is unaffected
- When **OFF**, no signal appears on the LVDS port

6 Input/Output  
6.7 Output

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:OUTPut:DBUS2[:STATe] OFF   ON   0   1</code><br><code>:OUTPut:DBUS2[:STATe]?</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Example        | <code>:OUTP:DBUS2 ON</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Notes          | If this command is sent while running a measurement that does not support <b>Wideband Digital Bus</b> , the message “Settings conflict; Feature not supported for this measurement” is displayed                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Dependencies   | Requires option RTS or control is not displayed<br><b>Digital Bus Out</b> and <b>Wideband Digital Bus</b> cannot both be <b>ON</b> at the same time, so: <ul style="list-style-type: none"><li>– When <b>Wideband Digital Bus</b> is turned <b>ON</b>, if <b>Digital Bus Out</b> is already <b>ON</b>, an advisory message is displayed, “Wideband Digital Bus On, Digital Bus (narrow band) forced to Off”</li><li>– When <b>Digital Bus Out</b> is turned <b>ON</b>, if <b>Wideband Digital Bus</b> is already <b>ON</b>, an advisory message is displayed, “Digital Bus (narrow band) On, Wideband Digital Bus forced to Off”</li></ul> |
| Preset         | <b>OFF</b><br>Set by <b>Restore Input/Output Defaults</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| State Saved    | Saved in Input/Output State                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |

Here is the Wideband LVDS connector as viewed from the rear panel. The pin assignments are listed below:



I-Cable

| Connection   | “-“ pin # | “+” pin # |
|--------------|-----------|-----------|
| GND          | 1         | 26        |
| N/C          | 2         | 27        |
| Stream_I[00] | 3         | 28        |
| Stream_I[01] | 4         | 29        |
| Stream_I[02] | 5         | 30        |
| Stream_I[03] | 6         | 31        |
| GND          | 7         | 32        |
| Stream_I[04] | 8         | 33        |
| Stream_I[05] | 9         | 34        |
| Stream_I[06] | 10        | 35        |
| Stream_I[07] | 11        | 36        |
| GND          | 12        | 37        |
| Stream_I[08] | 13        | 38        |
| Stream_I[09] | 14        | 39        |
| Stream_I[10] | 15        | 40        |

| Connection   | “-“ pin # | “+” pin # |
|--------------|-----------|-----------|
| Stream_I[11] | 16        | 41        |
| GND          | 17        | 42        |
| Stream_I[12] | 18        | 43        |
| Stream_I[13] | 19        | 44        |
| Stream_I[14] | 20        | 45        |
| Stream_I[15] | 21        | 46        |
| GND          | 22        | 47        |
| GND          | 23        | 48        |
| Stream_VALID | 24        | 49        |
| Stream_CLK   | 25        | 50        |

Q-Cable

| Connection   | “-“ pin # | “+” pin # |
|--------------|-----------|-----------|
| GND          | 1         | 26        |
| Stream_ALT   | 2         | 27        |
| Stream_Q[00] | 3         | 28        |
| Stream_Q[01] | 4         | 29        |
| Stream_Q[02] | 5         | 30        |
| Stream_Q[03] | 6         | 31        |
| GND          | 7         | 32        |
| Stream_Q[04] | 8         | 33        |
| Stream_Q[05] | 9         | 34        |
| Stream_Q[06] | 10        | 35        |
| Stream_Q[07] | 11        | 36        |
| GND          | 12        | 37        |
| Stream_Q[08] | 13        | 38        |
| Stream_Q[09] | 14        | 39        |
| Stream_Q[10] | 15        | 40        |
| Stream_Q[11] | 16        | 41        |
| GND          | 17        | 42        |
| Stream_Q[12] | 18        | 43        |
| Stream_Q[13] | 19        | 44        |
| Stream_Q[14] | 20        | 45        |
| Stream_Q[15] | 21        | 46        |
| GND          | 22        | 47        |
| GND          | 23        | 48        |

## 6 Input/Output

### 6.7 Output

| Connection     | “-“ pin #                                   | “+” pin # |
|----------------|---------------------------------------------|-----------|
| Stream_MARK_1  | 24                                          | 49        |
| Stream_MARK_2  | 25                                          | 50        |
| Stream_I       | 16 bit "I" Data                             |           |
| Stream_Q[15:0] | 16 bit "Q" Data                             |           |
| Stream_VALID   | Data valid, when '1' then I/Q data is valid |           |
| Stream_CLK     | 150 MHz DDR clock                           |           |
| Stream_MARK_1  | Stream Mark Bit 1                           |           |
| Stream_MARK_2  | Stream Mark Bit 2                           |           |
| Stream_ALT     | currently unused                            |           |

#### 6.7.5 Data Stream

Lets you choose data or a test pattern to output to the Wideband IF LVDS port. This can help you set up your streaming target devices.

|                |                                                                                       |
|----------------|---------------------------------------------------------------------------------------|
| Remote Command | <b>:OUTPut:DBUS2:DATA MEASure   TEST</b><br><b>:OUTPut:DBUS2:DATA?</b>                |
| Example        | <b>:OUTP:DBUS2:DATA TEST</b>                                                          |
| Notes          | Selecting <b>TEST</b> routes a test pattern to the Wideband Digital Bus stream output |
| Preset         | <b>MEAS</b> (set by Restore Input/Output Defaults)                                    |
| State Saved    | Saved in Input/Output State                                                           |

#### 6.7.6 I/Q Cal Out

The Baseband I/Q "Cal Out" port can be turned on with either a 1 kHz or a 250 kHz square wave. This can be turned on independent of the input selection. Preset resets this to **OFF**.

|                |                                                                                                                                                                                                                                |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <b>:OUTPut:IQ:OUTPut IQ1   IQ250   OFF</b><br><b>:OUTPut:IQ:OUTPut?</b>                                                                                                                                                        |
| Example        | <b>:OUTP:IQ:OUTP IQ1</b>                                                                                                                                                                                                       |
| Dependencies   | Only available with Option BBA                                                                                                                                                                                                 |
| Couplings      | An I/Q Cable Calibration or an I/Q Probe Calibration will change the state of the Cal Out port as needed by the calibration routine. When the calibration is finished the I/Q Cal Out is restored to the pre-calibration state |
| Preset         | <b>OFF</b>                                                                                                                                                                                                                     |
| State Saved    | Saved in instrument state                                                                                                                                                                                                      |
| Range          | 1 kHz Square Wave   250 kHz Square Wave   Off                                                                                                                                                                                  |

### 6.7.7 Aux IF Out

Controls the signals that appear on the SMA output on the rear panel labeled **AUX IF OUT**

#### NOTE

**Aux IF Out** is valid for the RF Input and for the External Mixer input. In external mixing, the Aux IF output level is set by factory default to accommodate expected IF levels for the RF path. When using the External Mixing path, the **Aux IF Out** levels (for all three options CR3, CRP and ALV) will therefore be uncalibrated.

|                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|-------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command                | <code>:OUTPut:AUX SIF   AIF   LOGVideo   OFF</code><br><br>See "Option Details" on page 812 and "Notes on the Aux IF Outputs" on page 813 below<br><code>:OUTPut:AUX?</code>                                                                                                                                                                                                                                                                        |
| Dependencies                  | Does not appear in models that do not support the Aux IF Out                                                                                                                                                                                                                                                                                                                                                                                        |
| Preset                        | Unaffected by Preset, but set to <b>OFF</b> by <b>Restore Input/Output Defaults</b> or <b>Restore System Defaults-&gt;All</b>                                                                                                                                                                                                                                                                                                                       |
| State Saved                   | Saved in Input/Output state                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Backwards Compatibility Notes | In PSA, the IF output had functionality equivalent to the <b>SIF</b> option in X-Series' <b>Aux IF Out</b> menu. In X-Series, it is necessary to switch <b>Aux IF Out</b> to <b>SIF</b> to get this functionality, whereas in PSA it is always on, since there are no other choices<br><br>Hence, if you are migrating remote code from PSA, and you use the IF Output in PSA, you will need to add a command to switch this function to <b>SIF</b> |

#### Option Details

The Aux IF Output options are:

| Source       | SCPI       | Notes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|--------------|------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Off          | <b>OFF</b> | No signal is output from the <b>AUX IF OUT</b> connector on the rear panel<br><br>The connector appears as an open-circuit (that is, it is not terminated in any way)                                                                                                                                                                                                                                                                                                                                                                                                            |
| Second IF    | <b>SIF</b> | The 2 <sup>nd</sup> IF output is routed to the rear panel connector. Annotation on the menu panel shows the current 2 <sup>nd</sup> IF frequency in use in the instrument                                                                                                                                                                                                                                                                                                                                                                                                        |
| Arbitrary IF | <b>AIF</b> | The 2 <sup>nd</sup> IF output is mixed with a local oscillator and mixer to produce an arbitrary IF output between 10 MHz and 75 MHz with 500 kHz resolution. The phase noise in this mode will not be as good as in Second IF mode<br><br>The IF output frequency is adjustable, through an active function which appears on the menu panel, from 10 MHz to 75 MHz with 500 kHz resolution<br><br>Note that, in instruments with Options B2X or B5X, the Arbitrary IF Output is only practical when the IF Bandwidth is ≤ 40 MHz, IF Path is ≤ 40 MHz, or FFT Width is ≤ 40 MHz |



## 6 Input/Output

### 6.7 Output

| Source         | SCPI     | Notes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|----------------|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Fast Log Video | LOGVideo | <p>The 2<sup>nd</sup> IF output is passed through a log amp and the log envelope of the IF signal is sent to the rear panel. The open circuit output level varies by about 25 mV per dB, with a top-of-screen signal producing about 1.6 Volts. The output impedance is nominally 50 ohms</p> <p>This mode is intended to meet the same requirement as Option E4440A-H7L Fast Rise Time Video Output on E4440A PSA Series, allowing you to characterize pulses with fast rise times using standard measurement suites on modern digital scopes</p> |

#### Notes on the Aux IF Outputs

##### Second IF

Does not appear unless Option CR3 is installed.

The frequency of the 2<sup>nd</sup> IF depends on the current IF signal path as shown in the table below:

| IF Path Selected | Frequency of "Second IF" Output |
|------------------|---------------------------------|
| 10 MHz           | 322.5 MHz                       |
| 25 MHz           | 322.5 MHz                       |
| 40 MHz           | 250 MHz                         |
| 85-160 MHz       | 300 MHz                         |
| 255 MHz          | 750 MHz                         |
| 510 MHz          | 877.1484375 MHz                 |

The signal quality, such as signal to noise ratio and phase noise, are excellent in this mode.

##### Arbitrary IF

Does not appear unless Option CRP is installed.

The bandwidth of this IF output varies with band and center frequency, but is about 40 MHz at the -3 dB width. When the output is centered at lower frequencies in its range, signal frequencies at the bottom of the bandwidth will "fold". For example, with a 40 MHz bandwidth (20 MHz half-bandwidth), and a 15 MHz IF center, a signal -20 MHz relative to the spectrum analyzer center frequency will have a relative response of about -3 dB with a frequency 20 MHz below the 15 MHz IF center. This -5 MHz frequency will fold to become a +5 MHz signal at the IF output. Therefore, lower IF output frequencies are only useful with known band-limited signals.

##### Fast Log Video

Does not appear unless Option ALV is installed.

The output is off during an alignment but not during a marker count, and is not blanked during retrace (after a sweep and before the next sweep starts).

## 6.7.8 Arbitrary IF Freq

Sets the frequency of the Arbitrary IF when "Aux IF Out" on page 812 is set to **AIF**.

### NOTE

In instruments with Options B2X or B5X, the Arbitrary IF Output is only practical when the IF Bandwidth is  $\leq 40$  MHz, IF Path is  $\leq 40$  MHz, or FFT Width is  $\leq 40$  MHz.

|                |                                                                                                                             |
|----------------|-----------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:OUTPut:AUX:AIF &lt;value&gt;</code><br><code>:OUTPut:AUX:AIF?</code>                                                 |
| Example        | <code>:OUTP:AUX:AIF 50 MHZ</code>                                                                                           |
| Dependencies   | Only appears if "Aux IF Out" on page 812 is <b>AIF</b>                                                                      |
| Preset         | Unaffected by a Preset, but set to 70 MHz by <b>Restore Input/Output Defaults</b> or <b>Restore System Defaults-&gt;All</b> |
| State Saved    | Saved in Input/Output State                                                                                                 |
| Min            | 10 MHz                                                                                                                      |
| Max            | 75 MHz                                                                                                                      |

## 6.7.9 Ext/Wide IF Out

Causes the signal that is normally routed to the IF to be routed instead to the **Ext IF Out** connector on the rear panel (N9041B) or **Wide IF Out** connector on the front panel (N9042B) or rear panel (N9032B). This is available in N9041B when RF Input 2 is the selected input port and in N9032B/N9042B on RF Input and, when V3050A is attached, External RF Input.

Only one IF output (**Ext/Wide IF Out**, IF2 Out, or Aux IF Out) can be selected at a time, so switching Ext/Wide IF Out to **ON** changes IF2 Out and Aux IF Out to **OFF**, and setting Aux IF Out to something other than **OFF** or IF2 Out to **ON** forces Ext/Wide IF Out to **OFF**.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:OUTPut:EIF ON   OFF   1   0</code><br><code>:OUTPut:EIF?</code>                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Example        | <code>:OUTP:EIF ON</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Dependencies   | Only appears in N9041B, N9032B, and N9042B<br>For N9041B, enabled when RF Input 2 is the selected input. When RF Input 2 is not selected, the control is grayed out and forced to Off and attempting to set it On will result in an error message<br>For N9032B/N9042B, enabled on RF Input and on External RF Input when V3050A is attached<br>When this switch is <b>ON</b> , no measurement is displayed, and the error "No result; meas invalid with Ext/Wide IF Out set to On" appears in the Status bar |

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### 6.7 Output

|                              |                                                                                                                                                                                                                                                                                    |
|------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Preset                       | <b>OFF</b><br>Not affected by <b>Mode Preset</b> , but set to <b>OFF</b> by <b>Input/Output Preset</b>                                                                                                                                                                             |
| State Saved                  | Saved in Input/Output state                                                                                                                                                                                                                                                        |
| Annotation                   | None (but error message appears when on)                                                                                                                                                                                                                                           |
| Status Bits/OPC dependencies | <b>STATus:QUESTIONable:INTEGRity</b> bit 1 is set when <b>Ext/Wide IF Out</b> is <b>ON</b> . This indicates an error, because no valid data is on the screen or available via SCPI. However, the signal at the <b>Ext/Wide IF Out</b> port is still valid given the other settings |

#### 6.7.10 IF2 Out

Causes the signal that is normally routed to the IF, when the 1 GHz IF Path is selected, to be routed instead to the **IF2 Out** connector on the rear panel.

Only one IF output (Ext IF Out, **IF2 Out**, or Aux IF Out) can be selected at a time, so switching IF2 Out to On changes Ext IF Out and Aux IF Out to Off, and setting Aux IF Out to something other than Off or Ext IF Out to On forces IF2 Out to Off.

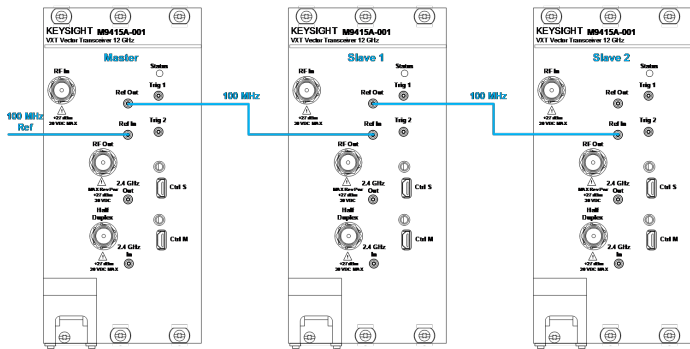
This control only appears if Option H1G is installed. It is only available when the 1 GHz IF Path is chosen, either directly or indirectly. In all other paths it is visible but grayed out and forced to Off. Attempting to set it On when the 1GHz path is not selected generates an error.

- Direct selection of the 1 GHz path: Measurements that directly support the 1 GHz path have a 1 GHz selection in the IF Path menu in Meas Setup
- Indirect selection of the 1 GHz path: certain measurements, like CCDF, always choose the widest available path, and so will choose the 1 GHz path if it is available, even if there is no IF Path menu in the measurement. IF2 Out will be visible when this results in the 1 GHz path being selected, even if there is no control or readout indicating that the 1 GHz path is chosen

|                              |                                                                                                                                                                                                                                                             |
|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command               | <b>:OUTPut:IF2 ON   OFF   1   0</b><br><b>:OUTPut:IF2?</b>                                                                                                                                                                                                  |
| Example                      | <b>:OUTP:IF2 ON</b>                                                                                                                                                                                                                                         |
| Dependencies                 | Only appears in UXA and only when Option H1G is installed<br>When this is <b>ON</b> , no measurement is displayed, and the error “No result; meas invalid with IF2 Out set to On” appears in the Status bar                                                 |
| Preset                       | <b>OFF</b><br>Not affected by Mode Preset but set to <b>OFF</b> by Input/Output Preset                                                                                                                                                                      |
| State Saved                  | Saved in Input/Output state                                                                                                                                                                                                                                 |
| Annotation                   | None (but error message appears when on)                                                                                                                                                                                                                    |
| Status Bits/OPC dependencies | <b>STATus:QUESTIONable:INTEGRity</b> bit 1 is set when IF2 Out is <b>ON</b> . This indicates an error, because no valid data is on the screen or available via SCPI. However, the signal at the <b>IF2 Out</b> port is still valid given the other settings |

6.7.11 REF Out

Lets you toggle the state of REF Out. The REF Out port is designed for MIMO, which provides the reference daisy chain for the Primary and Secondary modules.



|                |                                                                                                                                   |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | :OUTPut:EReference:OUTPut ON   OFF   1   0<br>:OUTPut:EReference:OUTPut?                                                          |
| Example        | :OUTP:EREF:OUTP ON<br>:OUTP:EREF:OUTP?                                                                                            |
| Notes          | Used to route the 100 MHz reference signal on the REF In port to the REF Out port                                                 |
| Dependencies   | Only available in VXT models M9415A/16A and M9415E/16E when <b>Freq Ref Input</b> is External, and <b>Ext Ref Freq</b> is 100 MHz |
| Preset         | OFF                                                                                                                               |
| Range          | ON OFF                                                                                                                            |

6.7.12 LO Ref Out

Turns the LO Reference Signal Out on or off. **LO Ref Out** is used to provide reference daisy chain in MIMO or Phase Coherency.

For VXT models M9410A/11A, controls the **4.8 GHz Out** port on the front panel. Setting it **ON** outputs a 4.8 GHz reference signal.

|                |                                                                                  |
|----------------|----------------------------------------------------------------------------------|
| Remote Command | :OUTPut:ROSCillator:LO:OUTPut ON   OFF   1   0<br>:OUTPut:ROSCillator:LO:OUTPut? |
|----------------|----------------------------------------------------------------------------------|

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6.7 Output

|              |                                                                        |
|--------------|------------------------------------------------------------------------|
| Example      | <code>:OUTP:ROSC:LO:OUTP ON</code><br><code>:OUTP:ROSC:LO:OUTP?</code> |
| Dependencies | Only available in VXT models M9410A/11A/15A/16A and M9410E/11E/15E/16E |
| Preset       | <code>OFF</code>                                                       |

## 6.8 Trigger Output

Accesses controls that configure the **Trigger Output** settings.

### 6.8.1 Trig 1 – 4 Out

Selects the type of output signal that will be output from the available **Trig n Out** connectors, where **n** = 1, 2, 3, or 4.

Some instruments do *not* support **Trig 2 Out** through **Trig 4 Out** outputs, nor their associated controls.

For most instruments, **Trig 1 Out** applies to the connector labeled **Trigger 1**, but for VXT model M9420A, it is labeled **Trigger 4**.

The front panel includes separate controls for each available trigger: **Trig 1 Out – Trig 4 Out**. The remote command can be used for *any* of the **Trig n Out** connectors, by specifying the appropriate parameter (for example **TRIG1**, **TRIG2**, etc.).

#### NOTE

Option **TARMed** is *not* available in modular instruments.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <pre>:TRIGger[1] 2 ... 4[:SEquence]:OUTPut HSWP   MEASuring   MAIN   GATE   GTRigger   OEVEN   TARMed   SPOint   S1Marker   S2Marker   S3Marker   S4Marker   PARB   FSYNc   OFF</pre> <p>See "Trigger Out Options" on page 819</p> <pre>:TRIGger[1] 2 ... 4[:SEquence]:OUTPut?</pre>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Example        | <pre>:TRIG:OUTP HSWP :TRIG2:OUTP GATE</pre>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Notes          | <p><b>Trig 2 Out</b> is used as the source trigger out in EXM and VXT model M9420A</p> <p>The available choices in EXM and VXT model M9420A are <b>S1Marker</b>, <b>S2Marker</b>, <b>S3Marker</b>, <b>S4Marker</b> and <b>OFF</b></p> <p>For Power Amplifier Mode, <b>Trig 2 Out</b> is set to Source Marker2 when <b>Burst Shape &amp; Mask</b> is <b>ON</b>. In this case, <b>Trigger 2</b> is used to output PA Enable Mask</p>                                                                                                                                                                                                                                                                                                                                                                                                         |
| Dependencies   | <p><b>Trig 2 Out</b> through <b>Trig 4 Out</b> are not supported in all models. In models that do not support them, the <b>Trig n Out</b> control is blanked, and sending the SCPI command for this output generates an error, "Hardware missing; Not available for this model number"</p> <p>Querying <b>Trig 2 Out</b> through <b>Trig 4 Out</b> in models that do not support them returns <b>OFF</b></p> <p>For VXT models M9410A/11A/15A/16A and M9410E/11E/15E/16E:</p> <ul style="list-style-type: none"> <li>When <b>Trig n Out Device</b> is <b>ANALyzer</b>, only <b>MEASuring</b>, <b>MAIN</b> and <b>OFF</b> are available</li> <li>When <b>Trig n Out Device</b> is <b>SOURce</b>, only <b>S1Marker</b>, <b>S2Marker</b>, <b>S3Marker</b>, <b>S4Marker</b>, <b>PARB</b>, <b>FSYNc</b> and <b>OFF</b> are available</li> </ul> |

## 6 Input/Output

### 6.8 Trigger Output

|             |                                                                                                                                                                                                                              |           |                          |           |      |           |                          |           |      |
|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|--------------------------|-----------|------|-----------|--------------------------|-----------|------|
|             | For VXT model M9421A, <b>Trig 2 Out</b> is used as the Analyzer trigger output                                                                                                                                               |           |                          |           |      |           |                          |           |      |
| Preset      | Unaffected by Preset, but preset to the following values by <b>Restore Input/Output Defaults</b> or <b>Restore System Defaults-&gt;All</b> :                                                                                 |           |                          |           |      |           |                          |           |      |
|             | <table> <tr> <td>Trigger 1</td><td>Sweeping (<b>HSWP</b>)</td></tr> <tr> <td>Trigger 2</td><td>Gate</td></tr> <tr> <td>Trigger 3</td><td>Sweeping (<b>HSWP</b>)</td></tr> <tr> <td>Trigger 4</td><td>Gate</td></tr> </table> | Trigger 1 | Sweeping ( <b>HSWP</b> ) | Trigger 2 | Gate | Trigger 3 | Sweeping ( <b>HSWP</b> ) | Trigger 4 | Gate |
| Trigger 1   | Sweeping ( <b>HSWP</b> )                                                                                                                                                                                                     |           |                          |           |      |           |                          |           |      |
| Trigger 2   | Gate                                                                                                                                                                                                                         |           |                          |           |      |           |                          |           |      |
| Trigger 3   | Sweeping ( <b>HSWP</b> )                                                                                                                                                                                                     |           |                          |           |      |           |                          |           |      |
| Trigger 4   | Gate                                                                                                                                                                                                                         |           |                          |           |      |           |                          |           |      |
| State Saved | Saved in instrument state                                                                                                                                                                                                    |           |                          |           |      |           |                          |           |      |

### Trigger Out Options

| Source               | SCPI             | Notes                                                                                                                                                                                                                                                                                                                                                                     |
|----------------------|------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Off                  | <b>OFF</b>       | Selects no signal to be output to the <b>Trig n Out</b> connector                                                                                                                                                                                                                                                                                                         |
| Sweeping             | <b>HSWP</b>      | Selects the Sweeping Trigger signal to be output to the <b>Trig n Out</b> connector when a measurement is made<br><br>This signal has historically been known as <b>HSWP</b> (High = Sweeping), and is 5 V TTL level with 50 $\Omega$ output impedance                                                                                                                    |
| Measuring            | <b>MEASuring</b> | Selects the Measuring trigger signal to be output to the <b>Trig n Out</b> connector. This signal is true while the Measuring status bit is true                                                                                                                                                                                                                          |
| Main Trigger         | <b>MAIN</b>      | Selects the current instrument trigger signal to be output to the <b>Trig n Out</b> connector<br><br>Note: For multi segment sweeps, only the first sweep segment uses the selected trigger signal. All other sweep segments trigger using Free-Run and the trigger output will reflect that                                                                              |
| Gate Trigger         | <b>GTRigger</b>  | Selects the gate trigger signal to be output to the <b>Trig n Out</b> connector. This is the source of the gate timing, not the actual gate signal                                                                                                                                                                                                                        |
| Gate                 | <b>GATE</b>      | Selects the gate signal to be output to the <b>Trig n Out</b> connector. The gate signal has been delayed and its length determined by delay and length settings. When the polarity is positive, a high on the <b>Trig n Out</b> connector represents the time the gate is configured to pass the signal                                                                  |
| Odd/Even Trace Point | <b>OEVen</b>     | Selects either the odd or even trace points as the signal to be output to the <b>Trig n Out</b> connector when performing swept spectrum analysis. When the polarity is positive, this output goes high during the time the instrument is sweeping past the first point (Point 0) and every other following trace point. The opposite is true if the polarity is negative |
| Trigger Armed        | <b>TARMed</b>    | Selects the "trigger armed" trigger signal to be output to the <b>Trig n Out</b> connector. This signal is true when the instrument reaches its trigger armed state<br><br><i>Not available in modular instruments</i>                                                                                                                                                    |
| Source Point Trigger | <b>SPOint</b>    | Selects the gate signal to be output to the <b>Trig n Out</b> connector for use as the Point Trigger when operating an external source in Tracking mode. When Ext Trigger 1 is                                                                                                                                                                                            |

| Source          | SCPI            | Notes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|-----------------|-----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                 |                 | selected as the Point Trigger under <b>Source</b> , the Source Point Trigger under <b>Trig 1 Out</b> automatically gets selected. A similar pattern is used for the other Ext Trigger inputs; for example, when Ext Trigger 2 is selected as the Point Trigger under <b>Source</b> , the Source Point Trigger under <b>Trig 2 Out</b> automatically gets selected                                                                                                                                                                                             |
| Source Marker 1 | <b>S1Marker</b> | Only available in VXT and M941xE. For M9420A, only for <b>TRIG2</b> , for M9410A/11A/15A/16A available for both <b>TRIG1</b> and <b>TRIG2</b><br>Selects the Trigger Output at Marker 1 in the Waveform file that is currently playing                                                                                                                                                                                                                                                                                                                        |
| Source Marker 2 | <b>S2Marker</b> | Only available in VXT and M941xE. For M9420A, only for <b>TRIG2</b> , for M9410A/11A/15A/16A and M9410E/11E/15E/16E available for both <b>TRIG1</b> and <b>TRIG2</b><br>Selects the Trigger Output at Marker 2 in the Waveform file that is currently playing                                                                                                                                                                                                                                                                                                 |
| Source Marker 3 | <b>S3Marker</b> | Only available in VXT and M941xE. For M9420A, only for <b>TRIG2</b> , for M9410A/11A/15A/16A and M9410E/11E/15E/16E available for both <b>TRIG1</b> and <b>TRIG2</b><br>Selects the Trigger Output at Marker 3 in the Waveform file that is currently playing                                                                                                                                                                                                                                                                                                 |
| Source Marker 4 | <b>S4Marker</b> | Only available in VXT and M941xE. For M9420A, only for <b>TRIG2</b> , for M9410A/11A/15A/16A and M9410E/11E/15E/16E available for both <b>TRIG1</b> and <b>TRIG2</b><br>Selects the Trigger Output at Marker 4 in the Waveform file that is currently playing                                                                                                                                                                                                                                                                                                 |
| PerArb          | <b>PARB</b>     | Only available in VXT Models M9410A/11A/15A/16A and M9410E/11E/15E/16E<br>Selects the Trigger Output as PerArb. PerArb is a synchronization trigger which is generated by the ARB at the beginning of each repetition of playing the signal                                                                                                                                                                                                                                                                                                                   |
| FSYNc           | <b>FSYNc</b>    | Only available in VXT Models M9410A/11A/15A/16A and M9410E/11E/15E/16E<br>Selects the Trigger Output as <b>FSYNc</b> , routing the Periodic Timer Sync Source signal to the specified Trigger output. That is, the signal selected by <b>:TRIGger[:SEquence]:FRAMe:SYNc</b> is routed to the specified trigger output<br>The following example specifies that External 1 trigger will be used as the Periodic Timer Sync Source, and this signal will then be routed to the <b>Trigger 2</b> output:<br><b>TRIG:FRAM:SYNc EXT1</b><br><b>TRIG2:OUTP FSYNc</b> |
| —               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |

## 6.8.2 Trig 1 – 4 Out Polarity

Sets the output to the **Trig n Out** connector to trigger on either the positive or negative polarity.

|                |                                                                                                                                     |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <b>:TRIGger[1] 2 ... 4[:SEquence]:OUTPut:POLarity POSitive   NEGative</b><br><b>:TRIGger[1] 2 ... 4[:SEquence]:OUTPut:POLarity?</b> |
| Example        | <b>:TRIG1:OUTP:POL POS</b>                                                                                                          |



## 6 Input/Output

### 6.8 Trigger Output

|              |                                                                                                                                                                                                                                                                                                                                                                                                                           |
|--------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Dependencies | You can only send <b>TRIG</b> parameters for the hardware you have; for example, you cannot send a <b>TRIG3</b> parameter if your hardware does not support <b>TRIG3</b> . Sending the command for an output you do not have generates an error, "Hardware missing; Not available for this model number"<br>Querying a non-existent output returns <b>OFF</b><br><b>Trig 2 Out Polarity</b> does not appear in EXM or VXT |
| Preset       | Unaffected by Preset, but set to <b>POSitive</b> by <b>Restore Input/Output Defaults</b> or <b>Restore System Defaults-&gt;All</b>                                                                                                                                                                                                                                                                                        |
| State Saved  | Saved in instrument state                                                                                                                                                                                                                                                                                                                                                                                                 |

#### 6.8.3 Trig 1 – 4 Out Device

Sets the output to the **Trig n Out** connector to trigger on either **ANALyzer** or **SOURce**.

| Remote Command    | <b>:TRIGger[1] 2 ... 4[:SEquence]:OUTPut:DIRection ANALyzer   SOURce</b><br><b>:TRIGger[1] 2 ... 4[:SEquence]:OUTPut:DIRection?</b>                                |                   |        |         |                 |   |               |
|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|--------|---------|-----------------|---|---------------|
| Example           | <b>:TRIG1:OUTP:DIR ANAL</b>                                                                                                                                        |                   |        |         |                 |   |               |
| Dependencies      | Only available on VXT models M9410A/11A/15A/16A and M9410E/11E/15E/16E                                                                                             |                   |        |         |                 |   |               |
| Preset            | Unaffected by Preset<br><b>Restore Input/Output Defaults</b> and <b>Restore System Defaults-&gt;All</b> preset the triggers as follows:                            |                   |        |         |                 |   |               |
|                   | <table> <tr> <th>Trig n Out Device</th><th>Preset</th></tr> <tr> <td>1, 3, 4</td><td><b>ANALyzer</b></td></tr> <tr> <td>2</td><td><b>SOURce</b></td></tr> </table> | Trig n Out Device | Preset | 1, 3, 4 | <b>ANALyzer</b> | 2 | <b>SOURce</b> |
| Trig n Out Device | Preset                                                                                                                                                             |                   |        |         |                 |   |               |
| 1, 3, 4           | <b>ANALyzer</b>                                                                                                                                                    |                   |        |         |                 |   |               |
| 2                 | <b>SOURce</b>                                                                                                                                                      |                   |        |         |                 |   |               |
| State Saved       | Saved in instrument state                                                                                                                                          |                   |        |         |                 |   |               |

#### 6.8.4 Src PXI Trig Out

Selects which signal will be routed to the backplane Source PXI Trigger Output Line.

|                |                                                                                                                                                                                            |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <b>:TRIGger:PXIE:SOURce[:SEquence]:OUTPut S1Marker   S2Marker   S3Marker   S4Marker   PARB   OFF</b><br>See "Option details" on page 822<br><b>:TRIGger:PXIE:SOURce[:SEquence]:OUTPut?</b> |
| Example        | <b>:TRIG:PXIE:SOUR:OUTP S1M</b><br><b>:TRIG:PXIE:SOUR:OUTP?</b>                                                                                                                            |
| Dependencies   | Only appears in EXM, VXT and M941xE                                                                                                                                                        |
| Preset         | <b>OFF</b>                                                                                                                                                                                 |
| State Saved    | Saved in instrument state                                                                                                                                                                  |

## Option details

Here are details of all Source PXI Trigger Output options:

| Source          | SCPI            | Notes                                                                                                                                                                                                                                                                                                               |
|-----------------|-----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Off             | <b>OFF</b>      | Selects no signal to be output to the Source PXI backplane line                                                                                                                                                                                                                                                     |
| Source Marker 1 | <b>S1Marker</b> | Selects the Trigger Output at Marker 1 in the Waveform file that is currently playing to be output to the Source PXI backplane line                                                                                                                                                                                 |
| Source Marker 2 | <b>S2Marker</b> | Selects the Trigger Output at Marker 2 in the Waveform file that is currently playing to be output to the Source PXI backplane line                                                                                                                                                                                 |
| Source Marker 3 | <b>S3Marker</b> | Selects the Trigger Output at Marker 3 in the Waveform file that is currently playing to be output to the Source PXI backplane line                                                                                                                                                                                 |
| Source Marker 4 | <b>S4Marker</b> | Selects the Trigger Output at Marker 4 in the Waveform file that is currently playing to be output to the Source PXI backplane line                                                                                                                                                                                 |
| PerArb          | <b>PARB</b>     | A synchronization trigger that is generated by the ARB at the beginning of each repetition of playing the signal. This selection causes the PerArb Trigger Output that is currently playing to be output to the Source PXI backplane line<br>Only available in VXT Models M9410A/11A/15A/16A and M9410E/11E/15E/16E |

### 6.8.5 Src Trig Out Polarity

Sets the output to the Source PXI backplane trigger line to trigger on either the positive or negative polarity.

|                |                                                                                                                                       |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <b>:TRIGger:PXIE:SOURce[:SEquence]:OUTPut:POLarity POSitive   NEGative</b><br><b>:TRIGger:PXIE:SOURce[:SEquence]:OUTPut:POLarity?</b> |
| Example        | <b>:TRIG:PXIE:SOUR:OUTP:POL POS</b>                                                                                                   |
| Dependencies   | Only appears in EXM, VXT and M941xE                                                                                                   |
| Preset         | Unaffected by Preset, but set to <b>POSitive</b> by <b>Restore Input/Output Defaults</b> or <b>Restore System Defaults-&gt;All</b>    |
| State Saved    | Saved in instrument state                                                                                                             |

### 6.8.6 Select Src PXI Line

Controls which backplane trigger line **TRIG[0...7]** is used for the Source Trigger Output.

|                |                                                                                                                        |
|----------------|------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <b>:TRIGger:PXIE:SOURce[:SEquence]:OUTPut:LINE &lt;line&gt;</b><br><b>:TRIGger:PXIE:SOURce[:SEquence]:OUTPut:LINE?</b> |
|----------------|------------------------------------------------------------------------------------------------------------------------|

## 6 Input/Output

### 6.8 Trigger Output

|              |                                                 |
|--------------|-------------------------------------------------|
| Example      | <code>:TRIGger:PXIE:SOURce:OUTPut:LINE 0</code> |
| Dependencies | Only appears in EXM, VXT and M941xE             |
| Preset       | 4                                               |
| State Saved  | Saved in instrument state                       |
| Range        | [0,7]                                           |

### 6.8.7 Analyzer PXI Trig Out

Selects the signal that will be output from Analyzer PXI Trigger Line (Backplane Trigger Line 0~3).

|                |                                                                                                                                                                                                                                 |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:TRIGger:PXIE:ANALyzer[:SEquence]:OUTPut HSWP   MEASuring   MAIN   GATE   GTRigger   OEVen   OFF</code><br><br>See <a href="#">"Option Details" on page 823</a><br><code>:TRIGger:PXIE:ANALyzer[:SEquence]:OUTPut?</code> |
| Example        | <code>:TRIG:PXIE:ANAL:OUTP HSWP</code>                                                                                                                                                                                          |
| Dependencies   | Only available on certain modular analyzers, such as CXA-m, VXT models M9410A/11A/15A/16A and M9410E/11E/15E/16E<br><br>For VXT models M9410A/11A/15A/16A, only <b>OFF</b> , <b>MEASuring</b> and <b>MAIN</b> are available     |
| Preset         | Unaffected by <b>Preset</b> but is preset to <b>OFF</b> by <b>Restore Input/Output Defaults</b> or <b>Restore System Defaults-&gt;All</b>                                                                                       |
| State Saved    | Saved in instrument state                                                                                                                                                                                                       |

### Option Details

Here are details of all Analyzer PXI Trigger Output options:

| Source          | SCPI        | Notes                                                                                                                                                                                                                                          |
|-----------------|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Off             | <b>OFF</b>  | Selects no signal to be output to the Analyzer PXI backplane trigger line                                                                                                                                                                      |
| Sweeping (HSWP) | <b>HSWP</b> | Selects the Sweeping Trigger signal to be output to the Analyzer PXI backplane trigger line when a measurement is made. This signal has historically been known as "HSWP" (High = Sweeping), and is 5 V TTL level with 50-ohm output impedance |
| Measuring       | <b>MEAS</b> | Selects the Measuring trigger signal to be output to the Analyzer PXI backplane trigger line. This signal is true while the Measuring status bit is true                                                                                       |
| Main Trigger    | <b>MAIN</b> | Selects the current instrument trigger signal to be output to the Analyzer PXI backplane trigger line                                                                                                                                          |
| Gate Trigger    | <b>GTR</b>  | Selects the gate trigger signal to be output to the Analyzer PXI backplane trigger line. This is the source of the gate timing, not the actual gate signal                                                                                     |
| Gate            | <b>GATE</b> | Selects the gate signal to be output to the Analyzer PXI backplane trigger line. The gate signal has been delayed and its length determined by delay and length settings. When the                                                             |

| Source               | SCPI       | Notes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|----------------------|------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Odd/Even Trace Point | <b>OEV</b> | <p>polarity is positive, a high on the Trig Out connector represents the time the gate is configured to pass the signal</p> <p>Selects either the odd or even trace points as the signal to be output to the Analyzer PXI backplane trigger line when performing swept spectrum analysis. When the polarity is positive, this output goes high during the time the instrument is sweeping past the first point (Point 0) and every other following trace point. The opposite is true if the polarity is negative</p> |

### 6.8.8 Analyzer Trig Out Polarity

Sets the output to the Analyzer PXI backplane trigger line to trigger on either the positive or negative polarity.

|                |                                                                                                                                             |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <b>:TRIGger:PXIE:ANALyzer[:SEquence]:OUTPut:POLarity POSitive   NEGative</b><br><b>:TRIGger:PXIE:ANALyzer[:SEquence]:OUTPut:POLarity?</b>   |
| Example        | <b>:TRIG:PXIE:ANAL:OUTP:POL POS</b>                                                                                                         |
| Dependencies   | Only available on certain modular analyzers, such as CXA-m, VXT models M9410A/11A/15A/16A and M9410E/11E/15E/16E                            |
| Preset         | Unaffected by Preset, but set to <b>POSitive</b> by <b>Restore Input/Output Defaults</b> or <b>Restore System Defaults-&gt;All POSitive</b> |
| State Saved    | Saved in instrument state                                                                                                                   |

### 6.8.9 Select Analyzer PXI Line

Controls which **PXI\_TRIG[0...3]** is used for the Analyzer Trigger Output.

|                |                                                                                                                            |
|----------------|----------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <b>:TRIGger:PXIE:ANALyzer[:SEquence]:OUTPut:LINE &lt;line&gt;</b><br><b>:TRIGger:PXIE:ANALyzer[:SEquence]:OUTPut:LINE?</b> |
| Example        | <b>:TRIGger:PXIE:ANALyzer:OUTPut:LINE 0</b>                                                                                |
| Dependencies   | Only available on certain modular analyzers, such as CXA-m, VXT models M9410A/11A/15A/16A and M9410E/11E/15E/16E           |
| Preset         | 0                                                                                                                          |
| State Saved    | Saved in instrument state                                                                                                  |
| Range          | [0,3]                                                                                                                      |

### 6.8.10 Source Internal Trig Out

Selects the signal which will be output from Source Internal Trigger Line.

NOTE

In some software released in 2018 and 2019, the SCPI command for this function was as below:

```
:TRIGger:SOURce:INTernal[:SEquence]:OUTPut
S1Marker|S2Marker|S3Marker|S4Marker|OFF
```

It was necessary to change this SCPI in release A.24.00 due to internal conflicts in the software. User code written for the A.22.xx or A.23.xx instrument software which used the old form must be rewritten to use the form below.

|                |                                                                                                                                                                                                                             |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:TRIGger[:SEquence]:INTernal:SOURce:OUTPut S1Marker   S2Marker   S3Marker   S4Marker   PARB   OFF</code><br><code>:TRIGger[:SEquence]:INTernal:SOURce:OUTPut?</code>                                                  |
| Example        | <code>:TRIG:INT:SOUR:OUTP S1M</code>                                                                                                                                                                                        |
| Notes          | <b>PARB</b> (Per ARB) -A synchronization trigger that is generated by the ARB at the beginning of each repetition of playing the signal                                                                                     |
| Dependencies   | Only available on VXT models M9420A, M9410A/11A/15A/16A and M9410E/11E/15E/16E                                                                                                                                              |
| Preset         | Unaffected by Preset but preset by <b>Restore Input/Output Defaults</b> or <b>Restore System Defaults-&gt;All</b> .<br>The value is Mode-dependent:<br>Power Amplifier Mode: <b>S1Marker</b><br>All other Modes: <b>OFF</b> |
| State Saved    | Saved in instrument state                                                                                                                                                                                                   |

## 6.8.11 Source Internal Trig Out Polarity

Sets the output to the Source Internal trigger line to trigger on either the positive or negative polarity.

NOTE

In some software released in 2018 and 2019, the SCPI command for this function was as below:

```
:TRIGger:SOURce:INTernal[:SEquence]:OUTPut:POLarity
POSitive|NEGative
```

It was necessary to change this SCPI in release A.24.00 due to internal conflicts in the software. User code written for the A.22.xx or A.23.xx instrument software which used the old form must be rewritten to use the form below.

|                |                                                                                                                                                           |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:TRIGger[:SEquence]:INTernal:SOURce:OUTPut:POLarity POSitive   NEGative</code><br><code>:TRIGger[:SEquence]:INTernal:SOURce:OUTPut:POLarity?</code> |
| Example        | <code>:TRIG:INT:SOUR:OUTP:POL POS</code>                                                                                                                  |
| Dependencies   | Only available on VXT models and M9410E/11E/15E/16E                                                                                                       |
| Preset         | Unaffected by <b>Preset</b> , but set to <b>POSitive</b> by <b>Restore Input/Output Defaults</b> or <b>Restore System</b>                                 |

---

| Defaults->All |                           |
|---------------|---------------------------|
| State Saved   | Saved in instrument state |

---

## 6.9 Calibration

Lets you configure the Comb Calibrator. This tab only appears when an RCal license is installed. Settings associated with the Calibrator are configured here.

### 6.9.1 Configuration

Opens the dialog shown below. This is a full screen dialog. Configuring of Cals is done using this dialog. The table consists of rows of Cals and Columns of Cal settings. You can scroll or swipe vertically or horizontally to view Cals or settings not currently shown on the screen.

Dialog with Example Table entries:

Cal Group  
1

Cal Input  
RF Input

Calibrate Checked Rows

Apply Cal Group  
On  
Off

Copy From Cal Group  
2

Copy

Select Calibrator  
RCal Module 1

Serial #: SN1234567  
Version 1.20

RCal Reference  
Internal

Identify RCal Module

Cal Status

Calibration Configuration

Description  
Switch and Amplifier

Go to Row  
2

Insert Row Below

Use Current Meas

Duplicate Row

Delete Row

Delete All

|   | Calibrate                           | Apply                               | Name              | Last Cal             | Applied | Type      | Start Freq | Stop Fr |
|---|-------------------------------------|-------------------------------------|-------------------|----------------------|---------|-----------|------------|---------|
| 1 | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | Entire Instrument | Jul 23 2019 03:32 PM | --      | Magnitude | 910.0 MHz  | 910.0 M |
| 2 | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | Switch Cal        | May 14 2019 09:35 AM | --      | Complex   | 1.000 GHz  | 2.000 G |
| 3 | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | Amp Cal           | May 14 2019 09:35 AM | --      | Magnitude | 10 Hz      | 26.5 GH |

Full Cal Group Table with Example entries:

**RCal Calibrations Table**

Table will scroll vertically and horizontally

|    | Calibrate                           | Apply                               | Name                       | Last Cal             | Applied | External Mixer                             | Cal Type |
|----|-------------------------------------|-------------------------------------|----------------------------|----------------------|---------|--------------------------------------------|----------|
| 1  | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | Entire Instrument          | Aug 30 2018 03:32 PM | Yes     | 11970A : Normal                            | Vector   |
| 2  | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | Wednesday with remote head | Sep 1 2018 02:27 PM  | No      | Custom : Normal                            | Vector   |
| 3  | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | 20190119 3:54pm            | --                   | --      | 11970U : Normal                            | Vector   |
| 4  | <input type="checkbox"/>            | <input type="checkbox"/>            | 1 GHz – 3 GHz              | --                   | --      | 11970V : Normal                            | Scalar   |
| 5  | <input type="checkbox"/>            | <input type="checkbox"/>            | 2 GHz – 4 GHz              | --                   | --      | K Band Single Harmonic No Doubler : Normal | Scalar   |
| 6  | <input type="checkbox"/>            | <input type="checkbox"/>            | External Preamp            | --                   | --      | W Band Single Harmonic No Doubler : Normal | Scalar   |
| 7  | <input type="checkbox"/>            | <input type="checkbox"/>            | (None)                     |                      |         |                                            |          |
| 8  | <input type="checkbox"/>            | <input type="checkbox"/>            | (None)                     |                      |         |                                            |          |
| 9  | <input type="checkbox"/>            | <input type="checkbox"/>            | (None)                     |                      |         |                                            |          |
| 10 | <input type="checkbox"/>            | <input type="checkbox"/>            | (None)                     |                      |         |                                            |          |

Only shows when External Mixer is the selected Cal Input

|        |
|--------|
| Scalar |
| Vector |

| Start Freq | Stop Freq | Freq Step   | Freq Points | Mech Atten | Mech Atten Start | Mech Atten Stop | Mech Atten Step | Elec Atten | Elec Atten Start |
|------------|-----------|-------------|-------------|------------|------------------|-----------------|-----------------|------------|------------------|
| 910.0 MHz  | 910.0 MHz | 0 Hz        | 1           | Step       | 0 dB             | 10 dB           | 2 dB            | Step       | 0 dB             |
| 1.000 GHz  | 2.000 GHz | 100.000 MHz | 100         | Reference  | 900 dB           | 900 dB          | 0 dB            | Bypass     | 0 dB             |
| 10 Hz      | 26.5 GHz  | 0 Hz        | 3           | All        | 0 dB             | 700 dB          | 2 dB            | All        | 0 dB             |
| 1.000 GHz  | 3.000 GHz | 100.00 MHz  | 20          | Step       | 10 dB            | 50 dB           | 10 dB           | Step       | 10 dB            |
| 2.000 GHz  | 4.000 GHz | 10.000 MHz  | 200         | Bypass     | 0 dB             | 700 dB          | 2 dB            | All        | 0 dB             |
| 2.000 GHz  | 2.000 GHz | 0 Hz        | 1           | Reference  | 900 dB           | 900 dB          | 0 dB            | Reference  | 900 dB           |
|            |           |             |             |            |                  |                 |                 |            |                  |
|            |           |             |             |            |                  |                 |                 |            |                  |
|            |           |             |             |            |                  |                 |                 |            |                  |
|            |           |             |             |            |                  |                 |                 |            |                  |

|        |
|--------|
| Step   |
| All    |
| Bypass |

|        |
|--------|
| Step   |
| All    |
| Bypass |



| Elec Atten Stop | Elec Atten Step | Full Atten | Full Atten Start | Full Atten Stop | Freq Ext Atten | Freq Ext Atten Start | Freq Ext Atten Stop | IF Path |
|-----------------|-----------------|------------|------------------|-----------------|----------------|----------------------|---------------------|---------|
| 10 dB           | 5 dB            | Step       | 0 dB             | 6 dB            | Step           | 0 dB                 | 6 dB                | 10 MHz  |
| 00 dB           | 00 dB           | All        | 00 dB            | 00 dB           | All            | 00 dB                | 00 dB               | 510 MHz |
| 20 dB           | 1 dB            | All        | 00 dB            | 200 dB          | All            | 00 dB                | 200 dB              | 25 MHz  |
| 20 dB           | 2 dB            | Step       | 6 dB             | 20 dB           | Step           | 6 dB                 | 20 dB               | 10 MHz  |
| 20 dB           | 1 dB            | All        | 00 dB            | 200 dB          | All            | 00 dB                | 200 dB              | 25 MHz  |
| 00 dB           | 00 dB           | All        | 000 dB           | 000 dB          | All            | 000 dB               | 000 dB              | 40 MHz  |
|                 |                 |            |                  |                 |                |                      |                     |         |
|                 |                 |            |                  |                 |                |                      |                     |         |
|                 |                 |            |                  |                 |                |                      |                     |         |
|                 |                 |            |                  |                 |                |                      |                     |         |

Step

All

Step

All

10 MHz

25 MHz

40 MHz

510 MHz

1 GHz

2 GHz

4 GHz

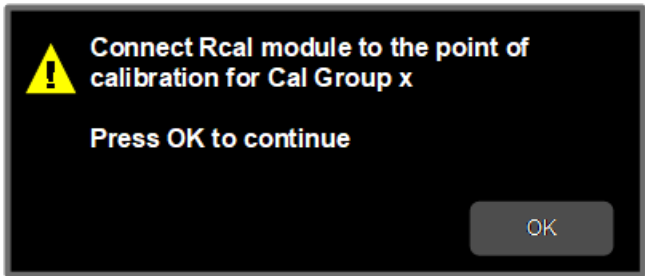
6.9.1.1 Cal Group

This is the same as "Cal Group" on page 862 in the Calibration tab.

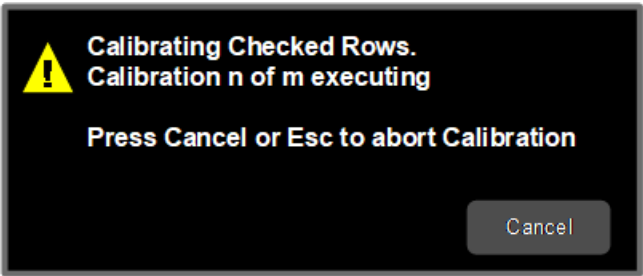
6.9.1.2 Calibrate Checked Rows

Executes the Cals within the currently selected Cal Group that have the Calibrate box checked in the RCal Configuration Table.

Once selected, the following dialog box is displayed;



When you click OK, the following dialog is displayed;



If there are multiple Cals being executed in a Cal Group, this dialog advises you when each Cal is complete. It also provides the ability to abort the Execute Cal Request.

If you choose to abort, calibrations that have completed use the new Cal data and update the Last Cal field. Calibrations that have not completed retain the existing Cal data and Last Cal timestamp, or show “---” if the Cal had never been executed.

|                |                                                                                                                                                                                                                         |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | :SYSTem:CALibration:INITiate:SElected                                                                                                                                                                                   |
| Example        | :SYST:CAL:INIT:SEL                                                                                                                                                                                                      |
| Notes          | Cals cannot be applied until they have been calibrated. Once a Cal has been calibrated, the Last Cal field in the table displays the date and time the Cal was last calibrated                                          |
| Dependencies   | Applied to the currently selected Cal Group                                                                                                                                                                             |
| Couplings      | <b>Calibrate Selected</b> is disabled if there are no Calibrate checkboxes checked. If the disabled control is selected, the advisory message “Check the Calibrate box for the Cals you want to calibrate” is displayed |

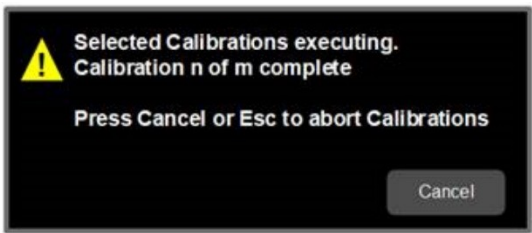
6.9.1.3 Apply Cal Group

This is the same as "Apply Cal Group" on page 862 in the Calibration tab.

6.9.1.4 Abort Calibration

Aborts the Calibration routine of the currently selected Cal Group

|                |                                                                                                                                                                                                                                                                                                            |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | :SYSTem:CALibration:ABORt                                                                                                                                                                                                                                                                                  |
| Example        | :SYST:CAL:ABOR                                                                                                                                                                                                                                                                                             |
| Dependencies   | Aborts the currently running calibration. The previously-run calibrations will still be available, but the current calibration is halted, and next calibrations selected are not executed. Once the calibration starts, the modal dialog appears, and the abort can be executed by selecting <b>Cancel</b> |



6.9.1.5 Copy From Cal Group

Determines the Cal Group from which existing rows are copied when using the "Copy" on page 831 Group feature.

|                |                                                                                         |
|----------------|-----------------------------------------------------------------------------------------|
| Remote Command | :SYSTem:CALibration:CGROUP:COPY:FROM <integer><br>:SYSTem:CALibration:CGROUP:COPY:FROM? |
| Example        | :SYST:CAL:CGR:COPY:FROM 2<br>:SYST:CAL:CGR:COPY:FROM?                                   |
| Preset         | 1                                                                                       |
| Min            | 1                                                                                       |
| Max            | 100                                                                                     |

6.9.1.6 Copy

Lets you copy the settings in the Cal Group specified by the Copy From Cal Group parameter.

All the rows in the table are copied to the selected Cal Group. The columns Apply, Last Cal and Applied are set to their default values.

The group level parameters are also copied, with the exception of Apply Cal Group and Copy From Cal Group.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | :SYSTem:CALibration:CGROUP:COPY                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Example        | :SYST:CAL:CGROUP:COPY                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Dependencies   | Applied to the currently selected Cal Group                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Couplings      | Disabled if Copy From Cal Group is the same as the currently selected Cal Group. If the disabled control is selected, the advisory message "Unable to Copy from same Cal Group" is displayed, and the same message is returned remotely as a Settings Conflict<br><br>If you attempt to copy from a Cal Group that is empty, the advisory message "Copy From Cal Group is empty" is displayed, and the same message is returned remotely as a Settings Conflict |

### 6.9.1.7 Tone Spacing Multiplier (Remote Command Only)

A multiplier to apply to the default tone spacing used when making vector calibrations. A value greater than one results in a larger tone space. A value smaller than one results in smaller tone space. Smaller tone space reduces the tone power and may result in longer calibration time.

|                |                                                                                                                                               |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SYSTem:CALibration:ROW[1] 2 ... 100:TSMultiplier &lt;Val&gt;</code><br><code>:SYSTem:CALibration:ROW[1] 2 ... 100:TSMultiplier?</code> |
| Example        | <code>:SYST:CAL:ROW2:TSM 0.5</code>                                                                                                           |
| Preset         | <b>1</b>                                                                                                                                      |
| Min            | <b>0.125</b>                                                                                                                                  |
| Max            | <b>8</b>                                                                                                                                      |

### 6.9.1.8 Cal Input

Maps the currently selected Cal Group to a particular I/O port. This control allows any Input port (including External Mixing, the RF2 input, etc.) to be mapped to a specific Cal Group

|                |                                                                                                                                                                              |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SYSTem:CALibration:INPut RFIN   RFIN2    EMIXer   ERFIN</code><br>See <a href="#">"Option Details" on page 832</a><br><code>:SYSTem:CALibration:INPut?</code>         |
| Example        | <code>:SYST:CAL:INPut RFIN2</code>                                                                                                                                           |
| Dependencies   | <b>RFIN2</b>   <b>EMIXer</b> are only available on C/E/M/P/UXA analyzers with the appropriate options loaded<br><b>ERFIN</b> is only available if a V3050A unit is connected |
| State Saved    | Saved in State                                                                                                                                                               |

### Option Details

Note that the presence of these ports is highly hardware dependent.

| Cal Input      | SCPI         | Notes                                                                       |
|----------------|--------------|-----------------------------------------------------------------------------|
| RF Input       | <b>RFIN</b>  | Main RF Port<br>Not available on EXM with hardware M9431A                   |
| RF Input 2     | <b>RFIN2</b> | Second RF Port, labeled RF Input 2<br>Only available on certain instruments |
| External Mixer | <b>EMIX</b>  | Requires option EXM                                                         |
| External RF    | <b>ERFIN</b> | Only available if a V3050A unit is connected                                |

### 6.9.1.9 Freq Offset

Specifies any frequency offset that is to be applied to the currently selected Cal Group. This can be used when using an external mixer.

|                |                                                                                                                      |
|----------------|----------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SYSTem:CALibration:FREQuency:OFFSet &lt;freq&gt;</code><br><code>:SYSTem:CALibration:FREQuency:OFFSet?</code> |
| Example        | <code>:SYST:CAL:FREQ:OFFS 1e9</code>                                                                                 |
| Dependencies   | The query applies to the currently selected Cal Group                                                                |
| Preset         | All 0 Hz                                                                                                             |
| State Saved    | Saved in instrument state                                                                                            |
| Min            | 0 Hz                                                                                                                 |
| Max            | 100.0 GHz                                                                                                            |

### 6.9.1.10 Select Calibrator

Selects the calibrator for the currently selected Cal Group to use for executing the calibration when multiple modules are connected.

|                |                                                                                                                                                                                                                                                                                                                 |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SYSTem:CALibration:MODule:SElect NONE   RCM1   RCM2   RCM3   RCM4   RCM5   RCM6   RCM7   RCM8   RCM9   RCM10</code><br><code>:SYSTem:CALibration:MODule:SElect?</code>                                                                                                                                   |
| Example        | <code>:SYST:CAL:MODule:SElect RCM1</code>                                                                                                                                                                                                                                                                       |
| Notes          | Details of the RCal module are displayed beneath the control. If there are no modules connected, the text states "No Modules Connected"<br><br>For SCPI, if the parameter sent is for a module that is not currently connected to the instrument, the message "Selected RCal module not connected" is generated |
| Dependencies   | The SCPI command is applied to the currently selected Cal Group                                                                                                                                                                                                                                                 |
| State Saved    | Saved in instrument state                                                                                                                                                                                                                                                                                       |
| Range          | All connected RCal modules                                                                                                                                                                                                                                                                                      |

### 6.9.1.11 Identify RCal Module

Control to connect to the RCal module of the currently selected Cal Group and blink its identity light

### 6.9.1.12 RCal Module Serial Number (Remote Query Only)

Returns the serial number of the specified module

|                |                                                                                            |
|----------------|--------------------------------------------------------------------------------------------|
| Remote Command | <code>:SYSTem:CALibration:MODule[1] 2 ... 10:SNUMber?</code>                               |
| Example        | <code>:SYST:CAL:MOD:SNUM?</code>                                                           |
| Notes          | If there is no module associated with the specified module number, returns an empty string |

### 6.9.1.13 RCal Reference

Determines the reference type used by the RCal module of the currently selected Cal Group

|                |                                                                                                               |
|----------------|---------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SYSTem:CALibration:REference INTernal   EXTernal</code><br><code>:SYSTem:CALibration:REference?</code> |
| Example        | <code>:SYST:CAL:REF EXT</code>                                                                                |
| Dependencies   | The SCPI command is applied to the currently selected Cal Group                                               |
| Preset         | <code>EXTernal</code>                                                                                         |
| State Saved    | Saved in instrument state                                                                                     |
| Range          | <code>INTernal EXTernal</code>                                                                                |

### 6.9.1.14 RCal Status

Opens a dialog that is used to provide the status of all active rows in all groups. Status can be one of the following: Calibrated, Applied, Calibration Failed or Apply Failed.

If a Calibration Fails, an error icon is shown in the **Calibrate** column of the row(s) that failed, with a message indicating the nature of the failure. If the failure cannot be addressed by the user, the error message "Calibration Failed. See Error Log" will be shown and details of the failure will be written to the SA Event Log.

Applying the Calibration can result in a warning if there is a mismatch between the currently executing instrument state and any of the following parameter settings;

- Cal Input
- Frequency
- IF Path
- IF Gain
- Phase Noise Optimization
- Preamp

- Coupling
- Mechanical Attenuator
- Electrical Attenuator
- Full Range Attenuator
- uW Path Control
- Mixing Mode
- External Mixer

When there is a mismatch a warning icon will be shown in the Applied column of the row(s) that had the mismatch with details in the format “<Parameter Name> does not match meas state”.

The Status dialog provides you with the group and row of a Calibration and its current state and any error details if the status is not OK.

**RCal Status (Remote Query Only)**

Returns a comma-separated list of the status of an individual row status in the format “Group”, “Row”, ‘Status’, “Details”

|                |                                                                                                                                                                                                                                                                                                                         |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | :SYSTem:CALibration:ROW[1]   2   ...   100:STATus?                                                                                                                                                                                                                                                                      |
| Example        | Return a comma-separated list for the status of an individual row, in the format “Group”, “Row”, ‘Status’, “Details”:<br>:SYST:CAL:ROW2:STAT?                                                                                                                                                                           |
| Dependencies   | The SCPI command is applied to the currently selected Cal Group. The subopcode is used to identify the Cal row in the Cal Group<br>If the subopcode does not reference an existing Cal row in the Cal Group, the error message “-221, Settings conflict; Subopcode does not reference an existing Cal row” is generated |

**All RCal Status (Remote Query Only)**

Returns a comma-separated list of all entries in the Cal Status table in the format “Group”, “Row”, ‘Status’, “Details”, which is repeated for each row in the table. If there are no entries in the table, returns an empty string.

|                |                                                                                                                                                                                    |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | :SYSTem:CALibration:STATus:ALL?                                                                                                                                                    |
| Example        | Return a comma-separated list of all entries in the Cal Status table in the format “Group”, “Row”, ‘Status’, “Details”, repeated for each row in the table:<br>:SYST:CAL:STAT:ALL? |

### 6.9.1.15 Go to Row

Sets the selected row in the Cal table for the currently selected Cal Group.

|             |                                                      |
|-------------|------------------------------------------------------|
| Notes       | You can only go to a row that has already been added |
| Preset      | 1                                                    |
| State Saved | Saved in instrument state                            |
| Min         | 1                                                    |
| Max         | 32                                                   |

### 6.9.1.16 Insert Row Below

Adds a new row to the currently selected Cal Group, under the currently selected row in the table or after the sub opcode used in the SCPI command. The default values for each of the settings in the row is used.

|                |                                                                                                                                                                                                                                                                                                                         |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SYSTem:CALibration:ROW[1]   2   ...   100:INSert</code>                                                                                                                                                                                                                                                          |
| Example        | <code>:SYST:CAL:ROW2:INSert</code>                                                                                                                                                                                                                                                                                      |
| Dependencies   | The SCPI command is applied to the currently selected Cal Group. The subopcode is used to identify the Cal row in the Cal Group<br>If the subopcode does not reference an existing Cal row in the Cal Group, the error message “-221, Settings conflict; Subopcode does not reference an existing Cal row” is generated |

### 6.9.1.17 Description

Provides a description for the currently selected Cal Group from which the operator can easily identify the Cal Group.

|                |                                                                                                             |
|----------------|-------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SYSTem:CALibration:DESCription "Description"</code><br><code>:SYSTem:CALibration:DESCription?</code> |
| Example        | <code>:SYST:CAL:DESC "Description"</code>                                                                   |
| Notes          | Also shown on the <b>Calibration</b> menu panel, but limited to the first 18 characters                     |
| Dependencies   | The SCPI command is applied to the currently selected Cal Group                                             |
| State Saved    | Saved in instrument state                                                                                   |

### 6.9.1.18 Use Current Meas

Takes the settings from the current running measurement state to populate the Cal Row settings of the currently selected Cal Group.



|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SYSTem:CALibration:ROW[1] 2 ... 100:UCMeas</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Example        | <code>:SYST:CAL:ROW2:UCM</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Dependencies   | <p>The SCPI command is applied to the currently selected Cal Group. The subopcode is used to identify the Cal row in the Cal Group</p> <p>If the group table is empty and subopcode is omitted or 1, a new row is created and populated using the current running measurement</p> <p>If the subopcode does not reference an existing Cal row in the Cal Group, the error message “-221,Settings conflict; Subopcode does not reference an existing Cal row” is generated</p> <p>Pressing the control or sending the SCPI command in measurements that do not support this parameter generates error -221, “Settings conflict; Feature not supported for this measurement”</p> |

### 6.9.1.19 Duplicate Row

Creates a new row the currently selected row, and populates the new row with the settings from the selected row of the currently selected Cal Group

|                |                                                                                                                                                                                                                                                                                                                                   |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SYSTem:CALibration:ROW[1] 2 ... 100:DUPLicate</code>                                                                                                                                                                                                                                                                       |
| Example        | <code>:SYST:CAL:ROW2:DUPL</code>                                                                                                                                                                                                                                                                                                  |
| Dependencies   | <p>The SCPI command is applied to the currently selected Cal Group. The subopcode is used to identify the Cal row in the Cal Group</p> <p>If the subopcode does not reference an existing Cal row in the Cal Group, the error message “-221,Settings conflict; Subopcode does not reference an existing Cal row” is generated</p> |

### 6.9.1.20 Delete Row

Deletes the settings from the selected row of the currently selected Cal Group

|                |                                                                                                                                                                                                                                                                                                                                    |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SYSTem:CALibration:ROW[1] 2 ... 100:DELeTe</code>                                                                                                                                                                                                                                                                           |
| Example        | <code>:SYST:CAL:ROW2:DEL</code>                                                                                                                                                                                                                                                                                                    |
| Notes          | Disabled if the Cal Group contains no Cal rows                                                                                                                                                                                                                                                                                     |
| Dependencies   | <p>The SCPI command is applied to the currently selected Cal Group. The subopcode is used to identify the Cal row in the Cal Group</p> <p>If the subopcode does not reference an existing Cal row in the Cal Group, the error message “-221, Settings conflict; Subopcode does not reference an existing Cal row” is generated</p> |

### 6.9.1.21 Delete All

Deletes all the Cals in the currently selected Cal Group

|                |                                             |
|----------------|---------------------------------------------|
| Remote Command | <code>:SYSTem:CALibration:DELeTe:ALL</code> |
|----------------|---------------------------------------------|

|              |                                                                 |
|--------------|-----------------------------------------------------------------|
| Example      | <code>:SYST:CAL:DEL:ALL</code>                                  |
| Notes        | Disabled if the Cal Group contains no Cal rows                  |
| Dependencies | The SCPI command is applied to the currently selected Cal Group |

### 6.9.1.22 Calibrate

Determines whether the Cal row should be included when Calibrate Selected is executed.

|                |                                                                                                                                                                                                                                                                                                                         |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SYSTem:CALibration:ROW[1] 2 ... 100:CALibrate:STATe ON   OFF   1   0</code><br><code>:SYSTem:CALibration:ROW[1] 2 ... 100:CALibrate:STATe?</code>                                                                                                                                                                |
| Example        | <code>:SYST:CAL:ROW2:CAL:STAT ON</code><br><code>:SYST:CAL:ROW2:CAL:STAT?</code>                                                                                                                                                                                                                                        |
| Dependencies   | The SCPI command is applied to the currently selected Cal Group. The subopcode is used to identify the Cal row in the Cal Group<br>If the subopcode does not reference an existing Cal row in the Cal Group, the error message “-221, Settings conflict; Subopcode does not reference an existing Cal row” is generated |
| Preset         | All <b>OFF</b>                                                                                                                                                                                                                                                                                                          |
| State Saved    | Saved in instrument state                                                                                                                                                                                                                                                                                               |
| Range          | <b>ON OFF</b>                                                                                                                                                                                                                                                                                                           |

### 6.9.1.23 Apply

Determines the Cal that is applied.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SYSTem:CALibration:ROW[1] 2 ... 100:APPLY:STATe ON   OFF   1   0</code><br><code>:SYSTem:CALibration:ROW[1] 2 ... 100:APPLY:STATe?</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Example        | <code>:SYST:CAL:ROW2:APPL:STAT ON</code><br><code>:SYST:CAL:ROW2:APPL:STAT?</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Dependencies   | The SCPI command is applied to the currently selected Cal Group. The subopcode is used to identify the Cal row in the Cal Group<br>If the subopcode does not reference an existing Cal row in the Cal Group, the error message “-221, Settings conflict; Subopcode does not reference an existing Cal row” is generated<br>You can only check the <b>Apply</b> checkbox for a Cal that has been executed. If you attempt to select the <b>Apply</b> checkbox for Cal's that have not been executed, the advisory message “Cal must be executed before it can be applied” is displayed<br>If Apply Cal is <b>ON</b> , and you attempt to check the <b>Apply</b> checkbox for a Cal that is invalid for use with the current measurement state, the error “Cal invalid with current measurement settings is shown, and the checkbox remains unchecked” |
| Couplings      | When the <b>Apply</b> check box is checked, if the Apply Cal Group setting is <b>OFF</b> , it will be turned on. Calibrations are only applied when the Apply Cal Group is <b>ON</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |

|             |                                                                                                                                                                           |
|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Preset      | All <b>OFF</b>                                                                                                                                                            |
| State Saved | Saved in instrument state                                                                                                                                                 |
| Range       | <b>ON OFF</b>                                                                                                                                                             |
| Annotation  | If any Cal check box in any group is checked and Apply Cal Group for that group is <b>ON</b> , RCal in the Meas Bar displays in amber to indicate Calibrations are in use |

#### 6.9.1.24 Name

Sets an ASCII text field allowing you to name the selected Cal

|                |                                                                                                                                                                                                                                                                                                                         |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <b>:SYSTem:CALibration:ROW[1] 2 ... 100:NAME &lt;string&gt;</b><br><b>:SYSTem:CALibration:ROW[1] 2 ... 100:NAME?</b>                                                                                                                                                                                                    |
| Example        | <b>:SYST:CAL:ROW2:NAM "Monday AM Cal"</b>                                                                                                                                                                                                                                                                               |
| Notes          | 45 chars max; may not fit on display if max chars used                                                                                                                                                                                                                                                                  |
| Dependencies   | The SCPI command is applied to the currently selected Cal Group. The subopcode is used to identify the Cal row in the Cal Group<br>If the subopcode does not reference an existing Cal row in the Cal Group, the error message "-221, Settings conflict; Subopcode does not reference an existing Cal row" is generated |
| Preset         | "Cal #", where # is corresponding Cal number                                                                                                                                                                                                                                                                            |
| State Saved    | Saved in instrument state                                                                                                                                                                                                                                                                                               |

#### 6.9.1.25 Last Cal

Displays the date and time the selected Cal was last executed. Read only field.

|                |                                                                                                                                                                                                                                                    |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <b>:SYSTem:CALibration:ROW[1] 2 ... 100:LAST?</b>                                                                                                                                                                                                  |
| Example        | Return data and time Cal 2 was last executed:<br><b>:SYST:CAL:ROW2:LAST?</b>                                                                                                                                                                       |
| Notes          | Returns a string containing the date and time the Cal was executed. If the Cal has never been executed, or any of the settings are changed, SCPI returns an empty string, and the front panel displays "---"                                       |
| Dependencies   | The SCPI query applies to the currently selected Cal Group<br>If the subopcode does not reference an existing Cal row in the Cal Group, the error message "-221, Settings conflict; Subopcode does not reference an existing Cal row" is generated |

#### 6.9.1.26 Cal Applied

Displays the status of a Cal once it is applied. Is either Yes or No, depending on if the Cal was successfully applied or not. See RCalStatus for more details. If it is not being applied, the field shows "---". Read-only field.

|                |                                                                                                                                                                                                                                                    |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SYSTem:CALibration:ROW[1] 2 ... 100:CAPPlied?</code>                                                                                                                                                                                        |
| Example        | Return Cal Stats of Cal 2:<br><code>:SYST:CAL:ROW2:CAPP?</code>                                                                                                                                                                                    |
| Notes          | Returns a string containing the date and time the Cal was executed. If the Cal has never been executed, or any of the settings are changed, SCPI returns an empty string, and the front panel displays "---"                                       |
| Dependencies   | The SCPI query applies to the currently selected Cal Group<br>If the subopcode does not reference an existing Cal row in the Cal Group, the error message "-221, Settings conflict; Subopcode does not reference an existing Cal row" is generated |

### 6.9.1.27 Cal Type

Specifies how the calibration is to be performed on the selected Cal. Options are;

- **MAGNitude**: A single CW tone is measured at the center of the screen for each frequency point
- **COMPLex**: A comb signal is measured across the full IF passband at each frequency point. Magnitude and Phase are measured

|                |                                                                                                                                                                                                                                                                                                                                                                                     |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SYSTem:CALibration:ROW[1] 2 ... 100:TYPE MAGNitude   COMPLex</code><br><code>:SYSTem:CALibration:ROW[1] 2 ... 100:TYPE?</code>                                                                                                                                                                                                                                               |
| Example        | <code>:SYST:CAL:ROW2:TYPE COMP</code>                                                                                                                                                                                                                                                                                                                                               |
| Dependencies   | Only available if the selected RCal module has a license for complex calibrations. If it does not, this control is disabled<br>The SCPI command applies to the currently selected Cal Group<br>If the subopcode does not reference an existing Cal row in the Cal Group, the error message "-221, Settings conflict; Subopcode does not reference an existing Cal row" is generated |
| Preset         | <b>MAGNitude</b>                                                                                                                                                                                                                                                                                                                                                                    |
| State Saved    | Saved in instrument state                                                                                                                                                                                                                                                                                                                                                           |
| Range          | <b>MAGNitude COMPLex</b>                                                                                                                                                                                                                                                                                                                                                            |

### 6.9.1.28 Start Freq

Specifies the start frequency of the selected Cal.

|                |                                                                                                                                                      |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SYSTem:CALibration:ROW[1] 2 ... 100:FREQuency:STARt &lt;freq&gt;</code><br><code>:SYSTem:CALibration:ROW[1] 2 ... 100:FREQuency:STARt?</code> |
| Example        | <code>:SYST:CAL:ROW2:FREQ:STAR 1e9</code>                                                                                                            |
| Notes          | Max values depend on Hardware Options (503, 507, 508, 513, 526)                                                                                      |
| Dependencies   | The SCPI command applies to the currently selected Cal Group                                                                                         |

|             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|             | <p>If the subopcode does not reference an existing Cal row in the Cal Group, the error message “-221, Settings conflict; Subopcode does not reference an existing Cal row” is generated</p> <p>By direct entry:</p> <p>You cannot set Start Frequency &gt; Stop Frequency. You can set the Start frequency = Stop frequency. If you set Start Frequency = Stop Frequency, <b>"Freq Step" on page 842</b> is adjusted to 0, and <b>"Freq Points" on page 843</b> is adjusted to 1</p> <p>With the knob or step keys:</p> <p>If you set Start Frequency = Stop Frequency, <b>Freq Step</b> is adjusted to 0, and <b>Freq Points</b> is adjusted to 1</p>                                                                                                                          |
| Couplings   | <p>If you change the start frequency of the selected range to a value &gt; the range's stop frequency, the stop frequency of the previous range is changed to the same value. <b>Freq Step</b> is set to 0 Hz and <b>Freq Points</b> is set to 1</p> <p>If you change the start frequency &lt;= min frequency of the instrument, the start frequency of the selected range is set to the minimum frequency of the instrument</p> <p>If you change the start frequency &gt;= maximum frequency of the instrument, the start frequency of the selected range is set to the maximum frequency of the instrument and the stop frequency of selected range is set to the maximum frequency of the instrument. <b>Freq Step</b> is set to 0 Hz and <b>Freq Points</b> is set to 1</p> |
| Preset      | Depends on the instrument maximum frequency                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| State Saved | Saved in instrument state                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Min         | If <b>Scale Type</b> is set to Lin, the min Start Frequency changes to -80 MHz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Max         | Depends on the instrument maximum frequency – 10 Hz minimum span                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |

### 6.9.1.29 Stop Freq

Specifies the stop frequency of the selected Cal.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <pre>:SYSTem:CALibration:ROW[1] 2 ... 100:FREQUENCY:STOP &lt;freq&gt; :SYSTem:CALibration:ROW[1] 2 ... 100:FREQUENCY:STOP?</pre>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Example        | <pre>:SYST:CAL:ROW2:FREQ:STOP 1e9</pre>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Notes          | Max values depend on Hardware Options                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Dependencies   | <p>The SCPI command applies to the currently selected Cal Group</p> <p>If the subopcode does not reference an existing Cal row in the Cal Group, the error message “-221, Settings conflict; Subopcode does not reference an existing Cal row” is generated</p> <p>By direct entry:</p> <p>You cannot set Stop frequency &lt; Start frequency. You cannot set Start frequency = Stop frequency. You can set Start frequency = Stop frequency. If you set Start Frequency = Stop Frequency, <b>"Freq Step" on page 842</b> is adjusted to 0, and <b>"Freq Points" on page 843</b> is adjusted to 1</p> <p>With the knob or step keys:</p> <p>If you set Start Frequency = Stop Frequency, <b>Freq Step</b> is adjusted to 0, and <b>Freq Points</b> is adjusted to 1</p> |

|             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Couplings   | <p>If you change the stop frequency of the selected range to a value &lt; the range's start frequency the start frequency of the range is changed to the same value. <b>Freq Step</b> is set to 0 Hz and <b>Freq Points</b> is set to 1</p> <p>If you change the stop frequency &gt;= the maximum frequency of the instrument, the stop frequency of the selected range is set to the maximum frequency of the instrument</p> <p>If you change stop frequency &lt;= the minimum frequency of the instrument, the stop frequency of the selected range is set to the minimum frequency of the instrument and the start frequency of the selected range is set to the minimum frequency of the instrument. <b>Freq Step</b> is set to 0 Hz and <b>Freq Points</b> is set to 1</p> |
| Preset      | Depends on the instrument maximum frequency                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| State Saved | Saved in instrument state                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Min         | If <b>Scale Type</b> is Lin, the min Stop Frequency is changed to -79.999990 MHz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Max         | Depends on the instrument maximum frequency                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |

### 6.9.1.30 Freq Step

Specifies the step frequency of the selected Cal. This determines the points between the start and stop frequencies to use for Calibration.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <pre>:SYSTem:CALibration:ROW[1] 2 ... 100:FREQuency:STEP &lt;freq&gt; :SYSTem:CALibration:ROW[1] 2 ... 100:FREQuency:STEP?</pre>                                                                                                                                                                                                                                                                                                                                                                     |
| Example        | <pre>:SYST:CAL:ROW2:FREQ:STEP 1e9</pre>                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Notes          | Max values depend on Hardware Options                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Dependencies   | <p>The SCPI command applies to the currently selected Cal Group</p> <p>If the subopcode does not reference an existing Cal row in the Cal Group, the error message "-221, Settings conflict; Subopcode does not reference an existing Cal row" is generated</p> <p>You cannot set <b>Freq Step</b> &gt; Stop frequency - Start frequency</p> <p>Attempts to set <b>Freq Step</b> &gt; Stop frequency - Start frequency results in <b>Freq Step</b> being set to Stop frequency - Start frequency</p> |
| Couplings      | <p>Coupled to "<b>Freq Points</b>" on page 843. Changing <b>Freq Step</b> adjusts <b>Freq Points</b> using <math>((\text{Stop Freq} - \text{Start Freq}) / \text{Freq Step}) + 1</math> and clips to the next integer value, which may result in <b>Freq Step</b> being clipped too</p> <p>If <b>Freq Step</b> is set to a value &gt; Stop Freq - Start Freq <b>Stop Freq</b> is increased, and <b>Freq Points</b> is set to 1</p>                                                                   |
| Preset         | All 10 kHz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| State Saved    | Saved in instrument state                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Min            | 1 Hz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Max            | Depends on the instrument maximum frequency                                                                                                                                                                                                                                                                                                                                                                                                                                                          |

### 6.9.1.31 Freq Points

Specifies the frequency points of the selected Cal. This determines the points between the start and stop frequencies to use for Calibration.

|                |                                                                                                                                                                                                                                              |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SYSTem:CALibration:ROW[1] 2 ... 100:FREQuency:POINts</code><br><code>:SYSTem:CALibration:ROW[1] 2 ... 100:FREQuency:POINts?</code>                                                                                                    |
| Example        | <code>:SYST:CAL:ROW2:FREQ:POIN 100</code>                                                                                                                                                                                                    |
| Couplings      | Coupled to " <b>Freq Step</b> " on page 842. Changing <b>Freq Points</b> adjusts <b>Freq Step</b> using (Stop Freq – Start Freq) / (Freq Points – 1) and clips to the next integer value, which may result in <b>Freq Step</b> being clipped |
| Preset         | 1                                                                                                                                                                                                                                            |
| Min            | 1                                                                                                                                                                                                                                            |
| Max            | 100000                                                                                                                                                                                                                                       |

### 6.9.1.32 Mech Atten Type

Specifies the Mech Atten type to use:

- **STEP**: Use multiple Mech Atten states determined by Mech Atten Start, Mech Atten Stop and Mech Atten Step
- **ALL**: Use all the attenuator states
- **BYPass**: Bypasses the attenuator

|                |                                                                                                                                                                                                                                                     |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SYSTem:CALibration:ROW[1] 2 ... 100:ATTenuation:TYPE STEP   ALL   BYPass</code><br><code>:SYSTem:CALibration:ROW[1] 2 ... 100:ATTenuation:TYPE?</code>                                                                                       |
| Example        | <code>:SYST:CAL:ROW3:ATT:TYPE STEP</code>                                                                                                                                                                                                           |
| Dependencies   | The SCPI command applies to the currently selected Cal Group<br>If the subopcode does not reference an existing Cal row in the Cal Group, the error message “-221,Settings conflict; Subopcode does not reference an existing Cal row” is generated |
| Preset         | <b>STEP</b>                                                                                                                                                                                                                                         |
| State Saved    | Saved in instrument state                                                                                                                                                                                                                           |
| Range          | <b>STEP ALL BYPass</b>                                                                                                                                                                                                                              |

### 6.9.1.33 Mech Atten Start

Determines the first Mechanical Attenuator to be used in the Calibration

|                |                                                                                                                                                              |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SYSTem:CALibration:ROW[1] 2 ... 100:ATTenuation:STARt &lt;rel_ampl&gt;</code><br><code>:SYSTem:CALibration:ROW[1] 2 ... 100:ATTenuation:STARt?</code> |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|

|              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|--------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Example      | <code>:SYST:CAL:ROW3:ATT:START 20</code>                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Dependencies | <p>Disabled unless "<b>Mech Atten Type</b>" on page 843 is <b>STEP</b></p> <p>The SCPI command applies to the currently selected Cal Group</p> <p>If the subopcode does not reference an existing Cal row in the Cal Group, the error message “-221,Settings conflict; Subopcode does not reference an existing Cal row” is generated</p>                                                                                                                                             |
| Couplings    | Coupled to " <b>Mech Atten Stop</b> " on page 844. <b>Mech Atten Start</b> must be $\leq$ <b>Mech Atten Stop</b> . If <b>Mech Atten Start</b> > <b>Mech Atten Stop</b> , then <b>Mech Atten Stop</b> = <b>Mech Atten Start</b>                                                                                                                                                                                                                                                        |
| Preset       | 10 dB                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| State Saved  | Saved in instrument state                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Min          | <p>0 dB</p> <p>The attenuation set by this control cannot be decreased below 6 dB with the knob or step keys. To get to a value below 6 dB it must be directly entered from the keypad or via SCPI. This protects from adjusting the attenuation to a dangerously small value, which can put the instrument at risk of damage to input circuitry. However, if the current mechanical attenuation is below 6 dB it can be increased with the knob and step keys, but not decreased</p> |
| Max          | <p>CXA Option 503 or 507: 50 dB</p> <p>EXA: 60 dB</p> <p>All other models: 70 dB</p> <p>Note that, in the single attenuator configuration, the total of ATT and EATT cannot exceed 50 dB, so if the EATT is set to 24 dB first, the main attenuation cannot be greater than 26 dB and is reduced accordingly; if the main attenuator is set to 40 dB first, EATT cannot be greater than 10 dB</p>                                                                                     |

### 6.9.1.34 Mech Atten Stop

Determines the last Mechanical Attenuator to be used in the Calibration

|                |                                                                                                                                                                                                                                                                                                                                           |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SYSTem:CALibration:ROW[1] 2 ... 100:ATTenuation:STOP &lt;rel_amp&gt;</code><br><code>:SYSTem:CALibration:ROW[1] 2 ... 100:ATTenuation:STOP?</code>                                                                                                                                                                                 |
| Example        | <code>:SYST:CAL:ROW3:ATT:STOP 30</code>                                                                                                                                                                                                                                                                                                   |
| Dependencies   | <p>Disabled unless "<b>Mech Atten Type</b>" on page 843 is <b>STEP</b></p> <p>The SCPI command applies to the currently selected Cal Group</p> <p>If the subopcode does not reference an existing Cal row in the Cal Group, the error message “-221,Settings conflict; Subopcode does not reference an existing Cal row” is generated</p> |
| Couplings      | Coupled to " <b>Mech Atten Start</b> " on page 843. <b>Mech Atten Start</b> must be $\leq$ <b>Mech Atten Stop</b> . If <b>Mech Atten Start</b> > <b>Mech Atten Stop</b> , then <b>Mech Atten Stop</b> = <b>Mech Atten Start</b>                                                                                                           |
| Preset         | 10 dB                                                                                                                                                                                                                                                                                                                                     |
| State Saved    | Saved in instrument state                                                                                                                                                                                                                                                                                                                 |
| Min            | <p>0 dB</p> <p>The attenuation set by this control cannot be decreased below 6 dB with the knob or step keys. To get to a value below 6 dB it must be directly entered from the keypad or via SCPI. This protects from</p>                                                                                                                |



|                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                           |       |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
|                                                                                                                                                                                                                                                                                                       | adjusting the attenuation to a dangerously small value which can put the instrument at risk of damage to input circuitry. However, if the current mechanical attenuation is below 6 dB it can be increased with the knob and step keys, but not decreased |       |
| Max                                                                                                                                                                                                                                                                                                   | CXA Option 503 or 507                                                                                                                                                                                                                                     | 50 dB |
|                                                                                                                                                                                                                                                                                                       | EXA                                                                                                                                                                                                                                                       | 60 dB |
|                                                                                                                                                                                                                                                                                                       | All other models                                                                                                                                                                                                                                          | 70 dB |
| Note that, in the single attenuator configuration, the total of ATT and EATT cannot exceed 50 dB, so if the EATT is set to 24 dB first, the main attenuation cannot be greater than 26 dB and is reduced accordingly; if the main attenuator is set to 40 dB first, EATT cannot be greater than 10 dB |                                                                                                                                                                                                                                                           |       |

### 6.9.1.35 Mech Atten Step

Determines the Mech Attenuation Step. This determines the points between the Mechanical Attenuation min and max to use for Calibration.

|                |                                                                                                                                                                                                                                                                                                                               |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SYSTem:CALibration:ROW[1] 2 ... 100:ATTenuation:STEP &lt;rel_amp1&gt;</code><br><code>:SYSTem:CALibration:ROW[1] 2 ... 100:ATTenuation:STEP?</code>                                                                                                                                                                    |
| Example        | <code>:SYST:CAL:ROW2:ATT:STEP 2dB</code>                                                                                                                                                                                                                                                                                      |
| Dependencies   | Disabled unless " <b>Mech Atten Type</b> " on page 843 is <b>STEP</b><br>The SCPI command applies to the currently selected Cal Group<br>If the subopcode does not reference an existing Cal row in the Cal Group, the error message "-221, Settings conflict; Subopcode does not reference an existing Cal row" is generated |
| Preset         | 2 dB                                                                                                                                                                                                                                                                                                                          |
| State Saved    | Saved in instrument state                                                                                                                                                                                                                                                                                                     |
| Min            | 2 dB                                                                                                                                                                                                                                                                                                                          |
| Max            | 10 dB                                                                                                                                                                                                                                                                                                                         |

### 6.9.1.36 Elec Atten Type

Specifies the Elec Atten type to use:

- **STEP**: Use multiple Elec Atten states determined by Elec Atten Start, Elec Atten Stop and Elec Atten Step
- **ALL**: Use all the attenuator states
- **BYPass**: Bypasses the attenuator

|                |                                                                                                                                                                 |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SYSTem:CALibration:ROW[1] 2 ... 100:EATTenuation:TYPE STEP   ALL   BYPass</code><br><code>:SYSTem:CALibration:ROW[1] 2 ... 100:EATTenuation:TYPE?</code> |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|

|              |                                                                                                                                                                                                                                                      |
|--------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Example      | <code>:SYST:CAL:ROW3:EATT:TYPE STEP</code>                                                                                                                                                                                                           |
| Dependencies | The SCPI command applies to the currently selected Cal Group<br>If the subopcode does not reference an existing Cal row in the Cal Group, the error message “-221, Settings conflict; Subopcode does not reference an existing Cal row” is generated |
| Preset       | <code>STEP</code>                                                                                                                                                                                                                                    |
| State Saved  | Saved in instrument state                                                                                                                                                                                                                            |
| Range        | <code>STEP ALL BYPass</code>                                                                                                                                                                                                                         |

### 6.9.1.37 Elec Atten Start

Determines the first Electronic Attenuator to be used in the Calibration

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SYSTem:CALibration:ROW[1] 2 ... 100:EATTenuation:STARt &lt;rel_ampl&gt;</code><br><code>:SYSTem:CALibration:ROW[1] 2 ... 100:EATTenuation:STARt?</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Example        | <code>:SYST:CAL:ROW3:EATT:STARt 0</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Dependencies   | <p>Only appears in Dual Attenuator models with an Electronic Attenuator installed and licensed. It does not appear in models with the Single Attenuator configuration, as in the single attenuator configuration there is no “electronic attenuator” there is only a single integrated attenuator (which has both a mechanical and electronic stage)</p> <p>Disabled unless <a href="#">"Elec Atten Type" on page 845</a> is <code>STEP</code></p> <p>The electronic attenuator is unavailable above the low band (0-3.6 GHz, 0-3.4 GHz, or 0-3 GHz, depending on the model). If the low band ranges from 0-3.6 GHz, and Stop Frequency of the Calibration is &gt; 3.6 GHz, then this parameter is grayed out</p> <p>If the Internal Preamp is on, meaning it is set to Low Band or Full, or the electronic attenuator is unavailable, then this parameter is grayed-out</p> <p>If either of the above is true, and if the SCPI command is sent, an error indicating that the electronic attenuator is unavailable is sent</p> <p>If both of the above are true, pressing the control generates error message -221, in other words, the frequency range lockout takes precedence</p> <p>The SCPI command applies to the currently selected Cal Group</p> <p>If the subopcode does not reference an existing Cal row in the Cal Group, the error message “-221, Settings conflict; Subopcode does not reference an existing Cal row” is generated</p> |
| Couplings      | Coupled to Elec Atten Stop. Elec Atten Start must be <= Elec Atten Stop. If Elec Atten Start > Elec Atten Stop, Elec Atten Stop = Elec Atten Start                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Preset         | 0 dB                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| State Saved    | Saved in instrument state                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Min            | 0 dB                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Max            | 24 dB                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |

### 6.9.1.38 Elec Atten Stop

Determines the last Electrical Attenuator to be used in the Calibration

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SYSTem:CALibration:ROW[1] 2 ... 100:EATTenuation:STOP &lt;rel_amp1&gt;</code><br><code>:SYSTem:CALibration:ROW[1] 2 ... 100:EATTenuation:STOP?</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Example        | <code>:SYST:CAL:ROW3:EATT:STOP 10</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Dependencies   | <p>Only appears in Dual Attenuator models with an Electronic Attenuator installed and licensed. It does not appear in models with the Single Attenuator configuration, as in the single attenuator configuration there is no “electronic attenuator” there is only a single integrated attenuator (which has both a mechanical and electronic stage)</p> <p>Disabled unless <b>"Elec Atten Type" on page 845</b> is <b>STEP</b></p> <p>The electronic attenuator is unavailable above the low band (0-3.6 GHz, 0-3.4 GHz or 0-3 GHz, depending on the model). If the low band ranges from 0-3.6 GHz, and Stop Frequency of the Calibration is &gt; 3.6 GHz, then this parameter is grayed out</p> <p>If the Internal Preamp is on, meaning it is set to Low Band or Full, the electronic attenuator is unavailable, then this parameter is grayed out</p> <p>If either of the above is true, and if the SCPI command is sent, an error indicating that the electronic attenuator is unavailable is sent</p> <p>If both of the above are true, pressing the control generates error message -221, in other words, the frequency range lockout takes precedence</p> <p>For SCPI, this query applies to the currently selected Cal Group</p> <p>If the subopcode does not reference an existing Cal row in the Cal Group, the error message “-221, Settings conflict; Subopcode does not reference an existing Cal row” is generated</p> |
| Couplings      | Coupled to Elec Atten Start. Elec Atten Stop must be >= Elec Atten Start. If Elec Atten Stop < Elec Atten Start, Elec Atten Start = Elec Atten Stop                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Preset         | 0 dB                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| State Saved    | Saved in instrument state                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Min            | 0 dB                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Max            | 24 dB                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |

### 6.9.1.39 Elec Atten Step

Determines the Elec Attenuation Step. This determines the points between the Electric Attenuation min and max to use for Calibration.

|                |                                                                                                                                                              |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SYSTem:CALibration:ROW[1] 2 ... 100:EATTenuation:STEP &lt;rel_amp1&gt;</code><br><code>:SYSTem:CALibration:ROW[1] 2 ... 100:EATTenuation:STEP?</code> |
| Example        | <code>:SYST:CAL:ROW2:EATT:STEP 2dB</code>                                                                                                                    |
| Dependencies   | <p>Disabled unless <b>"Elec Atten Type" on page 845</b> is <b>STEP</b></p> <p>The SCPI command applies to the currently selected Cal Group</p>               |

|             |                                                                                                                                                                                      |
|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|             | If the subopcode does not reference an existing Cal row in the Cal Group, the error message “-221, Settings conflict; Subopcode does not reference an existing Cal row” is generated |
| Preset      | 1 dB                                                                                                                                                                                 |
| State Saved | Saved in instrument state                                                                                                                                                            |
| Min         | 1 dB                                                                                                                                                                                 |
| Max         | 24 dB                                                                                                                                                                                |

#### 6.9.1.40 Full Range Atten Type

Specifies the Full Range Atten type to use. The Full Range Attenuator adds a second input attenuator at the beginning of the RF Input 2, which enhances the protection and optimizes the performance of the extra internal mixers used by RF Input 2.

- **STEP**: Use multiple Full Range Atten states determined by Full Range Atten Start and Full Range Atten Stop
- **ALL**: Use all the attenuator states

|                |                                                                                                                                                                                                                                                                                                                                                                     |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SYSTem:CALibration:ROW[1] 2 ... 100:FATTenuation:TYPE STEP   ALL  </code><br><code>:SYSTem:CALibration:ROW[1] 2 ... 100:FATTenuation:TYPE?</code>                                                                                                                                                                                                            |
| Example        | <code>:SYST:CAL:ROW3:FATT:TYPE STEP</code>                                                                                                                                                                                                                                                                                                                          |
| Dependencies   | Only appears if input RF is selected, and RF Input Port 2 is selected, and the Full Range Attenuator exists<br>The SCPI command applies to the currently selected Cal Group<br>If the subopcode does not reference an existing Cal row in the Cal Group, the error message “-221, Settings conflict; Subopcode does not reference an existing Cal row” is generated |
| Preset         | <b>STEP</b>                                                                                                                                                                                                                                                                                                                                                         |
| State Saved    | Saved in instrument state                                                                                                                                                                                                                                                                                                                                           |
| Range          | <b>STEP ALL </b>                                                                                                                                                                                                                                                                                                                                                    |

#### 6.9.1.41 Full Range Atten Start

Determines the first Full Range Attenuator to be used in the Calibration

|                |                                                                                                                                                                                                                                                                                              |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SYSTem:CALibration:ROW[1] 2 ... 100:FATTenuation:START &lt;rel_amp&gt;</code><br><code>:SYSTem:CALibration:ROW[1] 2 ... 100:FATTenuation:START?</code>                                                                                                                                |
| Example        | <code>:SYST:CAL:ROW3:FATT:START 0</code>                                                                                                                                                                                                                                                     |
| Dependencies   | Only appears in N9041B, when the RF input is selected, and the RF Input Port is set to RF Input 2, and the Full Range Attenuator is installed<br>Disabled unless " <b>Full Range Atten Type</b> " on page 848 is <b>STEP</b><br>The SCPI command applies to the currently selected Cal Group |

|             |                                                                                                                                                                                                    |
|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|             | If the subopcode does not reference an existing Cal row in the Cal Group, the error message “-221, Settings conflict; Subopcode does not reference an existing Cal row” is generated               |
| Couplings   | Coupled to Full Range Atten Stop. Full Range Atten Start must be $\leq$ Full Range Atten Stop. If Full Range Atten Start $>$ Full Range Atten Stop, Full Range Atten Stop = Full Range Atten Start |
| Preset      | 20 dB                                                                                                                                                                                              |
| State Saved | Saved in instrument state                                                                                                                                                                          |
| Min         | 0 dB                                                                                                                                                                                               |
| Max         | Only valid values are 0, 6, 14, 20 dB                                                                                                                                                              |

#### 6.9.1.42 Full Range Atten Stop

Determines the last Full Range Attenuator to be used in the Calibration

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SYSTem:CALibration:ROW[1] 2 ... 100:FATTenuation:STOP &lt;rel_amp&gt;</code><br><code>:SYSTem:CALibration:ROW[1] 2 ... 100:FATTenuation:STOP?</code>                                                                                                                                                                                                                                                                                                                        |
| Example        | <code>:SYST:CAL:ROW3:FAT:PT:STOP 10</code>                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Dependencies   | Only appears in N9041B, when the RF input is selected, and the RF Input Port is set to RF Input 2, and the Full Range Attenuator is installed<br>Disabled unless <b>"Full Range Atten Type" on page 848</b> is <b>STEP</b><br>The SCPI command applies to the currently selected Cal Group<br>If the subopcode does not reference an existing Cal row in the Cal Group, the error message “-221, Settings conflict; Subopcode does not reference an existing Cal row” is generated |
| Couplings      | Coupled to Full Range Atten Start. Full Range Atten Stop must be $\geq$ Full Range Atten Start. If Full Atten Stop $<$ Full Range Atten Start, Full Range Atten Start = Full Range Atten Stop                                                                                                                                                                                                                                                                                      |
| Preset         | 20 dB                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| State Saved    | Saved in instrument state                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Min            | 0 dB                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Max            | Only valid values are 0, 6, 14, 20 dB                                                                                                                                                                                                                                                                                                                                                                                                                                              |

#### 6.9.1.43 Frequency Extender Attenuation Type

Specifies the Frequency Extender Attenuation type to use. **Frequency Extender Attenuation** is applied to the frequency extender's high frequency input signal path (for example, with a V3050A frequency extender, the high frequency path is 50 GHz to 110 GHz).

- **STEP**: Use multiple Frequency Extender Attenuation states determined by Frequency Extender Attenuation Start and Frequency Extender Attenuation Stop
- **ALL**: Use all the attenuator states

|                |                                                                                                                                                                                                                                                                                                                                           |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SYSTem:CALibration:ROW[1] 2 ... 100:FEATtenuation:TYPE STEP   ALL</code><br><code>:SYSTem:CALibration:ROW[1] 2 ... 100:FEATtenuation:TYPE?</code>                                                                                                                                                                                  |
| Example        | <code>:SYST:CAL:ROW3:FEAT:TYPE STEP</code>                                                                                                                                                                                                                                                                                                |
| Dependencies   | Only applies, and is only visible, when the External RF (ERFIN) input is selected<br>The SCPI command applies to the currently selected Cal Group<br>If the subopcode does not reference an existing Cal row in the Cal Group, the error message “-221, Settings conflict; Subopcode does not reference an existing Cal row” is generated |
| Preset         | <code>STEP</code>                                                                                                                                                                                                                                                                                                                         |
| State Saved    | No                                                                                                                                                                                                                                                                                                                                        |
| Range          | <code>STEP   ALL   REFERENCE</code>                                                                                                                                                                                                                                                                                                       |

#### 6.9.1.44 Frequency Extender Attenuation Start

Determines the first Frequency Extender Attenuator to be used in the Calibration.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SYSTem:CALibration:ROW[1] 2 ... 100:FEATtenuation:START &lt;rel_amp&gt;</code><br><code>:SYSTem:CALibration:ROW[1] 2 ... 100:FEATtenuation:START?</code>                                                                                                                                                                                                                                                                                                                         |
| Example        | <code>:SYST:CAL:ROW3:FEAT:START 0</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Dependencies   | Only applies, and is only visible, when the External RF ( <a href="#">ERFIN</a> ) input is selected<br>Disabled unless " <a href="#">Frequency Extender Attenuation Type</a> " on <a href="#">page 849</a> is <code>STEP</code><br>The SCPI command applies to the currently selected Cal Group<br>If the subopcode does not reference an existing Cal row in the Cal Group, the error message “-221, Settings conflict; Subopcode does not reference an existing Cal row” is generated |
| Couplings      | Coupled to Frequency Extender Attenuation Stop. Frequency Extender Attenuation Start must be $\leq$ Frequency Extender Attenuation Stop. If Frequency Extender Attenuation Start $>$ Frequency Extender Attenuation Stop, Frequency Extender Attenuation Stop = Frequency Extender Attenuation Start                                                                                                                                                                                    |
| Preset         | 0 dB                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| State Saved    | Saved in instrument state                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Min            | 0 dB                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Max            | V3050A: 26 dB                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |

#### 6.9.1.45 Frequency Extender Attenuation Stop

Determines the last Frequency Extender Attenuation to be used in the Calibration.

|                |                                                                                                                                                               |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SYSTem:CALibration:ROW[1] 2 ... 100:FEATtenuation:STOP &lt;rel_amp&gt;</code><br><code>:SYSTem:CALibration:ROW[1] 2 ... 100:FEATtenuation:STOP?</code> |
| Example        | <code>:SYST:CAL:ROW3:FEAT:PT:STOP 26</code>                                                                                                                   |
| Dependencies   | Only applies, and is only visible, when the External RF (ERFIN) input is selected                                                                             |

|             |                                                                                                                                                                                                                                                                                                                                                                |
|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|             | <p>Disabled unless "<b>Frequency Extender Attenuation Type</b>" on page 849 is <b>STEP</b></p> <p>The SCPI command applies to the currently selected Cal Group</p> <p>If the subopcode does not reference an existing Cal row in the Cal Group, the error message “-221, Settings conflict; Subopcode does not reference an existing Cal row” is generated</p> |
| Couplings   | Coupled to Frequency Extender Attenuation Start. Frequency Extender Attenuation Stop must be $\geq$ Frequency Extender Attenuation Start. If Frequency Extender Attenuation Stop < Frequency Extender Attenuation Start, Frequency Extender Attenuation Start = Frequency Extender Attenuation Stop                                                            |
| Preset      | 26 dB                                                                                                                                                                                                                                                                                                                                                          |
| State Saved | Saved in instrument state                                                                                                                                                                                                                                                                                                                                      |
| Min         | 0 dB                                                                                                                                                                                                                                                                                                                                                           |
| Max         | V3050A: 26 dB                                                                                                                                                                                                                                                                                                                                                  |

#### 6.9.1.46 Frequency Extender Atten Step

Determines the Frequency Extender Attenuation Step. This determines the points between the Frequency Extender Attenuation min and max to use for Calibration.

|                |                                                                                                                                                                                                                                                                                                                                                                 |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <pre>:SYSTem:CALibration:ROW[1] 2 ... 100:FEATtenuation:STEP &lt;rel_ampl&gt; :SYSTem:CALibration:ROW[1] 2 ... 100:FEATtenuation:STEP?</pre>                                                                                                                                                                                                                    |
| Example        | <pre>:SYST:CAL:ROW2:FEAT:STEP 2dB</pre>                                                                                                                                                                                                                                                                                                                         |
| Dependencies   | <p>Only applies, and is only visible, when the External RF (<b>ERFIN</b>) input is selected</p> <p>The SCPI command applies to the currently selected Cal Group</p> <p>If the subopcode does not reference an existing Cal row in the Cal Group, the error message “-221, Settings conflict; Subopcode does not reference an existing Cal row” is generated</p> |
| Preset         | 1 dB                                                                                                                                                                                                                                                                                                                                                            |
| State Saved    | No                                                                                                                                                                                                                                                                                                                                                              |
| Min            | 1 dB                                                                                                                                                                                                                                                                                                                                                            |
| Max            | V3050A: 26 dB                                                                                                                                                                                                                                                                                                                                                   |

#### 6.9.1.47 IF Path

Determines the IF Path to be used in the Calibration.

|                |                                                                                                                                                                                                          |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <pre>:SYSTem:CALibration:ROW[1] 2 ... 100:IF:PATH B10M   B25M   B40M   B85M   B125M   B140M   B160M   B255M   B510M   B1G   B1500M   B2G   B4G   EXT :SYSTem:CALibration:ROW[1] 2 ... 100:IF:PATH?</pre> |
| Example        | <pre>:SYST:CAL:ROW2:IF:PATH B25M</pre>                                                                                                                                                                   |
| Notes          | <div style="display: flex; justify-content: space-between;"> <span><b>B10M</b></span> <span>10 MHz</span> </div>                                                                                         |

|               |                         |
|---------------|-------------------------|
| <b>B25M</b>   | 25 MHz                  |
| <b>B40M</b>   | 40 MHz                  |
| <b>B85M</b>   | 85 MHz                  |
| <b>B125M</b>  | 125 MHz                 |
| <b>B140M</b>  | 140 MHz                 |
| <b>B160M</b>  | 160 MHz                 |
| <b>B255M</b>  | 255 MHz                 |
| <b>B510M</b>  | 510 MHz                 |
| <b>B1G</b>    | 1 GHz                   |
| <b>B1500M</b> | 1.5 GHz                 |
| <b>B2G</b>    | 2 GHz                   |
| <b>B4G</b>    | 4 GHz                   |
| <b>EXT</b>    | Depends on the hardware |

In cases where the path is not available but is selected via SCPI, generates error -241, "Hardware missing; Option not installed"

| Dependencies | Path    | Availability requires Installation of:          |
|--------------|---------|-------------------------------------------------|
|              | 25 MHz  | 25 MHz or wider IF Bandwidth option             |
|              | 40 MHz  | 40 MHz or wider IF Bandwidth option             |
|              | 85 MHz  | 85 MHz or wider IF Bandwidth option             |
|              | 125 MHz | 125 MHz or wider IF Bandwidth option            |
|              | 140 MHz | Option B1X                                      |
|              | 160 MHz | Option B1Y. B1Y cannot be installed without B1X |
|              | 255 MHz | Option B2X or wider IF Bandwidth option         |
|              | 510 MHz | Option B5Y or wider IF Bandwidth option         |
|              | 1 GHz   | Option H1G/B1G or wider IF Bandwidth option     |
|              | 2 GHz   | Option B2G(R20) or wider IF Bandwidth option    |
|              | 4 GHz   | Option B4G(R40) or wider IF Bandwidth option    |
|              | 1.5 GHz | Option R15                                      |

If Option B85 *and* either Option B1A or Option B1X are installed, the 85 MHz option does not appear, and **B85M** is disabled. Sending the command to select **B85M** in this case generates an error -221, "Settings Conflict; Use wider bandwidth selection"

If Option B1A *and* Option B1X are both installed, the 125 MHz option does not appear, and **B125M** is disabled. Sending the command to select **B125M** in this case generates an error -221, "Settings Conflict; Use wider bandwidth selection"

In cases where the path is not available, but is selected via SCPI, error -241, "Hardware missing; Option not installed" is generated

The preset value depends on the Digital IF BW setting of the default measurement



|             |                                                                                                    |
|-------------|----------------------------------------------------------------------------------------------------|
| Preset      | If the 25 MHz path is not available, presets to 10 MHz                                             |
| State Saved | No                                                                                                 |
| Range       | B10M   B25M   B40M   B85M   B125M   B140M   B160M   B255M   B510M   B1G   B1500M   B2G   B4G   EXT |

#### 6.9.1.48 IF Gain

Determines the IF Gain to be used in the Calibration

|                |                                                                                                                                                                                                                                                    |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | :SYSTem:CALibration:ROW[1] 2 ... 100:IF:GAIN[:STATE]AUTO HIGH LOW ALL<br>:SYSTem:CALibration:ROW[1] 2 ... 100:IF:GAIN[:STATE]?                                                                                                                     |
| Example        | :SYST:CAL:ROW3:IF:GAIN ALL                                                                                                                                                                                                                         |
| Dependencies   | The SCPI command applies to the current selected Cal Group<br>If the subopcode does not reference an existing Cal row in the Cal Group, the error message “-221, Settings conflict; Subopcode does not reference an existing Cal row” is generated |
| Preset         | AUTO                                                                                                                                                                                                                                               |
| State Saved    | Saved in instrument state                                                                                                                                                                                                                          |
| Range          | Auto   High Gain   Low Gain   All                                                                                                                                                                                                                  |

#### 6.9.1.49 Preamp

Determines if the Preamp is to be used in the Calibration

|                |                                                                                                                                                                                                                                                    |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | :SYSTem:CALibration:ROW[1] 2 ... 100:POWer[:RF]:GAIN:BAND OFF   LOW   FULL<br>:SYSTem:CALibration:ROW[1] 2 ... 100:POWer:GAIN:BAND?                                                                                                                |
| Example        | :SYST:CAL:ROW2:POWer:GAIN:BAND OFF                                                                                                                                                                                                                 |
| Dependencies   | The SCPI command applies to the current selected Cal Group<br>If the subopcode does not reference an existing Cal row in the Cal Group, the error message “-221, Settings conflict; Subopcode does not reference an existing Cal row” is generated |
| Preset         | OFF                                                                                                                                                                                                                                                |
| State Saved    | Saved in instrument state                                                                                                                                                                                                                          |
| Range          | OFF   LOW   FULL                                                                                                                                                                                                                                   |

#### 6.9.1.50 Low Noise Amplifier (LNA)

Determines if the LNA is to be used in the Calibration.

|                |                                                                                                                                                        |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | :SYSTem:CALibration:ROW[1] 2 ... 100:POWer[:RF]:GAIN:LNA[:STATE] ON   OFF   1   0<br>:SYSTem:CALibration:ROW[1] 2 ... 100:POWer[:RF]:GAIN:LNA[:STATE]? |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|

|              |                                                                                                                                                                                                                                                                                                                         |
|--------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Example      | <code>:SYST:CAL:ROW2:POW:GAIN:LNA ON</code><br><code>:SYST:CAL:ROW2:POW:GAIN:LNA?</code>                                                                                                                                                                                                                                |
| Dependencies | The SCPI command is applied to the currently selected Cal Group. The subopcode is used to identify the Cal row in the Cal Group<br>If the subopcode does not reference an existing Cal row in the Cal Group, the error message “-221, Settings conflict; Subopcode does not reference an existing Cal row” is generated |
| Preset       | <b>OFF</b>                                                                                                                                                                                                                                                                                                              |
| State Saved  | No                                                                                                                                                                                                                                                                                                                      |
| Range        | <b>ON OFF</b>                                                                                                                                                                                                                                                                                                           |

### 6.9.1.51 $\mu$ W Path Control

Determines the  $\mu$ W Path Control to be used in the Calibration.

| Option                | SCPI            |
|-----------------------|-----------------|
| Standard Path         | <b>STD</b>      |
| Low Noise Path        | <b>LNPath</b>   |
| $\mu$ W Presel Bypass | <b>MPBypass</b> |
| Full Bypass           | <b>FULL</b>     |

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SYSTem:CALibration:ROW[1] 2 ... 100:POWer[:RF]:MW:PATH STD   LNPath   MPBypass   FULL</code><br><code>:SYSTem:CALibration:ROW[1] 2 ... 100:POWer[:RF]:MW:PATH?</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Example        | <code>:SYST:CAL:ROW2:POW:MW:PATH FULL</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Dependencies   | The SCPI command applies to the current selected Cal Group<br>If the subopcode does not reference an existing Cal row in the Cal Group, the error message “-221, Settings conflict; Subopcode does not reference an existing Cal row” is generated<br>This column is not shown in the table unless <i>either</i> Option MPB or Option LNB is present and licensed<br>The Low Noise Path selection does not appear unless Option LNP is present and licensed<br>The $\mu$ W Presel Bypass selection does not appear unless Option MPB is present and licensed<br>The Full Bypass selection does not appear unless Options LNP, MPB and FBP are installed and licensed<br>In any of these cases, if the required options are not present and the SCPI command is sent, error - 241, "Hardware missing; Option not installed" is generated |
| Preset         | <b>STD</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| State Saved    | Saved in instrument state                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Range          | <b>STD LNPath MPBypass FULL</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |

### 6.9.1.52 Coupling

Determines the Coupling to be used in the Calibration

|                |                                                                                                                                                                                                                                                    |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SYSTem:CALibration:ROW[1] 2 ... 100:COUPling AC   DC</code><br><code>:SYSTem:CALibration:ROW[1] 2 ... 100:COUPling?</code>                                                                                                                  |
| Example        | <code>:SYST:CAL:ROW3:COUP AC</code>                                                                                                                                                                                                                |
| Dependencies   | The SCPI command applies to the current selected Cal Group<br>If the subopcode does not reference an existing Cal row in the Cal Group, the error message “-221, Settings conflict; Subopcode does not reference an existing Cal row” is generated |
| Preset         | AC                                                                                                                                                                                                                                                 |
| State Saved    | Saved in instrument state                                                                                                                                                                                                                          |
| Range          | AC DC                                                                                                                                                                                                                                              |

### 6.9.1.53 Phase Noise Optimization

Selects the LO (local oscillator) phase noise behavior for various desired operating conditions.

For full details, see ["Parameter Options & Installed Options" on page 855](#) below.

|                |                                                                                                                                                                                                                                                                                                                                                                                                             |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SYSTem:CALibration:ROW[1] 2 ... 100:FREQuency:SYNThesis[:STATe] 1   ...   5</code><br>For the meaning of each numeric option value, see <a href="#">"Parameter Options &amp; Installed Options" on page 855</a> below<br><code>:SYSTem:CALibration:ROW[1] 2 ... 100:FREQuency:SYNThesis[:STATe]?</code>                                                                                              |
| Example        | Select optimization for best wide offset phase noise:<br><code>:SYST:CAL:ROW1:FREQ:SYNT 2</code>                                                                                                                                                                                                                                                                                                            |
| Dependencies   | The SCPI command applies to the current selected Cal Group<br>If the subopcode does not reference an existing Cal row in the Cal Group, the error message “-221, Settings conflict; Subopcode does not reference an existing Cal row” is generated                                                                                                                                                          |
| Couplings      | Coupled with <a href="#">"Phase Noise Optimization All Option" on page 860</a><br>When <b>Phase Noise Optimization All</b> is <b>ON</b> , selects all available LO mappings, and Phase Noise Optimization parameter will display <b>All</b> in the Configuration table. SCPI Query is still available to determine which parameter will be displayed when <b>Phase Noise Optimization All</b> is <b>OFF</b> |
| Preset         | 2                                                                                                                                                                                                                                                                                                                                                                                                           |
| State Saved    | Yes                                                                                                                                                                                                                                                                                                                                                                                                         |
| Range          | See <a href="#">"Ranges" on page 860</a> below                                                                                                                                                                                                                                                                                                                                                              |
| Min            | 1                                                                                                                                                                                                                                                                                                                                                                                                           |
| Max            | 5                                                                                                                                                                                                                                                                                                                                                                                                           |

### Parameter Options & Installed Options

The Phase Noise Optimization control lets you optimize the setup and behavior of the Local Oscillator (LO) depending on your specific measurement conditions. You

may wish to trade off noise and speed, for example, to make a measurement faster without regard to noise or with optimum noise characteristics without regard to speed.

#### Parameter Values Summary

| Option                         | #       | Description                                                                                                                                                                                                                                      |
|--------------------------------|---------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| "Balanced" on page 857         | 1       | <ul style="list-style-type: none"> <li>– In instruments with EPO, balances close-in phase noise with spur avoidance</li> <li>– In instruments without EPO optimizes phase noise for small frequency offsets from the carrier</li> </ul>          |
| "Best Wide-offset" on page 857 | 2       | Optimizes phase noise for wide frequency offsets from the carrier                                                                                                                                                                                |
| "Fast Tuning" on page 858      | 3       | Optimizes LO for tuning speed                                                                                                                                                                                                                    |
| "Best Close-in" on page 856    | 4 or 1* | <ul style="list-style-type: none"> <li>– In instruments with EPO, emphasizes close-in phase noise performance without regard to spur avoidance</li> <li>– In instruments without EPO, this setting is accepted but no action is taken</li> </ul> |
| "Best Spurs" on page 857       | 5       | <ul style="list-style-type: none"> <li>– In instruments with EPO, emphasizes spur avoidance over close-in phase noise performance</li> <li>– In instruments without EPO, this setting is accepted but no action taken</li> </ul>                 |
| Auto                           | -       | Automatically selects LO (local oscillator) phase noise behavior to optimize dynamic range and speed for various instrument operating conditions                                                                                                 |

\*Dependent on Option EPO installation. See "Best Close-in" on page 856 below.

The actual behavior varies somewhat depending on model number and option; for example, you always get Fast Tuning by choosing Option #3, but in some models, "Fast Tuning" on page 858 is identical in effect to "Best Close-in" on page 856.

#### Best Close-in

Without option EPO

**:FREQ:SYNT 1**

The LO phase noise is optimized for smaller offsets from the carrier, at the expense of phase noise farther out.

The actual frequency offset within which noise is optimized is shown with in square brackets, as this can vary depending on the hardware set in use. For example, in some instruments this annotation appears as [offset <20 kHz]

With option EPO

#### :FREQ:SYNT 4

In instruments with Option EP0, the LO is configured for the best possible close-in phase noise (offsets up to 600 kHz from the carrier), regardless of spurious products that occur with some center frequencies. Because this is generally less desirable for close-in measurements than the "Balanced" on page 857 setting, parameter 1 selects "Balanced" on page 857 in EP0 instruments, in the interests of optimizing code compatibility across the family. Parameter 4 selects "Best Close-in" on page 856, which is usually not as good a choice as "Balanced" on page 857.

### Balanced

#### :FREQ:SYNT 1

In instruments with EP0, the LO is configured for the best possible phase noise at offsets up to 600 kHz from the carrier whenever there are no significant spurs within the span observed with an on-screen carrier. When there will be such a spur, the LO is reconfigured in a way that allows the phase noise to increase by 7 dB mostly within  $\pm 1$  octave around 400 kHz offset. The spurs will always be below  $-70$  dBc.

### Best Spurs

#### :FREQ:SYNT 5

In instruments with EP0, the LO is configured for better phase noise than the "Best Wide-offset" on page 857 case close to the carrier, but the configuration has 11 dB worse phase noise than the "Best Close-in" on page 856 case mostly within  $\pm 1$  octave around 300 kHz offset. Spurs are even lower than in the "Balanced" on page 857 case at better than  $-90$  dBc, whether or not the carrier is on-screen.

This setting is never selected when Phase Noise Optimization is in Auto, you must select it manually.

### Best Wide-offset

#### :FREQ:SYNT 2

The LO phase noise is optimized for wider offsets from the carrier. Optimization is especially improved for offsets from 70 kHz to 300 kHz. Closer offsets are compromised and the throughput of measurements (especially remote measurements where the center frequency is changing rapidly), is reduced.

The actual frequency offset beyond which noise is optimized is shown with in square brackets, as this can vary depending on the hardware set in use. For example, in some instruments this annotation appears as [offset >30 kHz]

In instruments with Option EP0, the LO is configured for the best possible phase noise at offsets up to 600 kHz from the carrier whenever there are no significant spurs within the span observed with an on-screen carrier. When there will be such a spur, the LO is reconfigured in a way that allows the phase noise to increase by 7 dB

mostly within  $\pm 1$  octave around 400 kHz offset. The spurs will always be below  $-70$  dBc.

## Fast Tuning

**:FREQ:SYNT 3**

In this mode, the LO behavior compromises phase noise at many offsets from the carrier in order to allow rapid measurement throughput when changing the center frequency or span. The term **"Fast Tuning" on page 858** refers to the time it takes to move the local oscillator to the start frequency and begin a sweep; this setting does not impact the actual sweep time in any way.

In instruments with EP1, the LO behavior compromises phase noise at offsets below 4 MHz in order to improve measurement throughput. The throughput is especially affected when moving the LO more than 2.5 MHz and up to 10 MHz from the stop frequency to the next start frequency.

In instruments with Option EP0, this is the same configuration as **"Best Spurs" on page 857**. It is available with the **"Fast Tuning" on page 858** label for convenience, and to make the user interface more consistent with other X-Series instrument family members.

(In models whose hardware does not provide for a **"Fast Tuning" on page 858** option, the settings for **"Best Close-in" on page 856** are used if **"Fast Tuning" on page 858** is selected. This gives the fastest possible tuning for that hardware set.)

## Auto

**:FREQ:SYNT:AUTO ON**

Selects the LO (local oscillator) phase noise behavior to optimize dynamic range and speed for various instrument operating conditions. The selection rules are as follows.

## Auto Optimization Rules

X-Series instruments have several grades of LO, offering different configurations when in the Auto Mode. The rules for Auto selection are as follows:

| Models with Option                                                                                                           | Conditions                                     | Selection                         |
|------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------|-----------------------------------|
| EP0                                                                                                                          | Center frequency is $< 699.9$ kHz              | <b>"Balanced" on page 857</b>     |
| Models with option EP0 have a two stage local oscillator, which switches to a single loop for fast tuning (available in UXA) | Span $> 114.1$ MHz, <i>or</i>                  | <b>"Fast Tuning" on page 858</b>  |
|                                                                                                                              | RBW $> 800$ kHz                                |                                   |
|                                                                                                                              | RBW $> 290$ kHz, <i>or</i><br>Span $> 4.2$ MHz | <b>"Best Wide-offset" on page</b> |

## 6 Input/Output

### 6.9 Calibration

| Models with Option                                                                                                                                                                                                                                                                                                                                                                  | Conditions                                                                                                                                                                                                 | Selection                                                    |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------|
|                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                            | 857                                                          |
|                                                                                                                                                                                                                                                                                                                                                                                     | Other conditions                                                                                                                                                                                           | "Balanced" on page 857                                       |
| EP1<br>Models with option EP1 have a two-loop local oscillator, which switches to a single loop for fast tuning (available in PXA)                                                                                                                                                                                                                                                  | Span > 44.44 MHz, <i>or</i><br>RBW > 1.9 MHz, <i>or</i><br>Source Mode is set to "Tracking"<br>Center frequency is < 195 kHz, <i>or</i><br>CF >= 1 MHz <i>and</i> Span <= 1.3 MHz <i>and</i> RBW <= 75 kHz | "Fast Tuning" on page 858<br><br>"Best Close-in" on page 856 |
|                                                                                                                                                                                                                                                                                                                                                                                     | All other conditions                                                                                                                                                                                       | "Best Wide-offset" on page 857                               |
| EP2<br>Models with option EP2 use a different loop bandwidth for the fast-tuning choice, which is a compromise between tuning speed and phase noise, giving good tuning speed at all offsets. Although not as good as for "Best Close-in" on page 856; this is useful when you have to look across a wide range of spans (available, for example, in MXA for excellent phase noise) | CF < 130 kHz, <i>or</i><br>CF > 12 MHz <i>and</i> Span < 495 kHz <i>and</i> RBW < 40 kHz                                                                                                                   | "Best Close-in" on page 856                                  |
|                                                                                                                                                                                                                                                                                                                                                                                     | Span > 22 MHz, <i>or</i><br>RBW > 400 kHz, <i>or</i><br>CF ≤ 12 MHz <i>and</i> Span < 495 kHz <i>and</i> RBW < 23 kHz                                                                                      | "Fast Tuning" on page 858                                    |
|                                                                                                                                                                                                                                                                                                                                                                                     | All other conditions                                                                                                                                                                                       | "Best Wide-offset" on page 857                               |
| EP4<br>(available in CXA for improved phase noise)                                                                                                                                                                                                                                                                                                                                  | Span > 101 MHz <i>or</i><br>RBW > 1.15 MHz <i>or</i><br>Source Mode is set to "Tracking"                                                                                                                   | "Fast Tuning" on page 858                                    |
|                                                                                                                                                                                                                                                                                                                                                                                     | CF is < 109 kHz <i>or</i><br>CF >= 4.95 MHz <i>and</i> Span <= 666 kHz <i>and</i> RBW < 28 kHz                                                                                                             | "Best Close-in" on page 856                                  |
|                                                                                                                                                                                                                                                                                                                                                                                     | All other conditions                                                                                                                                                                                       | "Best Wide-offset" on page 857                               |
| All Other Models<br>Note that in these models, the hardware does not actually provide for an extra-fast tuning option, so the settings for "Fast Tuning" on page 858 are actually the same as "Best Close-in" on page 856, but the rules are implemented this way so that the user                                                                                                  | Span > 12.34 MHz, <i>or</i><br>RBW > 250 kHz, <i>or</i><br>Source Mode is set to "Tracking"                                                                                                                | "Fast Tuning" on page 858                                    |

| Models with Option                                                                                                                               | Conditions                                                       | Selection                      |
|--------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------|--------------------------------|
| who doesn't care about phase noise but does care about tuning speed doesn't have to remember which of the other two settings gives faster tuning | Center frequency is < 25 kHz, <i>or</i>                          | "Best Close-in" on page 856    |
|                                                                                                                                                  | CF >= 1 MHz <i>and</i> Span <= 141.4 kHz <i>and</i> RBW <= 5 kHz |                                |
|                                                                                                                                                  | All other conditions                                             | "Best Wide-offset" on page 857 |

In all the above cases:

- The RBW to be used in the calculations is the equivalent –3 dB bandwidth of the current RBW filter
- The rules apply whether in swept spans, zero span, or FFT spans

## Ranges

| Option        | Option # | Phase Noise Option | Range                   |
|---------------|----------|--------------------|-------------------------|
| No EPx Option | 1        | Best Close-in      | [offset < 20 kHz]       |
|               | 2        | Best Wide-offset   | [offset > 30 kHz]       |
|               | 3        | Fast Tuning        | [same as Best Close-In] |
| EP0           | 4        | Best Close-in      | [offset < 600 kHz]      |
|               | 1        | Balanced           | [offset < 600 kHz]      |
|               | 5        | Best Spurs         | [offset < 600 kHz]      |
|               | 2        | Best Wide-offset   | [offset > 800 kHz]      |
|               | 3        | Fast Tuning        | [same as Best Close-In] |
| EP1           | 1        | Best Close-in      | [offset < 140 kHz]      |
|               | 2        | Best Wide-offset   | [offset > 160 kHz]      |
|               | 3        | Fast Tuning        | [single loop]           |
| EP2, EP3, EP5 | 1        | Best Close-in      | [offset < 70 kHz]       |
|               | 2        | Best Wide-offset   | [offset > 100 kHz]      |
|               | 3        | Fast Tuning        | [medium loop bw]        |
| EP4           | 1        | Best Close-in      | [offset < 90 kHz]       |
|               | 2        | Best Wide-offset   | [offset > 130 kHz]      |
|               | 3        | Fast Tuning        | [same as Best Close-In] |

### 6.9.1.54 Phase Noise Optimization All Option

Selects all available LO settings



|                |                                                                                                                                                                                                                                                                                                                                                                            |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SYSTem:CALibration:ROW[1] 2 ... 100:FREQuency:SYNTHeSis:ALL[:STATe] ON   OFF<br/>  1   0<br/><br/>:SYSTem:CALibration:ROW[1] 2 ... 100:FREQuency:SYNTHeSis:ALL[:STATe]?</code>                                                                                                                                                                                      |
| Example        | <code>:SYST:CAL:ROW1:FREQ:SYNT:ALL ON</code>                                                                                                                                                                                                                                                                                                                               |
| Notes          | When this parameter is <b>ON</b> , it overrides the Phase Noise Optimization parameter, and selects all available LO settings                                                                                                                                                                                                                                              |
| Dependencies   | The SCPI command applies to the current selected Cal Group<br>If the subopcode does not reference an existing Cal row in the Cal Group, the error message “-221, Settings conflict; Subopcode does not reference an existing Cal row” is generated                                                                                                                         |
| Couplings      | Coupled with "Phase Noise Optimization" on page 855. When this parameter is <b>ON</b> , it selects all available LO mappings, and <b>Phase Noise Optimization</b> parameter displays <b>All</b> in the Configuration table. When this parameter is <b>OFF</b> , the <b>Phase Noise Optimization</b> parameter displays its previously set value in the Configuration table |
| Preset         | <b>OFF</b>                                                                                                                                                                                                                                                                                                                                                                 |
| State Saved    | Saved in instrument state                                                                                                                                                                                                                                                                                                                                                  |
| Range          | <b>ON OFF</b>                                                                                                                                                                                                                                                                                                                                                              |

#### 6.9.1.55 Mixing Mode

Determines the LO Mixing Mode to be used.

|                |                                                                                                                                                                                                                                                   |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SYSTem:CALibration:ROW[1] 2 ... 100:LO:MMODE NORMa1   ALTErnate   ALL<br/>:SYSTem:CALibration:ROW[1] 2 ... 100:LO:MMODE?</code>                                                                                                            |
| Example        | <code>:SYST:CAL:ROW3:LO:MMOD NORM</code>                                                                                                                                                                                                          |
| Dependencies   | The SCPI command applies to the current selected Cal Group<br>If the subopcode does not reference an existing Cal row in the Cal Group, the error message “-221,Settings conflict; Subopcode does not reference an existing Cal row” is generated |
| Preset         | <b>NORMa1</b>                                                                                                                                                                                                                                     |
| State Saved    | Saved in instrument state                                                                                                                                                                                                                         |
| Range          | <b>NORMa1 ALTErnate ALL</b>                                                                                                                                                                                                                       |

#### 6.9.1.56 Match State

Determines if the Cal settings must match exactly when applying the correction. If not, the system may find the closest matching state or interpolate between states.

|                |                                                                                                                                          |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SYSTem:CALibration:ROW[1] 2 ... 100:MATCH[:STATe] ON   OFF   1   0<br/>:SYSTem:CALibration:ROW[1] 2 ... 100:MATCH[:STATe]?</code> |
| Example        | <code>:SYST:CAL4:MATC ON<br/>:SYST:CAL4:MATC?</code>                                                                                     |

|              |                                                                                                                                                                                                                                                                                                                         |
|--------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Dependencies | The SCPI command is applied to the currently selected Cal Group. The subopcode is used to identify the Cal row in the Cal Group<br>If the subopcode does not reference an existing Cal row in the Cal Group, the error message “-221, Settings conflict; Subopcode does not reference an existing Cal row” is generated |
| Preset       | All True                                                                                                                                                                                                                                                                                                                |
| State Saved  | Saved in instrument state                                                                                                                                                                                                                                                                                               |
| Range        | True   False                                                                                                                                                                                                                                                                                                            |

## 6.9.2 Cal Group

Specifies the selected Calibration Group. You can use different Cal Groups for different external hardware configurations. The Cal Group is also an important concept when sending SCPI commands to the Calibration System, because in each case the SCPI command is directed to the currently-selected Cal Group, which is the Cal Group that is modified by the SCPI command.

|                |                                                                                                     |
|----------------|-----------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SYSTem:CALibration:CGRoup &lt;integer&gt;</code><br><code>:SYSTem:CALibration:CGRoup?</code> |
| Example        | <code>:SYST:CAL:CGR 2</code><br><code>:SYST:CAL:CGR?</code>                                         |
| Preset         | 1                                                                                                   |
| Min            | 1                                                                                                   |
| Max            | 100                                                                                                 |

## 6.9.3 Apply Cal Group

Controls whether or not the checked **Apply** rows of the currently selected Cal Group are applied.

|                |                                                                                                                                                                                                                                                                                                                                                                             |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SYSTem:CALibration:CGRoup:APPLy &lt;bool&gt;</code><br><code>:SYSTem:CALibration:CGRoup:APPLy?</code>                                                                                                                                                                                                                                                                |
| Example        | <code>:SYST:CAL:CGR:APPL ON</code><br><code>:SYST:CAL:CGR:APPL?</code>                                                                                                                                                                                                                                                                                                      |
| Dependencies   | The SCPI command is applied to the currently selected Cal Group<br>You can only turn on <b>Apply Cal Group</b> if at least one Cal for the currently selected group has been executed. If you attempt to select <b>Apply Cal Group</b> before any Cals have been executed, the advisory message “At least one Row must be calibrated before it can be applied” is displayed |
| Preset         | <b>OFF</b>                                                                                                                                                                                                                                                                                                                                                                  |
| State Saved    | Saved in instrument state                                                                                                                                                                                                                                                                                                                                                   |
| Range          | <b>ON OFF</b>                                                                                                                                                                                                                                                                                                                                                               |

---

|            |                                                                                                                         |
|------------|-------------------------------------------------------------------------------------------------------------------------|
| Annotation | If <i>any</i> Cal Group is <b>ON</b> , RCal in the Meas Bar displays in amber, to indicate that Calibrations are in use |
|------------|-------------------------------------------------------------------------------------------------------------------------|

### 6.9.4 All Apply Cal Group Off

Turns off **Apply Cal Group** for all groups.

---

|                |                                                    |
|----------------|----------------------------------------------------|
| Remote Command | <code>:SYSTem:CALibration:CGRoup:APPLY:AOff</code> |
| Example        | <code>:SYST:CAL:CGR:APPL:AOff</code>               |

---

### 6.9.5 Connection

Opens the **Connection** dialog, which provides step-by-step instructions for its use.

## 6.10 Calibrator Control

Lets you select a calibrator and control the calibrator settings.

### 6.10.1 Select Cal Source

Lets you select the calibrator to control.

|                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                   |                        |                      |                                               |                     |                                                                        |                    |                   |                      |                    |                           |             |
|---------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|------------------------|----------------------|-----------------------------------------------|---------------------|------------------------------------------------------------------------|--------------------|-------------------|----------------------|--------------------|---------------------------|-------------|
| Remote Command            | <code>:SYSTem:CALibration:TUNE[:SElected] NONE   REF50   REF4800   TUNAbLe   CALOUT   RCM1   RCM2   RCM3   RCM4   RCM5   RCM6   RCM7   RCM8   RCM9   RCM10</code><br><code>:SYSTem:CALibration:TUNE[:SElected]?</code>                                                                                                                                                                                                                                                                                                           |                   |                        |                      |                                               |                     |                                                                        |                    |                   |                      |                    |                           |             |
| Example                   | <code>:SYST:CAL:TUNE:SEL TUNABLE</code><br><code>:SYST:CAL:TUNE?</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                   |                        |                      |                                               |                     |                                                                        |                    |                   |                      |                    |                           |             |
| Notes                     | <p>Options are:</p> <table> <tr> <td><code>NONE</code></td><td>No calibrator selected</td></tr> <tr> <td><code>TUNAbLe</code></td><td>Tunable internal calibrator present in N9042B</td></tr> <tr> <td><code>CALOUT</code></td><td>Tunable calibrator available through CALOUT front panel port in N9042B</td></tr> <tr> <td><code>REF50</code></td><td>50 MHz calibrator</td></tr> <tr> <td><code>REF4800</code></td><td>4.8 GHz calibrator</td></tr> <tr> <td><code>RCM1 – RCM10</code></td><td>RCal module</td></tr> </table> | <code>NONE</code> | No calibrator selected | <code>TUNAbLe</code> | Tunable internal calibrator present in N9042B | <code>CALOUT</code> | Tunable calibrator available through CALOUT front panel port in N9042B | <code>REF50</code> | 50 MHz calibrator | <code>REF4800</code> | 4.8 GHz calibrator | <code>RCM1 – RCM10</code> | RCal module |
| <code>NONE</code>         | No calibrator selected                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                   |                        |                      |                                               |                     |                                                                        |                    |                   |                      |                    |                           |             |
| <code>TUNAbLe</code>      | Tunable internal calibrator present in N9042B                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                   |                        |                      |                                               |                     |                                                                        |                    |                   |                      |                    |                           |             |
| <code>CALOUT</code>       | Tunable calibrator available through CALOUT front panel port in N9042B                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                   |                        |                      |                                               |                     |                                                                        |                    |                   |                      |                    |                           |             |
| <code>REF50</code>        | 50 MHz calibrator                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                   |                        |                      |                                               |                     |                                                                        |                    |                   |                      |                    |                           |             |
| <code>REF4800</code>      | 4.8 GHz calibrator                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                   |                        |                      |                                               |                     |                                                                        |                    |                   |                      |                    |                           |             |
| <code>RCM1 – RCM10</code> | RCal module                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                   |                        |                      |                                               |                     |                                                                        |                    |                   |                      |                    |                           |             |
| Dependencies              | If the selected calibrator is not available, it does not appear in the dropdown. If you send SCPI to select a calibrator that is not available, the instrument generates an error                                                                                                                                                                                                                                                                                                                                                |                   |                        |                      |                                               |                     |                                                                        |                    |                   |                      |                    |                           |             |
| Couplings                 | <p>Selecting <code>REF50</code> sets the RF Calibrator to <code>REF50</code></p> <p>Selecting <code>REF4800</code> sets the RF Calibrator to <code>REF4800</code></p> <p>Selecting a calibrator source other than <code>REF50</code> or <code>REF4800</code> sets RF Calibrator to <code>OFF</code></p>                                                                                                                                                                                                                          |                   |                        |                      |                                               |                     |                                                                        |                    |                   |                      |                    |                           |             |
| Preset                    | Unaffected by <b>Mode Preset</b> . Set to <code>NONE</code> by <b>Restore Input/Output Defaults</b> or <b>Restore System Defaults-&gt;All</b>                                                                                                                                                                                                                                                                                                                                                                                    |                   |                        |                      |                                               |                     |                                                                        |                    |                   |                      |                    |                           |             |

### 6.10.2 Cal Output

Lets you set the selected calibrator's RF power output state.

|                |                                                                                                                                |
|----------------|--------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SYSTem:CALibration:TUNE:OUTput[:STATe] ON   OFF   1   0</code><br><code>:SYSTem:CALibration:TUNE:OUTput[:STATe]?</code> |
| Example        | <code>:SYST:CAL:TUNE:OUTP ON</code><br><code>:SYST:CAL:TUNE:OUTP?</code>                                                       |

|        |                                                                                                                                        |
|--------|----------------------------------------------------------------------------------------------------------------------------------------|
| Preset | Unaffected by <b>Mode Preset</b> . Set to <b>OFF</b> by <b>Restore Input/Output Defaults</b> or <b>Restore System Defaults-&gt;All</b> |
|--------|----------------------------------------------------------------------------------------------------------------------------------------|

### 6.10.3 Cal Frequency

Lets you set the selected calibrator's frequency.

|                |                                                                                                                                   |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SYSTem:CALibration:TUNE:FREQuency &lt;freq&gt;</code><br><code>:SYSTem:CALibration:TUNE:FREQuency?</code>                  |
| Example        | Set source frequency to 150 MHz:<br><code>:SYST:CAL:TUNE:FREQ 150000000</code>                                                    |
| Preset         | Unaffected by <b>Mode Preset</b> . Set to 1 GHz by <b>Restore Input/Output Defaults</b> or <b>Restore System Defaults-&gt;All</b> |
| Min/Max        | Depend on the selected calibrator                                                                                                 |

### 6.10.4 Cal Signal Type

Lets you set the selected calibrator's signal type.

|                |                                                                                                                                                                           |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SYSTem:CALibration:TUNE:TYPE CW   COMB</code><br><code>:SYSTem:CALibration:TUNE:TYPE?</code>                                                                       |
| Example        | <code>:SYST:CAL:TUNE:TYPE CW</code><br><code>:SYST:CAL:TUNE:TYPE?</code>                                                                                                  |
| Dependencies   | If the selected calibrator does not support a signal type, then that type is disabled in the dropdown<br>Changing the signal type to a disabled option generates an error |
| Preset         | Unaffected by <b>Mode Preset</b> . Set to <b>CW</b> by <b>Restore Input/Output Defaults</b> or <b>Restore System Defaults-&gt;All</b>                                     |

### 6.10.5 Cal Comb Spacing

Lets you set the calibrator's comb spacing, when the signal type is **COMB**.

|                |                                                                                                                                                                                                             |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SYSTem:CALibration:TUNE:SPACing &lt;freq&gt;</code><br><code>:SYSTem:CALibration:TUNE:SPACing?</code>                                                                                                |
| Example        | Set comb spacing to 1 MHz:<br><code>:SYST:CAL:TUNE:SPAC 1000000</code>                                                                                                                                      |
| Dependencies   | Only appears when <b>COMB</b> is selected as <a href="#">"Cal Signal Type" on page 865</a><br>If the selected calibrator does not support the Comb signal, attempting to set the spacing generates an error |

|         |                                                                                                                                  |
|---------|----------------------------------------------------------------------------------------------------------------------------------|
| Preset  | Unaffected by <b>Mode Preset</b> . Set to 0 Hz by <b>Restore Input/Output Defaults</b> or <b>Restore System Defaults-&gt;All</b> |
| Min/Max | Dependent on the selected calibrator                                                                                             |

## 6.10.6 Calibrator Reference

Determines the frequency reference type used by the RCal module of the currently selected Cal Group

|                |                                                                                                                                          |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SYSTem:CALibration:TUNE:REference INTERNAL   EXTERNAL</code><br><code>:SYSTem:CALibration:TUNE:REference?</code>                  |
| Example        | Set the calibrator frequency reference to Internal:<br><code>:SYSTem:CALibration:TUNE:REference INTERNAL</code>                          |
| Dependencies   | Only displayed when an RCal module is the selected calibrator                                                                            |
| Preset         | Unaffected by <b>Mode Preset</b> . Set to preset value by <b>Restore Input/Output Defaults</b> or <b>Restore System Defaults-&gt;All</b> |
| Range          | <code>INTERNAL   EXTERNAL</code>                                                                                                         |

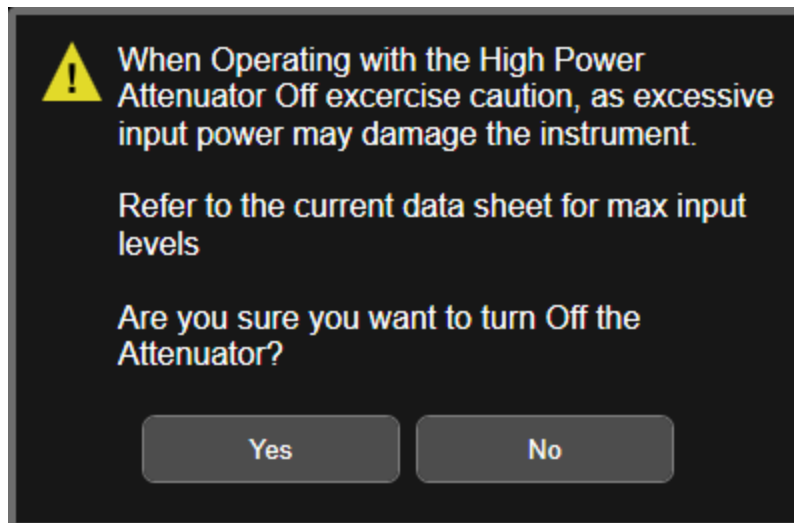
## 6.11 Advanced

### 6.11.1 T/R Port High Power Attenuator

Controls whether additional attenuation is added at the T/R Port. The T/R port has two input paths, one that provides a 16 dB attenuator, and the other that bypasses this attenuator.

- When **ON**, the path includes the 16 dB attenuator, so the max input level for this path is +47 dBm (50 W)
- When **OFF**, the 16 dB attenuator is bypassed, so the max input level for this path is +33 dBm (2 W)

If the attenuator is turned off, the following warning message is displayed and confirmation that the attenuator is to be turned off is required;



Whenever the attenuator is bypassed (**OFF**), a warning appears in the status bar: "Input caution; T/R unprotected"

In the case of an input overload at the T/R input, (>2 W with Attenuator off, or >50 W with attenuator on), or an over-temperature at the T/R input, the input is disconnected, and a dialog is displayed, stating:

"CAUTION! Excessive power has been detected at the T/R Port. The input has been disconnected. Remove the high signal power and press OK"

Or:

“CAUTION! Over temperature has been detected at the T/R Port. The input has been disconnected. Remove the signal, allow to cool & press OK”

Until you press **OK**, the input remains disconnected, and no measurement can be made.

|                |                                                                                                                                                   |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:FEED:RF:PORT:TR:HPOWer:ATTenuator[:STATe] ON   OFF</code><br><code>[ :SENSe]:FEED:RF:PORT:TR:HPOWer:ATTenuator[:STATe]?</code>    |
| Example        | <code>:FEED:RF:PORT:TR:HPOW:ATT ON</code><br><code>:FEED:RF:PORT:TR:HPOW:ATT?</code>                                                              |
| Dependencies   | Only appears in modular analyzers, and only when the M9470A module is installed, such as in M8920A. Option HDX is required to enable the T/R port |
| Preset         | <code>ON</code>                                                                                                                                   |
| State Saved    | Saved in instrument state                                                                                                                         |



## 6.12 Aux I/O Control

This menu is only available with Option LSN, indicating that the LISN IO board is installed. It is used to control each of the eight control lines out of the rear panel connector independently. There are eight bits of control lines. The LISN Control (Mode setup) of the EMI Receiver application affects the **AUX I/O Control** settings. Whenever you change the LISN Control in Mode Setup, the corresponding AUX I/O Control data lines will also be changed. The selection at the AUX I/O Control does not affect the LISN Control (Mode Setup) setting.

### 6.12.1 Data 0 – Data 7

Sets the value for Data 0 through Data 7 respectively.

|                |                                                                                                                       |
|----------------|-----------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:OUTPut:AUX:IO:DATA&lt;n&gt; OFF   ON   0   1</code><br>where <n> is an integer 0 - 7                           |
| Example        | <code>:OUTP:AUX:IO:DATA0 OFF</code>                                                                                   |
| Notes          | Unaffected by <b>Mode Preset</b> , but <b>Input/Output Preset</b> presets the value to <b>ON</b> for all 8 data lines |
| Preset         | <b>ON</b>                                                                                                             |
| Range          | <b>OFF   ON</b>                                                                                                       |

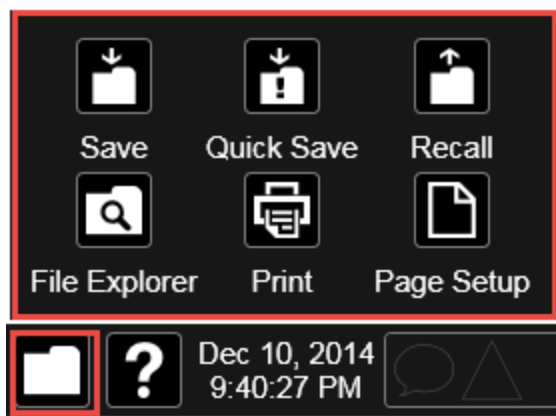
### 6.12.2 Aux IO Control (Remote Command Only)

Sets/Queries the value for all 8 data lines.

|                                 |                                                                                                                                                 |
|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command                  | <code>:OUTPut:AUX:IO &lt;Value&gt;</code><br><code>:OUTPut:AUX:IO?</code>                                                                       |
| Example                         | <code>:OUTP:AUX:IO 31</code>                                                                                                                    |
| Notes                           | Unaffected by <b>Mode Preset</b> , but <b>Input/Output Preset</b> presets the value to <b>ON</b> for all 8 data lines                           |
| Couplings                       | The states of Data 0 to Data 7 under the <b>AUX I/O Control</b> panel ( <b>Input/Output</b> menu) change according to the keyed-in AUX IO value |
| Preset                          | 31                                                                                                                                              |
| Min                             | 0                                                                                                                                               |
| Max                             | 255                                                                                                                                             |
| Backwards Compatibility<br>SCPI | <code>:OUTPut:UPORt &lt;Value&gt;</code>                                                                                                        |

## 7 Save/Recall/Print

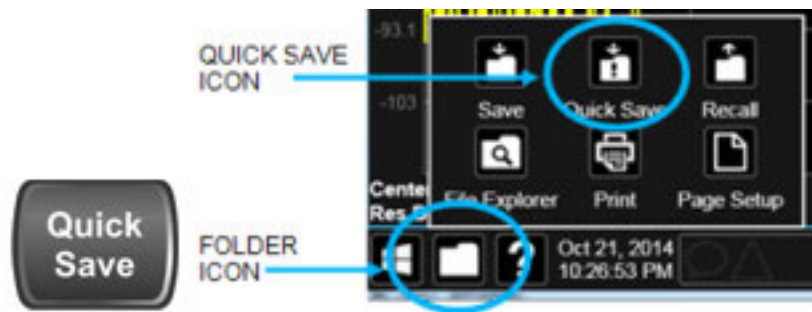
This section describes the functions that can be accessed via the front panel **Save**, **Quick Save**, and **Recall** hardkeys, as well as via the controls in the front-panel folder icon, as shown below.



## 7.1 Quick Save

**Quick Save** repeats the previous Save at the touch of a single button. Whatever you saved before gets saved again to the same directory, and with a filename derived from the previous filename.

You access Quick Save by pressing the **Quick Save** hardkey, or by pressing the folder icon at the bottom of the display and then pressing the **Quick Save** icon. In addition, if you have a PC keyboard plugged in, the sequence **CTL-Q** will perform a Quick Save.



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

- Register saves are not remembered as Saves for the purpose of the Quick Save function
- If the current measurement does not support the last non-register save that was performed, an informational message is generated, “File type not supported for this measurement”

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

If the previous save was a Screen Image save, Quick Save saves a Screen Image when the Quick Save button is pressed. This image is *exactly* what is on the screen when the **Quick Save** button is pressed. Quick Save does *not* force a dialog exit or navigate in any way, it simply snaps the image on the screen and saves it. This lets you save images of dialogs and setup screens that would be impossible to save using the **Save** dialog.

### NOTE

When **Quick Save** is pressed the display theme changes to the theme specified by the **Screen Image Theme** control in order to take the screen shot, and then changes back to the Display Theme, but no navigation is performed, and no dialogs are exited.

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

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

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

A four-digit number is appended to the prefix to create a unique file name. The numbering sequence starts at 0000 within each Mode for each file type and updates incrementally to 9999, then wraps to 0000 again. It remembers where it was through a Mode Preset and when leaving and returning to the Mode. It is reset by Restore Misc Defaults and Restore System Defaults and subsequent running of the instrument application. So, for example, the first auto file name generated for State files is **State\_0000.state**. The next is **State\_0001**, and so forth.

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

For example, if when we get to State\_0010.state there is already a State\_0010.state file in the current directory, it advances the counter to State\_0011.state to ensure that no conflict will exist (and then it verifies that State\_0011.state also does not exist in the current directory and advances again if it does, and so forth).

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

For example, if you save a measurement results file as “**fred.csv**”, then the next auto file name chosen for measurement results save will be **fred\_0000.csv**.

**NOTE**

Although 0000 is used in the example above, the number that is used is actually the current number in the Meas Results sequence, that is, the number that would

have been used if you had not entered your own file name.

---

NOTE

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

---

## Quick Save Mode

**Quick Save** can be operated in the Normal mode and in a special “Prompt” mode. There is a switch on the User Interface page of the **System** menus that lets you control this.

When Quick Save Mode is in Normal (the default setting), the instrument does an immediate save of a new file of the same type and to the same directory as the previous Save action. When Quick Save Mode is in the Prompt state, instead of immediately performing a Save, the Alpha Keyboard pops up with the proposed auto-filename in the entry area. The user can then press Enter to accept the auto filename, or edit the name and press Enter. This allows you to easily save a file with a custom file name.

---

|       |                                             |
|-------|---------------------------------------------|
| Notes | No remote command for this key specifically |
|-------|---------------------------------------------|

## 7.2 Recall

### 7.2.1 Recall From File / Open

For every Recall type, a button appears called **Recall From File** or **Open**. “Recall From File” appears for recall types that also include registers (like State and Trace+State), and “Open” appears for all other recall types.

When you push the “Recall From File” or “Open” button, a dialog slides in from the right which allows you to see what files are saved in the current directory. See the “Save to File/Save As” section (3.1) for a depiction of this screen for the Save menu, which is similar to Recall.

The default directory is the internal directory for the current Mode and save type, on the D: drive. You may also change to another Mode’s state directory by pressing the dropdown in the upper right corner labeled “Mode”. Once you have chosen a directory, the files in that directory whose extension matches the current data type (e.g., .state or .trace) are displayed in the right-hand window of the dialog. You can sort this list by name, date, file size or extension by tapping the Name, Date, Size, or Content header at the top of each column. A second tap toggles the sort order between Ascending and Descending.

Also displayed is a path depiction showing the path to the current directory. In the example shown, the path is D:\Users\Instrument\Documents\SA\screen. Tapping any element of this path lets you select an alternate route. Tapping the “Computer” arrow lets you select a different drive.



Tapping the “back” arrow navigates to the previously selected directory.

If you plug in a removable drive (e.g., a thumb drive), the browser immediately navigates to the root of that drive. Furthermore, if you had a thumb drive in and you were in a directory on the thumb, and then you exit the browser, when you come back in you are still in the same directory on that removable drive. If you remove the thumb drive, you return to the directory you had been in before the thumb drive was plugged in.

Note that for each data type there is a “current” directory, and it is the last directory used by either Save or Recall for that Mode. For example, if in SA Mode you save a Corrections file to a particular directory, then when you go to recall a Correction in SA Mode, you should be pointing at that directory. Or if in EMC Mode you recall a Limit from a particular directory then when in EMC Mode you go to save a Limit, it should be pointing at that same directory. There is one “current” directory for each data type for each Mode (not one for Save and one for Recall).

The Filename field, just below the Path field, shows the filename that will be used. The **File Name** field is loaded with the name of the selected file. You may edit the filename by tapping it, which brings up the onscreen alpha keyboard. Press the “Done” button on this keyboard when you are done editing.

Select a file to load and press Recall. After a successful recall, a message "File <filename> recalled" or "State Register <register number> recalled" is displayed in an info box for a few seconds.

The **Files of Type** field shows the file suffix for the type of file you have selected to recall. This field only appears for files which have multiple file types that can be recalled. These file types are:

Amplitude Corrections:

- Amplitude Corrections (\*.csv)
- Legacy Cable Corrections (\*.cbl)
- Legacy User Corrections (\*.amp)
- Legacy Other Corrections (\*.oth)
- Legacy Antenna Corrections (\*.ant)

Limits:

- Limit Data (\*.csv)
- Legacy Limit Data (\*.lim)

## 7.2.2 State

Lets you choose a register or file from which to recall the state.

See the Save State description for information on state files and their contents and the default paths. State files have the extension “.state”.

For rapid recall, the State menu lists 16 registers from which you can recall states. Pressing a Register button initiates the recall. You can also select a file from which to recall by pressing “Recall From File”.

Since each state file is only for one Mode, the settings for other Modes are unaffected when it is loaded. Recall State will cause a mode switch if the state being recalled is not from the current active mode.

### NOTE

**In products that run multiple simultaneous instances of the X-Series Application, all instances share the same registers and file directories, so make sure you know from what instance a file or register was saved before recalling it.**

|                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command               | <code>:MMEMory:LOAD:STATe &lt;filename&gt;</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Example                      | Load the state file data (on the default file directory path) into the instrument state:<br><code>:MMEM:LOAD:STAT "MyStateFile.state"</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Notes                        | <p>When you pick a file to recall, the instrument first verifies that the file is recallable in the current instrument by checking the software version and model number of the instrument. If there is a mismatch between the file and the instrument, the recall function tries to recall as much as possible. It may limit settings that differ based on model number, licensing or version number. In general, variables in the instrument which are not contained in the state file will be unaffected, and variables in the state file which are not contained in the instrument will be ignored</p> <p>The recall proceeds by aborting the currently running measurement, clearing any pending operations, and then loading the State from the saved state file. You can open state files from any Mode, so recalling a State file switches the instrument to the Mode that was active when the save occurred. After switching to the Mode of the saved state file, Mode settings and data (if any for the Mode) become those from the saved file. The active measurement becomes the measurement which was running when the state file was saved and the data relevant to the measurement (if there is any) is recalled</p> <p>After recalling the state, the Recall State function does the following:</p> <ul style="list-style-type: none"> <li>- Clears the input and output buffers</li> <li>- Status Byte is set to 0</li> <li>- Executes <code>*CLS</code></li> </ul> <p>If the file specified is empty an error is generated. If the specified file does not exist, another error is generated. If there is a mismatch between the file and the proper file type, an error is generated. If there is a mismatch between file version or model number or instrument version or model number, a warning is displayed. Then it returns to the State menu and File Open dialog goes away</p> <p>After the Recall, the instrument exits the Recall menu and returns to the previous menu</p> |
| Backwards Compatibility SCPI | <code>:MMEMory:LOAD:STATe 1,&lt;filename&gt;</code><br>The "1" is simply ignored                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |

### 7.2.2.1 Recall Type

If you have a built-in Source in your instrument, you may wish, when recalling State, to recall only the part of the State file that applies to the instrument, and leave the Source unaffected. Or you may wish to recall only the part of the State file that applies to the Source, and leave the instrument unaffected.

Lets you choose whether you wish to recall the entire Analyzer + Source state (**ALL**), just the Analyzer State (**ANALyzer**), or just the Source State (**SOURce**).

|                |                                                          |
|----------------|----------------------------------------------------------|
| Remote Command | <code>:MMEMory:LOAD:RTYPe ALL   ANALyzer   SOURce</code> |
| Example        | <code>:MMEM:LOAD:RTYP ALL</code>                         |



|              |                                                                     |
|--------------|---------------------------------------------------------------------|
| Dependencies | Only available in models with a built-in source, such as VXT models |
| Preset       | ALL                                                                 |
| Range        | ALL   ANALyzer   SOURce                                             |

### 7.2.2.2 Register 1 thru Register 16

Selecting any one of these register buttons causes the State to be recalled from the specified Register. The registers are provided for rapid saving and recalling, since you do not need to specify a filename or navigate to a file. Each of the register menu keys annotates whether it is empty or at what date and time it was last modified. In addition, you can edit any of the register names to enter custom names for any register.

Although these 16 registers are the only registers available from the front panel, there are 128 state registers available in the instrument. Registers 17-128 are only available from the SCPI interface, using the **\*RCL** command.

There is one set of 128 state registers in the instrument, not one set for each Mode. When a state is saved, the Mode it was saved from is saved with it; then when it is recalled, the instrument switches to that Mode.

NOTE

In products that run multiple simultaneous instances of the X-Series Application, all instances share the same registers and file directories, so make sure you know from what instance a file or register was saved before recalling it.

The date displayed follows the format specified in the **Date Format** setting in the **Control Panel**. The time shows hours and minutes.

After the recall completes, the message "Register <register number> recalled" is displayed.

If you are in the Spectrum Analyzer Mode, and you are recalling a register that was saved in the Spectrum Analyzer Mode, then after the recall, you will still be in the Recall Register menu. If the Recall causes you to switch modes, then after the Recall, you will be in the Frequency menu.

If a requested register is empty an error is generated.

|         |                                        |
|---------|----------------------------------------|
| Example | <b>*RCL 1</b>                          |
| Range   | 1-16 from front panel, 1-128 from SCPI |

### 7.2.2.3 Edit Register Names

You may enter a custom name on any of the **Register** keys, to help you remember what you are using that state to recall. To do this, press the **Name** field for the

register you want to rename, which brings up the onscreen alpha keyboard. Press the **Done** button on this keyboard when you are done editing.

The maximum number of characters for a register name is 30. If you delete all the characters in the custom name, it restores the default (time and date).

For more information and the SCPI command, see ["Edit Register Names" on page 900](#) under **Save, State**.

### 7.2.3 Trace+State

Lets you choose a register or file for recalling the state.

See **Save, "State"** on page 899 for information on state files and their contents and the default paths. State files have the extension **".state"**.

For rapid recall, the **Trace+State** menu lists 16 registers from which you can recall trace+state files. Pressing a **Register** control initiates the recall. You can also select a file from which to recall by pressing **Recall From File**.

Since each trace+state file is only for one Mode, the settings for other Modes are unaffected when it is loaded. **Recall Trace+State** will cause a mode switch if the trace+state being recalled is not from the current active Mode.

#### NOTE

**In products that run multiple simultaneous instances of the X-Series Application, all instances share the same registers and file directories, so make sure you know from what instance a file or register was saved before recalling it.**

Trace+State files have the extension **.trace**.

The Trace+State selection only appears for measurements that support trace saves. It is blanked for modes that do not support trace saves. Saving Trace is identical to saving State, except that a **.trace** extension is used on the file instead of **.state**, and internal flags are set in the file indicating which trace was saved.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:MMEMory:LOAD:TRACe TRACE1   ...   TRACE6,&lt;filename&gt;</code><br><code>:MMEMory:LOAD:TRACe:REGister TRACE1   ...   TRACE6,&lt;integer&gt;</code>                                                                                                                                                                                                                                                                                                                                                                          |
| Example        | <p>Loads the trace file data (on the default file directory path) into the specified trace; if it is a "single trace" save file, that trace is loaded to trace 2, and is set to be not updating:</p> <pre>:MMEM:LOAD:TRAC TRACE2,"MyTraceFile.trace"</pre> <p>Restore the trace data in register 2 to Trace 1:</p> <pre>:MMEM:LOAD:TRAC:REG TRACE1,2</pre>                                                                                                                                                                          |
| Notes          | When you perform the recall, the recalling Trace function must first verify the file is recallable in this instrument by checking instrument software version and model number, since it includes State. If everything matches, a full recall proceeds by aborting the currently running measurement, and loading the state from the saved state file to as close as possible to the context in which the save occurred. You can open .trace files from any mode that supports them, so recalling a Trace file switches to the mode |

---

that was active when the save occurred. After switching to the mode of the saved state file, mode settings and data (if any for the mode) are loaded with values from the saved file and the saved measurement of the mode becomes the newly active measurement, and the data relevant to the measurement (if there is any) is recalled

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

After recall, the instrument exits the **Recall** menu and returns to the previous menu

Some Modes and measurements do not have 6 available traces. For example, Phase Noise Mode:

```
:MMEMory:LOAD:TRACe TRACE1|TRACE2|TRACE3,<filename>
```

Some Modes and measurements have more than 6 traces. For example, Realtime SA Mode:

```
:MMEMory:STORe:TRACe TRACE1 | TRACE2 | TRACE3 | TRACE4 | TRACE5 |  
TRACE6 | TRACE7 | TRACE8 | TRACE9 | TRACE10 | TRACE11 | TRACE12 |  
ALL,<filename>
```

### 7.2.3.1 Recall To Trace

Lets you select which Trace to recall to. Not all Modes have the same number of available traces. The default is the currently selected trace, selected in this or any other menu with **Trace** selection. If you have selected **ALL**, then that remains selected until you specifically change it to a single trace, regardless of the trace selected in the **Trace** menu.

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

### 7.2.3.2 Register 1 thru Register 16

Selecting any one of these register buttons causes the specified trace(s) and the state of the currently active mode to be recalled from the specified Register. The registers are provided for rapid saving and recalling, since you do not need to specify a filename or navigate to a file. Each of the register menu keys annotates whether it is empty or at what date and time it was last modified. In addition, you can edit any of the register names to enter custom names for any register.

There is one set of 16 trace+state registers in the instrument, not one set for each Mode. When trace+state is saved, the Mode it was saved from is saved with it; then when it is recalled, the instrument switches to that Mode.

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**NOTE**

**In products that run multiple simultaneous instances of the X-Series Application, all instances share the same registers and file directories, so make sure you**

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know from what instance a file or register was saved before recalling it.

The date displayed follows the format specified in the **Date Format** setting under the **Control Panel**. The time shows hours and minutes.

After the recall completes, the message **Register <register number> recalled** is displayed. If a requested register is empty, an error is generated.

Recalling state from a Register is the same as recalling state from a **Trace+State** File.

|         |               |
|---------|---------------|
| Example | <b>*RCL 1</b> |
| Range   | 1-16          |

### 7.2.3.3 Edit Register Names

You may enter a custom name on any of the **Register** keys, to help you remember what you are using that state to recall. To do this, press the **Name** field for the register you want to rename, which brings up the onscreen alpha keyboard. Press the **Done** button on this keyboard when you are done editing

The maximum number of characters for a register name is 30. If you delete all the characters in the custom name, it restores the default (time and date).

For more information and the SCPI command, see **"Edit Register Names" on page 900** under **Save, State**.

## 7.2.4 Screen Config + State

Lets you load the complete configuration of all your screens from a file which you specify.

Note that recalling a screen config file wipes out your current screen configuration; you do not see a warning before it loads, but there is a note on the **Recall** page letting you know what is going to happen.

The filenames are of the form:

**State\_0001.screen**

|                |                                                                                                                                                      |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <b>:MMEMory:LOAD:SConfig &lt;filename&gt;</b>                                                                                                        |
| Example        | Load the screen configuration from the file <b>MyScreenConfig.screen</b> in the default directory:<br><b>:MMEM:LOAD:SCON "myScreenConfig.screen"</b> |

## 7.2.5 Measurement Data

Lets you specify a data type (for example, trace data) and choose a file from which to import the data.

**Measurement Data** files are comma-separated value (CSV) files, and contain the requested data in a form that can be imported into Excel or other spreadsheets, as well as header data that gives information on relevant instrument settings at the time the save occurred.

For more on **Measurement Data** files, see ["Measurement Data" on page 905](#) under **Save**.

Since the commonly exported data files are in CSV format, you can edit the data prior to importing it. This allows you to export a data file, manipulate the data in Excel (for example) and then import it.

### 7.2.5.1 Data Type

Lets you select the data type to recall.

|              |                                                                                                                                                                                                                                            |
|--------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Notes        | There is no SCPI command for Data Type, as the type is implied in the SCPI command for each item                                                                                                                                           |
| Dependencies | The <b>Data Type</b> menu for any given measurement only contains data types that are supported by that measurement. Data types that are not importable do not appear, even if they <i>do</i> appear in the corresponding <b>Save</b> menu |

## Trace

Allows you to import Trace files in the PC-readable CSV format.

**Trace** data files have the extension **.csv**. The trace file contains a “metadata” header which describes the state of the instrument when the file was saved. This metadata is compared to the current state of the instrument when the file is recalled; if it does not match the current state, the “invalid data indicator” (\*) is displayed.

|                |                                                                                                                                                                                                                              |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:MMEMory:LOAD:TRACe:DATA TRACE1   ...   TRACE6,&lt;filename&gt;</code>                                                                                                                                                 |
| Example        | Import the 2nd trace from the file <code>myTrace2.csv</code> in the current path. For SA Mode, the default path is:<br><code>My Documents\SA\data\traces</code><br><code>:MMEM:LOAD:TRAC DATA TRACE2,"myTrace2.csv"</code>   |
| Dependencies   | For SA measurements, a trace cannot be recalled from a trace file that was exported with <b>ALL</b> traces selected<br>A trace cannot be imported if the number of trace points in the file do not match the number of sweep |

|                              |                                                                                                                                                                                                                                                                    |
|------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                              | points currently set for the measurement. If this happens, an error message is generated<br>Errors are reported if the file is empty or missing, or if the file type does not match, or if there is a mismatch between the file type and the destination data type |
| Couplings                    | When a trace is imported, <b>Trace Update</b> is always turned <b>OFF</b> for that trace and <b>Trace Display</b> is always turned <b>ON</b>                                                                                                                       |
| Annotation                   | After recall is complete, an advisory is displayed in the message bar confirming which trace file was loaded                                                                                                                                                       |
| Status Bits/OPC dependencies | Sequential - aborts the current measurement                                                                                                                                                                                                                        |

## 7.2.6 Limit

Lets you select a file from which to import the **Limit** data.

**Limit** files are CSV files, and contain the limit data in a form that can be imported into Excel or similar spreadsheets, as well as header data that provides information on the limit.

See the **Save Limit** description ("**Limit**" on page 911) for information on Limit files and their contents and the default paths. **Limit** files have the extension **.csv**.

For backwards compatibility, older limit files with the extension **.lim** can be read into the instrument, but you can only save limits as **.csv** files.

A set of preloaded **Limits** files can be found in the directory:

**My Documents/EMC Limits and Ampcor/Limits**

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <b>:MMEMory:LOAD:LIMit</b> <b>LLINE1   LLINE2   LLINE3   LLINE4   LLINE5   LLINE6,&lt;-filename&gt;</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Example        | Import the 2nd Limit Line from the file <b>myLimitLine2.csv</b> in the current path:<br><b>:MMEM:LOAD:LIM</b> <b>LLINE2,"myLimitLine2.csv"</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Dependencies   | Errors are reported if the file is empty or missing, or if the file type does not match, or if there is a mismatch between the file type and the destination data type<br><br>In the Log Plot measurement in Phase Noise Mode, there are only three Limit Lines, so the valid parameters are <b>LLINE1   LLINE2   LLINE3</b><br><br>This key only appears if you have the proper option installed in your instrument                                                                                                                                                                                                                                                                                                                                                                                          |
| Couplings      | When a limit line is loaded from mass storage, it is automatically turned on. This allows the user to see it, thus confirming the load. The Margin settings will match those when the limit was saved<br><br>The instrument cannot mix <b>Limits</b> domains (X Axis Unit must be <b>Frequency</b> or <b>Time</b> for both <b>Limits</b> ). So, when a <b>Limits</b> file is loaded, the instrument sets the <b>Limits</b> domain (X Axis Unit) to match that of the file. If this changes the <b>Limits</b> domain from what it was before the file was loaded, all <b>Limits</b> data in all <b>Limits</b> sets is erased before the data loads. If this operation is over the remote interface, there is no warning if this occurs, so care should be taken to know the domain of the file you are loading |
| Annotation     | After recall is complete, an advisory is displayed in the message bar confirming which limit file was                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |

|                              |                                             |
|------------------------------|---------------------------------------------|
|                              | loaded                                      |
| Status Bits/OPC dependencies | Sequential - aborts the current measurement |

7.2.6.1 Select Limit

Selects the Limit register into which the recalled **Limit** will be placed, for example, **Limit 1**.

|        |                                                                                                         |
|--------|---------------------------------------------------------------------------------------------------------|
| Preset | Not part of <b>Preset</b> , but is reset to LLINE1 by <b>Restore Mode Defaults</b><br>Survives shutdown |
|--------|---------------------------------------------------------------------------------------------------------|

7.2.6.2 Limit

Sets the import file type to **Limits** and determines which limit the data is to be recalled to.

|                |                                                        |
|----------------|--------------------------------------------------------|
| Remote Command | :MMEMory:LOAD:LIMit LLINE1   ...   LLINE4, <file_name> |
| Example        | :MMEM:LOAD:LIM LLINE1, "C:\Limit1.csv"                 |

The required fields are:

Filetype

Version Number

Limit Type

Limit Trace

Limits Data

All other fields are ignored. Below is a valid CSV file, used to save and recall **Limits** data into the instrument:

[Filetype Limits]

[Version 1.0]

[Limitttype UPPER]

[Limitttrace Trace1]

10000000, 13.087

10000000, 13.036

20000000, 13.056

30000000, 13.051

50000000, 14.974

## 7.2.7 Correction

Allows you to import Amplitude Corrections files in the PC-readable CSV format.

**Amplitude Correction** files contain the correction data in a form that can be imported into Excel or similar spreadsheets, as well as header data that provides information on the correction.

For backwards compatibility, older limit files with the extensions **.amp**, **.cbl**, **.ant** and **.oth** can be read into the instrument.

A set of preloaded **Corrections** files can be found in the directory:

**My Documents\EMC Limits and Ampcor\Ampcor**

The default path for CSV files is:

**My Documents\amplitudeCorrections\**

Antenna corrections are a particular kind of Amplitude Corrections – they are distinguished in the corrections file by having **Antenna Unit** set to a value other than **None**. When the Amplitude Correction is an Antenna correction and the **Antenna Unit** in the file is not **None**, the Y-Axis Unit setting changes to match the Antenna (Transducer) Unit in the file.

|                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command               | <b>:MMEMory:LOAD:CORRection 1   ...   8, &lt;filename&gt;</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Example                      | Recall the Amplitude Correction data from the file <b>myAmpcor.csv</b> in the current directory to the 2nd Amplitude Correction table, and turns on Correction 2:<br><b>:MMEM:LOAD:CORR 2, "myAmpcor.csv"</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Dependencies                 | <p>Only one Transducer units can be on at any given time. Note that this means that if a correction file with a Transducer Unit is loaded into a particular Correction, all other Corrections are set to that same Transducer unit</p> <p>Corrections are not supported by all Measurements. If in a Mode in which some Measurements support it, this key is grayed-out in measurements that do not. The key does not show at all if no measurements in the Mode support it</p> <p>Errors are reported if the file is empty or missing, or if the file type does not match, or if there is a mismatch between the file type and the destination data type</p> <p>This key does not appear unless you have the proper option installed in your instrument</p> <p>This command will generate an "Option not available" error unless you have the proper option installed in your instrument</p> |
| Couplings                    | When a correction file is loaded from mass storage, it is automatically turned on ( <b>CorrectionON</b> ) and <b>Apply Corrections</b> is set <b>ON</b> . This allows you to see its effect, thus confirming the load                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Annotation                   | After recall is complete, an advisory is displayed in the message bar confirming which file was recalled                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Backwards Compatibility SCPI | <b>:MMEMory:LOAD:CORRection ANTenna   CABLE   OTHer   USER, &lt;filename&gt;</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|                              | For backwards compatibility, <b>ANTenna</b> maps to 1, <b>CABLE</b> maps to 2, <b>OTHer</b> maps to 3 and <b>USER</b> maps to 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |



7.2.7.1 Select Correction

Selects the register into which the recalled **Correction** will be placed, for example, **Correction 1**.

|        |                                                                                                                             |
|--------|-----------------------------------------------------------------------------------------------------------------------------|
| Preset | Not part of <b>Preset</b> , but reset to <b>Correction 1</b> by <b>Restore Input/Output Defaults</b><br>Survives a shutdown |
|--------|-----------------------------------------------------------------------------------------------------------------------------|

7.2.8 Complex Correction

Imports **Complex Corrections** files in the PC-readable **.s2p** format.

**Complex Correction** files contain amplitude and phase correction data in a form that can be imported into Excel or similar spreadsheets, as well as header data that gives information on the correction.

The default path for Complex Corrections files is:

**My Documents\complexCorrections\**

|                |                                                                                                                                                                                                                                                                                           |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <b>:MMEMory:LOAD:CCORrection &lt;integer&gt;, &lt;filename&gt;</b>                                                                                                                                                                                                                        |
| Example        | Recall the <b>Complex Correction</b> data from the file <b>mycor.s2p</b> in the current directory to the 2nd Complex Correction table, and turns on <b>Complex Correction 2</b> :<br><b>:MMEM:LOAD:CCOR 2, "mycor.s2p"</b>                                                                |
| Dependencies   | Not supported by all measurements. The tab does not appear at all if no measurements in the Mode support it<br><br>Errors are reported if the file is empty or missing, or if the file type does not match, or if there is a mismatch between the file type and the destination data type |
| Couplings      | When a complex correction file is loaded from mass storage, it is automatically turned <b>ON</b> and <b>Apply Corrections</b> is set <b>ON</b> . This allows you to see its effect, thus confirming the load                                                                              |
| Annotation     | After recall is complete, an advisory is displayed in the message bar confirming which file was recalled                                                                                                                                                                                  |

7.2.8.1 Select Complex Correction

Selects the register into which the recalled **Complex Correction** will be placed, for example, **Complex Correction 1**.

|        |                                                                                                                         |
|--------|-------------------------------------------------------------------------------------------------------------------------|
| Preset | Not part of <b>Preset</b> , but is reset to Correction 1 by <b>Restore Input/Output Defaults</b><br>Survives a shutdown |
|--------|-------------------------------------------------------------------------------------------------------------------------|

## 7.2.9 Recall VDI CCD Correction

Imports VDI CCD External Mixer Correction files in the PC-readable CSV (.csv) format.

The default path for VDI CCD External Mixer Correction files is the instrument's [My Documents](#) folder.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:MMEMory:LOAD:VCORrection &lt;filename&gt;</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Example        | <code>:MMEM:LOAD:VCOR "vdi_ccd_corr.csv"</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Dependencies   | <p>Requires the EXW (External Mixing Wide Bandwidth) and Ampcor (Amplitude Correction) licenses</p> <p>VDI CCD Corrections are not supported by all measurements. The tab does not appear at all if no measurements in the Mode support it</p> <p>Errors are reported if the file is empty or missing, or if the file type does not match, or if there is a mismatch between the file type and the destination data type</p> <p>If the file is empty, message -250 is reported. If the file does not exist, message -256 is reported. If there is a mismatch between the file and the destination data type, message -250 is reported</p> |
| Couplings      | When a VDI CCD correction file is loaded into memory, if the correction matches the current external mixer setup and <a href="#">"Select VDI CCD Correction" on page 713</a> is <b>NONE</b> , the selected VDI CCD Correction is set to the serial number of the matching correction data                                                                                                                                                                                                                                                                                                                                                 |
| Annotation     | After recall is complete, an advisory is displayed in the message bar confirming which file was recalled                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |

## 7.2.10 SCPI Recorder

Contains controls to let you recall SCPI recordings.

## 7.2.11 Mask

The **Mask** data type is used to import and export Mask files for measurements that use masks, such as cellular comms and real-time measurements.

## 7.2.12 Sequence

These need to be brought over for the EXT and/or Sequence Analyzer when they are available in the Touch UI

## 7.2.13 Waveform

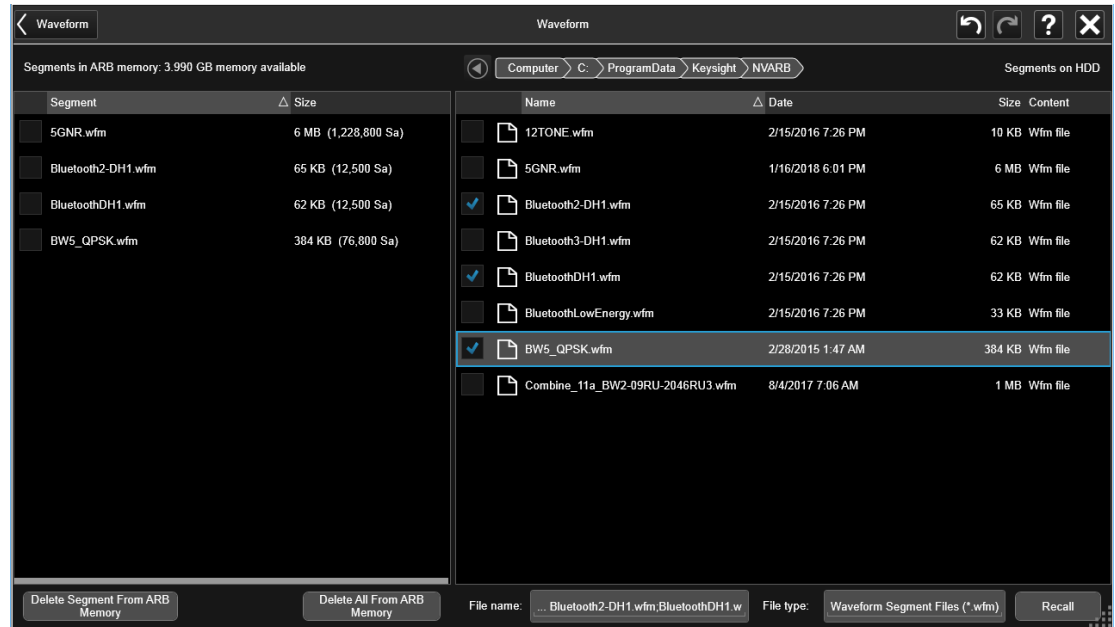
Recalls waveforms into the ARB memory of an Internal Source.

## 7 Save/Recall/Print

### 7.2 Recall

When you select the **Waveform** tab in the **Save** dialog,, a hint appears saying “Recalls files from Mass Storage to the ARB and lets you manage the ARB memory at the same time.”

You then tap **Recall From File** to display the **Recall Waveform** dialog.



The left-hand window shows the files in ARB memory. The right-hand window shows the files on the hard drive.

You can select one or more waveform files in the right-hand window. Each file selected has a blue check box in it. To select a single file, tap that file’s row. To select additional files, tap the check box in the row of the desired additional files.

When you have selected the file or files that you wish to recall, tap Recall. The file(s) are recalled into the ARB memory, and appear in the left-hand window.

If a file of the same name already exists within ARB memory, it is overwritten. If you wish to load two segments of the same name, you must rename one of the segments before loading it into ARB memory. To rename a segment, you can either use Windows File Explorer, or **:MMEMory: COPY**.

You can select one or more segments in the left-hand window and tap “Delete Segments from ARB memory” to delete the selected files. You can also delete all files in ARB memory by tapping “Delete All from ARB memory.”

You can change the current directory by tapping on an element of the file path at the top of the screen and selecting the desired subdirectory in the list that appears, and repeating until you have the path you want. The current directory is used for manually loading waveform segments into ARB memory for playback, and as a search location for waveform segments that are required to be loaded into ARB memory for playback of a waveform sequence or a list sequence.

File Type allows you to specify a waveform format. The available file types are listed below:

| Type           | Extension         | Notes                                                                                                                              |
|----------------|-------------------|------------------------------------------------------------------------------------------------------------------------------------|
| Waveform Files | <code>.wfm</code> | Keysight Signal Studio files                                                                                                       |
| Binary Files   | <code>.bin</code> | Interleaved IQ data files. They could be single precision or double precision customer created files. One-byte marker may be added |
| CSV Files      | <code>.csv</code> | Comma-separated value file. Could be generated by Excel                                                                            |
| Text Files     | <code>.txt</code> |                                                                                                                                    |
| Matlab Files   | <code>.mat</code> | Should be Level 4, Level 5 or HDF5 MAT-files (only Level 5 Matlab file is supported in X24)                                        |

Waveforms in `.csv`, `.txt` and `.mat` formats are supported by models with a built-in source, such as VXT and EXM.

`.txt` files are formatted according to the following rules:

1. Text files only contain the IQ information. Data in the right column represents the amplitude of real(I) points, Data in the left column represents the amplitude of imaginary(Q) points
2. The amount of data should be multiple of two (IQ pairs)
3. The data range is from  $-1e10$  to  $1e10$ , the data type should be `int`, `float` or `double`. 16 digits or fewer for every data is acceptable
4. The values are separated by comma or tab. Extra commas or tabs are ignored
5. Use **Enter** to separate IQ pairs

Example for text file data:

```
0.46425922,-0.57411048
0.47184454,-0.58435995
0.48107329,-0.59014958
0.49223323,-0.58998679
0.50419607,-0.58558843
0.51679158,-0.57721768
0.53005322,-0.56481976
0.54373011,-0.54879346
0.55759183,-0.52950807
0.57141409,-0.50732489
```

Rules 1-3 above also apply to `.csv` data.

---

|              |                                                                           |
|--------------|---------------------------------------------------------------------------|
| Dependencies | Only appears if your hardware includes an Internal Source, such as in VXT |
|--------------|---------------------------------------------------------------------------|

### 7.2.13.1 Load Segment to ARB Memory

Loads a single segment to ARB memory. Same as pressing the **Recall** button with a single waveform selected.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <p><b>:SOURce:RADio:ARB:LOAD</b> &lt;string&gt;</p> <p>&lt;string&gt; - specifies the path name of the file to load from the HDD into ARB memory. May be a &lt;full path + filename&gt;, or &lt;"NVWFM" MSUS + colon + filename&gt;</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Example        | <p><b>:SOUR:RAD:ARB:LOAD "D:\NVARB\testwaveform.bin"</b></p> <p>or</p> <p><b>:SOUR:RAD:ARB:LOAD "NVWFM:testwaveform.bin"</b></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Notes          | <p>Because loading the file involves a delay of unpredictable length, this command should be followed by <b>*OPC?</b>, which holds off subsequent commands until the loading operating is complete</p> <p>If you specify a file over SCPI, but the file is not at the specified location, an error is generatedIf you try to load a waveform file but the file contains less than 500 IQ samples, an error is generated</p> <p>VXT models M9410A/11A/15A/16A and M9410E/11E/15E/16E:</p> <p>If you try to load a waveform file but the file contains less than 1024 IQ samples, an error is generated</p> <p>If you try to load a Signal Studio waveform <b>*.wfm</b> that contains invalid waveform header, an error is generated</p> <p>If the ARB is <b>ON</b> when you load a file to ARB memory or delete a file from ARB memory, the playing waveform segment may not keep phase continuity during the ARB memory operation. The waveform is replayed after the ARB operation is finished</p> <p>ARB can be loaded into ARB memory even if required licenses are not present on the instrument. In this case, a GUI-only warning message -800, "Operation complete; Loaded &lt;filename&gt; successfully, but no license &lt;required licenses&gt; installed". You can install required licenses according to &lt;required licenses&gt; string to license it, or multi-pack license it</p> <p>When in Sequence Analyzer Mode, and <b>Include Source</b> is <b>Yes</b>, an attempt to load a file to ARB memory is rejected with an error. When <b>Include Source</b> is <b>No</b>, and if there is insufficient free ARB memory to load the selected waveform, an error is generated</p> |
| Remote Command | <p><b>:SOURce:RADio:ARB:LOAD:ALL</b> &lt;string&gt;</p> <p>&lt;string&gt; specifies the directory on the HDD to load the files into ARB memory from</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Example        | <p><b>:SOUR:RAD:ARB:LOAD:ALL "D:\nvarb"</b></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Notes          | <p>Loads all the segment files within the currently selected directory into ARB memory. If a file of the same name already exists within ARB memory, it is overwritten. If you wish to load two segments of the same name, you must rename one of the segments before loading it into ARB memory. To rename a segment, either use Windows File Explorer, or <b>:MEMory:COPY</b></p> <p>If you specify a directory over SCPI, but the directory does not exist, an error is generated</p> <p>If the ARB is <b>ON</b>, and you then load or delete a file to ARB memory, the playing waveform segment may not keep phase continuity during the ARB memory operation. The waveform is replayed after the ARB operation is finished</p> <p>When in Sequence Analyzer Mode, and <b>Include Source</b> is <b>Yes</b>, an attempt to load all files from a</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |

directory to ARB memory is rejected with an error. When **Include Source** is **No** and there is insufficient free ARB memory to load all the waveforms, when the ARB memory is full, the copy ceases, and an error is generated

### 7.2.13.2 Delete Segment From ARB Mem

Deletes a segment from ARB memory.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SOURce:RADio:ARB:DELeTe &lt;string&gt;</code><br><code>&lt;string&gt;</code> specifies the waveform to be deleted from the ARB playback memory                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Example        | <code>:SOUR:RAD:ARB:DEL "testwaveform.bin"</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Notes          | <p>It is possible to delete files from within the ARB memory when the ARB is <b>ON</b>. However, if you attempt to delete the file that is currently playing an error is generated</p> <p>It is possible to delete a file from within the ARB memory when the sequencer state is <b>ON</b>, and the file is not being used by the List Sequencer. If you attempt to delete a file that is being used by the list sequencer, an error is generated</p> <p>When the Sequencer state of the List Sequencer is <b>On</b>, even if ARB state is <b>On</b>, the selected waveform will not be played. In this case, if the selected waveform is not used in List Sequence, it can be deleted, and the ARB state is turned <b>Off</b></p> <p>If the ARB is <b>ON</b> and you load a file to ARB memory or delete a file from ARB memory, the playing waveform segment may not keep phase continuity during the ARB memory operation. The waveform is replayed after the ARB operation is finished</p> <p>When in Sequence Analyzer Mode, and <b>Include Source</b> is <b>Yes</b>, an attempt to delete a file from ARB memory is rejected with an error. When <b>Include Source</b> is <b>No</b>, and you specify a file that does not exist within ARB memory, an error is generated</p> |

### 7.2.13.3 Delete All From ARB Memory

Removes all segments from ARB memory.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SOURce:RADio:ARB:DELeTe:ALL</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Example        | <code>:SOUR:RAD:ARB:DELeTe:ALL</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Notes          | <p>If you attempt to delete all files from ARB memory when there are waveform files used in the Sequencer function of the List Sequencer and the Sequencer state is <b>ON</b>, all files except the files currently being used in list sequencer are deleted, and an error is generated</p> <p>If the ARB is <b>ON</b> and you load a file to ARB memory or delete a file from ARB memory, the playing waveform segment may not keep phase continuity during the ARB memory operation. The waveform is replayed after the ARB operation is finished</p> <p>When in Sequence Analyzer Mode, and <b>Include Source</b> is <b>Yes</b>, an attempt to delete all files from ARB memory is rejected with an error. When <b>Include Source</b> is <b>No</b>, and you attempt to delete all files from ARB memory when the ARB is currently playing a file, all files except the one playing are deleted and an error is generated</p> |

#### 7.2.13.4 Set Default Directory (Remote Command Only)

Sets the default directory for loading ARB files from SCPI.

|                |                                                                                                                                                                                                                                  |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SOURce:RADio:ARB:DEFAult:DIRectory &lt;string&gt;</code><br><code>:SOURce:RADio:ARB:DEFAult:DIRectory?</code>                                                                                                             |
| Example        | <code>:SOUR:RAD:ARB:DEF:DIR "D:\ArbFiles"</code><br><code>:SOUR:RAD:ARB:DEF:DIR?</code>                                                                                                                                          |
| Notes          | Sets the default directory to be used as a search location for waveform segments that are required to be loaded into ARB memory for playback of a waveform sequence, and as a search location for selecting waveforms using SCPI |
| State Saved    | Persistent, survives a power cycle and a preset but not saved in the instrument state                                                                                                                                            |

#### 7.2.13.5 Query ARB Memory File List (Remote Query Only)

Queries the instrument for the list of waveform segments in the ARB memory.

##### NOTE

Returns a string for waveform segment names in ARB memory. If you want a string list of waveform segments in the ARB memory, use **"Query ARB Memory Full File List (Remote Query Only)"** on page 891.

|                                |                                                                                                                                                                                                                                                                                                                                          |                              |             |                              |             |                                |                                                             |
|--------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|-------------|------------------------------|-------------|--------------------------------|-------------------------------------------------------------|
| Remote Command                 | <code>:SOURce:RADio:ARB:CATalog?</code>                                                                                                                                                                                                                                                                                                  |                              |             |                              |             |                                |                                                             |
| Example                        | <code>:SOUR:RAD:ARB:CATalog?</code>                                                                                                                                                                                                                                                                                                      |                              |             |                              |             |                                |                                                             |
| Notes                          | The return data is in the following format:<br><table border="1"> <tr> <td><code>&lt;integer&gt;</code></td><td>memory used</td></tr> <tr> <td><code>&lt;integer&gt;</code></td><td>memory free</td></tr> <tr> <td><code>&lt;string&gt;...</code></td><td>comma separated list of waveform segments within ARB memory</td></tr> </table> | <code>&lt;integer&gt;</code> | memory used | <code>&lt;integer&gt;</code> | memory free | <code>&lt;string&gt;...</code> | comma separated list of waveform segments within ARB memory |
| <code>&lt;integer&gt;</code>   | memory used                                                                                                                                                                                                                                                                                                                              |                              |             |                              |             |                                |                                                             |
| <code>&lt;integer&gt;</code>   | memory free                                                                                                                                                                                                                                                                                                                              |                              |             |                              |             |                                |                                                             |
| <code>&lt;string&gt;...</code> | comma separated list of waveform segments within ARB memory                                                                                                                                                                                                                                                                              |                              |             |                              |             |                                |                                                             |

#### 7.2.13.6 Query ARB Memory Full File List (Remote Query Only)

Queries the instrument for the string list of waveform segments in the ARB memory. Returns a string list for waveform segment names in the ARB memory.

|                |                                             |
|----------------|---------------------------------------------|
| Remote Command | <code>:SOURce:RADio:ARB:FCATalog?</code>    |
| Example        | <code>:SOUR:RAD:ARB:FCATalog?</code>        |
| Notes          | The return data is in the following format: |

|                                     |                                                                    |
|-------------------------------------|--------------------------------------------------------------------|
| <integer>                           | Memory used                                                        |
| <integer>                           | Memory free                                                        |
| <integer>                           | File count in ARB memory                                           |
| <string>, <string>, ...<br><string> | Comma-separated string list of waveform segments within ARB memory |

Example:

```
:SOUR:RAD:ARB:FCAT?
```

EXT returns: 27499,2069653,3,"c2k.wfm","gsm.wfm","wcdma.wfm"

### 7.2.14 Power Sensor Cal Factor

Selects a file to which to export the Power Sensor Cal factor data.

**Cal Factor** files are XML files, and contain the cal factor data and header data that gives information on the power sensor.

The default path for **Cal Factor** Files is:

```
My Documents\<mode name>\data\PSCF
```

where <mode name> is the parameter used to select the mode with **:INST:SEL** (for example, **MRECEIVE** for Measuring Receiver Mode). Hence, a **Cal Factor** file from any measurement in the Measuring Receiver mode would be stored in:

```
My Documents\MRECEIVE\data\PSCF
```

**Cal Factor** files have the extension **.xml**. The default filename is **<Sensor Model>\_<Sensor Serial Number>\_0000.xml**, where the 4-digit number is the lowest number that does not conflict with any filename in the current directory. If the sensor model or serial number is blank, the default filename is **PSCF\_0000.xml**.

|                |                                                                                                                                                                                                                                                                                                                                         |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <b>:MMEMory:STORe:PSCFactor</b> <file_name>                                                                                                                                                                                                                                                                                             |
| Example        | <b>:MMEM:STOR:PSCF</b> "myPSCF.xml"                                                                                                                                                                                                                                                                                                     |
| Notes          | <p>If the save is initiated via SCPI, and the file already exists, the file will be overwritten</p> <p>Using the <b>C:</b> drive is strongly discouraged, since it runs the risk of being overwritten during an instrument software upgrade</p> <p>Both single and double quotes are supported for any filename parameter over SCPI</p> |
| Dependencies   | Only appears if you have the proper option installed in your instrument                                                                                                                                                                                                                                                                 |

### 7.2.15 ENR Table

Sets the import file type to ENR Meas Table or to ENR Cal Table.



|                              |                                                                                 |
|------------------------------|---------------------------------------------------------------------------------|
| Remote Command               | :MMEMory:LOAD:ENR MEASurements   CALibration,<file_name>                        |
| Example                      | :MMEM: LOAD:ENR MEAS,"C:\ENRTable.csv"<br>:MMEM: LOAD:ENR CAL,"C:\CalTable.csv" |
| Backwards Compatibility SCPI | :MMEMory:LOAD:ENR                                                               |

The required fields are:

Filetype  
Version Number  
Serial Number  
Model  
ENR Data

All other fields are ignored. Below is a valid CSV file, used to save and recall ENR data into the Instrument:

[Filetype ENR]  
[Version 1.0]  
[Serialnumber 4015A05185]  
[Model 346C]  
10000000, 13.087  
100000000, 13.036  
1000000000, 13.056  
2000000000, 13.051  
26500000000, 14.974

7.2.16 Loss Comp

Sets the import file type to Loss Compensation Before DUT Table or to Loss Compensation After DUT Table.

|                |                                                                                   |
|----------------|-----------------------------------------------------------------------------------|
| Mode           | NFIGURE                                                                           |
| Parameter Name | Recall Loss Comp                                                                  |
| Control Path   | Recall                                                                            |
| Parameter Type | ImmediateAction                                                                   |
| SCPI Command   | :MMEMory:LOAD:LOSS BEFore   AFTer,<file_name>                                     |
| SCPI Example   | :MMEM:LOAD:LOSS BEF,"C:\LossBefore.csv"<br>:MMEM:LOAD:LOSS AFT,"C:\LossAfter.csv" |

|                              |                                                                                                                                                                                                     |
|------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Notes                        | Three file formats are supported: <ul style="list-style-type: none"><li>- Loss Compensation file (.csv)</li><li>- Legacy Loss Compensation file (.loss)</li><li>- S parameter file (.s2p)</li></ul> |
| Soft Key Label               | Loss Comp                                                                                                                                                                                           |
| Backwards Compatibility SCPI | :MMEMory:LOAD:LOSS                                                                                                                                                                                  |
| Initial S/W Revision         | A.04.00                                                                                                                                                                                             |

For .s2p files, only the S21 component is used for the loss compensation.  
The CSV format contains the following data:

File Type  
Application Name: Measurement Name  
Version and Model Number  
Loss Comp Data

Below is an example of a valid CSV Loss Compensation file:

```
[Filetype LossCompensation]
[NF:NFIG]
Ver. ***, Model ***
10, 1.0000
20, 2.0000
30, 3.0000
40, 4.0000
50, 5.0000
60, 6.0000
```

### 7.2.17 Frequency List

Sets the import file type to Frequency List. When a frequency list is imported, the frequency list is populated.

|                              |                                        |
|------------------------------|----------------------------------------|
| Remote Command               | :MMEMory:LOAD:FREQuency <file_name>    |
| Example                      | :MMEM:LOAD:FREQ "C:\FrequencyList.csv" |
| Backwards Compatibility SCPI | :MMEMory:LOAD:FREQuency                |

The CSV format replaces the legacy .lst format. It has the following required fields (note that frequency context is now saved alongside the frequency list data):

Filetype

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Application Name: Measurement Name

Version

Frequency List Data

MCON Frequency List Data (N9069A-2FP license is required)

- RF Frequency List Data
- LO Frequency List Data
- IF Frequency List Data

Below is an example of a valid CSV Frequency List file:

[Filetype: FrequencyList]

[NF:NFIG]

Ver. \*\*\*.

4000000000

5000000000

6000000000

25000000000

26500000000

MCON frequency lists

RF

4000000000

5000000000

6000000000

25000000000

26500000000

LO

4000000000

5000000000

6000000000

25000000000

26500000000

IF

4000000000

5000000000

6000000000

25000000000

26500000000

### 7.2.18 Data Pattern

Lets you choose a file from which to import the data pattern for generating an NRZ waveform to be used by the Audio Generator ARB.

**Data Pattern** files are CSV files, containing the bit pattern data in a form that can be imported into Excel or similar spreadsheets.

**Data Pattern** files have the extension **.csv**.

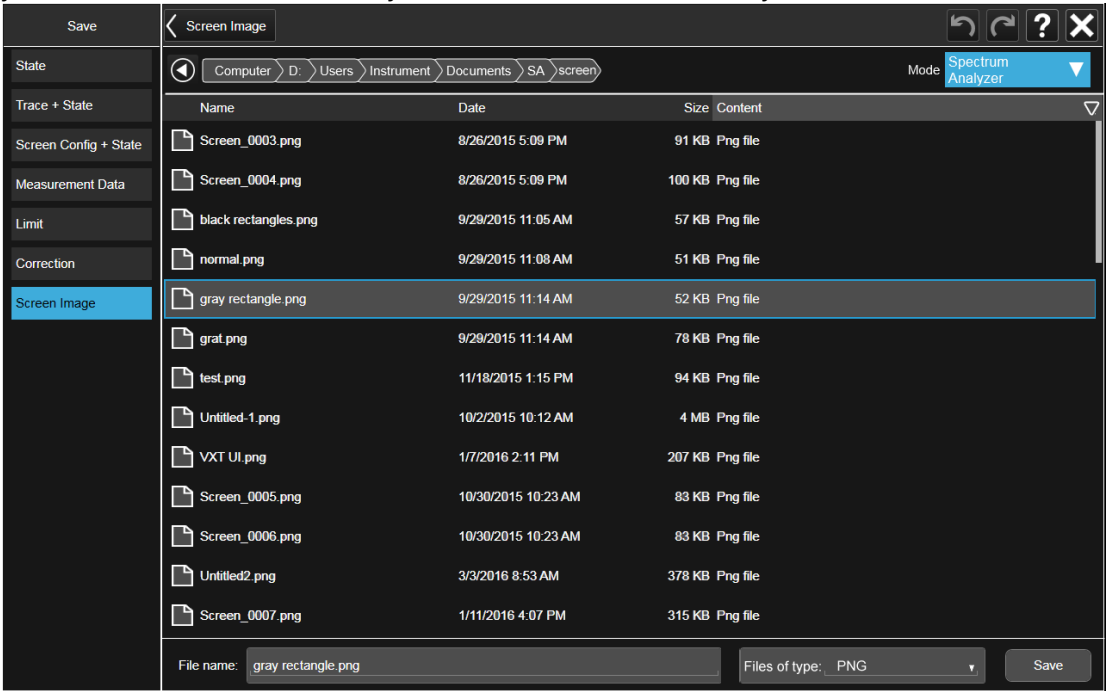
|                              |                                                                                                                                                                        |
|------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command               | <code>:MMEMory:LOAD:RTS:DATA:PATtern &lt;filename&gt;</code>                                                                                                           |
| Example                      | Import the data pattern from the file <code>myDataPattern.csv</code> in the current path:<br><code>:MMEM:LOAD:RTS:DATA:PATT "myDataPattern.csv"</code>                 |
| Dependencies                 | Errors are reported if the file is empty or missing, or if the file type does not match, or if there is a mismatch between the file type and the destination data type |
| Annotation                   | After recall is complete, an advisory is displayed in the message bar confirming the sync pattern strings were loaded                                                  |
| Status Bits/OPC dependencies | Sequential - aborts the current measurement                                                                                                                            |

## 7.3 Save

### 7.3.1 Save to File / Save As

For every Save type, a control appears labeled **Save to File** or **Save As**. **Save to File** appears for save types that also include registers (like State and Trace+State), and **Save As** appears for all other save types.

When you press **Save to File** or **Save As**, a dialog slides in from the right that allows you to see what files are already saved in the current directory.



The default directory is the internal directory for the current Mode and save type, on

the **D:** drive. You may also change to another Mode's state directory by pressing the dropdown in the upper right corner labeled **Mode**. Once you have chosen a directory, the files in that directory whose extension matches the current data type (for example, **.state** or **.trace**) are displayed in the right-hand window of the dialog. You can sort this list by name, date, file size or extension by tapping the Name, Date, Size, or Content header at the top of each column. A second tap toggles the sort order between Ascending and Descending.

Also displayed is a path depiction showing the path to the current directory. In the example above, the path is **D:\Users\Instrument\Documents\SA\screen**. Tapping any element of this path lets you select an alternate route. Tapping the **Computer** arrow lets you select a different drive.



Tapping the “Back” arrow navigates to the previously selected directory.

Note: Using the C: drive is strongly discouraged, due to the risk of data being overwritten during an instrument software upgrade.

If you plug in a removable drive (for example, a thumb drive), the browser immediately navigates to the root of that drive. Furthermore, if you had a thumb drive in and you were in a directory on the thumb, and then you exit the browser, when you come back in you are still in the same directory on that removable drive. If you remove the thumb drive, you return to the directory you had been in before the thumb drive was plugged in.

Note that for each data type there is a “current” directory, and it is the last directory used by either Save or Recall for that Mode. For example, if in SA Mode you save a Corrections file to a particular directory, then when you go to recall a Correction in SA Mode, you should be pointing at that directory. Or if in EMC Mode you recall a Limit from a particular directory then when in EMC Mode you go to save a Limit, it should be pointing at that same directory. There is one “current” directory for each data type for each Mode (not one for Save and one for Recall).

The Filename field, just below the Path field, shows the filename that will be used. The **File Name** field is initially loaded with an automatically generated filename specific to the appropriate Save Type. The automatically generated filename is guaranteed not to conflict with any filename currently in the directory. You may edit the filename by tapping it, which brings up the onscreen alpha keyboard. Press the “Done” button on this keyboard when you are done editing.

Select a file to overwrite, type in a file name, or use the name suggested by the instrument (guaranteed not to conflict with any file in the current directory), and press Save. If the file specified already exists, a dialog will appear that allows you to replace the existing file by selecting **OK**, or you can Cancel the request.

After a successful save, a message "File <filename> saved" or "State Register <register number> saved" is displayed in an info box for a few seconds.

See **"Quick Save" on page 871** for details of the automatic file naming algorithm.

### 7.3.2 State

Selects a register or file for saving the state.

**State** files contain essentially all the information required to return the instrument to the measurement and settings that were in effect at the time of the save. **State** files are in a proprietary binary form (for speed) and cannot be read or edited by PC software, but can be loaded back into the instrument to restore the state.

**State** files contain all the settings of the **Input/Output** system as well, even though **Input/Output** variables are outside of the Mode's state and unaffected by **Mode Preset**, because these are needed to restore the complete setup.

Persistent System settings (for example, GPIB address) are affected by neither **Mode Preset** nor **Restore Mode Defaults**, nor are they included in a saved **State** file.

For rapid saving, the **State** menu lists 16 registers to which you can save states. Pressing a **Register** button initiates the save. You can also select a file to which to save by pressing **Save to File**.

The default path for all **State** files is:

`My Documents\<mode name>\state`

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

**State** files have the extension `.state`. The default filename is `State_0000.state`, where the 4-digit number is the lowest number that does not conflict with any filename in the current directory.

NOTE

In products that run multiple simultaneous instances of the X-Series Application, all instances share the same registers and file directories, so take care not to overwrite files and/or registers from one instance that were saved by another instance.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:MMEMory:STORe:STATe &lt;filename&gt;</code>                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Example        | Store the current instrument state data in the file <code>MyStateFile.state</code> in the default directory:<br><code>:MMEM:STOR:STATe "MyStateFile.state"</code>                                                                                                                                                                                                                                                                                                                        |
| Notes          | Both single and double quotes are supported for any filename parameter over remote<br>After saving to a register, that register's menu key is updated with the date the time, unless a custom label has been entered for that key<br>After saving to a register, you remain in the <b>Save State</b> menu, so that you can see the <b>Register</b> key update. After saving to a file, the instrument automatically returns to the previous menu and any <b>Save As</b> dialog goes away |

---

|               |                                                      |
|---------------|------------------------------------------------------|
| Backwards     | <code>:MMEMory:STORe:STATe 1,&lt;filename&gt;</code> |
| Compatibility | The "1" is simply ignored. The command is sequential |
| SCPI          |                                                      |

### 7.3.2.1 Register 1 thru Register 16

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

Although these 16 registers are the only registers available from the front panel, there are 128 state registers available in the instrument. Registers 17-128 are only available from the SCPI interface, using the `*SAV` command.

There is one set of 128 state registers in the instrument, not one set for each Mode. When a state is saved, the Mode it was saved from is saved with it; then when it is recalled, the instrument switches to that Mode.

#### NOTE

**In products that run multiple simultaneous instances of the X-Series Application, all instances share the same registers and file directories, so take care not to overwrite files and/or registers from one instance that were saved by another instance.**

---

The date displayed follows the format specified in the **Date Format** setting under the **Control Panel**. The time shows hours and minutes.

After the save completes, the corresponding register menu key annotation is updated with the date and time and the message **Register <register number> saved** is displayed.

---

|         |                                        |
|---------|----------------------------------------|
| Example | <code>*SAV 1</code>                    |
| Range   | 1-16 from front panel, 1-128 from SCPI |

---

### 7.3.2.2 Edit Register Names

You may enter a custom name for any of the **Registers**, to help you remember what you are using that state to save. To do this, press the **Name** field for the register you want to rename, which displays the onscreen alpha keyboard. Press **Done** on this keyboard when you are done editing.

The maximum number of characters for a register name is 30. If you delete all the characters in the custom name, it restores the default (time and date).



The register names are stored within the state files, but they are not part of the instrument state; that is, once you have edited a register name, loading a new state will not change that register name. Another consequence of this is that the names will be persistent through a power cycle. Also, if a named state file is transferred to another instrument, it will bring its custom name along with it.

If you try to edit the name of an empty register, the instrument first saves the state to have a file to put the name in. If you load a named state file into an instrument with older firmware, it ignores the metadata.

The **\*SAV** and **\*RCL** commands are not affected by the custom register names, nor are the **:MMEM** commands.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <b>:MMEMory:REGister:STATe:LABel &lt;reg number&gt;,"label"</b><br><b>:MMEMory:REGister:STATe:LABel? &lt;reg number&gt;</b>                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Example        | <b>:MMEM:REG:STAT:LAB 1,"my label"</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Notes          | <b>&lt;reg number&gt;</b> is an integer from 1 to 16. If the SCPI specifies an invalid register number an error message is generated, -222, "Data out of range; Invalid register label number"<br><b>"label"</b> is a string from 0 to 30 characters in length. If a label exceeds 30 characters, an error message is generated, -150, "String data error; Label clipped to 30 characters"<br><b>"label"</b> of zero length erases the custom label and restores the default (time and date) label. For example, <b>:MMEM:REG:STAT:LAB 1,""</b> |
| Preset         | The names are unaffected by <b>Preset</b> or power cycle but are set to the default label (time and date) on <b>Restore System Defaults&gt;Misc</b>                                                                                                                                                                                                                                                                                                                                                                                             |

### 7.3.3 Trace+State

Selects a register or file for saving selected traces and the state.

**Trace+State** files contain essentially all the information required to return the instrument to the measurement and settings that were in effect at the time of the save, as well as the data for one or all traces. **Trace+State** files are in a proprietary binary form (for speed) and cannot be read or edited by PC software, but can be loaded back into the instrument to restore the state and trace(s).

**Trace+State** files contain all the settings of the **Input/Output** system as well, even though **Input/Output** variables are outside of the Mode's state and unaffected by **Mode Preset**, because these are needed to restore the complete setup.

Persistent **System** settings (for example, GPIB address) are affected by neither **Mode Preset** nor **Restore Mode Defaults**, nor are they included in a saved **Trace+State** file.

For rapid saving, the **Trace+State** menu lists 16 registers to which you can save trace+state files. The **Trace+State** registers are separate registers from the **State** registers. Pressing a **Register** button initiates the save. You can also select a file to which to save by pressing **Save to File**.

The default path for all **Trace+State** files is the same as that for **State** files:

My Documents\<mode name>\state

where <mode name> is the parameter used to select the mode with **:INST:SEL** (for example, **BASIC** for IQ Analyzer Mode).

#### NOTE

In products that run multiple simultaneous instances of the X-Series Application, all instances share the same registers and file directories, so take care not to overwrite files and/or registers from one instance that were saved by another instance.

**Trace+State** files have the extension **.trace**. The default filename is **State\_0000.trace**, where the 4-digit number is the lowest number that does not conflict with any filename in the current directory.

The **Trace+State** selection only appears for measurements that support trace saves. It is blanked for modes that do not support trace saves. Saving **Trace** is identical to saving **State** except a **.trace** extension is used on the file instead of **.state**, and internal flags are set in the file indicating which trace was saved.

See "More Information" on page 903.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <pre>:MMEMory:STORe:TRACe TRACE1   TRACE2   TRACE3   TRACE4   TRACE5   TRACE6   ALL,&lt;filename&gt;</pre> <pre>:MMEMory:STORe:TRACe:REGister TRACE1   TRACE2   TRACE3   TRACE4   TRACE5   TRACE6   ALL,&lt;integer&gt;</pre>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Example        | <p>Save the file <b>myState.trace</b> on the default path and flags it as a "single trace" file with Trace 1 as the single trace (even though all of the traces are in fact stored):</p> <pre>:MMEM:STOR:TRAC TRACE1,"myState.trace"</pre> <p>Save the file <b>myState.trace</b> on the default path and flags it as an "all traces" file:</p> <pre>:MMEM:STOR:TRAC ALL,"myState.trace"</pre> <p>Store trace 1 data in trace register 2:</p> <pre>:MMEM:STOR:TRAC:REG TRACE1,2</pre>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Notes          | <p>This command actually performs a <b>Save State</b>, which in the Swept SA measurement includes the trace data. However, it flags it (in the file) as a "save trace" file of the specified trace (or all traces)</p> <p>Some Modes and measurements do not have available all 6 traces. The Phase Noise Mode command, for example, is:</p> <pre>:MMEMory:STORe:TRACe TRACE1   TRACE2   TRACE3   ALL,&lt;filename&gt;</pre> <p>Some modes and measurements have more than 6 traces available. The Realtime SA Mode command, for example, is:</p> <pre>:MMEMory:STORe:TRACe TRACE1   TRACE2   TRACE3   TRACE4   TRACE5   TRACE6   TRACE7   TRACE8   TRACE9   TRACE10   TRACE11   TRACE12   ALL,&lt;filename&gt;</pre> <p>The range for the register parameter is 1-5</p> <p>When you initiate a save, if the file already exists, a dialog will appear that allows you to replace the existing file by selecting <b>OK</b> or you can cancel the request. If you select <b>OK</b>, the file will be overwritten. Using the <b>C:</b> drive is strongly discouraged, since it runs the risk of being overwritten during an instrument software upgrade</p> |

---

Both single and double quotes are supported for any filename parameter over remote

After saving to a register, that register's menu key is updated with the date and time of the save

After saving to a register, you remain in the **Save Trace** menu, so that you can see the **Register** key update. After saving to a file, the instrument automatically returns to the previous menu and any **Save As** dialog goes away

**More Information**

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

The following table describes the **Trace Save** and **Recall** possibilities:

|                                                                                |                                                                                                                                                         |                                                                                                                                                                                                                             |
|--------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| You want to recall state and one trace's data, leaving other traces unaffected | <b>Save Trace+State</b> from 1 trace. Make sure that no other traces are updating (they should all be in View or Blank mode) when the save is performed | On recall, specify the trace you want to load the one trace's data into. This trace loads in view. All other traces' data will be unaffected, although their trace mode will be as it was when the state save was performed |
| You want to recall all traces                                                  | <b>Save Trace+State</b> from <b>ALL</b> traces                                                                                                          | On recall, all traces come back in <b>View</b> (or <b>Blank</b> if they were in <b>Blank</b> or <b>Background</b> when saved)                                                                                               |
| You want all traces to load exactly as they were when saved                    | <b>Save State</b>                                                                                                                                       | On recall, all traces' mode and data will be exactly as they were when saved. Any traces that were updating will have their data immediately overwritten                                                                    |

**7.3.3.1 Save From Trace**

Selects the trace to be saved. The default is the currently selected trace, selected in this this or any other menu with Trace selection. If you have chosen All then it remains chosen until you specifically change it to a single trace, regardless of the trace selected in the **Trace** menu.

When you select a trace, it makes that trace the current trace, so it displays on top of all of the other traces.

### 7.3.3.2 Register 1 thru Register 16

Selecting any one of these register buttons causes the specified trace(s) and the state of the currently active mode to be saved to the specified register. The registers are provided for rapid saving and recalling, since you do not need to specify a filename or navigate to a file. Each of the register menu keys annotates whether it is empty or at what date and time it was last modified. In addition, you can edit any of the register names to enter custom names for any register.

There is one set of 16 trace+state registers in the instrument, not one set for each Mode. When trace+state is saved, the Mode it was saved from is saved with it; then when it is recalled, the instrument switches to that Mode.

**NOTE**

In products that run multiple simultaneous instances of the X-Series Application, all instances share the same registers and file directories, so take care not to overwrite files and/or registers from one instance that were saved by another instance.

---

The date displayed follows the format specified in the **Date Format** setting in **Control Panel**. The time shows hours and minutes.

After the save completes, the corresponding register menu key annotation is updated with the date and time and the message **Register <register number> saved** is displayed.

---

|         |        |
|---------|--------|
| Example | *SAV 1 |
| Range   | 1-16   |

---

### 7.3.3.3 Edit Register Names

You may enter a custom name for any of the registers, to help you remember what you are using that trace+state to save. To do this, press the **Name** field for the register you want to rename, which displays the onscreen alpha keyboard. Press the **Done** button on this keyboard when you are done editing.

The maximum number of characters for a register name is 30. If you delete all the characters in the custom name, it restores the default (time and date).

The register names are stored within the trace+state files, but they are not part of the instrument state; that is, once you have edited a register name, loading a new state does not change that register name. Another consequence of this is that the names are persistent through a power cycle. Also, if a named state file is transferred to another instrument, it brings its custom name along with it.

## 7 Save/Recall/Print

### 7.3 Save

If you try to edit the name of an empty register, the instrument will first save the trace+state to have a file to put the name in. If you load a named state file into an instrument with older firmware, it ignores the metadata.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:MMEMory:REGister:TRACe:LABel &lt;reg number&gt;,"label"</code><br><code>:MMEMory:REGister:TRACe:LABel? &lt;reg number&gt;</code>                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Example        | <code>:MMEM:REG:TRAC:LAB 1,"my label"</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Notes          | <p><code>&lt;reg number&gt;</code> is an integer from 1 to 16. If the SCPI specifies an invalid register number an error message is generated, -222, "Data out of range; Invalid register label number"</p> <p><code>"label"</code> is a string from 0 to 30 characters in length. If a label exceeds 30 characters, an error message is generated, -150, "String data error; Label clipped to 30 characters"</p> <p><code>"label"</code> of zero length erases the custom label and restores the default (time and date) label, e.g., <code>:MMEM:REG:TRAC:LAB 1,""</code></p> |
| Preset         | The names are unaffected by <b>Preset</b> or power cycle but are set to the default label (time and date) on <b>Restore System Defaults &gt; Misc</b>                                                                                                                                                                                                                                                                                                                                                                                                                           |

#### 7.3.4 Screen Config + State

Saves the complete configuration of all your screens to a file. You choose a file to which to export the data.

|                |                                                                                                                                                                         |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:MMEMory:STORe:SCONfig &lt;filename&gt;</code>                                                                                                                    |
| Example        | Store the current screen configuration in the file <code>myScreenConfig.screen</code> in the default directory:<br><code>:MMEM:STOR:SCON "myScreenConfig.screen"</code> |

#### 7.3.5 Measurement Data

Specifies a data type (for example, trace data) and choose a file to which to export the data.

**Measurement Data** files are comma-separated Value (CSV) files, and contain the requested data in a form that can be imported into Excel or similar spreadsheets, as well as header data that gives information on relevant instrument settings at the time the save occurred.

The main application of **Measurement Data** files is for importing data to a PC for analysis, but in some cases **Measurement Data** files can also be imported back into the instrument to recreate the data object that existed at the time of the save. For example, most **Trace** data files can be imported back into the instrument.

The default path for **Measurement Data** Files is:

`My Documents\<mode name>\data`

with the subdirectory reflecting the data type and where **<mode name>** is the parameter used to select the Mode with **:INST:SEL** (for example, **SA** for Spectrum Analyzer Mode) and **<measurement name>** is the parameter used to select the measurement with **:CONF** (for example, **SAN** for Swept SA). For example, a Peak Table file from Swept SA in SA Mode would be stored in:

```
My Documents\SA\data\SAN\results
```

**Measurement Data** files have extension **.csv**. The default filename is **Prefix\_0000.csv**, where the 4-digit number is the lowest number that does not conflict with any filename in the current directory, and “Prefix” is dependent on the data type:

| Type               | Default Prefix |
|--------------------|----------------|
| Traces             | Trace_         |
| Measurement Result | MeasR_         |
| Capture Buffer     | CapBuf_        |

For example, the default filename for a trace data file in an empty directory would be **Trace\_0000.csv**

7.3.5.1 Save From

Selects the specific item to be saved, for example, if you are exporting trace data you may specify Trace 1, Trace 2, etc.

The default for traces is the currently selected trace, selected in this this or any other menu with Trace selection. If you have chosen **All** then it remains chosen until you specifically change it to a single trace, regardless of the trace selected in the Trace menu. The **All** selection saves all six traces in one CSV file with the x-axis data in the first column and the individual trace data in succeeding columns. The header data and x-axis data in this file reflect the current settings of the measurement. Note that any traces that are in **View** or **Blank** may have different x-axis data than the current measurement settings; but this different x-axis data is *not* output to the file.

|        |                                                                                                  |
|--------|--------------------------------------------------------------------------------------------------|
| Preset | Not part of <b>Preset</b> , but is reset to by <b>Restore Mode Defaults</b><br>Survives shutdown |
|--------|--------------------------------------------------------------------------------------------------|

7.3.5.2 Data Type

You choose the data type to save by using the radio button selection box. Below are the specifications for Data files for each measurement.

|              |                                                                                                                     |
|--------------|---------------------------------------------------------------------------------------------------------------------|
| Notes        | There is no SCPI command for <b>Data Type</b> , as the type is implied in the SCPI command for each item            |
| Dependencies | The <b>Data Type</b> menu for any given measurement only contains data types that are supported by that measurement |

## Meas Results

**Meas Results** files contain information that describes the current state of the instrument, as detailed in Meas Result File Contents below.

This command is only available in certain measurements, such as:

- PowerSuite: Channel Power, OBW, ACP, Spectrum Emissions Mask, Spurious Emissions, Power Stat CCDF, Transmit Power, Monitor Spectrum, IQ Waveform
- IQ Analyzer: Complex Spectrum
- Phase Noise: Log Plot and Spot Frequency
- WCDMA: Code Domain, Mod Accuracy, Power Control, and QPSK EVM
- Analog Demod: AM, FM, PM and FM Stereo
- Noise Figure
- Pulse

In general, the data in the Meas Results file matches the data which is returned to a measurement data query (**:FETCh?**, **:READ?**, **:MEASure?**). These queries and the results they return are documented for each measurement, and can be found in the Help for that measurement (or in the manual for that measurement) in the section titled **Remote Command Results**.

In the **MeasResults** file, you will see a column for each value of **n**. Each column contains the value for the corresponding value of **n** in the **Remote Command Results** table.

For example, Complex Spectrum allows values of **n** up to 17, and the **MeasResults** file for Complex Spectrum has 17 columns. So, the data returned when you send **:FETCh:SPECTrum1?** matches the data in the column labeled **MeasResult1** of the Meas Results file. See the example below:

Response to FETCh:SPECTrum1?

```
2.125444221E+01,6.487077992E+07,2.050000000E+02,6.004725051E+07,3.9215
68627E+04,2.370000000E+02,0.000000000E+00,1.000000000E-
07,1.000000000E+00,2.360000000E-05,2.500000000E+01
```

MeasResult1 column from Meas Results file

```
MeasResult1
-21.25444221
64870779.92
```

205  
 60047250.51  
 39215.68627  
 237  
 0  
 1.00E-07  
 1  
 2.36E-05  
 25

In addition, examples of the Meas Results files are given for each data type in the Help below.

|                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command               | <code>:MMEMory:STORe:RESults &lt;string&gt;</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Example                      | <code>:MMEM:STOR:RES "MeasR_0000.csv"</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Notes                        | <p>If the save is initiated via SCPI and the file already exists, the file will be overwritten</p> <p>The SCPI command exports measurement results to the file specified as the parameter in the current path. The default path is:</p> <p><code>My Documents\&lt;current mode&gt;\data\&lt;measurement name&gt;\results</code></p> <p>where <code>&lt;mode name&gt;</code> is the parameter used to select the mode with the <code>:INST:SEL</code> command (for example, <code>SA</code> for Spectrum Analyzer Mode) and <code>&lt;measurement name&gt;</code> is the parameter used to select the measurement with the <code>:CONF:</code> command (for example, <code>SAN</code> for the Swept SA measurement)</p> <p>Using the <code>C:</code> drive is strongly discouraged, since it runs the risk of being overwritten during an instrument software upgrade</p> <p>The SCPI parameter is a quoted string, which specifies the filename. Both single and double quotes are supported for any filename parameter over SCPI</p> |
| Annotation                   | After the save is complete, an advisory is displayed in the window so that the user can confirm which file was saved                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Status Bits/OPC dependencies | Sequential – waits for the previous measurement to complete                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |

## Noise Figure Meas Results File Contents

### General Info

- Application Name
- Measurement Name



## 7 Save/Recall/Print

### 7.3 Save

- Date

- Time

#### DUT Setup Parameters

- DUT Type

- System Downconverter Status\*

- Side Band

#### External LO Parameters\*

- Ext LO Control State

- Ext LO Fixed Frequency

- Ext LO Power

- Ext LO Start Frequency

- Ext LO Stop Frequency

- LO Frequency Mode

- Multiplier Denominator

- Multiplier Numerator

- Noise Source Settling Time

- Source Address

#### External SysLO Parameters

- SysLO Control State

- SysLO Fixed Frequency

- SysLO Frequency Mode

- SysLO Multiplier Denominator

- SysLO Multiplier Numerator

- SysLO Power

- SysLO Settling Time

- SysLO Source Address
- SysLO Start Frequency
- SysLO Stop Frequency

#### Measurement Parameters

- Average State
- Cal Tcold
- ENR Mode
- Ext LO Start Frequency
- Ext LO Stop Frequency
- Frequency Context
- Frequency Mode
- Internal Preamp State
- Meas Tcold
- Number of Averages
- Resolution Bandwidth
- Spot State
- Spot ENR
- Spot Thot
- Sweep Points

#### Corrected Measurement Results

Measurement results after calibration data has been accounted for at each frequency point. Columns are:

- RF Frequency (Hz)
- IF Frequency (Hz)
- LO Frequency (Hz)
- Noise Figure (dB)

- Noise Factor (lin)
- Gain (dB)
- Effective Temperature (K)
- Phot (dB)
- Pcold (dB)
- Tcold (K)

\* Only reported when "Freq Context" on page 218 = LO

#### Uncorrected Measurement Results

Measurement results before calibration data has been accounted for at each frequency point. Columns are as above, except for Gain:

- RF Frequency (Hz)
- IF Frequency (Hz)
- LO Frequency (Hz)\*
- Noise Figure (dB)
- Noise Factor (lin)
- Y Factor (dB)
- Effective Temperature (K)
- Phot (dB)
- Pcold (dB)
- Tcold (K)

\* Only reported when "Freq Context" on page 218 = LO

### 7.3.6 Limit

Lets you choose a file to which to export the **Limit** data.

**Limit** files are CSV files, and contain the limit data in a form that can be imported into Excel or similar spreadsheets, as well as header data that gives information on the limit.

The default path for most Limits files is:

`My Documents\<mode name>\data\limits`

where `<mode name>` is the parameter used to select the mode with the `:INST:SEL` command (for example, `SA` for Spectrum Analyzer). Hence a **Limit** file from any measurement in Spectrum Analyzer Mode would be stored in:

`My Documents\SA\data\limits`

The default path for **Limit** files from the Log Plot measurement in Phase Noise Mode is:

`My Documents\PNOISE\data\LPL\limits`

The default filename is `Limit_0000.csv`, where the 4-digit number is the lowest number that does not conflict with any filename in the current directory.

For backwards compatibility, older limit files with the extension `.lim` can be read into the instrument, but you can only save limits as `.csv` files.

|                              |                                                                                                                                                                                                                                                                                                                          |
|------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command               | <code>:MMEMory:STORe:LIMit LLINE1   ...   LLINE6,&lt;filename&gt;</code>                                                                                                                                                                                                                                                 |
| Example                      | Save the 2nd Limit Line to the file <code>myLimitLine2.csv</code> in the current path:<br><code>:MMEM:STOR:LIM LLINE2,"myLimitLine2.csv"</code>                                                                                                                                                                          |
| Notes                        | If the save is initiated via SCPI, and the file already exists, the file will be overwritten<br>Using the <b>C:</b> drive is strongly discouraged, since it runs the risk of being overwritten during an instrument software upgrade<br>Both single and double quotes are supported for any filename parameter over SCPI |
| Dependencies                 | Only appears if you have the proper option installed in your instrument<br>In the Log Plot measurement in Phase Noise Mode, there are only three Limit Lines, so the valid parameters are <code>LLINE1   LLINE2   LLINE3</code>                                                                                          |
| Preset                       | 1<br>Not part of <b>Preset</b> , but reset by <b>Restore Mode Defaults</b><br>Survives power cycles                                                                                                                                                                                                                      |
| State Saved                  | The selected Limit number is saved in instrument state                                                                                                                                                                                                                                                                   |
| Status Bits/OPC dependencies | Sequential - waits for previous measurement to complete                                                                                                                                                                                                                                                                  |

## Limit File Contents

Limits may be exported into a data file with a `.csv` extension. They may be imported from that data file; they may also be imported from a legacy limit file with a `.lim` extension. The `.lim` files meet the specification for limit files contained in the EMI measurement guide, HP E7415A.

### .csv file format

Except for information in quotes, limit line files are not case sensitive. Information in bold is required verbatim; other text is example text, and italic text is commentary which should not be present in the file.

7 Save/Recall/Print  
7.3 Save

The first five lines are system-required header lines, and must be in the correct order:

|                             |                                          |
|-----------------------------|------------------------------------------|
| <b>Limit</b>                | <i>Data file type name</i>               |
| <b>"FCC Part 15"</b>        | <i>File Description</i>                  |
| <b>"Class B Radiated"</b>   | <i>Comment</i>                           |
| <b>A.01.00.R0001.N9020A</b> | <i>Instrument Version, Model Number</i>  |
| <b>P13 EA3 UK6 .01</b>      | <i>Option List, File Format Version{</i> |

The next few lines describe the parameters; on export they will be in the order shown, on import they can be in any order. If some parameters are missing, they will revert to the default.

|                                             |                                                                               |
|---------------------------------------------|-------------------------------------------------------------------------------|
| <b>Type, Upper</b>                          | <i>Upper Lower</i>                                                            |
| <b>X Axis Unit, MHz</b>                     | <i>MHz S; other units should be converted; this also specifies the domain</i> |
| <b>Amplitude Unit, dBm</b>                  | <i>dBm V; all other units should be converted appropriately</i>               |
| <b>Frequency Interpolation, Linear</b>      | <i>Logarithmic Linear</i>                                                     |
| <b>Amplitude Interpolation, Logarithmic</b> | <i>Logarithmic Linear</i>                                                     |
| <b>X Control, Fixed</b>                     | <i>Fixed Relative; on input we consider only the first three characters</i>   |
| <b>Y Control, Fixed</b>                     | <i>Fixed Relative; on input we consider only the first three characters</i>   |
| <b>Margin, 0</b>                            | <i>Always in dB. A 0 margin is equivalent to margin off</i>                   |
| <b>X Offset, 10</b>                         | <i>Expressed in the X axis units</i>                                          |
| <b>Y Offset, 5</b>                          | <i>Expressed in the Amplitude units</i>                                       |

The Amplitude Unit line in the limits file may contain a transducer (formerly "antenna") factor unit, for example:

Amplitude Unit=dBuV/m

Transducer factor units are dBuV/m, dBuA/m, dBpT, and dBG. In this case, the unit is treated exactly as though it were dBuV, meaning that all of the limits are interpreted to have units of dBuV. The box does NOT change Y Axis Units when such a limit is loaded in.

The X-Axis unit also specifies the domain (time or frequency). It is not possible to have both time-domain lines and frequency-domain lines at the same time; if a time-domain line is imported while the other lines are in the frequency domain (or vice-versa), all limit lines will be deleted prior to import.

If the sign of the margin is inappropriate for the limit type (for example a positive margin for an upper limit), the sign of the margin will be changed internally so that it is appropriate.

The remaining lines describe the data. Each line in the file represents an X-Y pair. The X values should be monotonically non-decreasing, although adjacent lines in the file can have the same X value as an aid to building a stair-stepped limit line. To specify a region over which there is no limit, use +1000 dBm for upper limits or -1000 dBm for lower limits.

The data region begins with the keyword **DATA**:

```
DATA
200.000000,-10.00
300.000000,-10.00
300.000000,-20.00
500.000000,-20.00
```

### .lim file format

This is a legacy format which allows files saved from older instruments to be loaded into the X-Series. *Design of files in this format is not recommended.*

Except for name and description text (which is taken verbatim), limit line files are not case sensitive.

The file may optionally start with a description block, consisting of the single line [DESCRIPTION] followed by arbitrary text. If there is no Limit Line Name header, the description text will be used as the limit line description in the GUI. If there is a Limit Line Name header, the Limit Line Name will be used instead.

Arbitrary text

The header block begins with the single line [HEADER], followed by some or all of the following fields, each with <parameter name>=<parameter value>. Excess white space around the “=” is ignored. If a field is not present or the data is invalid, the value is not changed when the limit line is loaded. Ordering of the fields is unimportant.

Limit Line Name="FCC Part 15;Class B  
Radiated"

Type=Upper

Upper|Lower

Frequency Unit=MHz

For time domain limits, this should say "Time Unit"

Amplitude Unit=dBm

Frequency Interpolation=Lin

Log|Lin; on input we consider only the first three characters

Amplitude Interpolation=Log

Log|Lin; on input we consider only the first three characters

Mode=Fixed

Fixed|Relative

Margin=0

Always in dB. A 0 margin is equivalent to margin off

Domain=Frequency

Frequency|Time

Delimiter=TAB

The data block begins with the line [DATA], and consists of any number of segments.

The Data lines represent segments – X1, Y1, X2, Y2. If the list of segments includes a gap in the middle on input, the space inside the gap will be set to ensure the limit does not fail: for upper limits maxtracevalue, for lower limits mintracevalue. If two

segments overlap on input, the stricter of the two segments is used – for upper limits the lower segment, for lower limits the upper segment.

Thus, the following segments indicate into a –5 dB limit from 10 MHz to 20 MHz and 30 MHz to 40MHz:

|    |    |    |    |
|----|----|----|----|
| 10 | –5 | 20 | –5 |
| 30 | –5 | 40 | –5 |

If this was an upper limit, this would be translated into the following set of limit points:

|    |     |               |      |       |
|----|-----|---------------|------|-------|
| 10 |     | –5            |      |       |
| 20 |     | –5            |      |       |
| 20 |     | maxtracevalue |      |       |
| 30 |     | maxtracevalue |      |       |
| 30 |     | –5            |      |       |
| 40 |     | –5            |      |       |
|    | 30  | –29.5         | 88   | –29.5 |
|    | 88  | –33           | 216  | –33   |
|    | 230 | –35.6         | 960  | –35.6 |
|    | 960 | –43.5         | 5000 | –43.5 |

note that we are stair-stepping the line

The gap between 216 MHz and 230 MHz will never fail

7.3.6.1 Select Limit

Selects the specific Limit to be saved, for example, Limit 1.

|        |                                                                                                             |
|--------|-------------------------------------------------------------------------------------------------------------|
| Preset | Not part of <b>Preset</b> , but reset to <b>LLINE1</b> by <b>Restore Mode Defaults</b><br>Survives shutdown |
|--------|-------------------------------------------------------------------------------------------------------------|

7.3.6.2 Limit

Selects the Limit Line values to be exported for external viewing/editing or recall at a later date.

|                |                                                                                                                                 |
|----------------|---------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:MMEMory:StORe:LiMIt LLINE1   ...   LLINE4, &lt;file_name&gt;</code>                                                      |
| Example        | <code>:MMEM:StOR:LIM LLINE2, "C:\Limit2.csv"</code>                                                                             |
| Notes          | Limit specified must contain data otherwise error -250 will be displayed<br><br>The required fields are:<br><br><b>Filetype</b> |

Version Number

Limit Type

Limit Trace

Limits Data

All other fields are ignored. Below is a valid CSV file, used to save and recall **Limits** data into the instrument:

```
[Version 1.0]
[Limittype UPPER]
[Limittrace Trace1]
10000000, 13.087
100000000, 13.036
200000000, 13.056
300000000, 13.051
500000000, 14.974
```

### 7.3.7 Correction

Exports Amplitude Corrections files in the PC-readable **.csv** format.

Amplitude Correction files contain the correction data in a form that can be imported into Excel or similar spreadsheets, as well as header data that gives information on the correction.

The default filename is **Ampcor\_0000.csv**, where the 4-digit number is the lowest number that does not conflict with any filename in the current directory.

The default path for Corrections files is:

**My Documents\amplitudeCorrections**

For backwards compatibility, older limit files with the extensions **.amp**, **.cbl**, **.ant** and **.oth** can be read into the instrument, but you can only save corrections as **.csv** files.

See **"Correction Data File"** on page 917

|                |                                                                                                                                                                                                                                                                                                                          |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <b>:MMEMory:STORe:CORRection 1   ...   8, &lt;filename&gt;</b>                                                                                                                                                                                                                                                           |
| Example        | Save Correction 2 to the file <b>myAmpcor.csv</b> on the current path:<br><b>:MMEM:STOR:CORR 2 "myAmpcor.csv"</b>                                                                                                                                                                                                        |
| Notes          | If the save is initiated via SCPI, and the file already exists, the file will be overwritten<br>Using the <b>C:</b> drive is strongly discouraged, since it runs the risk of being overwritten during an instrument software upgrade<br>Both single and double quotes are supported for any filename parameter over SCPI |
| Dependencies   | Corrections are not supported by all measurements. If in a Mode in which some measurements                                                                                                                                                                                                                               |



## 7 Save/Recall/Print

### 7.3 Save

|                              |                                                                                                                                                                                                                    |
|------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                              | support it, this key is grayed-out in measurements that do not. Does not appear at all if no measurements in the Mode support it<br>Does not appear unless you have the proper option installed in your instrument |
| Annotation                   | After save is complete, an advisory is displayed in the message bar confirming which file was saved                                                                                                                |
| Backwards Compatibility SCPI | :MMEMory:STORe:CORRection ANTenna   CABLe   OTHer   USER, <filename><br>For backwards compatibility, <b>ANTenna</b> maps to 1, <b>CABLe</b> maps to 2, <b>OTHer</b> maps to 3 and <b>USER</b> maps to 4            |

## Correction Data File

A Correction Data File contains a copy of one of the instrument correction tables. Corrections provide a way to adjust the trace display for predetermined gain curves (such as for cable loss).

Corrections files are text files in **.csv** (Comma-Separated Values) form, to make them importable into Excel or other spreadsheet programs. The format for Corrections files is as follows:

| Line # | Type of field                                             | Example                         | Notes                                                                                                                                                                                                     |
|--------|-----------------------------------------------------------|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1      | File type, must be "Amplitude Correction"                 | Amplitude Correction            | May not be omitted                                                                                                                                                                                        |
| 2      | File Description (in quotes)                              | "Correction Factors for 11966E" | 60 characters max; may be empty but may not be omitted. If exceeds 60 characters, error -233 Too much data reported                                                                                       |
| 3      | Comment (in quotes)                                       | "Class B Radiated"              | 60 characters max; may be empty but may not be omitted. . If exceeds 60 characters, error -233 Too much data reported                                                                                     |
| 4      | Instrument Version, Model #                               | A.02.06,N9020A                  | May be empty but may not be omitted                                                                                                                                                                       |
| 5      | Option List, File Format Version                          | K03 LFE EXM ,01                 | May be empty but may not be omitted                                                                                                                                                                       |
| 6      | Freq Unit to be used for all frequency values in the file | Frequency Unit, MHz             | assumed to be Hz if omitted                                                                                                                                                                               |
| 7      | Transducer Unit                                           | Antenna Unit, None              | If omitted leaves the Transducer unit unchanged. The amplitude unit in the Transducer Unit field is a conversion factor that is used to adjust the Y Axis Units of the current mode, if the mode supports |

| Line # | Type of field                                             | Example                         | Notes                                                                                                                                                                       |
|--------|-----------------------------------------------------------|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|        |                                                           |                                 | Transducer Units. For more details on transducer correction data, refer to the Input/Output, Corrections key description. Allowable values: dBuV/m, dBuA/m, dBG, dBpT, None |
| 8      | Freq Interpolation                                        | Frequency Interpolation, Linear | if omitted leaves the Freq Interpolation unchanged. Allowable values: Linear, Logarithmic                                                                                   |
| 9      | Bias value in mA                                          | Bias,0.00                       | If omitted leaves the Bias value unchanged (added as of A.08.50)                                                                                                            |
| 10     | Bias State                                                | Bias State,On                   | If omitted leaves the Bias State unchanged. Allowable values: On, Off (added as of A.08.50)                                                                                 |
| 11     | Overlap, two values, Freq1 and Freq2, separated by commas | Overlap,33500,40000             | Uses Freq Unit from line 6. Thus, in this example Freq1=33.5 GHz, Freq2= 40.0 GHz (see note below). If omitted leaves the overlap unchanged (added as of A.08.50)           |
| 12     | DATA marker                                               | DATA                            | Corrections data begins in the next line                                                                                                                                    |

Lines 2 through 5 can be empty but must appear in the file. Lines 6 through 11 are optional, the lines can be left out of the file altogether.

The Overlap row and the two Bias rows apply only to external mixing. Both are read-only, they are never written by the instrument. The only way to insert or modify these rows is to edit the file with a text editor or a spreadsheet editor. These rows are intended for use by mixer manufacturers, as they allow the manufacturer to insert data about how the mixer corrections were generated and how they should be applied. The Bias rows allow you to specify whether to turn Bias on or off when the Correction is turned on and to specify a Bias value (turning off the Correction does not change the Bias, but turning it back on again sets it to the value specified in the file). The Overlap row allows you to specify an overlap region in which two different corrections may be applied. It is expected that in the corrections data itself, there will be TWO corrections values exactly at Max Freq, otherwise Overlap is ignored. The way the overlap is processed is as follows: if at any given time the current instrument Start Freq is greater than Freq 1 and lower than Freq 2, and the current Stop Freq is greater than Freq 2, extend the first correction point at or above Freq 2 down to Freq 1, rather than using the correction data between Freq1 and Freq2.

Only one Transducer units can be on at any given time. Note that this means that if a correction file with a Transducer Unit is loaded into a particular Correction, all other Corrections are set to that same Transducer unit. Note that the legacy term "Antenna Unit" is still used in the correction file, even though the more modern term "Transducer Unit" is used in the user interface.

## 7 Save/Recall/Print

### 7.3 Save

Similarly, the Bias rows can only be used in Correction register 1, because there can only be one setting for Bias at any given time. If a Correction file with a Bias or Bias State row is loaded into any Correction register but 1, an error is generated: Mass storage error; Can only load Bias Settings into Correction 1

The data follows the DATA row, as comma separated X, Y pairs; one pair per line.

For example, suppose you have an Antenna to correct for on an N9020A version A.02.06 and the correction data is:

- 0 dB at 200 MHz
- 17 dB at 210 MHz
- 14.8 dB at 225 MHz

Then the file will look like:

- Amplitude Correction
- "Correction Factors for 11966E"
- "Class B Radiated"
- A.02.06,N9020A
- P13 EA3 UK6,01
- Frequency Unit, MHz
- Antenna Unit, dBuV/m
- Frequency Interpolation, Linear
- DATA
- 200.000000,0.00
- 210.000000,17.00
- 225.000000,14.80

The choices for the 1 of N fields in the metadata are as follows:

- Frequency Unit: Hz, kHz, MHz, GHz
- Antenna Unit: dBuV/m, dBuA/m, dBG, dBpT, None
- Frequency Interpolation: Logarithmic, Linear

### 7.3.7.1 Select Correction

Selects the specific Correction to be saved, for example, Correction 1.

---

|        |                                                                                                                               |
|--------|-------------------------------------------------------------------------------------------------------------------------------|
| Preset | Not part of a <b>Preset</b> , but reset to <b>Correction 1</b> by <b>Restore Input/Output Defaults</b><br>Survives a shutdown |
|--------|-------------------------------------------------------------------------------------------------------------------------------|

---

### 7.3.8 SCPI Recorder

Contains controls to allow you to save SCPI recordings.

### 7.3.9 Mask

The **Mask** data type is used to import and export Mask files for measurements that use masks, such as cellular comms and real-time measurements.

### 7.3.10 Waveform Sequence

Saves waveform sequences from the ARB memory of an Internal Source. When you open the Save **Waveform Sequence** dialog and press **Save**, the current waveform sequence is saved to the selected directory.

---

|              |                                                                           |
|--------------|---------------------------------------------------------------------------|
| Notes        | No remote command, front panel only                                       |
| Dependencies | Only appears if your hardware includes an Internal Source, such as in VXT |

---

### 7.3.11 Screen Image

Selects a file for saving the contents of the display.

**Screen Image** files are PNG (Portable Network Graphics) files with the same resolution as the data display. They contain the image that was on the screen before you opened the **Save** dialog. When the **Screen Image** key is pressed, a "thumbnail" of the captured image is displayed, with the note "This is the image that will be saved" below it.

After you have completed the save, a message "File image.png saved" (assuming **image.png** was the filename you used).

|      |                                                                                                                                                                                                                                              |
|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| NOTE | As of firmware release A.17.50, sending <b>*CLS</b> (Clear Status) removes any message displayed on the screen. If you do not want to see the "File saved" message after sending <b>:MMEM:STOR:SCR</b> (described below), send the following |
|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

---

sequence (substituting your file name for `filename.png`): `:MMEM:STOR:SCR "filename.png";*CLS`

NOTE

As of firmware release A.19.50, saving a screen image removes any informational message displayed on the screen before it captures the screen. This is useful if you are sending “save image” commands in rapid sequence, as it keeps the “File saved” message from one screen capture from appearing in the next screen capture. Error messages are still captured.

If you send a succession of screen image commands *too* rapidly, the system may not have time to remove the previous message before the next screen capture. Sending screen image commands more rapidly than twice per second is not advised.

The default path for State Files is:

`My Documents\<mode name>\screen`

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

**Screen Image** files have extension `.png`. The default filename is `Screen_0000.png`, where the 4-digit number is the lowest number that does not conflict with any filename in the current directory.

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

|                              |                                                                                                                                                                                                                                                                               |
|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command               | <code>:MMEMory:STORe:SCReen &lt;filename&gt;</code>                                                                                                                                                                                                                           |
| Example                      | Store the current screen image in the file <code>MyScreenFile.png</code> in the default directory:<br><code>:MMEM:STOR:SCR "myScreen.png"</code>                                                                                                                              |
| Backwards Compatibility SCPI | <code>:HCOPy:SDUMp:DATA?</code><br>returns the screen image in a <code>&lt;DEFINITE LENGTH ARBITRARY RESPONSE DATA&gt;</code> element. The response data is IEEE Block format; the controlling computer can strip the header and store the result as a <code>.png</code> file |

Blocking Screen Capture (Remote Command Only)

This command works *only* when the measurement is in **Single** mode (see ["Sweep/Measure" on page 358](#)). When the command is sent, it blocks the SCPI client, waits for the current refresh to complete, then captures the screen shot and saves it. In some instances, a single measurement is taken, and a screen shot of that measurement is captured.

This command ensures that the last-measured data is refreshed on the screen before it is captured, by blocking the command and waiting for refresh to complete. The command may time out, in which case it must be re-sent.

If timeout occurs, or if the active measurement is in **Continuous** mode, an error is returned.

|                |                                                                                                                                                                                                                                              |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:MMEMory:STORe:SCReen:BLOCKed &lt;filename&gt;</code>                                                                                                                                                                                  |
| Example        | Wait for the current screen refresh to complete before capturing the screen shot, then store the current screen image in the file <code>MyScreenFile.png</code> in the default directory:<br><code>:MMEM:STOR:SCR:BLOC "myScreen.png"</code> |

### 7.3.11.1 Theme

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

See "[More Information](#)" on page 923 for examples of the themes.

|                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|-------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command                | <code>:MMEMory:STORe:SCReen:THEMe FILLed   OUTLine</code><br><code>:MMEMory:STORe:SCReen:THEMe?</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Example                       | <code>:MMEM:STOR:SCR:THEM OUTL</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Preset                        | <b>FILLed</b> ; not part of <b>Preset</b> , but reset by <b>Restore Misc Defaults</b> or <b>Restore System Defaults All</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Backwards Compatibility SCPI  | <code>:MMEMory:STORe:SCReen:THEMe TDCoLor   TDMonochrome   FCoLoR   FMONochrome</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Backwards Compatibility Notes | <p>To permit code compatibility with A-model X-Series Signal Analyzer instruments, the command parameters from the A-models are mapped as follows:</p> <p><b>TDCoLor</b> and <b>TDMonochrome</b> are both mapped to <b>FILLed</b><br/>(exact full color representation of what is on the screen)</p> <p><b>FCoLoR</b> and <b>FMONochrome</b> are both mapped to <b>OUTLine</b><br/>(uses color for traces and other items, but most filled areas are white)</p> <p>There is no Monochrome theme in B-models, so the A-models monochrome commands yield color</p> <p><code>:MMEM:STOR:SCR:THEM?</code> always returns <b>FILLed</b> or <b>OUTLine</b>, never <b>FCoLoR</b>, <b>FMONochrome</b>, <b>TDCoLor</b>, or <b>TDMonochrome</b></p> <p>There is no monochrome theme in the X-Series Touch UI</p> |

More Information

- The **FILLed** theme is an exact representation of the information on the display
- The **OUTLine** theme eliminates most of the filled areas, in order to save ink when the image is printed. In addition, the yellow trace color is changed to be more orange, to improve visibility against a white background. Note that some objects remain filled. In particular, the selected marker remains filled with the green marker color, in order to distinguish it from the other markers. This is important, as it is the selected marker whose readout appears in the upper right corner of the display

7.3.12 Power Sensor Cal Factor

Selects a file to which to export the Power Sensor Cal factor data.

**Cal Factor** files are XML files, and contain the cal factor data and header data that gives information on the power sensor.

The default path for **Cal Factor** Files is:

My Documents\<mode name>\data\PSCF

where <mode name> is the parameter used to select the mode with **:INST:SEL** (for example, **MRECEIVE** for Measuring Receiver Mode). Hence, a **Cal Factor** file from any measurement in the Measuring Receiver mode would be stored in:

My Documents\MRECEIVE\data\PSCF

**Cal Factor** files have the extension **.xml**. The default filename is **<Sensor Model>\_<Sensor Serial Number>\_0000.xml**, where the 4-digit number is the lowest number that does not conflict with any filename in the current directory. If the sensor model or serial number is blank, the default filename is **PSCF\_0000.xml**.

|                |                                                                                                                                                                                                                                                                                                                          |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <b>:MMEMory:STORe:PSCFactor &lt;file_name&gt;</b>                                                                                                                                                                                                                                                                        |
| Example        | <b>:MMEM:STOR:PSCF "myPSCF.xml"</b>                                                                                                                                                                                                                                                                                      |
| Notes          | If the save is initiated via SCPI, and the file already exists, the file will be overwritten<br>Using the <b>C:</b> drive is strongly discouraged, since it runs the risk of being overwritten during an instrument software upgrade<br>Both single and double quotes are supported for any filename parameter over SCPI |
| Dependencies   | Only appears if you have the proper option installed in your instrument                                                                                                                                                                                                                                                  |

### 7.3.13 Uncertainty Results

Saves the sweep uncertainty results for external viewing. The saved results *cannot* be recalled.

### 7.3.14 ENR Table

- Selects either of:
- the current ENR Meas Table values to be exported for external viewing/editing or recall at a later date
  - the current ENR Calibration Table values to be exported for external viewing/editing or recall at a later date

|                              |                                                                                 |
|------------------------------|---------------------------------------------------------------------------------|
| Remote Command               | :MMEMory:STORe:ENR MEASurements   CALibration,<file_name>                       |
| Example                      | :MMEM:STORe:ENR MEAS,"C:\ENRTable.csv"<br>:MMEM:STORe:ENR CAL,"C:\CalTable.csv" |
| Notes                        | Meas/Cal Table must contain data, otherwise error -250 is displayed             |
| Backwards Compatibility SCPI | :MMEMory:STORe:ENR                                                              |

The required fields are:

Filetype

Version Number

Serial Number

Model

ENR Data

All other fields will be ignored. Below is a valid CSV file, used to save and recall ENR data into the Instrument:

```
[Version 1.0]
[Serialnumber 4015A05185]
[Model 346C]
10000000, 13.087
100000000, 13.036
1000000000, 13.056
2000000000, 13.051
26500000000, 14.974
```



### 7.3.15 Loss Comp

Selects either:

- Current Loss Compensation Before DUT values to be exported for external viewing/editing or recall at a later date
- Current Loss Compensation After DUT values to be exported for external viewing/editing or recall at a later date

|                                 |                                                                                      |
|---------------------------------|--------------------------------------------------------------------------------------|
| Remote Command                  | :MMEMory:STORe:LOSS BEFore   AFTer,<file_name>                                       |
| Example                         | :MMEM:STOR:LOSS BEF,"C:\LossBefore.csv"<br>:MMEM:STOR:LOSS AFT,"C:\LossAfter.csv"    |
| Notes                           | Loss Comp Before/After DUT Table must contain data otherwise error -250 is displayed |
| Backwards Compatibility<br>SCPI | :MMEMory:STORe:LOSS                                                                  |

The .csv format contains the following data:

File Type  
Application Name:Measurement Name  
Version and Model Number  
Loss Comp Data

Below is an example of a valid CSV Loss Compensation file:

```
[NF:NFIG]
Ver. ***, Model ***
10, 1.0000
20, 2.0000
30, 3.0000
40, 4.0000
50, 5.0000
60, 6.0000
```

### 7.3.16 Frequency List

Selects the current Frequency List values to be exported for external viewing/editing or recall at a later date.

|        |                                      |
|--------|--------------------------------------|
| Remote | :MMEMory:STORe:FREQuency <file_name> |
|--------|--------------------------------------|

|                                    |                                                                           |
|------------------------------------|---------------------------------------------------------------------------|
| Command                            |                                                                           |
| Example                            | <code>:MMEM:STOR:FREQ "C:\FrequencyList.csv"</code>                       |
| Notes                              | Frequency List Table must contain data, otherwise error -250 is displayed |
| Backwards<br>Compatibility<br>SCPI | <code>:MMEMory:STORe:FREQuency</code>                                     |

The .csv format replaces the legacy .lst format. It has the following required fields (note frequency context is now saved alongside the frequency list data):

#### Filetype

Application Name:Measurement Name

#### Version

#### Frequency List Data

MCON Frequency List Data (N9069A-2FP license is required)

- RF Frequency List Data
- LO Frequency List Data
- IF Frequency List Data

Below is an example of a valid CSV Frequency List file:

```
[NF:NFIG]
Ver.***
4000000000
5000000000
6000000000
25000000000
26500000000
MCON frequency lists
RF
4000000000
5000000000
6000000000
25000000000
26500000000
LO
4000000000
5000000000
6000000000
```

7 Save/Recall/Print  
7.3 Save

25000000000  
26500000000  
IF  
40000000000  
50000000000  
60000000000  
25000000000  
26500000000

7.3.17 Remote Only Commands

The following commands execute file system operations such as move, copy, and transfer data from a file.

7.3.17.1 Mass Storage Catalog (Remote Command Only)

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:MMEMory:CATalog? [&lt;directory_name&gt;]</code><br>The string <code>&lt;directory_name&gt;</code> must be a valid logical path. If no string then it uses the current directory                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Example        | <code>:MMEM:CAT? "C:\"</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Notes          | Queries disk usage information (drive capacity, free space available) and obtains a list of files and directories in a specified directory in the following format:<br><code>&lt;numeric_value&gt;,&lt;numeric_value&gt;,\{&lt;file_entry&gt;\}</code><br>It returns two numeric parameters and as many strings as there are files and directories<br>The first parameter indicates the total amount of storage currently used in bytes<br>The second parameter indicates the total amount of storage available, also in bytes. <code>&lt;file_entry&gt;</code> is a string. Each <code>&lt;file_entry&gt;</code> indicates the name, type, and size of one file in the directory list:<br><code>&lt;file_name&gt;,&lt;file_type&gt;,&lt;file_size&gt;</code><br>As the Windows file system has an extension that indicates file type, <code>&lt;file_type&gt;</code> is always empty. <code>&lt;file_size&gt;</code> provides the size of the file in bytes. For directories, <code>&lt;file_entry&gt;</code> is surrounded by square brackets and both <code>&lt;file_type&gt;</code> and <code>&lt;file_size&gt;</code> are empty |

7.3.17.2 Mass Storage Change Directory (Remote Command Only)

|                |                                                                                                                                                                    |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:MMEMory:CDIRectory [&lt;directory_name&gt;]</code><br><code>&lt;directory_name&gt;</code> must be a valid logical path<br><code>:MMEMory:CDIRectory?</code> |
| Example        | <code>:MMEM:CDIR "C:\Program Files"</code>                                                                                                                         |

|       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|-------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Notes | <p>Changes the current directory for a mass memory file system. The <code>&lt;directory_name&gt;</code> parameter is a string. If no parameter is specified, the directory is set to the <code>*RST</code> value</p> <p>At <code>*RST</code>, this value is set to the default user data storage area, that is defined as <code>System.Environment.SpecialFolder.Personal</code></p> <p>Query returns full path of the current directory as a quoted string</p> |
|-------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

### 7.3.17.3 Mass Storage Copy (Remote Command Only)

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <p><code>:MMEMory:COpy &lt;string&gt;,&lt;string&gt;[,&lt;string&gt;,&lt;string&gt;]</code></p> <p><code>&lt;string&gt;</code> must be a valid logical path</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Example        | <code>:MMEM:COpy "C:\TEMP\Screen_0000.png", "C:\\"</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Notes          | <p>Copies an existing file to a new file or an existing directory to a new directory</p> <p>If no directory is specified, uses the current directory</p> <p>Two forms of parameters are allowed. The first form has two parameters. In this form, the first parameter specifies the source, and the second parameter specifies the destination</p> <p>The second form has four parameters. In this form, the first and third parameters specify the source. The second and fourth parameters specify the directories. The first pair of parameters specifies the source. The second pair specifies the destination. An error is generated if the source doesn't exist or the destination file already exists</p> <p>This command will generate an "access denied" error if the destination is a restricted folder (for example, <code>C:\Windows</code>) and you do not have Power User or Administrator privileges</p> |

### 7.3.17.4 Mass Storage Device Copy (Remote Command Only)

Transfers data to/from a file and a peripheral device.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <p><code>:MMEMory:COpy:DEvice &lt;source_string&gt;,&lt;dest_string&gt;</code></p> <p><code>&lt;source_string&gt;</code> and <code>&lt;dest_string&gt;</code> must be valid logical paths</p>                                                                                                                                                                                                                                              |
| Notes          | <p>The strings must be a valid logical path or a valid device keyword. If <code>dest_string</code> is a device keyword, the data is copied from the source file to the device. If <code>source_string</code> is a device keyword, the data is copied to the source file from the device</p> <p>Valid device keywords are:</p> <p><code>SNS</code> (smart noise source)</p> <p>An error is generated if the file or device is not found</p> |

### 7.3.17.5 Mass Storage Delete (Remote Command Only)

|                |                                                                                                                                                                                          |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <p><code>:MMEMory:DElete &lt;file_name&gt;[,&lt;directory_name&gt;]</code></p> <p><code>&lt;file_name&gt;</code> and <code>&lt;directory_name&gt;</code> must be valid logical paths</p> |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|         |                                                                                                                                                                                                                                                                                                                                                                                   |
|---------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Example | <code>:MMEM:DEL "Screen_0000.png"</code>                                                                                                                                                                                                                                                                                                                                          |
| Notes   | <p>If no directory is specified, uses the current directory</p> <p>Removes a file from the specified directory. <code>&lt;file_name&gt;</code> specifies the file name to be removed. This command generates an “access denied” error if the file is in a restricted folder (for example, <code>C:\Windows</code>) and you do not have Power User or Administrator privileges</p> |

### 7.3.17.6 Mass Storage Data (Remote Command Only)

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

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:MMEMory:DATA &lt;file_name&gt;, &lt;data&gt;</code><br><code>&lt;file_name&gt;</code> must be a valid logical path<br><code>:MMEMory:DATA? &lt;file_name&gt;</code>                                                                                                                                                                                                                                                                                         |
| Example        | <code>:MMEM:DATA? "MyFile.txt"</code>                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Notes          | <p>If no directory is specified, uses the current directory</p> <p>The command form <code>:MMEMory:DATA &lt;file_name&gt;,&lt;data&gt;</code> loads <code>&lt;data&gt;</code> into the file <code>&lt;file_name&gt;</code>. <code>&lt;data&gt;</code> is in 488.2 block format. <code>&lt;file_name&gt;</code> is string data</p> <p>The response to <code>:MMEMory:DATA? &lt;file_name&gt;</code> is the associated <code>&lt;data&gt;</code> in block format</p> |

### 7.3.17.7 Mass Storage Make Directory (Remote Command Only)

|                |                                                                                                                                                                                                                                                                                                       |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:MMEMory:MDIRectory &lt;directory_name&gt;</code><br><code>&lt;directory_name&gt;</code> must be a valid logical path                                                                                                                                                                           |
| Example        | <code>:MMEM:MDIR "C:\TEMP\NewDir"</code>                                                                                                                                                                                                                                                              |
| Notes          | <p>Creates a new directory. <code>&lt;directory_name&gt;</code> specifies the name to be created</p> <p>Generates an “access denied” error if the new directory would be in a restricted folder (for example, <code>C:\Windows</code>) and you do not have Power User or Administrator privileges</p> |

### 7.3.17.8 Mass Storage Move (Remote Command Only)

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:MMEMory:MOVE &lt;string&gt;,&lt;string&gt;[,&lt;string&gt;,&lt;string&gt;]</code><br><code>&lt;string&gt;</code> must be valid logical paths                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Example        | <code>:MMEM:MOVE "C:\TEMP\Screen_0000.png", "C:\\"</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Notes          | <p>Moves an existing file to a new file or an existing directory to a new directory</p> <p>Two forms of parameters are allowed. The first form has two parameters. In this form, the first parameter specifies the source, and the second parameter specifies the destination</p> <p>The second form has four parameters. In this form, the first and third parameters specify the source. The second and fourth parameters specify the directories. The first pair of parameters specifies the source. The second pair specifies the destination. An error is generated if the source doesn't exist or</p> |

---

the destination file already exists

This command generates an “access denied” error if the destination is a restricted folder (for example, [C:\Windows](#)) and you do not have Power User or Administrator privileges

### 7.3.17.9 Mass Storage Remove Directory (Remote Command Only)

---

|                |                                                                                                                                                                                                                                                                                                                                                                                                                               |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <a href="#">:MMEMory:RDIRectory &lt;directory_name&gt;</a><br><a href="#">&lt;directory_name&gt;</a> must be a valid logical path                                                                                                                                                                                                                                                                                             |
| Example        | <a href="#">:MMEM:RDIR "C:\TEMP\NewDir"</a>                                                                                                                                                                                                                                                                                                                                                                                   |
| Notes          | Removes a directory. The <a href="#">&lt;directory_name&gt;</a> parameter specifies the directory name to be removed. All files and directories under the specified directory will also be removed<br>This command generates an “access denied” error if the folder is a restricted folder (for example, <a href="#">C:\Windows</a> ) or is in a restricted folder and you do not have Power User or Administrator privileges |

---

### 7.3.17.10 Mass Storage Determine Removable Media (Remote Query Only)

Used to determine whether any removable media devices are connected to the instrument. Primarily, these are USB memory devices plugged-in to the front panel or rear panel USB ports. On instruments with PC6 or PC7 CPUs, one SD card slot is available for removable media. The instrument’s primary disk drive is *not* a removable media device.

---

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <a href="#">:MMEMory:RMEDia:LIST?</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Example        | <a href="#">:MMEM:RMED:LIST?</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Notes          | The return value is a string containing a list of partition identifiers, which are removable media devices. Each identifier will be separated by a comma. If no removable media is present, an empty string is returned<br>Examples: <ul style="list-style-type: none"><li>– One removable device present results in a return string of “F:”</li><li>– Two removable devices present results in a return string of “F:,G:”</li></ul> No removable devices present results in a return string of “” |

---

### 7.3.17.11 Mass Storage Determine Removable Media Label (Remote Command Only)

Used to set or query a removable media device’s label.

---

|                |                                                                                                                                    |
|----------------|------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <a href="#">:MMEMory:RMEDia:LABel &lt;partition&gt;,&lt;string&gt;</a><br><a href="#">:MMEMory:RMEDia:LABel? &lt;partition&gt;</a> |
|----------------|------------------------------------------------------------------------------------------------------------------------------------|

---

|         |                                                                                                                                                                                                                                                                                                                                                                                           |
|---------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Example | <code>:MMEM:RMED:LAB "F:","My Device"</code>                                                                                                                                                                                                                                                                                                                                              |
| Notes   | <p>If the <code>&lt;partition&gt;</code> specified does not exist or is not a removable media device, the error -252, "Missing Media" is generated</p> <p>Setting the removable media label requires Administrative privileges. If the currently logged-in user does not have appropriate privileges, error "-221, Settings conflict; Administrator privileges required" is generated</p> |

### 7.3.17.12 Mass Storage Determine Removable Media Write-protect status (Remote Query Only)

Used to query a removable media device's write-protect status.

|                |                                                                                                                                                                                                                                                           |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:MMEMory:RMEDia:WPRotect? &lt;partition&gt;</code>                                                                                                                                                                                                  |
| Example        | <code>:MMEM:RMED:WPR? "F:"</code>                                                                                                                                                                                                                         |
| Notes          | <p>The return value is 1 if the device is write-protected, and 0 if the device is write-enabled</p> <p>If the <code>&lt;partition&gt;</code> specified does not exist or is not a removable media device the error -252, "Missing Media" is generated</p> |
| Preset         | The return value depends on the SD card installed                                                                                                                                                                                                         |

### 7.3.17.13 Mass Storage Determine Removable Media size (Remote Query Only)

Queries a removable media device's total memory size (not available memory size).

|                |                                                                                                                                                                                                                                                           |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:MMEMory:RMEDia:SIZE? &lt;partition&gt;</code>                                                                                                                                                                                                      |
| Example        | <code>:MMEM:RMED:SIZE? "F:"</code>                                                                                                                                                                                                                        |
| Notes          | <p>The return value is integer value in GBytes. Any device that is less than 1 GB returns 0 GB</p> <p>If the <code>&lt;partition&gt;</code> specified does not exist or is not a removable media device, the error -252, "Missing Media" is generated</p> |

### 7.3.17.14 :SYSTem:SET (Remote Command Only)

Obtains the state of the currently active mode in a form that can then be loaded back into the instrument quickly.

|                |                                                                                                                                                                                                                                   |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:SYSTem:SET &lt;instrument state in IEEE Block&gt;</code><br><code>:SYSTem:SET?</code>                                                                                                                                      |
| Notes          | <p>The query returns current instrument state of the active mode in IEEE Block data format. The state is in a machine-readable format only, as follows:</p> <p><code>&lt;syst set preamble&gt;&lt;state block data&gt;</code></p> |

---

Where:

<syst set preamble> is the format:

#NMMM

- N = number of digits that comprise MMM
- MMM = length in bytes of following data

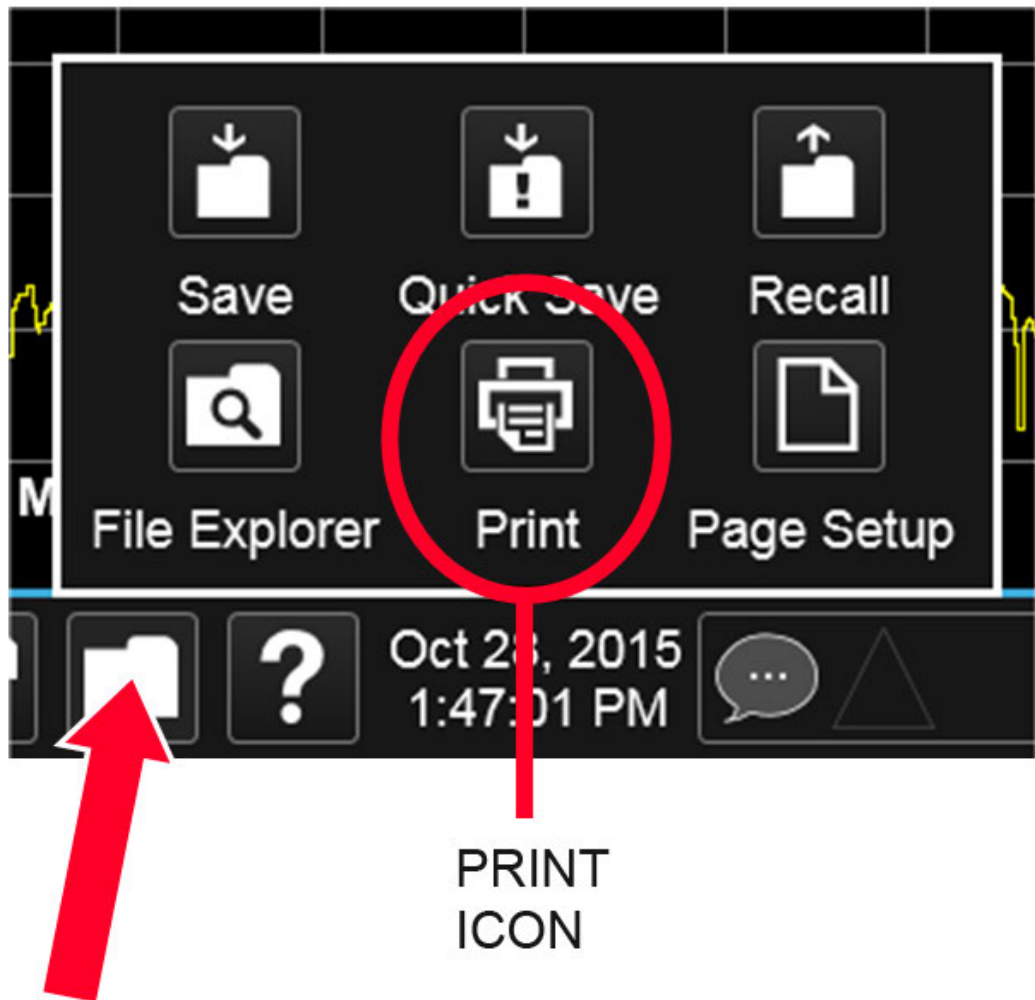
<state block data> is machine readable state data

Example response: #42016<state data>

The state is recalled by sending the :SYST:SET? response data to the instrument. From example above: :SYST:SET #42016<state data>



## 7.4 Print



Opens a dialog for configuring printing (to the printer of your choice).

The `:HCOPY` command is equivalent to pressing the **PRINT** key.

---

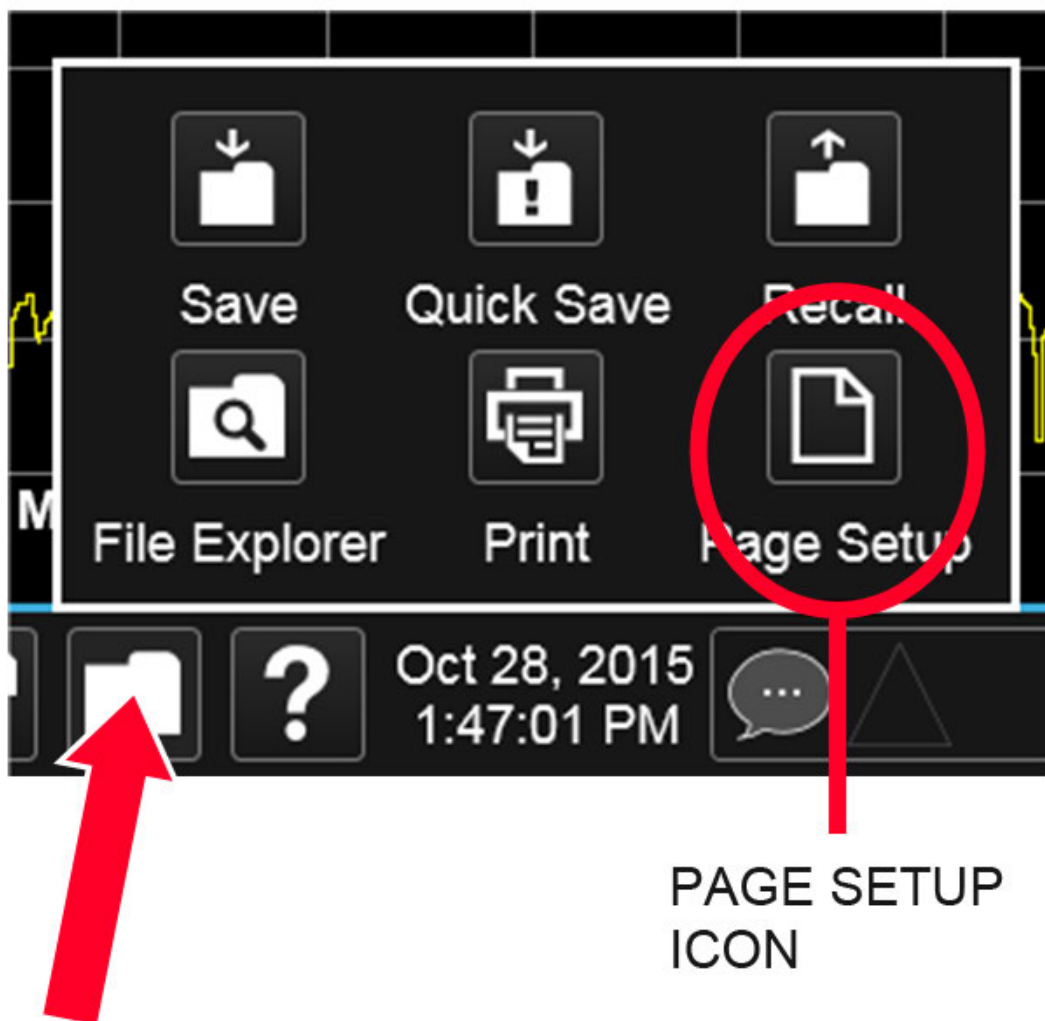
Remote Command    `:HCOPY[:IMMediate]`

`:HCOPY:ABORT` can be used to abort a print that is already in progress. Sending `:HCOPY:ABORT` causes the instrument to stop sending data to the printer, although the printer may continue or even complete the print, depending on how much data was sent to the printer before you sent the `:ABORT` command.

---

Remote Command    `:HCOPY:ABORT`

## 7.5 Page Setup



Opens a Windows Page Setup dialog that allows you to control aspects of the pages sent to the printer when the **PRINT** hardkey is pressed.

Depending on the abilities of the attached printer, paper size, paper source, page orientation and margins may all be set. There are no SCPI commands for controlling these parameters.

The dialog also has a dropdown control to let you select the Display Theme to use when printing. **Page Setup** themes are the same as those for **Screen Image** "Theme" on page 922.

The **Theme** control has a corresponding SCPI command:

7 Save/Recall/Print  
7.5 Page Setup

|                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|-------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command                | <code>:SYSTem:PRINt:THEMe FILLed   OUTLine</code><br><code>:SYSTem:PRINt:THEMe?</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Example                       | <code>:SYST:PRIN:THEM OUTL</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Preset                        | <b>OUTL</b> ; not part of <b>Preset</b> , but reset by <b>Restore Misc Defaults</b> or <b>Restore System Defaults All</b> and survives subsequent running of the modes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| State Saved                   | No                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Backwards Compatibility SCPI  | <code>:SYSTem:PRINt:THEMe TDColor   TDMonochrome   FCOLor   FMONochrome</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Backwards Compatibility Notes | <p>To permit code compatibility with A-model X-Series Signal Analyzer instruments, the command parameters from A-models are mapped as follows:</p> <p><b>TDColor</b> and <b>TDMonochrome</b> are both mapped to <b>FILLed</b>:<br/>Exact full color representation of what is on the screen</p> <p><b>FCOLor</b> and <b>FMONochrome</b> are both mapped to <b>OUTLine</b>:<br/>Uses color for traces and other items, but most filled areas are white</p> <p>There is no Monochrome theme in B-models, so the A-models' monochrome commands yield color</p> <p><code>:SYST:PRINT:THEM?</code> always returns <b>FILLed</b> or <b>OUTLine</b>; never <b>FCOLor</b>, <b>FMONochrome</b>, <b>TDColor</b>, or <b>TDMonochrome</b></p> |

## 8 Trigger

Controls the **Trigger** system of the instrument. In general, these are functions associated with internal triggers or trigger inputs. Trigger Output functions are configured under **Input/Output**.

**Trigger** functions are common across multiple Modes and measurements, although some controls appear only in certain Modes and/or certain measurements. Additionally, some of the tabs on the **Trigger** menu are only available in certain Modes.

Many of the trigger functions can be set graphically using the "[Trigger Settings Diagram](#)" on [page 983](#). For more information see: "[Trigger Optimization](#)" on [page 982](#)

In general, each measurement can have a different trigger source, and each measurement remembers its previous-trigger setting.

## 8.1 Trigger

Contains controls that let you select the trigger source, and setup of each of the trigger sources. The instrument is designed to allow triggering from many sources, for example, Free Run, Video, External, RF Burst, etc.

In general, each Measurement can have a different Trigger Source, and each Measurement remembers its previous-Trigger Source.

### 8.1.1 Select Trig Source

Specifies the trigger source for the currently selected instrument input (RF or I/Q). If you change inputs, the new input remembers the trigger source it was last programmed to for the current measurement and uses that trigger source. When in External Mixing, the instrument uses the RF trigger source. You can directly set the trigger source for the RF Input and for the I/Q input using SCPI commands; see ["Trigger Source Presets" on page 943](#), ["Trigger Parameter Applicability" on page 945](#), and ["I/Q Trigger Source \(Remote Command Only\)" on page 949](#).

In general, each measurement can have a different trigger source, and each measurement remembers its previously-set trigger source. Not every trigger source is available for every measurement, so the available choices for **Select Trig Source** may vary from Mode to Mode and measurement to measurement. The trigger sources that are available for each measurement are shown in ["List of available Trigger sources" on page 938](#) below.

Note that the controls available on the **Trigger** tab change depending on which trigger source is selected. Tap each trigger source in the table in ["List of available Trigger sources" on page 938](#) to see what parameters are available for that trigger source.

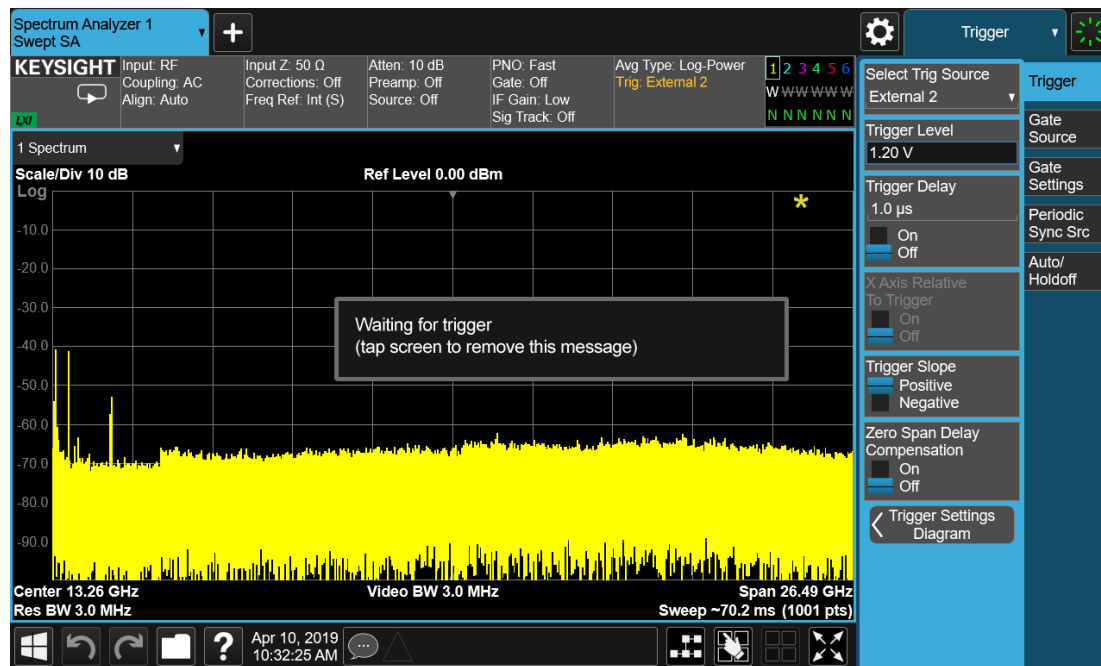
Note that most measurements require the inclusion of a `<measurement>` parameter in the trigger source command, *except* for the Swept SA and RTSA measurements. For backwards compatibility, no `<measurement>` parameter is used when setting the trigger source for the Swept SA or RTSA measurements.

#### Waiting for Trigger

After you select a trigger source, the instrument will start its next measurement when that trigger source is satisfied. For example, if you choose **External 1**, the next measurement will start when the appropriate signal appears at the **Trigger 1 In** connector.

If the trigger source is not satisfied (for example, if no signal at the appropriate level appears at the **Trigger 1 In** connector), after approximately 2 seconds a popup

message appears that says, "Waiting for trigger". The trigger annotation in the Meas Bar also turns amber, as shown below:



Tap anywhere on the screen (except on the message itself) to clear the popup. The annotation will remain amber until the trigger conditions are satisfied.

For more details, see also ["Trigger Parameter Applicability" on page 945](#), ["Trigger Setup Parameters" on page 946](#), ["Backwards Compatibility SCPI" on page 946](#), ["RF Trigger Source \(Remote Command Only\)" on page 947](#), and ["I/Q Trigger Source \(Remote Command Only\)" on page 949](#).

### List of available Trigger sources

The tables show which trigger sources are available for which Modes and measurements, with the following exceptions:

- Noise Figure Mode does not support triggering at all
- The Disturbance Analyzer measurement in EMI Mode does not support triggering
- The Tx Band Spur measurement in GSM/EDGE Mode does not support triggering
- For some models (like N9042B) with ADC trigger: some IF Paths do not support Video trigger, instead they support ADC trigger

"Free Run" on page

IMMediate

All Modes and measurements, except those measurements that support no

## 8 Trigger

### 8.1 Trigger

|                           |           |                                                                                                                                                                                                                                                                                                                                                 |
|---------------------------|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 950                       |           | triggers at all                                                                                                                                                                                                                                                                                                                                 |
| "Video/ADC" on page 950   | VIDeo     | All Modes except RTSA and Pulse<br>In Spectrum Analyzer Mode, all measurements except ACP and List Sweep<br>In WCDMA, MSR, Short Range Comms, VMA and LTE, all measurements except ACP<br>In WLAN, all measurements<br>In Phase Noise, all measurements except Log Plot and Spot Frequency                                                      |
| "ADC Trigger" on page 951 | ADC       | All Modes and measurements supporting Video or Level, except Spectrum Analyzer mode<br>Only supported in certain model's IF Paths                                                                                                                                                                                                               |
| "Line" on page 951        | LINE      | All Modes except EMI, Avionics and Analog Demod<br>In Spectrum Analyzer, all measurements except List Sweep<br>In WLAN and GSM/EDGE, all measurements except Power vs. Time<br>In LTE and 5G NR, all measurements except Transmit On/Off Power<br>In Short Range Comms, all measurements except Modulation Analysis<br>In MSR, all measurements |
| "External 1" on page 952  | EXTErnal1 | All Modes and measurements                                                                                                                                                                                                                                                                                                                      |
| "External 2" on page 953  | EXTErnal2 | All Modes and measurements                                                                                                                                                                                                                                                                                                                      |
| "External 3" on page 953  | EXTErnal3 | See <b>External 3 Support</b> below                                                                                                                                                                                                                                                                                                             |
| "RF Burst" on page 955    | RFBurst   | All Modes except EMI<br>In Spectrum Analyzer, all measurements except List Sweep                                                                                                                                                                                                                                                                |
| "Periodic" on page 955    | FRAMe     | All Modes except EMI<br>In Spectrum Analyzer, all measurements except List Sweep                                                                                                                                                                                                                                                                |

### I/Q Triggers

|                                      |                   |                                                                                                                                                                                                          |
|--------------------------------------|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| "I/Q Mag" on page 957                | <b>IQMag</b>      | All Modes except EMI, Avionics, RTSA, Analog Demod and Pulse<br>In Spectrum Analyzer, only in Power Stat CCDF and Burst Power                                                                            |
| "Input I" on page 958                | <b>IINPut</b>     | In WCDMA, only in Power Stat CCDF and IQ Waveform                                                                                                                                                        |
| "Input Q" on page 958                | <b>QINPut</b>     | In GSM/EDGE, only in EVM, GMSK Phase & Freq Error, Transmit Power and IQ Waveform<br>In Phase Noise, only in IQ Waveform                                                                                 |
| "I (Demodulated)" on page 959        | <b>IDEMod</b>     | In Bluetooth, only in Transmit Analysis<br>In LTE, only in Power Stat CCDF, Modulation Analysis, Conformance EVM, and IQ Waveform                                                                        |
| "Q (Demodulated)" on page 959        | <b>QDEMod</b>     | In WLAN, only in Power Stat CCDF, Modulation Analysis, Spectral Flatness, and IQ Waveform                                                                                                                |
| "Aux I/Q Mag" on page 960            | <b>AIQMag</b>     | In Short Range Comms, only in Power Stat CCDF and Modulation Analysis<br>In VMA, only in Power Stat CCDF, Digital Demod and IQ Waveform<br>In CQM, only in Group Delay, Power Stat CCDF, and IQ Waveform |
| "PXI" on page 960                    | <b>PXI</b>        | All Modes and measurements (only found in modular analyzers)                                                                                                                                             |
| "Internal" on page 961               | <b>INTernal</b>   | All Modes and measurements (only found in modular analyzers)                                                                                                                                             |
| "Audio External" on page 954         | <b>AEXTernal</b>  | Via the TRIG IN connector on the M9260A Audio Analyzer module                                                                                                                                            |
| "Prot Channel Detection" on page 961 | <b>PRTChandet</b> | Base Station Emulation; valid UL signal detected (PUSCH/PUCCH/PRACH/SRS)                                                                                                                                 |
| "Prot Frame Aligned" on page 962     | <b>PRTFrame</b>   | Base Station Emulation; periodic technology format radio frame with data frame aligned to the BSE timing                                                                                                 |
| "Prot Event" on page 962             | <b>PRTEvent</b>   | Base Station Emulation events                                                                                                                                                                            |

### External 3 Support

Trigger Source **External 3** is available only in certain Modes and measurements, as follows:

|                         |                                                                                          |
|-------------------------|------------------------------------------------------------------------------------------|
| <b>SGNR</b>             | Transmit On Off, Modulation Analysis, Power Stat CCDF, and IQ Waveform measurements only |
| <b>ADEMOD</b>           | Not supported                                                                            |
| <b>AVIONICS</b>         | Not supported                                                                            |
| <b>BT</b>               | Not supported                                                                            |
| <b>CQM</b>              | Group Delay, Power Stat CCDF, and IQ Waveform measurements only                          |
| <b>EMI</b>              | Not supported                                                                            |
| <b>GSMEDGE</b>          | IQ Waveform and Transmit Power measurements only                                         |
| <b>LTEAFDD, LTEATDD</b> | Power Stat CCDF, IQ Waveform, and Transmit On Off measurements only                      |
| <b>MSR</b>              | Power Stat CCDF, and IQ Waveform measurements only                                       |
| <b>PA</b>               | Power Amplifier measurement                                                              |



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### 8.1 Trigger

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| PNOISE         | IQ Waveform measurement only                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| PULSEX         | Pulse measurement only                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| SA             | Power Stat CCDF and Burst Power measurements only                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| SRCOMMS        | Modulation Analysis, Power Stat CCDF, and IQ Waveform measurements only                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| VMA            | Digital Demod, Custom OFDM, IQ Waveform, and Power Stat CCDF measurements only                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| WCDMA          | QPSK EVM, Power Stat CCDF, and IQ Waveform measurements only                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| WLAN           | Spectral Flatness, Modulation Analysis, Power Vs Time, Power Stat CCDF, and IQ Waveform measurements only                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Remote Command | <p>Swept SA and RTSA measurements:</p> <pre>:TRIGger[:SEquence]:SOURce EXTernal1   EXTernal2   EXTernal3   IMMEDIATE   LINE   FRAME   RFBurst   VIDEO   TV   PXI   INTERNAL</pre> <pre>:TRIGger[:SEquence]:SOURce?</pre> <p>All other measurements</p> <pre>:TRIGger:&lt;measurement&gt;[:SEquence]:SOURce EXTernal1   EXTernal2   EXTernal3   AEXTernal   IMMEDIATE   LEVEL   FMT   LINE   ADC   FRAME   RFBurst   VIDEO   IQMag   IDEMod   QDEMod   IINPut   QINPut   AIQMag   PXI   INTERNAL   PRTChandet   PRTFrame   PRTEvent</pre> <p>For option details, see "<a href="#">List of available Trigger sources</a>" on page 938 above</p> <pre>:TRIGger:&lt;measurement&gt;[:SEquence]:SOURce?</pre> |
| Example        | <p>The following commands set the External 1 trigger input for various measurements</p> <p>Swept SA and RTSA measurements:</p> <pre>:TRIG:SOUR EXT1</pre> <p>Other Spectrum Analyzer Mode measurements:</p> <p>Harmonics:</p> <pre>:TRIG:HARM:SOUR EXT1</pre> <p>Power Suite measurements (appear in many Modes):</p> <p>Channel Power:</p> <pre>:TRIG:CHP:SOUR EXT1</pre> <p>Occupied BW, Output Spectrum BW:</p> <pre>:TRIG:OBW:SOUR EXT1</pre>                                                                                                                                                                                                                                                        |
| Notes          | <p>For some of the trigger parameters, the tie-in to the parameter is not obvious. These are:</p> <p><b>IMMEDIATE</b>, selects Free Run</p> <p><b>FRAME</b>, selects Periodic Trigger</p> <p><b>FMT</b>, selects Frequency Mask Trigger</p> <p><b>AEXTernal</b>, selects Audio External trigger, using the TRIG IN connector on the M9260A Audio Analyzer module</p> <p>For most measurements, the <b>&lt;measurement&gt;</b> keyword follows <b>TRIGger</b>. For Swept SA and RTSA Modes, do <i>not</i> use the <b>&lt;measurement&gt;</b> keyword. Using the wrong command form will result in an Undefined Header error</p>                                                                           |

|              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|--------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|              | <p>Other trigger-related commands are found in the <b>:INITiate</b> and <b>:ABORT</b> SCPI command subsystems</p> <p><b>*OPC</b> should be used after requesting data. This will hold off any subsequent changes to the selected trigger source, until after the sweep is completed and the data is returned</p> <p>Available ranges and presets can vary from mode to mode</p> <p><b>FMT (Pulse and RTSA apps):</b></p> <p>The amplitude resolution of the Frequency Mask is coupled to the Scale/Division. There are 256 vertical points therefore the amplitude resolution is computed using the algorithm:<br/> <math display="block">(10 * \text{Scale/Div}) / \# \text{ Vertical Points}</math></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Dependencies | <p>Not all trigger sources are available for each input. See "<b>RF Trigger Source (Remote Command Only)</b>" on page 947 and "<b>I/Q Trigger Source (Remote Command Only)</b>" on page 949 commands for detailed information on which trigger sources are available for each input</p> <p>In some models, there is no second External input. In these models, the External 2 selection is not shown and the <b>EXTernal2</b> parameter will generate a "Hardware missing; Not available for this model number" message</p> <p><b>EXTernal3</b> is available only when Option H1G is installed</p> <p>For the E7760 the only available selections are:<br/> <b>EXTernal1   IMMEDIATE   INTERNAL   RFBURST   VIDEO</b></p> <p>For UXM the only available selections are:<br/> <b>EXTernal1   IMMEDIATE   PRTCHANDET   PRTFRAME   PRTEVENT</b></p> <p>In the Pulse app, when Option B2X and H1G are installed and Digital IF BW is greater than 255.176 MHz, only three trigger sources, <b>IMMEDIATE</b>, <b>LEVEL</b>, and <b>EXTernal3</b> are available</p> <p><b>Level Trigger (Pulse and RTSA apps):</b></p> <p>Level trigger is allowed in average detector mode</p> <p>When Level Trigger is the selected Trigger Source in the Spectrum measurement, Spectrum minimum Acquisition Time is limited to the PVT minimum Acquisition Time. If the Spectrum Acquisition Time changed as a result of going into Level Trigger, a message is posted "Min Acq Time is 200 usec when Level Trigger is ON". When Level Trigger is no longer the selected Trigger Source, Spectrum minimum Acquisition Time is restored</p> <p><b>FMT (Pulse and RTSA apps):</b></p> <p>If you were not in Free Run when you entered the FMT Setup View, you can change Trigger Source to Free Run while in the editor. This will allow you to configure the mask with a continually updating trace. When exiting FMT Setup View, the Trigger Source will be changed back to FMT</p> <p>For Power Stat CCDF and IQ Waveform in 5G NR and LTEATDD, switching the radio direction changes this parameter to the preset value</p> <p>In Transmit On/Off Power in 5G NR and LTEATDD, the value changes as follows</p> <ul style="list-style-type: none"> <li>- If changed to uplink: Periodic</li> <li>- If changed to downlink: External 1 except for models with the H1G option. With the H1G option, it changes as follows <ul style="list-style-type: none"> <li>- External 1, when Info BW <math>\leq</math> 255 MHz</li> </ul> </li> </ul> |

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– External 3, when Info BW  $\geq$  256 MHz

Preset See ["Trigger Source Presets" on page 943](#) below

Status Bits/OPC dependencies The Status Operation Register bit 5 "Waiting for Trigger" is set at the same time as the Sweeping or Measuring bit is set. It is cleared when the trigger actually occurs (that is, after the trigger event occurs and all the applicable trigger criteria have been met). A corresponding pop-up message ("Waiting for trigger") is generated if no trigger signal appears after approximately 2 sec. This message goes away when a trigger signal appears

### Trigger Source Presets

The preset values for each measurements after **Mode Preset** or **Meas Preset** are as follows:

| Meas                           | Mode                                                       | Preset for RF                                                        | Preset for IQ                                        |
|--------------------------------|------------------------------------------------------------|----------------------------------------------------------------------|------------------------------------------------------|
| Swept SA                       | SA                                                         | IMM                                                                  | IQ not supported                                     |
| CHP                            | SA, WCDMA, MSR, SRCOMMS, 5GNR, WLAN                        | IMM                                                                  | IQ not supported                                     |
| OBW                            | SA, WCDMA, LTEAFDD, LTEATDD, BT, 5GNR, WLAN                | 1xEVDO: EXT1<br>Others: IMM                                          | IQ not supported                                     |
| Transmit Analysis              | BT                                                         | RFB                                                                  | IQM                                                  |
| Adjacent Channel Power         | BT                                                         | IMM                                                                  | IQ not supported                                     |
| LE In-band Emissions           | BT                                                         | IMM                                                                  | IQ not supported                                     |
| EDR In-band Spurious Emissions | BT                                                         | RF Burst                                                             | IQ not supported                                     |
| CCDF                           | SA, WCDMA, LTEAFDD, LTEATDD, MSR, SRCOMMS, 5GNR, WLAN, CQM | LTEATDD:<br>– BTS: External 1<br>– MS: Periodic Timer<br>Others: IMM | LTEATDD:<br>– BTS: EXT1<br>– MS: FRAM<br>Others: IMM |
| ACP                            | SA, WCDMA, LTEAFDD, LTEATDD, MSR, SRCOMMS, 5GNR            | IMM                                                                  | IQ not supported                                     |
| Tx Power                       | SA, GSM                                                    | RFBurst                                                              | IMM                                                  |
| SPUR                           | SA, WCDMA, MSR, LTEAFDD, LTEATDD, 5GNR, WLAN               | IMM                                                                  | IQ not supported                                     |
| SEM                            | SA, WCDMA, MSR, LTEAFDD, LTEATDD, SRCOMMS, 5G NR, WLAN     | IMM                                                                  | IQ not supported                                     |
| CDP                            | WCDMA                                                      | IMM                                                                  | IMM                                                  |
| RHO                            | WCDMA                                                      | IMM                                                                  | IMM                                                  |

| Meas                  | Mode                                  | Preset for RF                                                                                 | Preset for IQ                                                             |
|-----------------------|---------------------------------------|-----------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|
| PCON                  | WCDMA                                 | IMM                                                                                           | IMM                                                                       |
| QPSK                  | WCDMA                                 | EXT1                                                                                          | IMM                                                                       |
| MON                   | All except:<br>SA, BASIC              | IMM                                                                                           | IQ not supported                                                          |
| WAV                   | All except:<br>SA                     | LTEATDD:<br>- BTS: External 1<br>- MS: Periodic Timer<br>GSM/EDGE: RFBurst<br>All others: IMM | LTEATDD:<br>- BTS: EXT1<br>- MS: FRAM<br>GSM/EDGE: IQM<br>All others: IMM |
| EVM                   | LTEAFDD, LTEATDD, SRCOMMS, 5GNR, WLAN | IMM                                                                                           | IMM                                                                       |
| PVT                   | WLAN                                  | RFB                                                                                           | IQ not supported                                                          |
| Spectral Flatness     | WLAN                                  | IMM                                                                                           | IMM                                                                       |
| SPEC                  | BASIC                                 | IMM                                                                                           | IMM                                                                       |
| LOG Plot              | PN                                    | IMM                                                                                           | IQ not supported                                                          |
| Spot Freq             | PN                                    | IMM                                                                                           | IQ not supported                                                          |
| GMSK PVT              | EDGE/GSM                              | RFB                                                                                           | IMM                                                                       |
| GMSK PFER             | EDGE/GSM                              | RFB                                                                                           | IQM                                                                       |
| GMSK ORFS             | EDGE/GSM                              | RFB                                                                                           | IQ not supported                                                          |
| EDGE PVT              | EDGE/GSM                              | RFB                                                                                           | IMM                                                                       |
| EDGE EVM              | EDGE/GSM                              | RFB                                                                                           | IQM                                                                       |
| EDGE ORFS             | EDGE/GSM                              | Periodic Timer                                                                                | IQ not supported                                                          |
| Combined WCDMA        | WCDMA                                 | IMM                                                                                           | IQ not supported                                                          |
| Combined GSM          | EDGE/GSM                              | RFB                                                                                           | IQ not supported                                                          |
| List Power Step       | WCDMA, EDGE/GSM                       | IMM                                                                                           | IQ not supported                                                          |
| Transmit On/Off Power | LTETDD, LTEATDD, 5GNR                 | BTS: External 1<br>(External3 when IFBW $\geq$ 256 MHz with H1G option)<br>MS: Periodic Timer | BTS: EXT1<br>MS: FRAM                                                     |
| Transmit Analysis     | BLUETOOTH                             | RFB                                                                                           | IQ not                                                                    |

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| Meas                           | Mode                  | Preset for RF  | Preset for IQ    |
|--------------------------------|-----------------------|----------------|------------------|
| Adjacent Channel Power         | BLUETOOTH             | IMM            | supported        |
| LE In-band Emissions           | BLUETOOTH             | IMM            | IQ not supported |
| EDR In-band Spurious Emissions | BLUETOOTH             | Periodic Timer | IQ not supported |
| Conformance EVM                | LTEAFDD, LTEATDD, MSR | IMM            | IMM              |
| Spectrum & PVT                 | RTSA                  | IMM            | IQ not supported |
| Pulse                          | PULSEX                | IMM            | IQ not supported |
| AM, FM, PM, FM Stereo          | ADEMOD                | IMM            | IQ not supported |
| PAVT                           | SA, 5GNR, VMA         | IMM            | IMM              |
| Group Delay                    | CQM                   | IMM            | IMM              |

#### Trigger Parameter Applicability

The **Trigger** menus let you select the trigger source and trigger settings for a sweep or measurement. In triggered operation (basically, any trigger source other than **Free Run**), the instrument will begin a sweep or measurement only when the selected trigger conditions are met, generally when your trigger source signal meets the specified trigger level and polarity requirements. (In FFT measurements, the trigger controls when the data acquisition begins for FFT conversion.)

For each of the trigger sources, you may define a set of operational parameters or settings, which will be applied when that source is selected as the current trigger source. Examples of these settings are **Trigger Level**, **Trigger Delay**, and **Trigger Slope**. You may apply different settings for each source; so, for example, you could have a **Trigger Level** of 1 V for **External 1** trigger and –10 dBm for **Video** trigger.

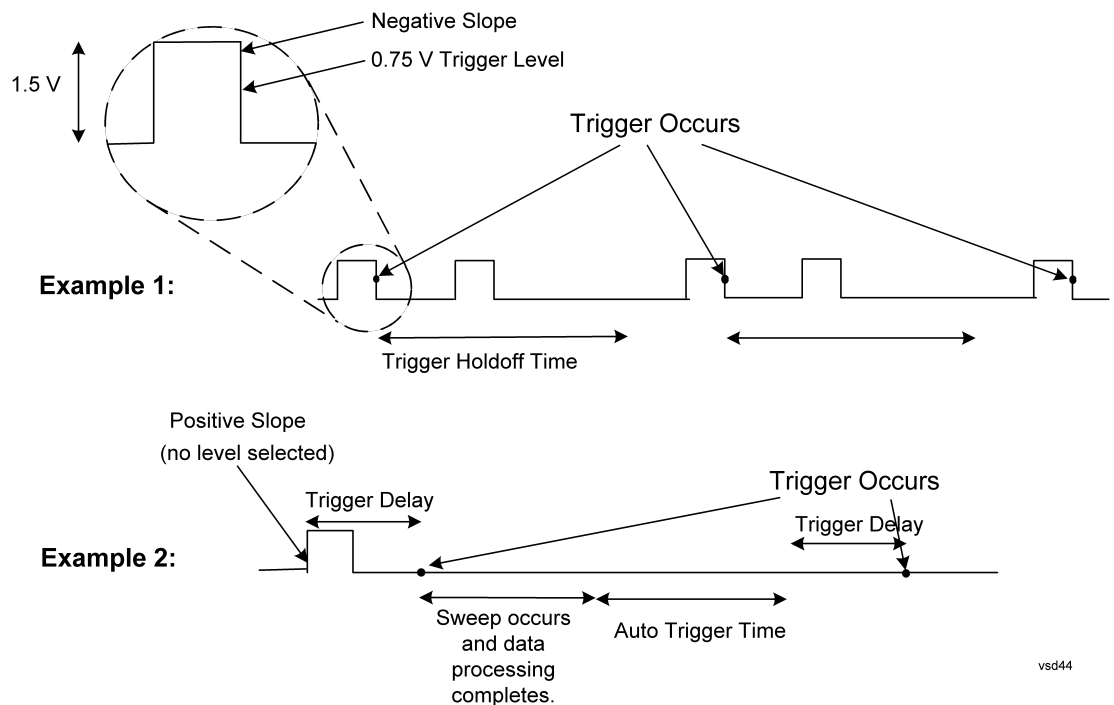
Once you have established the settings for a given trigger source, they generally will remain unchanged for that trigger source as you go from measurement to measurement within a Mode (although the settings can change as you go from Mode to Mode). Furthermore, the trigger settings within a Mode are the same for the **Trigger** menu, the **Gate Source** menu, and the **Periodic Sync Src** menu. That is, if **Ext1** trigger level is set to 1 V in the **Trigger** menu, it will appear as 1 V in both the **Gate Source** and the **Periodic Sync Src** menus. For these reasons, the trigger settings commands are not qualified with the measurement name, the way the trigger source commands are.

## Trigger Setup Parameters

The following examples show trigger setup parameters using an external trigger source.

Example 1 illustrates the trigger conditions with negative slope and no trigger occurs during trigger Holdoff time.

Example 2 illustrates the trigger conditions with positive slope, trigger delay, and auto trigger time.



vsd44

## Backwards Compatibility SCPI

The following SCPI commands are provided for Backwards Compatibility:

Backwards  
Compatibility  
SCPI

**:TRIGger[:SEquence]:SOURCe EXTeRnal**

For backward compatibility, the parameter **EXTeRnal** is mapped to **EXTeRnal1**

**[ :SENSe ] : < measurement > : TRIGger : SOURCe**

This backwards compatibility alias command is provided for ESA/PSA compatibility

This backwards compatibility command does not apply to the Swept SA measurement, for that just use

**:TRIGger : SOURCe**

This backwards compatibility command does not apply to the monitor spectrum, log plot and spot frequency measurements

**[ :SENSe ] : < measurement > : TRIGger : SOURCe IF**

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In earlier instruments, the parameter IF was used by apps for the video trigger, so using the IF parameter selects **VIDeo** triggering. Sending IF in the command causes **VID** to be returned to a query **[ :SENSe]:ACPR:TRIGger:SOURce**

This backwards Compatibility SCPI command is provided to support the same functionality as **[ :SENSe]:ACPr:TRIGger:SOURce** (PSA W-CDMA, PSA cdma2000 and PSA 1xEVDO) due to the fact that the **ACPr** node conflicts with the **ACPower** node

The legacy command:

**:TRIGger[:SEQuence]:RFBurst:FSElectivity[:STATe] OFF | ON | 0 | 1**

is not supported in the X-Series, as the hardware to do Frequency Selective burst triggers does not exist in X-Series

**RF Trigger Source (Remote Command Only)**

Selects the trigger to be used for the specified measurement when RF is the selected input. The RF trigger source can be queried and changed even while another input is selected, but it is inactive until RF becomes the selected input.

Note the inclusion of the <measurement> parameter in the command below. Because each measurement remembers its own Trigger Source, the command must be qualified with the measurement name. Note that for the Swept SA measurement this is not the case; for backwards compatibility, no <measurement> parameter is used when setting the Trigger Source for the Swept SA measurement.

Remote Command     **:TRIGger:<measurement>[:SEQuence]:RF:SOURce EXTernal1 | EXTernal2 | IMMEDIATE | LEVel | FMT | LINE | FRAMe | RFBurst | VIDeo | IF | TV | PXI | INTernal | PRTChandet | PRTFrame | PRTEvent**

For option details, see "[List of available Trigger sources](#)" on page 938 above

**:TRIGger:<measurement>[:SEQuence]:RF:SOURce?**

Note that the available parameters are model number and hardware dependent

Example     Select the external 1 trigger input for the ACP measurement and the RF input:

**:TRIG:ACP:RF:SOUR EXT1**

Select video triggering for the **SANalyzer** measurement and the RF input. For **SAN**, do not use the **<measurement>** keyword:

**:TRIG:RF:SOUR VID**

Notes     Not all measurements have all the trigger sources available to them. Check the trigger source documentation for your specific measurement to see what sources are available

Note that not all trigger sources are available for each input, and that the available parameters are model number and hardware dependent

For the **RF Trigger Source**, the following trigger sources are available:

**IMMEDIATE**     free run triggering

|              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|--------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|              | <b>VIDeo</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | triggers on the video signal level                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|              | <b>LEVe1</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | triggers on the video signal level with time qualified triggering                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|              | <b>FMT</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | triggers on the amplitude spectrum with frequency mask triggering                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|              | <b>LINE</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | triggers on the power line signal                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|              | <b>EXTernal1</b><br>or <b>EXTernal</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | triggers on an externally connected trigger source marked "Trigger 1 In" on the rear panel of standalone instruments, "Trigger 3" on the front panel of EXM and VXT models M9420A/21A, and "Trigger 1" on the front panel of VXT models M9410A/11A/15A/16A and M9410E/11E/15E/16E                                                                                                                                                                                                                                    |
|              | <b>EXTernal2</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | triggers on an externally connected trigger source marked "Trigger 2 In" on the front panel of standalone instruments, and "Trigger 1" on the front panel of EXM and VXT models M9420A/21A, and "Trigger 2" on the front panel of VXT models M9410A/11A/15A/16A and M9410E/11E/15E/16E. In some models, there is no second External input. In these models, the External 2 selection is not shown and the <b>EXTernal2</b> parameter will generate a "Hardware missing; Not available for this model number" message |
|              | <b>RFBurst</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | triggers on the bursted frame                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|              | <b>FRAMe</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | triggers on the periodic timer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|              | <b>IF (video)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | same as video, for backwards compatibility only                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|              | <b>PRTChandet</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | triggers on Base Station Emulation detecting a valid UL signal (PUSCH/PUCCH/PRACH/SRS)                                                                                                                                                                                                                                                                                                                                                                                                                               |
|              | <b>PRTFrame</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | triggers on the Base Station Emulation periodic technology format radio frame with data frame aligned to the BSE timing                                                                                                                                                                                                                                                                                                                                                                                              |
|              | <b>PRTEvent</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | triggers on the Base Station Emulation events                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|              | <b>INTernal</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | triggers on the internal source trigger output, for models with an internal source such as VXT                                                                                                                                                                                                                                                                                                                                                                                                                       |
|              | <b>PXI trigger</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | only supported in PXI (modular) instruments                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|              | <p><b>*OPC</b> should be used after requesting data. This will hold off any subsequent changes to the selected trigger source, until after the sweep is completed and the data is returned</p> <p>Available ranges, and presets can vary from mode to mode</p>                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Dependencies | <p>The available choices for VXT are: Free Run, Video, Internal, External 1, External 2, RF Burst, Periodic and PXI</p> <p>In VXT, <b>Internal</b> is only in VXT models M9410A/11A/15A/16A and M9410E/11E/15E/16E, not in models M9420/21A, and Internal and Periodic are not available in Spectrum Analyzer Mode</p> <p><b>PXI</b> appears only in VXT</p> <p>The available choices for EXM are Free Run, Video, Internal, External 1, External 2, RF Burst, and Periodic</p> <p>The available choices for UXM are Free Run, External 1, Prot Channel Detection, Prot Frame Aligned, and Prot Event</p> <p>Prot Channel Detection, Prot Frame Aligned, and Prot Event are only available in UXM</p> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |



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|                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                  |                     |                  |                                                                                         |                  |                                                                       |              |                                             |               |                                                    |               |                                                    |               |                                         |               |                                         |               |                                                                        |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|---------------------|------------------|-----------------------------------------------------------------------------------------|------------------|-----------------------------------------------------------------------|--------------|---------------------------------------------|---------------|----------------------------------------------------|---------------|----------------------------------------------------|---------------|-----------------------------------------|---------------|-----------------------------------------|---------------|------------------------------------------------------------------------|
|                                                                                                                                                                                                                                                                                                                                    | <p>The available choices for E7760 are Free Run, External 1, Internal, Video and RF Burst</p> <p>In some models, there is no second External input. In these models, the <b>External 2</b> selection is not shown and the <b>EXTernal12</b> parameter will generate a "Hardware missing; Not available for this model number" error</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                  |                     |                  |                                                                                         |                  |                                                                       |              |                                             |               |                                                    |               |                                                    |               |                                         |               |                                         |               |                                                                        |
| Status Bits/OPC dependencies                                                                                                                                                                                                                                                                                                       | <p>The Status Operation Register bit 5 "Waiting for Trigger" is set at the same time as the Sweeping or Measuring bit is set. It is cleared when the trigger actually occurs (that is, after the trigger event occurs and all the applicable trigger criteria have been met). A corresponding pop-up message ("Waiting for trigger") is generated if no trigger signal appears after approximately 2 seconds. This message goes away when a trigger signal appears</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                  |                     |                  |                                                                                         |                  |                                                                       |              |                                             |               |                                                    |               |                                                    |               |                                         |               |                                         |               |                                                                        |
| <h3>I/Q Trigger Source (Remote Command Only)</h3> <p>Selects the trigger to be used for the specified measurement when I/Q (which requires option BBA) is the selected input. The I/Q trigger source can be queried and changed even while another input is selected, but it is inactive until I/Q becomes the selected input.</p> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                  |                     |                  |                                                                                         |                  |                                                                       |              |                                             |               |                                                    |               |                                                    |               |                                         |               |                                         |               |                                                                        |
| Remote Command                                                                                                                                                                                                                                                                                                                     | <pre>:TRIGger:&lt;measurement&gt;[:SEquence]:IQ:SOURce EXTernal1   EXTernal2   IMMEDIATE   IQMag   IDEMod   QDEMod   IINPut   QINPut   AIQMag</pre> <p>For option details, see "<a href="#">List of available Trigger sources</a>" on page 938 above</p> <pre>:TRIGger:&lt;measurement&gt;[:SEquence]:IQ:SOURce?</pre>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                  |                     |                  |                                                                                         |                  |                                                                       |              |                                             |               |                                                    |               |                                                    |               |                                         |               |                                         |               |                                                                        |
| Example                                                                                                                                                                                                                                                                                                                            | <pre>:TRIG:WAVEform:SOUR IQM</pre> <p>Selects I/Q magnitude triggering for the IQ Waveform measurement and the I/Q input</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                  |                     |                  |                                                                                         |                  |                                                                       |              |                                             |               |                                                    |               |                                                    |               |                                         |               |                                         |               |                                                                        |
| Notes                                                                                                                                                                                                                                                                                                                              | <p>Not all measurements have all the trigger sources available to them. Check the trigger source documentation for your specific measurement to see what sources are available</p> <p>Note that not all trigger sources are available for each input, and that the available parameters are model number and hardware dependent</p> <p>For the <b>I/Q Trigger Source</b>, the following trigger sources are available:</p> <table> <tr> <td><b>IMMEDIATE</b></td><td>Free run triggering</td></tr> <tr> <td><b>EXTernal1</b></td><td>Triggers on an externally connected trigger source on the rear panel or <b>EXTernal</b></td></tr> <tr> <td><b>EXTernal2</b></td><td>Triggers on an externally connected trigger source on the front panel</td></tr> <tr> <td><b>IQMag</b></td><td>Triggers on the magnitude of the I/Q signal</td></tr> <tr> <td><b>IDEMod</b></td><td>Triggers on the I/Q signal's demodulated I voltage</td></tr> <tr> <td><b>QDEMod</b></td><td>Triggers on the I/Q signal's demodulated Q voltage</td></tr> <tr> <td><b>IINPut</b></td><td>Triggers on the I channel's ADC voltage</td></tr> <tr> <td><b>QINPut</b></td><td>Triggers on the Q channel's ADC voltage</td></tr> <tr> <td><b>AIQMag</b></td><td>Triggers on the magnitude of the auxiliary receiver channel I/Q signal</td></tr> </table> <p><b>*OPC</b> should be used after requesting data. This will hold off any subsequent changes to the selected trigger source, until after the sweep is completed and the data is returned</p> | <b>IMMEDIATE</b> | Free run triggering | <b>EXTernal1</b> | Triggers on an externally connected trigger source on the rear panel or <b>EXTernal</b> | <b>EXTernal2</b> | Triggers on an externally connected trigger source on the front panel | <b>IQMag</b> | Triggers on the magnitude of the I/Q signal | <b>IDEMod</b> | Triggers on the I/Q signal's demodulated I voltage | <b>QDEMod</b> | Triggers on the I/Q signal's demodulated Q voltage | <b>IINPut</b> | Triggers on the I channel's ADC voltage | <b>QINPut</b> | Triggers on the Q channel's ADC voltage | <b>AIQMag</b> | Triggers on the magnitude of the auxiliary receiver channel I/Q signal |
| <b>IMMEDIATE</b>                                                                                                                                                                                                                                                                                                                   | Free run triggering                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                  |                     |                  |                                                                                         |                  |                                                                       |              |                                             |               |                                                    |               |                                                    |               |                                         |               |                                         |               |                                                                        |
| <b>EXTernal1</b>                                                                                                                                                                                                                                                                                                                   | Triggers on an externally connected trigger source on the rear panel or <b>EXTernal</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                  |                     |                  |                                                                                         |                  |                                                                       |              |                                             |               |                                                    |               |                                                    |               |                                         |               |                                         |               |                                                                        |
| <b>EXTernal2</b>                                                                                                                                                                                                                                                                                                                   | Triggers on an externally connected trigger source on the front panel                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |                     |                  |                                                                                         |                  |                                                                       |              |                                             |               |                                                    |               |                                                    |               |                                         |               |                                         |               |                                                                        |
| <b>IQMag</b>                                                                                                                                                                                                                                                                                                                       | Triggers on the magnitude of the I/Q signal                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                  |                     |                  |                                                                                         |                  |                                                                       |              |                                             |               |                                                    |               |                                                    |               |                                         |               |                                         |               |                                                                        |
| <b>IDEMod</b>                                                                                                                                                                                                                                                                                                                      | Triggers on the I/Q signal's demodulated I voltage                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                  |                     |                  |                                                                                         |                  |                                                                       |              |                                             |               |                                                    |               |                                                    |               |                                         |               |                                         |               |                                                                        |
| <b>QDEMod</b>                                                                                                                                                                                                                                                                                                                      | Triggers on the I/Q signal's demodulated Q voltage                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                  |                     |                  |                                                                                         |                  |                                                                       |              |                                             |               |                                                    |               |                                                    |               |                                         |               |                                         |               |                                                                        |
| <b>IINPut</b>                                                                                                                                                                                                                                                                                                                      | Triggers on the I channel's ADC voltage                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                  |                     |                  |                                                                                         |                  |                                                                       |              |                                             |               |                                                    |               |                                                    |               |                                         |               |                                         |               |                                                                        |
| <b>QINPut</b>                                                                                                                                                                                                                                                                                                                      | Triggers on the Q channel's ADC voltage                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                  |                     |                  |                                                                                         |                  |                                                                       |              |                                             |               |                                                    |               |                                                    |               |                                         |               |                                         |               |                                                                        |
| <b>AIQMag</b>                                                                                                                                                                                                                                                                                                                      | Triggers on the magnitude of the auxiliary receiver channel I/Q signal                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                  |                     |                  |                                                                                         |                  |                                                                       |              |                                             |               |                                                    |               |                                                    |               |                                         |               |                                         |               |                                                                        |

|                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                              | Available ranges, and from mode-to-mode presets can vary                                                                                                                                                                                                                                                                                                                                                                                                    |
| Status Bits/OPC dependencies | The Status Operation Register bit 5 "Waiting for Trigger" is set at the same time as the Sweeping or Measuring bit is set. It is cleared when the trigger actually occurs (that is, after the trigger event occurs and all the applicable trigger criteria have been met). A corresponding pop-up message ("Waiting for trigger") is generated if no trigger signal appears after approximately 2 sec. This message goes away when a trigger signal appears |

### 8.1.1.1 Free Run

**Free Run** triggering occurs immediately after the sweep/measurement is initiated.

|              |                                                                                                                                        |
|--------------|----------------------------------------------------------------------------------------------------------------------------------------|
| Example      | <p>Swept SA measurement:</p> <pre>:TRIG:SOUR IMM</pre> <p>Measurements other than Swept SA:</p> <pre>:TRIG:&lt;meas&gt;:SOUR IMM</pre> |
| Annunciation | Free Run (in the Meas Bar)                                                                                                             |

### 8.1.1.2 Video/ADC

The Video trigger condition is met when the video signal at the left edge of the graticule (the filtered and detected version of the input signal, including both RBW and VBW filtering) crosses the video trigger level with the chosen slope.

The Video trigger level is shown as a labeled line on the display. The line is displayed as long as Video is the selected trigger source. The Trigger Level line can be adjusted using the step keys, knob, or numeric keypad. It can also be dragged on the display with your finger or with a mouse.

When the detector selected for all active traces is the average detector, the video signal for triggering does not include any VBW filtering.

Log Plot and Spot Frequency measurements, in the Phase Noise Mode, do not support Video Trigger.

The **Trigger** tab contains the following Trigger Source dependent controls when Video Trigger is selected:

- "Prot Frame Aligned" on page 962
- "Trigger Delay" on page 965
- "Trigger Slope" on page 969

Additional controls are also present, which are not dependent on the selected Trigger Source.

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Note that Video Trigger is a software trigger of the acquired trace for some measurements and a hardware trigger of the IF envelope for others. Most measurements support one method or the other, although some (like ACP) don't support Video Trigger at all. For those measurements that support Video Trigger as a software trigger, the Trigger Level units will be dependent on the current Y Axis Unit for the measurement; for those that support Video Trigger as an IF Envelope trigger, the units are typically in dBm.

|              |                                                                                                           |
|--------------|-----------------------------------------------------------------------------------------------------------|
| Example      | Swept SA measurement:<br>:TRIG:SOUR VID<br><br>Measurements other than Swept SA:<br>:TRIG:<meas>:SOUR VID |
| Annunciation | Video (in the Meas Bar)                                                                                   |

8.1.1.3 ADC Trigger

Some IF Paths in certain models (like N9042B) in IQ Measurements have an ADC trigger. ADC is like the Video trigger, but with 2 limitations due to a lack of post-processing.

First, the trigger is not limited to the current measurement's setup IF BW. The trigger sees everything in the passband, so measurements like IQA Complex Spectrum can be triggered outside of the current Digital IF BW.

The final limitation is, due to lack of post-processing, the amplitude accuracy of **ADC Trigger** is less than the video trigger.

If **ADC Trigger** is available for at least one IF Path on a model, then **ADC Trigger** will always be available as a trigger option in IQ Measurements. However, it will only be selectable (not grayed-out) when using IF Paths that support it.

If "Video/ADC" on page 950 Trigger is selected, and measurement setup (IF Path or IF BW) is changed to a path that only supports **ADC Trigger** instead, then **ADC Trigger** will be selected and *vice versa*.

|              |                                                            |
|--------------|------------------------------------------------------------|
| Example      | Measurements other than Swept SA:<br>:TRIG:<meas>:SOUR ADC |
| Annunciation | ADC (in the Meas Bar)                                      |

8.1.1.4 Line

When **Line** is selected, start of a new sweep/measurement will be synchronized with the next cycle of the line voltage.

**Line** trigger is not available when operating from a "dc power source", for example, when the instrument is powered from batteries.

**Line** trigger is not available when using modular instruments like the VXT.

The **Trigger** tab contains the following Trigger Source-dependent controls when **Line** Trigger is selected:

- "Trigger Delay" on page 965
- "Trigger Slope" on page 969

Additional controls are also present that are not dependent on the selected Trigger Source.

---

|              |                                                                                                                                       |
|--------------|---------------------------------------------------------------------------------------------------------------------------------------|
| Example      | <code>:TRIG:SOUR LINE</code><br>Swept SA measurement<br><code>:TRIG:&lt;meas&gt;:SOUR LINE</code><br>Measurements other than Swept SA |
| Annunciation | LINE (in the Meas Bar)                                                                                                                |

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#### 8.1.1.5 External 1

When **External 1** is selected, a new sweep/measurement starts when the external trigger condition is met using the TRIGGER 1 IN input connector on the rear panel.

Grayed-out if Ext 1 is in use by Point Trigger in the Source Setup menu of Swept SA. Forced to "Free Run" on page 950 if already selected and Point Trigger is set to **External 1**.

The **Trigger** tab contains the following Trigger Source-dependent controls when **External 1** trigger is selected:

- "Prot Frame Aligned" on page 962
- "Trigger Delay" on page 965
- "Trigger Slope" on page 969

Additional controls are also present that do not depend on the selected Trigger Source.

---

|              |                                                                                                                                       |
|--------------|---------------------------------------------------------------------------------------------------------------------------------------|
| Example      | <code>:TRIG:SOUR EXT1</code><br>Swept SA measurement<br><code>:TRIG:&lt;meas&gt;:SOUR EXT1</code><br>Measurements other than Swept SA |
| Annunciation | External 1 (in the Meas Bar)                                                                                                          |

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8.1.1.6 External 2

When **External 2** is selected, a new sweep/measurement starts when the external trigger condition is met using the TRIGGER 2 IN input connector on the rear panel.

Grayed-out if Ext 2 is in use by Point Trigger in the Source Setup menu of Swept SA. Forced to "Free Run" on page 950 if already selected and Point Trigger is set to **External 2**.

The **Trigger** tab contains the following Trigger Source-dependent controls when **External 2** trigger is selected:

- "Prot Frame Aligned" on page 962
- "Trigger Delay" on page 965
- "Trigger Slope" on page 969

Additional controls are also present that do not depend on the selected Trigger Source.

|              |                                                                                                                                       |
|--------------|---------------------------------------------------------------------------------------------------------------------------------------|
| Example      | <code>:TRIG:SOUR EXT2</code><br>Swept SA measurement<br><code>:TRIG:&lt;meas&gt;:SOUR EXT2</code><br>Measurements other than Swept SA |
| Annunciation | External 2 (in the Meas Bar)                                                                                                          |

8.1.1.7 External 3

When **External 3** is selected, a new sweep/measurement starts when the external trigger condition is met using the **TRIGGER 3 IN** input connector on the rear panel.

This control only appears in certain instrument and option combinations, as follows.

- For N9042B, selects the Precision External Trigger, but available only when IF Path is 255 MHz or wider. The resolution will be within one sample count of the 4.8 GHz ADC sampling rate for 255 ~ 2 GHz IF Paths, and within one sample count of the 10.2 GHz sampling rate for the 4 GHz IF Path
- For all other instruments, available only if Option H1G is installed. It is only available when the 1 GHz path is chosen, either directly or indirectly; in all other paths it is visible but grayed-out. Direct and indirect selection of the 1 GHz path occurs as follows:
  - **Direct:** Measurements that directly support the 1 GHz path have a 1 GHz selection in the **IF Path** menu in **Meas Setup**

- **Indirect:** Certain measurements, such as Power Statistics CCDF ([PST](#)), always select the widest available path, and so will select the 1 GHz path if it is available, even if there is no **IF Path** menu for the measurement. **External 3** will be visible when this results in the 1 GHz path being selected, even if there is no control or readout indicating that the 1 GHz path has been selected

For a full list of Modes and measurements that support **External 3**, see **External 3 Support** in the section ["Select Trig Source" on page 937](#).

When **External 3** is set, and then becomes disabled because you switched away from the 1 GHz path, the Trigger Source selection reverts to the default (["Free Run" on page 950](#)).

When **External 3** Trigger is selected, the **Trigger** tab displays the following Trigger Source-dependent controls:

- ["Prot Frame Aligned" on page 962](#)
- ["Trigger Delay" on page 965](#)
- ["Trigger Slope" on page 969](#)

Additional controls are also present that do not depend on the selected Trigger Source.

|              |                                                                                                                 |
|--------------|-----------------------------------------------------------------------------------------------------------------|
| Example      | <code>:TRIG:SPEC:SOUR EXT3</code><br>Sets External 3 as the trigger source for the Complex Spectrum measurement |
| Annunciation | External 3 (in the Meas Bar)                                                                                    |

8.1.1.8 Audio External

When **Audio External** is selected, a new sweep/measurement starts when the external trigger condition is met using the **TRIG IN** input connector on the front panel of the M9260A Audio Analyzer module. This is a TTL level input (*not* analog) that supports both rising edge and falling edge triggers.

Only appears in modular instruments, and only when the M9260A Audio Analyzer module is installed, such as in M8920A.

The **Trigger** tab contains the following Trigger Source-dependent controls when **Audio External** trigger is selected:

- ["Trigger Delay" on page 965](#)
- ["Trigger Slope" on page 969](#)

Additional controls are also present that do not depend on the selected Trigger Source.

|              |                                                                                                               |
|--------------|---------------------------------------------------------------------------------------------------------------|
| Example      | Set Audio External as the trigger source for the Radio Test measurement:<br><code>:TRIG:RTES:SOUR AEXT</code> |
| Annunciation | Audio Ext (in the Meas Bar)                                                                                   |

8.1.1.9 RF Burst

When **RF Burst** is selected, a new sweep/measurement starts when an RF burst envelope signal is identified from the signal at the RF Input connector.

In some models, a variety of burst trigger circuitry is available, resulting in various available burst trigger bandwidths. The instrument automatically chooses the appropriate trigger path based on the hardware configuration and other settings of the instrument.

The **Trigger** tab contains the following Trigger Source-dependent controls when **RF Burst** is selected:

- "Trigger Level Absolute/Relative" on page 970
- "Absolute Trigger Level" on page 970
- "Relative Trigger Level" on page 971
- "Trigger Delay" on page 965
- "Trigger Slope" on page 969

Additional controls are also present that do not depend on the selected Trigger Source.

|              |                                                                                                                                             |
|--------------|---------------------------------------------------------------------------------------------------------------------------------------------|
| Example      | <code>:TRIG:SOUR RFB</code><br><br>Swept SA measurement<br><code>:TRIG:&lt;meas&gt;:SOUR RFB</code><br><br>Measurements other than Swept SA |
| Annunciation | RF Burst (in the Meas Bar)                                                                                                                  |

8.1.1.10 Periodic

When **Periodic** is selected, the instrument uses a built-in periodic timer signal as the trigger. Trigger occurrences are set by the **Periodic Timer** parameter, which is modified by **Offset** and **Periodic Sync Src**.

Use this trigger when there is a periodic signal but no reliable signal on which to trigger. You can synchronize the periodic signal with outside events (using **Periodic Sync Src**) to get closer to a reliable trigger signal (see "More Information" on page 956 below).

If you do not have a sync source selected (**OFF**), then the internal timer is not synchronized with any external timing events.

The **Trigger** tab contains the following Trigger Source-dependent controls when **Periodic** trigger is selected:

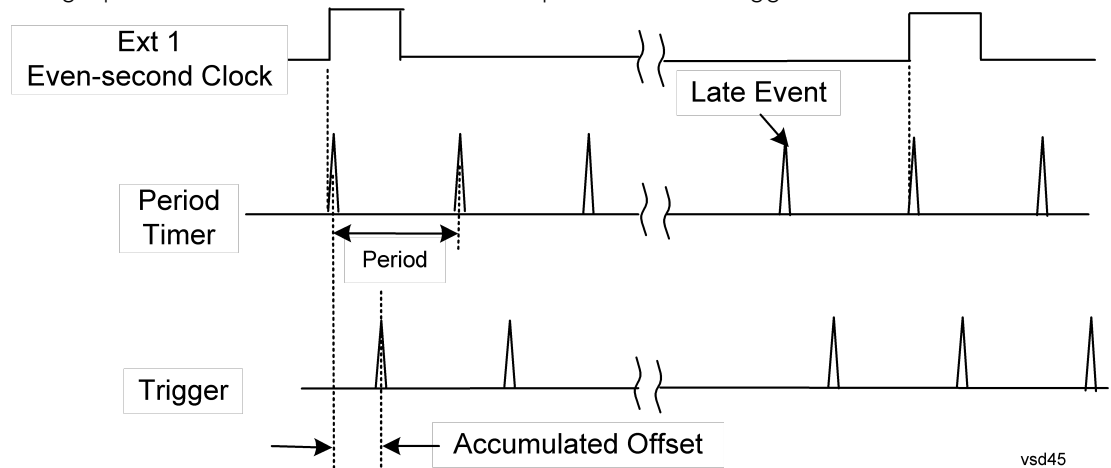
- "Period" on page 973
- "Offset" on page 973
- "Reset Offset Display" on page 974
- "Sync Source" on page 975
- "Trigger Delay" on page 965

Additional controls are also present that do not depend on the selected Trigger Source.

|              |                                                                                                                                       |
|--------------|---------------------------------------------------------------------------------------------------------------------------------------|
| Example      | <code>:TRIG:SOUR FRAM</code><br>Swept SA measurement<br><code>:TRIG:&lt;meas&gt;:SOUR FRAM</code><br>Measurements other than Swept SA |
| Annunciation | Periodic (in the Meas Bar)                                                                                                            |

## More Information

The graphic below shows the action of the periodic timer trigger.



A common application is measuring periodic burst RF signals for which a trigger signal is not easily available. For example, we might be measuring a TDMA radio that bursts every 20 ms. Let's assume that the 20 ms period is very consistent. Let's also assume that we do not have an external trigger source available that is



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synchronized with the period, and that the signal-to-noise ratio of the signal is not high enough to provide a clean RF burst trigger at all of the analysis frequencies. For example, we might want to measure spurious transmissions at an offset from the carrier that is larger than the bandwidth of the RF burst trigger. In this application, we can set the Periodic Timer to a 20.00 ms period and adjust the offset from that timer to position our trigger just where we want it. If we find that the 20.00 ms is not exactly right, we can adjust the period slightly to minimize the drift between the period timer and the signal to be measured.

A second way to use this feature would be to use **Sync Source** temporarily, instead of **Offset**. In this case, we might tune to the signal in a narrow span and use the RF Burst trigger to synchronize the periodic timer. Then we would turn the sync source off so that it would not miss-trigger. Miss-triggering can occur when we are tuned so far away from the RF burst trigger that it is no longer reliable.

A third example would be to synchronize to a signal that has a reference time element of much longer period than the period of interest. In some CDMA applications, it is useful to look at signals with a short periodicity, by synchronizing that periodicity to the "even-second clock" edge that happens every two seconds. Thus, we could connect the even-second clock trigger to Ext1 and use then Ext1 as the sync source for the periodic timer.

The figure below illustrates this third example. The top trace represents the even-second clock. It causes the periodic timer to synchronize with the leading edge shown. The instrument trigger occurs at a time delayed by the accumulated offset from the period trigger event. The periodic timer continues to run, and triggers continue to occur, with a periodicity determined by the instrument time base. The timer output (labeled "late event") will drift away from its ideal time due to imperfect matching between the time base of the signal being measured and the time base of the instrument, and also because of imperfect setting of the period parameter. But the synchronization is restored on the next even-second clock event. ("Accumulated offset" is described in the in the **Offset** function section.)

#### 8.1.1.11 I/Q Mag

When **I/Q Mag** is selected, the trigger condition is met when the I/Q magnitude crosses the I/Q magnitude trigger level. The magnitude is measured at the output of the main I/Q digital receiver.

This trigger type is only valid for measurements that support I/Q inputs.

The **Trigger** tab contains the following Trigger Source-dependent controls when **I/Q Mag** trigger is selected:

- "Prot Frame Aligned" on page 962
- "Trigger Delay" on page 965
- "Trigger Slope" on page 969

Additional controls are also present that do not depend on the selected Trigger Source.

---

|         |                       |
|---------|-----------------------|
| Example | :TRIG:<meas>:SOUR IQM |
|---------|-----------------------|

---

|              |                           |
|--------------|---------------------------|
| Annunciation | I/Q Mag (in the Meas Bar) |
|--------------|---------------------------|

#### 8.1.1.12 Input I

When **Input I** is selected, the condition is met when the voltage at the I Input crosses the trigger level.

This trigger type is only valid for measurements that support I/Q inputs.

The **Trigger** tab contains the following Trigger Source-dependent controls when **Input I** trigger is selected:

- "Prot Frame Aligned" on page 962
- "Trigger Delay" on page 965
- "Trigger Slope" on page 969

Additional controls are also present that do not depend on the selected Trigger Source.

---

|         |                        |
|---------|------------------------|
| Example | :TRIG:<meas>:SOUR IINP |
|---------|------------------------|

---

|              |                           |
|--------------|---------------------------|
| Annunciation | Input I (in the Meas Bar) |
|--------------|---------------------------|

#### 8.1.1.13 Input Q

When **Input Q** is selected, the condition is met when the voltage at the I Input crosses the trigger level.

This trigger type is only valid for measurements that support I/Q inputs.

The **Trigger** tab contains the following Trigger Source-dependent controls when **Input Q** trigger is selected:

- "Prot Frame Aligned" on page 962
- "Trigger Delay" on page 965
- "Trigger Slope" on page 969

Additional controls are also present that do not depend on the selected Trigger Source.

---

|         |                        |
|---------|------------------------|
| Example | :TRIG:<meas>:SOUR QINP |
|---------|------------------------|

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|              |                           |
|--------------|---------------------------|
| Annunciation | Input Q (in the Meas Bar) |
|--------------|---------------------------|

8.1.1.14 I (Demodulated)

When I (Demodulated) is selected, the trigger condition is met when the I voltage crosses the I voltage trigger level.

This trigger type is only valid for measurements that support I/Q inputs.

The **Trigger** tab contains the following Trigger Source-dependent controls when I (Demodulated) trigger is selected:

- "Prot Frame Aligned" on page 962
- "Trigger Delay" on page 965
- "Trigger Slope" on page 969

Additional controls are also present that do not depend on the selected Trigger Source.

|              |                             |
|--------------|-----------------------------|
| Example      | :TRIG:<meas>:SOUR IDEM      |
| Annunciation | I (Demod) (in the Meas Bar) |

8.1.1.15 Q (Demodulated)

When Q (Demodulated) is selected, the trigger condition is met when the Q voltage crosses the Q voltage trigger level.

This trigger type is only valid for measurements that support the I/Q inputs.

The **Trigger** tab contains the following Trigger Source-dependent controls when Q (Demodulated) trigger is selected:

- "Prot Frame Aligned" on page 962
- "Trigger Delay" on page 965
- "Trigger Slope" on page 969

Additional controls are also present that do not depend on the selected Trigger Source.

|              |                             |
|--------------|-----------------------------|
| Example      | :TRIG:<meas>:SOUR QDEM      |
| Annunciation | Q (Demod) (in the Meas Bar) |

### 8.1.1.16 Aux I/Q Mag

When **Aux I/Q Mag** is selected, the trigger condition is met when the auxiliary receiver's I/Q magnitude output crosses the Auxiliary I/Q magnitude trigger level.

This trigger type is only valid for measurements that support I/Q inputs.

The **Trigger** tab contains the following Trigger Source-dependent controls when **Aux I/Q Mag** trigger is selected:

- "Prot Frame Aligned" on page 962
- "Trigger Delay" on page 965
- "Trigger Slope" on page 969
- "Trigger Center Frequency" on page 978
- "Trigger BW" on page 979

Additional controls are also present that do not depend on the selected Trigger Source.

|              |                                           |
|--------------|-------------------------------------------|
| Example      | <code>:TRIG:&lt;meas&gt;:SOUR AIQM</code> |
| Annunciation | Aux I/Q Mag (in the Meas Bar)             |

### 8.1.1.17 PXI

When **PXI** is selected, a new sweep/measurement will start when detecting the signal from the PXI backplane trigger line.

This trigger type is only found in the modular instrument products.

The **Trigger** tab contains the following Trigger Source-dependent controls when **PXI** trigger is selected:

- "Select PXI Line" on page 980
- "Trigger Delay" on page 965
- "Trigger Slope" on page 969

Additional controls are also present that do not depend on the selected Trigger Source.

|         |                                                      |
|---------|------------------------------------------------------|
| Example | Swept SA measurement:<br><code>:TRIG:SOUR PXI</code> |
|---------|------------------------------------------------------|

|              |                                                            |
|--------------|------------------------------------------------------------|
|              | Measurements other than Swept SA:<br>:TRIG:<meas>:SOUR PXI |
| Annunciation | PXI (in the Meas Bar)                                      |

8.1.1.18 Internal

When **Internal** is selected, the trigger condition is met when detecting the signal from the internal RF Source module.

This trigger type is only found in the modular instrument products.

The **Trigger** tab contains the following Trigger Source-dependent controls when **Internal** trigger is selected:

- "Prot Frame Aligned" on page 962
- "Trigger Delay" on page 965
- "Trigger Slope" on page 969

Additional controls are also present that do not depend on the selected Trigger Source.

For an **Internal** trigger to occur, there must be a trigger output from the internal RF source. This means that you must configure the Source Trigger Output before selecting **Internal** as the Trigger Source. To enable the Source Trigger Output, output trigger should not be off if internal source works as list sequence mode and **Trig 2 Out** should not be off if internal source works as MXG mode. Otherwise, no trigger occurs, and measurement does not start.

|              |                                                                                                                     |
|--------------|---------------------------------------------------------------------------------------------------------------------|
| Example      | Swept SA measurement:<br>:TRIG:SOUR Internal<br><br>Measurements other than Swept SA:<br>:TRIG:<meas>:SOUR Internal |
| Annunciation | Internal (in the Meas Bar)                                                                                          |

8.1.1.19 Prot Channel Detection

Selects a protocol channel detection Base Station Emulation as the trigger. When Prot Channel Detection is selected, a new sweep/measurement will start when the protocol channel detection trigger condition is met.

Protocol Channel Detection Trigger is defined as the Base Station Emulation protocol channel detection event of PUSCH, PUCCH, PRACH or SRS. With this trigger, the IQ data, and therefore the measurement, is aligned at the beginning of the LTE sub-frame where the particular event was detected. Channel transmission is

aligned to the sub-frame boundary; therefore, the measurement is aligned with its transmission with the exception of SRS, which might not start at the beginning of the sub-frame containing the SRS as it might have an offset from the start of the sub-frame base on the SRS configuration, In this case, the trigger and measurement are aligned to the beginning of the sub-frame containing SRS as defined by this trigger type (which is not the beginning of the SRS itself due to the offset).

This trigger type is only available in UXM.

|              |                                 |
|--------------|---------------------------------|
| Example      | :TRIG:<meas>:SOUR PRTC          |
| Annunciation | Prot Chan Det (in the Meas Bar) |

#### 8.1.1.20 Prot Frame Aligned

Selects a protocol frame aligned Base Station Emulation as the trigger. When Prot Frame Aligned is selected, a new sweep/measurement will start when the protocol frame aligned data trigger condition is met.

**Prot Frame Aligned** Trigger is aligned with the Base Station Emulation Protocol uplink frame timing boundary. It depends on the technology format of the base station call processing.

This trigger type is only available in UXM.

|              |                              |
|--------------|------------------------------|
| Example      | :TRIG:<meas>:SOUR PRTF       |
| Annunciation | Prot Frame (in the Meas Bar) |

#### 8.1.1.21 Prot Event

Selects a protocol frame aligned Base Station Emulation as the trigger. When Prot Frame Aligned is selected, a new sweep/measurement will start when the protocol frame aligned data trigger condition is met.

**Prot Event** Trigger is defined as the Base Station Emulation protocol internal event such as the starting of a predefined uplink pattern for a relative power control ramp. With this trigger, the IQ data, and therefore the measurement, is aligned with the start of the desired uplink pattern.

This trigger type is only available in UXM.

|              |                              |
|--------------|------------------------------|
| Example      | :TRIG:<meas>:SOUR PRTF       |
| Annunciation | Prot Frame (in the Meas Bar) |

8.1.2 Trigger Level

Sets the amplitude level for Trigger and Gate sources that use level triggering. When the video signal crosses this level, with the chosen slope, the trigger occurs.

For any given **Trigger**, **Gate**, or **Periodic Sync Src**, the same **Trigger Level** is used for the Trigger source in the **Trigger** menu, for the Gate source in the **Gate Source** menu, and for the Periodic Sync source in the **Periodic Sync Src** menu.

If **Video** is the selected trigger source, the trigger level displays as a green horizontal line with the label **TRIG LVL** just above it on the right:



If the value of trigger level is off screen low this line displays along the bottom of the graticule. If the value of trigger level is off screen high this line displays above the graticule but no farther above than 1.5 % of the graticule height (the same as the trace itself). Note that the **TRIG LVL** label cannot display above the graticule so the label itself stops at the top of the graticule.

For the I/Q Triggers, the I/Q reference impedance is used for converting between power and voltage.

Trigger Level Parameters

| Source       | Example              | Min                                                                     | Max                                                                      | Preset  | Resoluti<br>on | Step<br>Key Incr            | Knob<br>Incr                |
|--------------|----------------------|-------------------------------------------------------------------------|--------------------------------------------------------------------------|---------|----------------|-----------------------------|-----------------------------|
| Video        | TRIG:VID:LEV -40 dBm | -170 dBm                                                                | +30 dBm                                                                  | -25 dBm | .01 dB         | Scale/Div (Log), 1 dB (Lin) | Step/10, but never < 0.1 dB |
| Level        | TRIG:LEV:LEV -40 dBm | -170 dBm                                                                | +30 dBm                                                                  | -25 dBm | .01 dB         | Scale/Div (Log), 1 dB (Lin) | Step/10, but never < 0.1 dB |
| External 1 2 | TRIG:EXT1:LEV 0.4 V  | -5 V<br>VXT models<br>M9410A/11A/15A/16A and<br>M9410E/11E/15E/16E: 0 V | 5 V<br>VXT models<br>M9410A/11A/15A/16A and<br>M9410E/11E/15E/16E: 2.5 V | 1.2 V   | 10 mV          | 0.5 V                       | 0.1 V                       |

| Source                 | Example                                                                                                                                                                                                                                                                                                          | Min                                                                     | Max                                                                      | Preset  | Resolution           | Step Key Incr                  | Knob Incr                   |
|------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|--------------------------------------------------------------------------|---------|----------------------|--------------------------------|-----------------------------|
| I/Q<br>Mag             | <code>TRIG:IQM:LEV -30 dBm</code>                                                                                                                                                                                                                                                                                | -200 dBm                                                                | 100 dBm                                                                  | -25 dBm | .1 dB                | Scale/Div (Log),<br>1 dB (Lin) | Step/10, but never < 0.1 dB |
| I<br>(Demo d)          | <code>TRIG:IDEM:LEV 0.5 V</code>                                                                                                                                                                                                                                                                                 | -1 V                                                                    | 1 V                                                                      | 0.25 V  | 4 significant digits | Scale/Div                      | Step/100, but never < 1 µV  |
| Q<br>(Demo d)          | <code>TRIG:QDEM:LEV 0.5 V</code>                                                                                                                                                                                                                                                                                 | -1 V                                                                    | 1 V                                                                      | 0.25 V  | 4 significant digits | Scale/Div                      | Step/100, but never < 1 µV  |
| Input I                | <code>TRIG:IINP:LEV 0.5 V</code>                                                                                                                                                                                                                                                                                 | -1 V                                                                    | 1 V                                                                      | 0.25 V  | 4 significant digits | Scale/Div                      | Step/100, but never < 1 µV  |
| Input Q                | <code>TRIG:QINP:LEV 0.5 V</code>                                                                                                                                                                                                                                                                                 | -1 V                                                                    | 1 V                                                                      | 0.25 V  | 4 significant digits | Scale/Div                      | Step/100, but never < 1 µV  |
| Aux Chan<br>I/Q<br>Mag | <code>TRIG:AIQM:LEV -30 dBm</code>                                                                                                                                                                                                                                                                               | -200 dBm                                                                | 100 dBm                                                                  | -25 dBm | .1 dB                | Scale/Div (Log),<br>1 dB (Lin) | Step/10, but never < 0.1 dB |
| Internal               | <code>TRIG:INT:LEV 1.2 V</code>                                                                                                                                                                                                                                                                                  | -5 V<br>VXT models<br>M9410A/11A/15A/16A and<br>M9410E/11E/15E/16E: 0 V | 5 V<br>VXT models<br>M9410A/11A/15A/16A and<br>M9410E/11E/15E/16E: 2.5 V | 1.2 V   | 10 mV                | .5 V                           | .1 V                        |
| ADC                    | <code>TRIG:ADC:LEV -30 dBm</code>                                                                                                                                                                                                                                                                                | -170 dBm                                                                | 30 dBm                                                                   | -25 dBm | .01 dB               | Scale/Div (Log),<br>1 dB (Lin) | Step/10, but never < 0.1 dB |
| Remote Command         | <code>:TRIGger[:SEquence]:&lt;trig_source&gt;:LEVel &lt;ampl&gt;</code><br><code>:TRIGger[:SEquence]:&lt;trig_source&gt;:LEVel?</code><br>where <trig_source> is one of:<br><code>EXTernal1   EXTernal2   EXTernal3   VIDEo   ADC   LEVel   IQMag   IDEMod   QDEMod   IINPut   QINPut   AIQMag   INTernal</code> |                                                                         |                                                                          |         |                      |                                |                             |
| Example                | <code>:TRIG:VID:LEV -40 dBm</code>                                                                                                                                                                                                                                                                               |                                                                         |                                                                          |         |                      |                                |                             |
| Dependencies           | Only appears when <b>Video</b> , <b>External 1 2</b> , or an I/Q trigger is selected as the Trigger Source                                                                                                                                                                                                       |                                                                         |                                                                          |         |                      |                                |                             |



## 8 Trigger

### 8.1 Trigger

|                              |                                                                                                                                                                                                                                                                                                                                           |
|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| State Saved                  | Saved in instrument state                                                                                                                                                                                                                                                                                                                 |
| Backwards Compatibility SCPI | <code>:TRIGger[:SEquence]:IF:LEVel</code><br>taken as video trigger level<br><code>:TRIGger[:SEquence]:IF:LEVel?</code><br>taken as video trigger level query<br><code>:TRIGger[:SEquence]:EXTernal:LEVel</code><br>the parameter <b>EXTernal</b> is mapped to <b>EXTernal1</b><br><code>:TRIGger[:SEquence]:FRAMe:EXTernal1:LEVel</code> |

#### More Information

For **VideoTrigger Level**, when sweep type = FFT, the video trigger uses the amplitude envelope in a bandwidth wider than the FFT width as a trigger source. This can be useful but does not have the same relationship between the displayed trace and the trigger level as in swept triggering.

For **VideoTrigger Level** the settable resolution of the function is 0.01 dB, even when the Y Axis Unit is linear. In Linear Y Axis Unit (for example, Volts) this requires 4 significant digits to display on the control.

For the **Level** trigger source, used in RTSA Mode, and in other measurements, External Gain and Ref Level Offset modify the actual trace data as it is taken and are taken into account by **Trigger Level**.

### 8.1.3 Trigger Delay

Controls a time delay that the instrument will wait to begin a sweep after meeting the trigger criteria, for Trigger and Gate sources that support Trigger Delay.

For any given Trigger, Gate, or Periodic Sync source, the same Trigger Delay is used for the Trigger source in the Trigger menu, for the Gate source in the Gate Source menu, and for the Periodic Sync source in the Periodic Sync Src menu.

Negative trigger delays can be used. Negative trigger delay makes intuitive sense in time domain and works well in FFT mode where the bandwidth of the filter before the video trigger is about 1.25 span. You can use negative delay to pre-trigger the instrument in the time domain or FFT, but not in swept spans. Video trigger delay may be set to negative values, in time domain, FFT and even swept, but in swept spans, negative settings of Trig Delay are treated as a zero setting within the internal hardware and the advisory message "Neg. Trig Delay unavailable in Swept Mode, zero delay used." is generated when such a delay is set.

|                |                                                                                                                                        |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:TRIGger[:SEquence]:&lt;trig_source&gt;:DElay &lt;time&gt;</code><br><code>:TRIGger[:SEquence]:&lt;trig_source&gt;:DElay?</code> |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------|

|                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|-------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                               | <p>where &lt;trig_source&gt; is one of:</p> <p>LINE   EXternal1   EXternal2   EXternal3   AEXternal   VIDEO   ADC   RFBurst<br/>  FRAME   LEVEL   FMT   IQMag   IDEMod   QDEMod   IINPut   QINPut   AIQMag  <br/>PXI   INTERNAL</p>                                                                                                                                                                                                                                                                                                                                     |
| Example                       | <pre>:TRIG:VID:DEL:STAT ON :TRIG:VID:DEL 100 ms</pre>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Dependencies                  | Only appears when Video, Line, External 1 2, RF Burst, Periodic Timer or an I/Q trigger is selected as the Trigger Source                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Couplings                     | <p>When FMT Trigger Criteria is <b>INSIDE</b> or <b>OUTSIDE</b>, FMT Trigger Delay State is forced to <b>OFF</b></p> <p>FMT Trigger Delay MaxValue is dependent on the current AcquisitionTime. The equation is: MaxValue = <math>2^{16} \times \text{AcqTime}</math>, but never to exceed 70 sec. Ex: In PVT View with a min PVT Acq Time of 200 us, this Trigger Delay MaxValue is 13.26 sec. In RT Spectrum and Spectrogram with a min Acq Time of 100 us, this Trigger Delay MaxValue is 6.55 sec. When the Acq Time is increased, this MaxValue also increases</p> |
| State Saved                   | Saved in instrument state                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Annotation                    | Trig Delay (in the Measurement Bar)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Backwards Compatibility Notes | <p>For backward compatibility with VSA/PSA comms apps</p> <pre>:TRIGger[:SEquence]:IF:DElay :TRIGger[:SEquence]:DElay</pre> <p>The legacy <b>:TRIGger[:SEquence]:DElay</b> command affects the delay for the <b>VID</b>, <b>LINE</b>, <b>EXT1</b>, <b>EXT2</b>, and <b>RFB</b> triggers</p> <p>Auto Function</p>                                                                                                                                                                                                                                                        |
| Remote Command                | <pre>:TRIGger[:SEquence]:&lt;trig_source&gt;:DElay:STATe OFF   ON   0   1 :TRIGger[:SEquence]:&lt;trig_source&gt;:DElay:STATe?</pre> <p>where &lt;trig_source&gt; is one of:</p> <p>LINE   EXternal1   EXternal2   EXternal3   AEXternal   VIDEO   ADC   RFBurst<br/>  FRAME   LEVEL   FMT   IQMag   IDEMod   QDEMod   IINPut   QINPut   AIQMag  <br/>PXI   INTERNAL</p>                                                                                                                                                                                                |
| Preset                        | OFF                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |

## Backwards Compatibility Commands

|                              |                                                                                                                                                                |
|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Example                      | <pre>:TRIG:DEL 1 ms</pre>                                                                                                                                      |
| Preset                       | 1 us                                                                                                                                                           |
| State Saved                  | Saved in instrument state                                                                                                                                      |
| Backwards Compatibility SCPI | <pre>:TRIGger[:SEquence]:DElay &lt;time&gt; :TRIGger[:SEquence]:DElay? :TRIGger[:SEquence]:DElay:STATe OFF   ON   0   1 :TRIGger[:SEquence]:DElay:STATe?</pre> |

## 8 Trigger

### 8.1 Trigger

|                              |                                                                                                                                                                                                                                                                                                                                                                |
|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Example                      | <code>:TRIG:OFFS ON</code><br><code>:TRIG:OFFS -100 ms</code>                                                                                                                                                                                                                                                                                                  |
| Notes                        | ESA commands for trigger offset, which allowed you to use a positive or negative delay when in zero span and in a Res BW >= 1 kHz. For ESA compatibility, X-series instruments keep track of this offset and adds it to the Trigger Delay for VIDEO, LINE, EXTERNAL1 or EXTERNAL2 whenever the value is sent to the hardware, if in Zero Span and RBW >= 1 kHz |
| Preset                       | Off, 0 s                                                                                                                                                                                                                                                                                                                                                       |
| State Saved                  | Saved in instrument state                                                                                                                                                                                                                                                                                                                                      |
| Min/Max                      | -/+11 s                                                                                                                                                                                                                                                                                                                                                        |
| Backwards Compatibility SCPI | <code>:TRIGger[:SEquence]:OFFSet &lt;time&gt;</code><br><code>:TRIGger[:SEquence]:OFFSet?</code><br><br>Auto Function                                                                                                                                                                                                                                          |
| Remote Command               | <code>:TRIGger[:SEquence]:OFFSet:STATe OFF   ON   0   1</code><br><code>:TRIGger[:SEquence]:OFFSet:STATe?</code>                                                                                                                                                                                                                                               |
| Preset                       | OFF                                                                                                                                                                                                                                                                                                                                                            |

### Trigger Delay Parameters

Note: in Swept SA, when transitioning from Zero Span to Swept spans, the trigger delay is clipped to -150 ms if it had been longer in Zero Span.

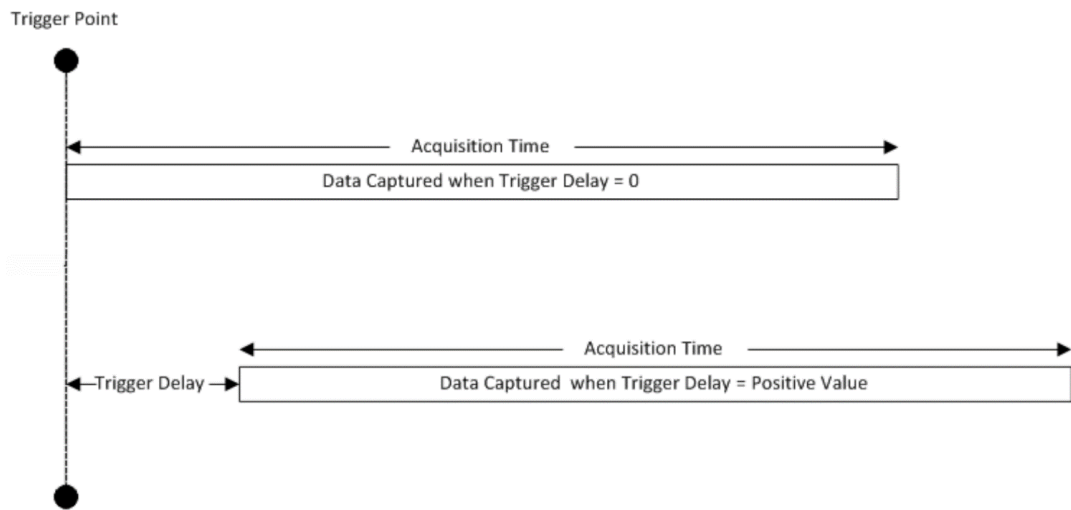
| Source       | Example                                                                 | Preset     | Min                                     | Max                                         | Resolution                       |
|--------------|-------------------------------------------------------------------------|------------|-----------------------------------------|---------------------------------------------|----------------------------------|
| Video        | <code>TRIG:VID:DEL:STAT ON</code><br><code>TRIG:VID:DEL 100 ms</code>   | Off, 1 us  | -150 ms<br>(-10s in Swept SA Zero Span) | +500 ms                                     | 100 ns                           |
| Level        | <code>TRIG:LEV:DEL:STAT ON</code><br><code>TRIG:LEV:DEL 100 ms</code>   | Off, 30 ms | 0 ms                                    | 70 sec (but dependent on Acq Time like FMT) | Multiple of Acq Time (as is FMT) |
| FMT          | <code>TRIG:FMT:DEL:STAT ON</code><br><code>TRIG:FMT:DEL 100 ms</code>   | Off, 30 ms | 0 ms                                    | 70 sec (but dependent on Acq Time like FMT) | Multiple of Acq Time (as is FMT) |
| External 1 2 | <code>TRIG:EXT1:DEL:STAT ON</code><br><code>TRIG:EXT2:DEL 100 ms</code> | Off, 1 us  | -150 ms<br>(-10s in Swept SA Zero Span) | +500 ms                                     | 100 ns                           |
| Line         | <code>TRIG:LINE:DEL:STAT ON</code><br><code>TRIG:LINE:DEL 100 ms</code> | Off, 1 us  | -150 ms<br>(-10s in Swept SA Zero Span) | +500 ms                                     | 100 ns                           |

| Source                 | Example                                       | Preset    | Min                                     | Max     | Resolution |
|------------------------|-----------------------------------------------|-----------|-----------------------------------------|---------|------------|
| RF Burst               | TRIG:RFB:DEL:STAT ON<br>TRIG:RFB:DEL 100 ms   | Off, 1 us | -150 ms<br>(-10s in Swept SA Zero Span) | +500 ms | 100 ns     |
| Periodic Timer         | TRIG:FRAM:DEL:STAT ON<br>TRIG:FRAM:DEL 100 ms | Off, 1 us | -150 ms<br>(-10s in Swept SA Zero Span) | +500 ms | 100 ns     |
| I/Q Mag                | TRIG:IQM:DEL:STAT ON<br>TRIG:IQM:DEL 10 ms    | Off, 1 us | -2.5 s                                  | +10 s   | 10 ns      |
| I (Demod)              | TRIG:IDEM:DEL:STAT ON<br>TRIG:IDEM:DEL 10 ms  | Off, 1 us | -2.5 s                                  | +10 s   | 10 ns      |
| Q (Demod)              | TRIG:QDEM:DEL:STAT ON<br>TRIG:QDEM:DEL 10 ms  | Off, 1 us | -2.5 s                                  | +10 s   | 10 ns      |
| Input I                | TRIG:IINP:DEL:STAT ON<br>TRIG:IINP:DEL 10 ms  | Off, 1 us | -2.5 s                                  | +10 s   | 10 ns      |
| Input Q                | TRIG:QINP:DEL:STAT ON<br>TRIG:QINP:DEL 10 ms  | Off, 1 us | -2.5 s                                  | +10 s   | 10 ns      |
| Aux Chan I/Q Mag       | TRIG:AIQM:DEL:STAT ON<br>TRIG:AIQM:DEL 10 ms  | Off, 1 us | -2.5 s                                  | +10 s   | 10 ns      |
| PXI                    | TRIG:PXI:DEL:STAT ON<br>TRIG:PXI:DEL 10 ms    | Off, 1 us | -150 ms                                 | +500 ms | 100 ns     |
| Internal               | TRIG:INT:DEL:STAT ON<br>TRIG:INT:DEL 10 ms    | Off, 1 us | -150 ms                                 | +500 ms | 100 ns     |
| Prot Channel Detection | TRIG:PRTC:DEL:STAT ON<br>TRIG:PRTC:DEL 1 ms   | Off, 1 ms | -10 ms                                  | +10 ms  | 100 ns     |
| Prot Frame Aligned     | TRIG:PRTF:DEL:STAT ON<br>TRIG:PRTF:DEL 1 ms   | Off, 1 ms | -10 ms                                  | +10 ms  | 100 ns     |
| Prot Event             | TRIG:PRTE:DEL:STAT ON<br>TRIG:PRTE:DEL 1 ms   | Off, 1 ms | -10 ms                                  | +10 ms  | 100 ns     |

Note: in Bluetooth Mode, the preset value of Trigger Delay is always (On, -20us).

## More Information

Here is the diagram for Frequency Mask Trigger (FMT) Trigger Delay:



8.1.4 Trigger Slope

Sets the trigger polarity for Trigger and Gate sources that support Trigger Slope. It is set positive to trigger on a rising edge and negative to trigger on a falling edge.

For any given Trigger, Gate, or Periodic Sync source, the same Trigger Slope is used for the Trigger source in the Trigger menu, for the Gate source in the Gate Source menu, and for the Periodic Sync source in the Periodic Sync Src menu.

|                              |                                                                                                                                                                                                                                                                                                                                                                     |
|------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command               | <code>:TRIGger[:SEquence]:&lt;trig_source&gt;:SLOPe POSitive   NEGative</code><br><code>:TRIGger[:SEquence]:&lt;trig_source&gt;:SLOPe?</code><br>where <code>&lt;trig_source&gt;</code> is one of:<br><code>LINE   EXTernal1   EXTernal2   EXTernal3   AEXTernal   VIDEo   ADC RFBurst   IQMag   IDEMod   QDEMod   IINPut   QINPut   AIQMag   PXI   INTernal</code> |
| Example                      | <code>:TRIG:VID:SLOP NEG</code><br><code>:TRIG:VID:SLOP?</code><br><code>:TRIG:EXT1: SLOP NEG</code>                                                                                                                                                                                                                                                                |
| Dependencies                 | Only appears when Video, Line, External 1 2, RF Burst or an I/Q trigger is selected as the Trigger Source                                                                                                                                                                                                                                                           |
| Preset                       | <code>POSitive</code>                                                                                                                                                                                                                                                                                                                                               |
| State Saved                  | Saved in instrument state                                                                                                                                                                                                                                                                                                                                           |
| Backwards Compatibility SCPI | <code>:TRIGger[:SEquence]:IF:SLOPe NEGative   POSitive</code><br><code>:TRIGger[:SEquence]:IF:SLOPe?</code><br>For backward compatibility with VSA/PSA comms apps<br><code>:TRIGger[:SEquence]:EXTernal:SLOPe</code>                                                                                                                                                |

For backward compatibility, the parameter **EXTERNAL** is mapped to **EXTERNAL1**  
`:TRIGger[:SEquence]:FRAME:EXTERNAL1:SLOPe`  
`:TRIGger[:SEquence]:FRAME:EXTERNAL2:SLOPe`

|                                 |                                                                                                       |
|---------------------------------|-------------------------------------------------------------------------------------------------------|
| Example                         | <code>:TRIG:SLOP NEG</code>                                                                           |
| Preset                          | <b>POSitive</b>                                                                                       |
| State Saved                     | Saved in instrument state                                                                             |
| Backwards Compatibility<br>SCPI | <code>:TRIGger[:SEquence]:SLOPe POSitive   NEGative</code><br><code>:TRIGger[:SEquence]:SLOPe?</code> |

Note: when transitioning from Zero Span to Swept spans, the trigger delay is clipped to -150 ms if it had been longer in Zero Span.

### 8.1.5 Trigger Level Absolute/Relative

Selects either Absolute or Relative Burst Triggering.

|                |                                                                                                                                 |
|----------------|---------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:TRIGger[:SEquence]:RFBurst:LEVel:TYPE ABSolute   RELative</code><br><code>:TRIGger[:SEquence]:RFBurst:LEVel:TYPE?</code> |
| Example        | Set the trigger level type of the RF burst trigger to Relative:<br><code>:TRIG:RFB:LEV:TYPE REL</code>                          |
| Dependencies   | Only appears when RF Burst is selected as the Trigger Source                                                                    |
| Preset         | <b>ABSolute</b>                                                                                                                 |
| State Saved    | Saved in instrument state                                                                                                       |

### 8.1.6 Absolute Trigger Level

Sets the absolute trigger level for the RF burst envelope.

**NOTE** When using the External Mixing path, **Absolute Trigger Level** is uncalibrated because the factory default was set to accommodate the expected IF levels for the RF path.

|                |                                                                                                                                                                                                                   |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:TRIGger[:SEquence]:RFBurst:LEVel:ABSolute &lt;ampl&gt;</code><br><code>:TRIGger[:SEquence]:RFBurst:LEVel:ABSolute?</code>                                                                                  |
| Example        | Set the trigger level of the RF burst envelope signal to the absolute level of 10 dBm:<br><code>:TRIG:RFB:LEV:ABS 10 dBm</code>                                                                                   |
| Notes          | Sending this command does not switch the setting from relative to absolute; to switch it you need to send <code>:TRIGger[:SEquence]:RFBurst:LEVel:TYPE</code><br>For Bluetooth Mode, the default value is -50 dBm |

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### 8.1 Trigger

|                              |                                                                                                                                                                                                    |                                           |
|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|
| Dependencies                 | Only appears when RF Burst is selected as the Trigger, Gate or Periodic Sync Source                                                                                                                |                                           |
| Couplings                    | This same level is used for the RF Burst trigger source in the Trigger menu, for the RF Burst selection in the Gate Source menu, and also for the RF Burst selection in the Periodic Sync Src menu |                                           |
| Preset                       | <b>Mode</b>                                                                                                                                                                                        | <b>Value</b>                              |
|                              | LTEA FDD/TDD                                                                                                                                                                                       | –40 dBm or –50 dBm<br>Depends on hardware |
|                              | 5G NR                                                                                                                                                                                              | –40 dBm                                   |
|                              | All others                                                                                                                                                                                         | –20 dBm                                   |
|                              |                                                                                                                                                                                                    |                                           |
| State Saved                  | Saved in instrument state                                                                                                                                                                          |                                           |
| Min                          | –200 dBm                                                                                                                                                                                           |                                           |
| Max                          | 100 dBm                                                                                                                                                                                            |                                           |
| Backwards Compatibility SCPI | :TRIGger[:SEquence]:FRAMe:RFBurst:LEVel:ABSolute                                                                                                                                                   |                                           |

#### 8.1.7 Relative Trigger Level

Sets the relative trigger level for the RF burst envelope.

In some models, the relative burst trigger function is implemented in hardware. In other models, without the advanced triggering hardware required, the relative burst trigger function is implemented in software in some measurements, and is unavailable in other measurements.

When implemented in software, the relative RF Burst trigger function is implemented as follows:

1. The measurement starts with the absolute RF Burst trigger setting. If it cannot get a trigger with that level, auto trigger fires and the acquisition starts anyway. After the acquisition, the measurement searches for the peak in the acquired waveform and saves it
2. In the next cycle of the measurement, the measurement determines a new absolute RF Burst level based on the peak value from the first measurement and the Relative RF Burst Trigger Level (always 0 or negative dB) set by the user. The following formula is used: absolute RF Burst level = peak level of the previous acquisition + relative RF Burst level
3. If the new absolute RF Burst level differs from the previous by more than 0.5 dB, the new level is sent to the hardware; otherwise, it is not updated (to avoid slowing down the acquisition)

Steps 2 and 3 repeat for subsequent measurements.

| Remote Command               | <code>:TRIGger[:SEquence]:RFBurst:LEVel:RELative &lt;rel_ampl&gt;</code><br><code>:TRIGger[:SEquence]:RFBurst:LEVel:RELative?</code>                                                                                                                                                                                                                                             |      |       |          |        |            |       |
|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-------|----------|--------|------------|-------|
| Example                      | Set the trigger level of the RF burst envelope signal to the relative level of -10 dB:<br><code>:TRIG:RFB:LEV:REL -10 dB</code>                                                                                                                                                                                                                                                  |      |       |          |        |            |       |
| Notes                        | Sending this command does not switch the setting from absolute to relative; to switch it you need to send <code>:TRIGger[:SEquence]:RFBurst:LEVel:TYPE</code><br>The relative trigger level is not available in some measurements. In those measurements the <code>RELative</code> parameter, and <code>:TRIGger[:SEquence]:RFBurst:LEVel:TYPE</code> generates an error if sent |      |       |          |        |            |       |
| Dependencies                 | This control is grayed-out and <b>Absolute Trigger Level</b> selected if the required hardware is not present in your instrument and the current measurement does not support Relative triggering<br>Only appears when <b>RF Burst</b> is selected as the Trigger Source                                                                                                         |      |       |          |        |            |       |
| Preset                       | <table> <tr> <th>Mode</th><th>Value</th></tr> <tr> <td>EDGE GSM</td><td>-25 dB</td></tr> <tr> <td>All others</td><td>-6 dB</td></tr> </table>                                                                                                                                                                                                                                    | Mode | Value | EDGE GSM | -25 dB | All others | -6 dB |
| Mode                         | Value                                                                                                                                                                                                                                                                                                                                                                            |      |       |          |        |            |       |
| EDGE GSM                     | -25 dB                                                                                                                                                                                                                                                                                                                                                                           |      |       |          |        |            |       |
| All others                   | -6 dB                                                                                                                                                                                                                                                                                                                                                                            |      |       |          |        |            |       |
| State Saved                  | Saved in instrument state                                                                                                                                                                                                                                                                                                                                                        |      |       |          |        |            |       |
| Min                          | -45 dB                                                                                                                                                                                                                                                                                                                                                                           |      |       |          |        |            |       |
| Max                          | 0 dB                                                                                                                                                                                                                                                                                                                                                                             |      |       |          |        |            |       |
| Backwards Compatibility SCPI | <code>:TRIGger[:SEquence]:RFBurst:LEVel</code><br>This legacy command is aliased to<br><code>:TRIGger[:SEquence]:RFBurst:LEVel:RELative</code><br>because PSA had <i>only</i> relative burst triggering                                                                                                                                                                          |      |       |          |        |            |       |

In some models, a variety of burst trigger circuitry is available, resulting in various available burst trigger bandwidths. The instrument automatically chooses the appropriate trigger path based on the hardware configuration and other settings of the instrument. Here is the RF Burst Trigger Bandwidth table for Swept SA Measurement in SA mode:

| Model | Option  | Span    | Swp Type | FFT Width | Trigger BW, -10 dB | Notes         |
|-------|---------|---------|----------|-----------|--------------------|---------------|
| EXA   | any     | All     | all      | all       | 16 MHz             |               |
| MXA   | w/o B25 | All     | all      | all       | 16 MHz             |               |
| MXA   | B25     | Zero    | N/A      | N/A       | 16 MHz             |               |
| MXA   | B25     | All     | Swept    | N/A       | 16 MHz             |               |
| MXA   | B25     | < 8 MHz | FFT      | all       | 16 MHz             |               |
| MXA   | B25     | ≥ 8 MHz | FFT      | 25 MHz    | 30 MHz             |               |
| PXA   | any     | all     | all      | all       | > 80 MHz           | Exceptions(*) |



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(\*) Exceptions: When the RF Burst Trigger Level Type is Absolute, the start frequency is below 300 MHz, and the sweep type is either Swept or FFT with an FFT width of less than 25 MHz, then the RF Burst Trigger Bandwidth is not >80 MHz. It would be 16 MHz except in the subcase of Sweep Type = FFT and FFT Width between 8 and 25 MHz inclusive, where it would be 30 MHz.

8.1.8 Period

Sets the period of the internal periodic timer clock. For digital communications signals, this is usually set to the frame period of your current input signal. In the case that sync source is not set to OFF, and the external sync source rate is changed for some reason, the periodic timer is synchronized at every external synchronization pulse by resetting the internal state of the timer circuit.

| Remote Command | <code>:TRIGger[:SEquence]:FRAMe:PERiod &lt;time&gt;</code><br><code>:TRIGger[:SEquence]:FRAMe:PERiod?</code>                                                                                    |  |      |       |          |             |       |       |            |       |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|------|-------|----------|-------------|-------|-------|------------|-------|
| Example        | <code>:TRIG:FRAM:PER 100 ms</code>                                                                                                                                                              |  |      |       |          |             |       |       |            |       |
| Dependencies   | The invalid data indicator turns on when the period is changed, until the next sweep/measurement completes<br>Only appears when <b>Periodic</b> Timer is selected as the Trigger or Gate Source |  |      |       |          |             |       |       |            |       |
| Couplings      | The same period is used in the Gate Source selection of the period timer                                                                                                                        |  |      |       |          |             |       |       |            |       |
| Preset         | <table><tr><th>Mode</th><th>Value</th></tr><tr><td>EDGE GSM</td><td>4.615383 ms</td></tr><tr><td>5G NR</td><td>10 ms</td></tr><tr><td>All Others</td><td>20 ms</td></tr></table>                |  | Mode | Value | EDGE GSM | 4.615383 ms | 5G NR | 10 ms | All Others | 20 ms |
| Mode           | Value                                                                                                                                                                                           |  |      |       |          |             |       |       |            |       |
| EDGE GSM       | 4.615383 ms                                                                                                                                                                                     |  |      |       |          |             |       |       |            |       |
| 5G NR          | 10 ms                                                                                                                                                                                           |  |      |       |          |             |       |       |            |       |
| All Others     | 20 ms                                                                                                                                                                                           |  |      |       |          |             |       |       |            |       |
| State Saved    | Saved in instrument state                                                                                                                                                                       |  |      |       |          |             |       |       |            |       |
| Min            | 100.000 ns                                                                                                                                                                                      |  |      |       |          |             |       |       |            |       |
| Max            | 559.0000 ms                                                                                                                                                                                     |  |      |       |          |             |       |       |            |       |

8.1.9 Offset

Adjusts the accumulated offset between the periodic timer events and the trigger event. Adjusting the accumulated offset is different than setting an offset and requires explanation.

The periodic timer is usually not synchronized with any external events, so the timing of its output events has no absolute meaning. Since the timing relative to external events (RF signals) is important, you need to be able to adjust (offset) it. However, you have no direct way to see when the periodic timer events occur. All that you can see is the trigger timing. When you want to adjust the trigger timing, you will be

changing the internal offset between the periodic timer events and the trigger event. Because the absolute value of that internal offset is unknown, we will just call that the accumulated offset. Whenever the Offset parameter is changed, you are changing that accumulated offset. You can reset the displayed offset using Reset Offset Display. Changing the display does not change the value of the accumulated offset, and you can still make additional changes to accumulated offset.

To avoid ambiguity, we define that an increase in the "offset" parameter, either from the knob or the SCPI adjust command, serves to delay the timing of the trigger event.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:TRIGger[:SEquence]:FRAMe:OFFSet &lt;time&gt;</code><br><code>:TRIGger[:SEquence]:FRAMe:OFFSet?</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Example        | <code>:TRIG:FRAM:OFFS 1.2 ms</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Notes          | <p>The front panel interface (for example, the knob), and this command, adjust the accumulated offset, which is shown on the control</p> <p>However, the actual amount sent to the hardware each time the offset is updated is the delta value, that is, the current accumulated offset value minus the previous accumulated offset value. Note that the accumulated offset value is essentially arbitrary; it represents the accumulated offset from the last time the offset was zeroed (with the Reset Offset Display key)</p> <p>Note that this command does not change the period of the trigger waveform. Note also that Offset is used only when the sync source is set to <b>OFF</b>, otherwise delay is used, see <a href="#">"Trigger Delay" on page 965</a></p> <p>An increase in the "offset" parameter, either from the knob or the SCPI adjust command, serves to delay the timing of the trigger event</p> <p>When the SCPI command is sent the value shown on the control is updated with the new value. However, the actual amount sent to the hardware is the delta value, that is, the current accumulated offset value minus the previous accumulated offset value</p> <p>The SCPI query simply returns the value currently showing on the key</p> |
| Dependencies   | <p>The invalid data indicator turns on when the offset is changed, until the next sweep/measurement completes</p> <p>Only appears when <b>Periodic</b> Timer is selected as the Trigger or Gate Source</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Couplings      | The same offset is used in the Gate Source selection of the period timer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Preset         | 0 s                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| State Saved    | Saved in instrument state                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Min/Max        | -/+10.000 s                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |

### 8.1.10 Reset Offset Display

Resets the value of the periodic trigger offset display setting to 0.0 seconds. The current displayed trigger location may include an offset value defined with the **Offset** key. Pressing this control redefines the currently displayed trigger location as the new trigger point that is 0.0 s offset. The **Offset** control can then be used to add offset relative to this new timing.

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|                |                                                                                   |
|----------------|-----------------------------------------------------------------------------------|
| Remote Command | <code>:TRIGger[:SEquence]:FRAMe:OFFSet:DISPlay:RESet</code>                       |
| Example        | <code>:TRIG:FRAM:OFFS:DISP:RES</code>                                             |
| Dependencies   | Only appears when <b>Periodic</b> Timer is selected as the Trigger or Gate Source |

#### 8.1.11 Offset Adjust (Remote Command Only)

Lets you advance the phase of the frame trigger by the amount you specify. It does *not* work in the same way as the related front panel keys.

The command does not change the period of the trigger waveform. If the command is sent multiple times, it advances the phase of the frame trigger an additional amount each time it is sent. Negative numbers are permitted.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:TRIGger[:SEquence]:FRAMe:ADJJust &lt;time&gt;</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Example        | <code>:TRIG:FRAM:ADJ 1.2 ms</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Notes          | <p>Note also that Offset is used only when the sync source is set to OFF, otherwise delay is used, see section <a href="#">"Trigger Delay" on page 965</a></p> <p>An increase in the "offset" parameter, either from the knob or the SCPI adjust command, serves to delay the timing of the trigger event</p> <p>The front panel interface (for example, the knob) and the <code>:TRIG:FRAM:OFFS</code> command adjust the accumulated offset, which is shown on the active function display. However, the actual amount sent to the hardware is the delta value, that is, the current offset value minus the previous offset value</p> <p>When the SCPI command is sent the value shown on the control (and the Active Function, if this happens to be the active function) is updated by increasing it (or decreasing it if the value sent is negative) by the amount specified in the SCPI command</p> <p>This is no query for this command</p> |
| Dependencies   | The invalid data indicator turns on when the offset is changed, until the next sweep/measurement completes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Couplings      | The same offset is used in the Gate Source selection of the period timer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Preset         | 0 s                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| State Saved    | Saved in instrument state                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Min            | -10.000 s                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Max            | 10.000 s                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |

#### 8.1.12 Sync Source

For convenience, you can select the Periodic Timer Sync Source using this dropdown. You can also select it from the **Periodic Sync Src** tab, which also contains controls that let you configure the Sync Source.

Selects a signal source for you to synchronize your periodic timer trigger to, otherwise you might be triggering at some arbitrary location in the frame. Synchronization reduces the precision requirements on the setting of the period.

|              |                                                                                              |
|--------------|----------------------------------------------------------------------------------------------|
| Example      | <pre>:TRIG:FRAM:SYNC EXT1 :TRIG:FRAM:SYNC EXT2 :TRIG:FRAM:SYNC RFB :TRIG:FRAM:SYNC OFF</pre> |
| Dependencies | Only appears when <b>Periodic</b> Timer is selected as the Trigger or Gate Source            |
| Preset       | OFF                                                                                          |
| State Saved  | Saved in instrument state                                                                    |

### 8.1.13 TV Line

Selects the **TV Line** number on which to trigger. Line number range is dependent on the settings of the **"Standard" on page 977** and **"Field" on page 977** menus within the TV trigger setup functions. When the line number is incremented beyond the upper limit, the value will change to the lower limit and continue incrementing from there. When the line number is decremented below the lower limit, the value will change to the upper limit and continue decrementing from there.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <pre>:TRIGger[:SEquence]:TV:LINE &lt;integer&gt; :TRIGger[:SEquence]:TV:LINE?</pre>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Example        | <pre>:TRIG:TV:LINE 20 :TRIG:TV:LINE?</pre>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Dependencies   | Only available in the Swept SA measurement<br>Only appears when <b>TV</b> is selected as the Trigger Source                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Preset         | 17                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| State Saved    | Saved in instrument state                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Min            | 1<br><br>The minimum value is the minimum line and rolls over to the maximum value. The minimum line number depends on which Field and standard are selected                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Max            | <p>The maximum value is the maximum line and rolls over to the minimum value. The maximum line number depends on which Field and standard are selected</p> <p>Field 1 (<b>ODD</b>):</p> <ul style="list-style-type: none"> <li>Maximum line is 263 for formats NTSC-M, NTSC-Japan, NTSC-4.43, PAL-M and PAL-60</li> <li>Maximum line is 313 for formats PAL-B, D, G, H, I, PAL-N, PAL-N Combin, and SECAM-L</li> </ul> <p>Field 2 (<b>EVEN</b>):</p> <ul style="list-style-type: none"> <li>The maximum line 262 for formats NTSC-M, NTSC-Japan, NTSC-4.43, PAL-M and PAL-60</li> </ul> |

- The maximum line is 312 for formats PAL-B, D, G, H, I, PAL-N, PAL-N Combin, and SECAM-L

Field = **ENTire** Frame:

- 525, for formats NTSC-M, NTSC-Japan, NTSC-4.43, PAL-M and PAL-60
- 625, for formats PAL-B, D, G, H, I, PAL-N, PAL-N Combin, and SECAM-L

8.1.14 Field

Selects the **Field** on which to trigger:

|              |               |                                                                                                                                                                                                                                                                       |
|--------------|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Entire Frame | <b>ENTire</b> | Causes the selected line number to be viewed as an offset into the entire frame starting with line 1, the first line in Field One                                                                                                                                     |
| Field One    | <b>ODD</b>    | Causes the selected line number to be viewed as an offset into the first field starting with Line 1, the first line in Field One                                                                                                                                      |
| Field Two    | <b>EVEN</b>   | Causes the selected line number to be viewed as an offset into the second field. If Line 1 is selected, it is the 264th line of the frame (NTSC-M, NTSC-Japan, NTSC-4.43, PAL-M, PAL-60) or the 314th line of the frame (PAL-B,D,G,H,I, PAL-N, PAL-N-Combin, SECAM-L) |

|                |                                                                                                                                                                         |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <b>:TRIGger[:SEquence]:TV:FMODe ENTire   ODD   EVEN</b><br><b>:TRIGger[:SEquence]:TV:FMODe?</b>                                                                         |
| Example        | <b>:TRIG:TV:FMOD ENT</b><br><b>:TRIG:TV:FMOD EVEN</b><br><b>:TRIG:TV:FMOD ODD</b>                                                                                       |
| Dependencies   | Only available in the Swept SA measurement<br>Only appears when <b>TV</b> is selected as the Trigger Source<br>Available only when Option B7B (TV trigger) is installed |
| Preset         | <b>ENTire</b>                                                                                                                                                           |
| Range          | <b>ENTire ODD EVEN</b>                                                                                                                                                  |

8.1.15 Standard

Accesses the **Standard** menu keys, which select from the following TV standards:

|               |                |
|---------------|----------------|
| NTSC-M        | <b>MNTSc</b>   |
| NTSC-Japan    | <b>JNTSc</b>   |
| NTSC-4.43     | <b>NTSC443</b> |
| PAL-M         | <b>MPAL</b>    |
| PAL-B,D,G,H,I | <b>BPAL</b>    |

|              |       |
|--------------|-------|
| PAL-N        | NPAL  |
| PAL-N-Combin | CPAL  |
| PAL-60       | PAL60 |
| SECAM-L      | LSEC  |

As the TV standard is changed, the current line value is clipped as necessary to keep it valid for the chosen standard and field mode. For example, line 600 is selected in Entire Frame mode in PAL-N; if NTSC-M is selected, the line number is clipped to 525. Or, if line 313 is selected in Field 1 mode in PAL-N and NTSC-M is selected, the line number is clipped to 263. Changing back to the PAL-N standard will leave the line number at 263.

|                |                                                                                                                                                                  |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:TRIGger[:SEquence]:TV:STANdard MNTSc   JNTSc   NTSC443   MPAL   BPAL   NPAL   CPAL   PAL60   LSEC</code><br><code>:TRIGger[:SEquence]:TV:STANdard?</code> |
| Example        | Set NTSC-M:<br><code>:TRIG:TV:STAN MNTS</code><br><br>Queries Standard<br><code>:TRIG:TV:STAN?</code>                                                            |
| Dependencies   | Only available in the Swept SA measurement<br>Only appears when <b>TV</b> is selected as the Trigger Source                                                      |
| Preset         | MNTS                                                                                                                                                             |
| State Saved    | Saved in instrument state                                                                                                                                        |
| Range          | MNTSc   JNTSc   NTSC443   MPAL   BPAL   NPAL   CPAL   PAL60   LSEC                                                                                               |

### 8.1.16 Trigger Center Frequency

Sets the center frequency to be used by the auxiliary receiver for the **Auxiliary Channel I/Q Magnitude** trigger.

|                |                                                                                                                |
|----------------|----------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:TRIGger[:SEquence]:AIQMag:CENTer &lt;freq&gt;</code><br><code>:TRIGger[:SEquence]:AIQMag:CENTer?</code> |
| Example        | <code>:TRIG:AIQM:CENT 10 MHz</code>                                                                            |
| Notes          | Trigger CF + 1/2 Trigger BW < Max<br>Trigger CF - 1/2 Trigger BW > Min                                         |
| Dependencies   | Only appears when Aux Channel I/Q Mag is selected as the Trigger Source                                        |
| Preset         | 0 Hz                                                                                                           |
| State Saved    | Saved in instrument state                                                                                      |
| Min/Max        | -/+40 MHz                                                                                                      |

### 8.1.17 Trigger BW

Sets the information bandwidth used by the auxiliary receiver for the Auxiliary Channel I/Q Magnitude trigger.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:TRIGger[:SEquence]:AIQMag:BANDwidth &lt;freq&gt;</code><br><code>:TRIGger[:SEquence]:AIQMag:BANDwidth?</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Example        | <code>:TRIG:AIQM:BAND 8 MHz</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Notes          | <p>The combined sample rate for the main and auxiliary receivers cannot exceed 100 MSa/sec. The bandwidth available to <b>Trigger BW</b> is limited to what is available after the main receiver's bandwidth (Info BW, sometimes pre-FFT BW) is set. Because of this limitation, the Max is not always achievable. The combination of "<b>Trigger Center Frequency</b>" on page 978 and <b>Trigger BW</b> is also limited:</p> <ul style="list-style-type: none"> <li>– <math>\text{Trigger CF} + 1/2 \text{ Trigger BW} &lt; \text{Max}</math></li> <li>– <math>\text{Trigger CF} - 1/2 \text{ Trigger BW} &gt; \text{Min}</math></li> </ul> |
| Dependencies   | Only appears when Aux Channel I/Q Mag is selected as the Trigger Source                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Preset         | <p>Bandwidth option dependent:</p> <ul style="list-style-type: none"> <li>– No Opt: 10 MHz</li> <li>– Opt B25: 25 MHz</li> <li>– Opt S40: 40 MHz</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| State Saved    | Saved in instrument state                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Range          | 10 Hz to Maximum                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Min            | 10 Hz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Max            | <p>Bandwidth option &amp; I/Q input path-dependent:</p> <ul style="list-style-type: none"> <li>– No Opt, I or Q Only: 10 MHz, I+jQ: 20 MHz</li> <li>– Opt B25, I or Q Only: 25 MHz, I+jQ: 50 MHz</li> <li>– Opt S40, I or Q Only: 40 MHz, I+jQ: 80 MHz</li> </ul>                                                                                                                                                                                                                                                                                                                                                                             |

### 8.1.18 Zero Span Delay Compensation On/Off

In **Zero Span**, there is a natural delay in the signal path, which comes from the RBW filter. This is usually desirable, as it lets you trigger on events and also see those events, because the signal is delayed from the trigger event. However, in some cases it is desirable to eliminate this delay, so that trigger events line up exactly with the zero-time point in **Zero Span**. You can use **Zero Span Delay Comp On/Off** to enable or disable zero span delay compensation.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:TRIGger[:SEquence]:EXTernal1 EXTernal2 RFBurst:DElay:COMPensation OFF   ON</code><br><code>  0   1</code><br><code>:TRIGger[:SEquence]:EXTernal1 EXTernal2 RFBurst:DElay:COMPensation?</code>                                                                                                                                                                                                                                                                                                                  |
| Example        | <code>:TRIG:EXT1:DEL:COMP ON</code><br><code>:TRIG:EXT1:DEL:COMP?</code><br><code>:TRIG:EXT2:DEL:COMP ON</code><br><code>:TRIG:RFB:DEL:COMP ON</code>                                                                                                                                                                                                                                                                                                                                                                 |
| Dependencies   | No effect except in zero-span, but not locked out in nonzero spans<br><b>Zero Span Delay Compensation</b> only appears in the Swept SA and List Power Step measurements.<br>Only External and RF Burst triggers support it<br>Does not appear in VXT<br>If the SCPI command is sent when the control is not shown, an error is returned: -221, "Settings conflict; Feature not supported for this measurement"<br>Only appears when External 1 2 or RF Burst is selected as the Trigger, Gate or Periodic Sync Source |
| Preset         | <b>OFF</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| State Saved    | Saved in instrument state                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |

### 8.1.19 Select PXI Line

Controls which `PXI_TRIG[0..7]` backplane line is used for the trigger source.  
Only found in modular analyzer products.

|                |                                                                                                      |
|----------------|------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:TRIGger[:SEquence]:PXI:LINE &lt;line&gt;</code><br><code>:TRIGger[:SEquence]:PXI:LINE?</code> |
| Example        | <code>:TRIG:PXI:LIN 2</code>                                                                         |
| Preset         | 0                                                                                                    |
| State Saved    | Saved in instrument state                                                                            |
| Range          | [0,7]                                                                                                |

### 8.1.20 Reset Sync Monitor

Lets you reset the status of Synchronization for **Periodic** trigger This control works together with bit 6 "Waiting for Periodic Sync Source" in the `:STATus:OPERation:CONDition` status register.

When you first switch to **Periodic** trigger, RF Burst is the default Sync Source. The register will be set immediately. A "Periodic Trigger, Waiting for Sync Source" message will be generated after 2 seconds (if the instrument is not synchronized). The system is waiting for a RF Burst signal. You can tap the screen to remove the message.



## 8 Trigger

### 8.1 Trigger

Periodic Trigger, Waiting for Sync Source  
(tap screen to remove this message)

Once RF burst signal is provided and the hardware synchronized, the register will be cleared and a “Periodic Trigger Synchronized” message will be generated.

 Periodic Trigger Synchronized

When change to a new Sync Source other than Off, take External1 as an example. You'll get the condition register set to 1 and a pop-up message again. There are the possible following conditions:

- External1 is provided: the register is cleared, message is updated
- External1 is *not* provided, you set the Sync Source to Off: the register is cleared, message is cleared
- External1 is *not* provided, you set the Sync Source to External2: the register and message keep the same
- External1 is *not* provided, you set the Sync Source back to RF Burst: the register is cleared, message is also cleared. That's because the instrument is synchronized to RF Burst already. If you want to make a new synchronization, you have to press “Reset Sync Monitor” you send **:TRIG:FRAM:SMON:RES**

|                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command               | <b>:TRIGger[:SEquence]:FRAMe:SMONitor:RESet</b>                                                                                                                                                                                                                                                                                                                                                                                                          |
| Example                      | <b>:TRIG:FRAM:SMON:RES</b>                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Notes                        | <p>This control works together with bit 1 “Waiting for Periodic Sync Source” in the <b>:STATus:OPERa-tion:INSTrument:CONDition</b> status register</p> <p>A “Periodic Trigger, Waiting for Sync Source” message will be generated after pressing this control, and the status bit will be set</p> <p>A “Periodic Trigger Synchronized” message will be generated after successfully synchronizing to Sync Source, and the status bit will be cleared</p> |
| Dependencies                 | <p>Only functional when <b>Periodic</b> Trigger is selected as the <b>Trigger</b> or <b>Gate</b> Source, and <b>Sync Source</b> is not Off</p> <p>Only available in VXT models M9410A/11A/15A/16A and M9410E/11E/15E/16E</p>                                                                                                                                                                                                                             |
| Status Bits/OPC dependencies | Bit 6 of <b>:STATus:OPERation:CONDition</b> will be set after pressing this control                                                                                                                                                                                                                                                                                                                                                                      |

## 8.1.21 Trigger Optimization

Sets the trigger behavior for various desired operation conditions.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <b>:TRIGger[:SEquence]:OPTimize:MODE</b> <b>NORMal</b>   <b>MJITter</b>   <b>HAMJitter</b><br>For option details, see "Options" on page 982<br><b>:TRIGger[:SEquence]:OPTimize:MODE?</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Example        | Select trigger optimization for minimum jitter:<br><b>:TRIG:OPT:MOD MJIT</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Dependencies   | <p>Only appears in VXT models M9410A/11A/15A/16A and M9410E/11E/15E/16E</p> <p>Minimum jitter is functional only when digital IF BW is lower than 300 MHz. When <b>Trigger Optimization</b> is set to <b>MJITter</b> and it is not in effect, the following warning message appears in the status bar:</p> <p><b>Settings Alert; Minimum Jitter is not available</b></p> <p>When you select Hardware Accuracy Minimum Jitter, digital IF BW must be greater than 1 MHz. The jitter will be reduced when digital IF BW is lower than 300 MHz</p> <p>When <b>Trigger Optimization</b> is set to <b>HAMJitter</b> and digital IF BW is lower than 1 MHz, the following warning message appears:</p> <p><b>Settings conflict; Hardware Accuracy Minimum Jitter is not available when IF BW is less than 1 MHz</b></p> <p>Hardware Accuracy Minimum Jitter is only available in IQ Analyzer(Basic) Mode</p> <p>When <b>Trigger Optimization</b> is set to <b>HAMJitter</b> in other modes, the following warning message appears:</p> <p><b>Illegal parameter value; The value HWAccMinjitter is disabled</b></p> |
| Preset         | <b>NORMal</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| State Saved    | Yes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Range          | <b>NORMal</b>   <b>MJITter</b>   <b>HAMJitter</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |

### Options

Trigger optimization options are:

| Trigger Optimization | SCPI           | Notes                                                                                                                                                                                                                                                                                                                                     |
|----------------------|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Normal               | <b>NORMal</b>  | No optimization                                                                                                                                                                                                                                                                                                                           |
| Minimum Jitter       | <b>MJITter</b> | <p>Optimizes trigger for minimum jitter. A software resample method is provided to reduce jitter, at the expense of some measurement speed</p> <p>The acquisition jitter depends on the digital IF BW, the jitter will be smaller when digital IF BW gets larger. For example, when the digital IF BW is 98.3 MHz in 5GNR, the jitter</p> |

| Trigger Optimization             | SCPI             | Notes                                                                                                                                                                                                                                                                                                                                                                                                                             |
|----------------------------------|------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Hardware Accuracy Minimum Jitter | <b>HAMJitter</b> | <p>varies under 15ns. When set MJITter as trigger optimization type, the jitter will be reduced to 1ns</p> <p>This setting apples to all the Trigger Sources</p> <p>A hardware resample method is provided to reduce jitter when digital IF BW is lower than 300 MHz. When select Hardware Accuracy Minimum Jitter, digital IF BW must be greater than 1 MHz</p> <p>This setting is only available in IQ Analyzer(Basic) Mode</p> |

8.1.22 Trigger Settings Diagram

Lets you configure the **Trigger** system using a visual utility.

First, select what you want to configure (Trigger, Gate or Periodic Sync Source) by tapping the box for **Trigger**, **Gate** or **Periodic Sync Source**.

Next, tap any box in the gray row to choose a Trigger Source to connect to. For **Periodic Sync Source**, you can also tap **Off**.

The **Trigger Settings Diagram** changes depending on context. The Trigger Sources that are available change depending on which input you have selected.

## 8.2 Gate Source

Contains controls that let you select and configure **Gate** control signals.

This tab appears in the **Trigger** menu panel for measurements that support gating. In measurements that do not support gating, this tab does not appear.

The menus under the **Gate Source** tab are the same as those under the **Trigger** tab, with these exceptions:

- A smaller set of sources is available for gating.
- The **Free Run** and **Video** selections are not provided for **Gate**
- The Trig Delay controls are not present
- Relative RF Burst Triggering is not available, just Absolute
- There is an additional control, **Sync Holdoff**, under **Gate Source**

Any changes to the settings in the setup menus under each Gate Source selection (for example: Trigger Level, Trigger Delay, etc.) also affect the corresponding settings under the **Trigger** menu keys. The gate system uses the Trigger SCPI commands for the setup functions, since each setting affects both Gate and Trigger.

Example: to set the Trigger Level for External 1 Trigger, you use the command `:TRIG:EXT1:LEV`; to set the Trigger Level for External 1 Gate you use the same command, `:TRIG:EXT1:LEV`. By the same token, once you set the External 1 Trigger Level to 1V, it is 1V whether External 1 is being used as a Gate Source or a Trigger Source.

If a command is sent to the **TRIG** node to set the functions that are omitted from the **Gate Source** menus (**Auto Trig**, **Holdoff**, **Trig Delay**), it is accepted and the values stored, but the values are not visible from the **Gate Source** menus.

### 8.2.1 Select Gate Source

Selects the source of the Gate signal for performing Gated Trigger measurements.

This version of the **Select Gate Source** function is used in all measurements except the Pulse measurement application.

For the selection of the gate source the SCPI node, `:TRIGger[:SEquence]:` is replaced by `[:SENSe]:SWEep:EGATe:` as shown in the remote command below. Because you can independently set the Gate Source and the Trigger Source, there is a separate SCPI command for the Gate Source.

## 8 Trigger

### 8.2 Gate Source

|                |                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                     |      |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| Remote Command | [:SENSe]:SWEep:EGATe:SOURce EXTernal1   EXTernal2   LINE   FRAMe   RFBurst   TV   VIDEo   PXI   INTernal<br>[:SENSe]:SWEep:EGATe:SOURce?                                                                                                          |                                                                                                                                                                                                                                                     |      |
| Example        | :SWE:EGAT:SOUR EXT1<br>:SWE:EGAT:SOUR?                                                                                                                                                                                                            |                                                                                                                                                                                                                                                     |      |
| Dependencies   | Available selections differ depending on models as below                                                                                                                                                                                          |                                                                                                                                                                                                                                                     |      |
|                | Benchtop                                                                                                                                                                                                                                          | Line, External 1, External 2, RF Burst, Periodic, TV (Swept SA only)                                                                                                                                                                                |      |
|                | VXT                                                                                                                                                                                                                                               | Video, Internal, External 1, External 2, RF Burst, Periodic, PXI Internal and Periodic are not available in Spectrum Analyzer Mode<br><br>– Internal is available only in M9410A/11A/15A/16A and in M9410E/11E/15E/16E and unavailable in M9420/21A |      |
|                | EXM                                                                                                                                                                                                                                               | Video, Internal, External 1, External 2, RF Burst, Periodic                                                                                                                                                                                         |      |
|                | Not available in E7760<br><br>In some models, there is no second External input. In these models, the External 2 selection is not shown and the EXTernal2 parameter will generate a “Hardware missing; Not available for this model number” error |                                                                                                                                                                                                                                                     |      |
| Preset         | Mode                                                                                                                                                                                                                                              | Value                                                                                                                                                                                                                                               |      |
|                | GSM/EDGE                                                                                                                                                                                                                                          | FRAM                                                                                                                                                                                                                                                |      |
|                | Phase Noise                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                     |      |
|                | LTEATDD                                                                                                                                                                                                                                           | Direction is Downlink                                                                                                                                                                                                                               | EXT1 |
|                | 5G NR                                                                                                                                                                                                                                             | Direction is Uplink                                                                                                                                                                                                                                 | FRAM |
|                | All Others                                                                                                                                                                                                                                        | EXT1                                                                                                                                                                                                                                                |      |

#### 8.2.2 Sync Holdoff

Applies only to the Periodic Timer. Specifies the duration that the sync source signal for the Periodic Timer must be kept false before the transition to true to be recognized as the sync timing. The periodic timer phase is aligned when the sync source signal becomes true, after the Holdoff time is satisfied.

A holdoff of 2 ms works with most WiMAX signals, but there may be cases where the burst off duration is less than 1 ms and this value will need to be changed.

|                |                                                                                          |
|----------------|------------------------------------------------------------------------------------------|
| Remote Command | :TRIGger[:SEquence]:FRAME:SYNC:HOLDoff <time><br>:TRIGger[:SEquence]:FRAME:SYNC:HOLDoff? |
| Example        | :TRIG:FRAME:SYNC:HOLD 5                                                                  |

|                | :TRIG:FRAM:SYNC:HOLD?                                                                                                                                                                     |  |      |       |                |          |            |              |            |             |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|------|-------|----------------|----------|------------|--------------|------------|-------------|
| Dependencies   | Only appears if <b>Periodic</b> is the selected Gate Source<br>Does not appear in all Measurements. For example, does not appear in Swept SA                                              |  |      |       |                |          |            |              |            |             |
| Preset         | <table><tr><th>Mode</th><th>Value</th></tr><tr><td>LTEATDD</td><td>ON, 1 ms</td></tr><tr><td>5G NR</td><td>ON, 250.0 us</td></tr><tr><td>All others</td><td>OFF, 4 msec</td></tr></table> |  | Mode | Value | LTEATDD        | ON, 1 ms | 5G NR      | ON, 250.0 us | All others | OFF, 4 msec |
| Mode           | Value                                                                                                                                                                                     |  |      |       |                |          |            |              |            |             |
| LTEATDD        | ON, 1 ms                                                                                                                                                                                  |  |      |       |                |          |            |              |            |             |
| 5G NR          | ON, 250.0 us                                                                                                                                                                              |  |      |       |                |          |            |              |            |             |
| All others     | OFF, 4 msec                                                                                                                                                                               |  |      |       |                |          |            |              |            |             |
| State Saved    | Saved in instrument state                                                                                                                                                                 |  |      |       |                |          |            |              |            |             |
| Min            | 0 ms                                                                                                                                                                                      |  |      |       |                |          |            |              |            |             |
| Max            | +500 ms                                                                                                                                                                                   |  |      |       |                |          |            |              |            |             |
|                | Auto Function                                                                                                                                                                             |  |      |       |                |          |            |              |            |             |
| Remote Command | :TRIGger[:SEQuence]:FRAMe:SYNC:HOLDoff:STATe OFF   ON   0   1<br>:TRIGger[:SEQuence]:FRAMe:SYNC:HOLDoff:STATe?                                                                            |  |      |       |                |          |            |              |            |             |
| Preset         | <table><tr><th>Mode</th><th>Value</th></tr><tr><td>LTEATDD, 5G NR</td><td>ON</td></tr><tr><td>All others</td><td>OFF</td></tr></table>                                                    |  | Mode | Value | LTEATDD, 5G NR | ON       | All others | OFF          |            |             |
| Mode           | Value                                                                                                                                                                                     |  |      |       |                |          |            |              |            |             |
| LTEATDD, 5G NR | ON                                                                                                                                                                                        |  |      |       |                |          |            |              |            |             |
| All others     | OFF                                                                                                                                                                                       |  |      |       |                |          |            |              |            |             |

## 8.3 Gate Settings

Contains controls that let you control the gating function. The **Gate** functionality is used to view signals best viewed by qualifying them with other events.

This tab appears in the **Trigger** menu panel for measurements that support gating. In measurements that do not support gating, this tab does not appear.

In the Swept SA measurement, the **Gate** controls, and all SCPI under the `[ :SENSe ] :SWEep:EGATe` SCPI node are unavailable when **Source Mode** is set to **Tracking**. This is because the **Gate** circuitry is used to sync the external source. If the Tracking Source is turned on, the **Gate** is turned off.

Gate setup parameters are the same for all measurements – they do not change as you change measurements. Settings like these are called “Meas Global” and are unaffected by Meas Preset.

Note that Sweep Time auto coupling rules and annotation are changed when Gate is on.

### 8.3.1 Gate On/Off

Turns the **Gate** function on or off.

When the **Gate** function is **ON**, the selected "**Gate Method**" on page 992 is used along with the gate settings and the signal at the gate source to control the sweep and video system with the gate signal. Not all measurements allow every type of **Gate Method**.

If **Gate** were to be turned **ON** without a gate signal present, **Marker Count** operation would be unreliable, so it is locked out whenever **Gate** is on for measurements that support **Marker Count**.

|                |                                                                                                                                                                                                                                                                                                                                                                                      |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe ] :SWEep:EGATe [ :STATe ] OFF   ON   0   1</code><br><code>[ :SENSe ] :SWEep:EGATe [ :STATe ] ?</code>                                                                                                                                                                                                                                                                |
| Example        | <code>:SWE:EGAT ON</code><br><code>:SWE:EGAT ?</code>                                                                                                                                                                                                                                                                                                                                |
| Dependencies   | <p>The function is unavailable (grayed-out) and <b>OFF</b> when:</p> <ul style="list-style-type: none"><li>– <b>Gate Method</b> is LO or Video and FFT Sweep Type is manually selected</li><li>– <b>Gate Method</b> is FFT, and Swept Sweep Type is manually selected</li><li>– <b>Marker Count</b> is ON</li></ul> <p>The following are unavailable whenever <b>Gate</b> is on:</p> |

- FFT under Sweep Type when Method=LO or Video or Swept under Sweep Type when Method=FFT

- **Marker Count**

While **Gate** is on, the Auto Rules for Sweep Type are modified so that the choice agrees with the Gate Method: i.e., FFT for Method = FFT and Swept for Method = LO or Video

When in the ACP measurement:

- When **Meas Method** is RBW or FAST, this function is unavailable, and the control is grayed-out
- Whenever **Gate** is on, Meas Method, RBW, or FAST is unavailable and keys for those are grayed-out
- When **Gate** is on, Offset Res BW and Offset Video BW are ignored (if you set these values) and the measurement works as if all Offset Res BW and all Offset Video BW are coupled with the Res BW and the Video BW under the BW menu. When **Gate** is on, the Offset BW control in the **Offset/Limit** menu is grayed-out

|                               |                                                                                                                                                                                                                                  |              |
|-------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| Preset                        | <b>Mode</b>                                                                                                                                                                                                                      | <b>Value</b> |
|                               | LTEATDD                                                                                                                                                                                                                          | ON           |
|                               | All others                                                                                                                                                                                                                       | OFF          |
| State Saved                   | Saved in instrument state                                                                                                                                                                                                        |              |
| Range                         | OFF   ON                                                                                                                                                                                                                         |              |
| Annunciation                  | Annunciated in the Meas Bar ; if Gate is on, the word "Gate:" followed by the gate type appears, where <ul style="list-style-type: none"> <li>- LO = Gated LO</li> <li>- Vid = Gated Video</li> <li>- FFT = Gated FFT</li> </ul> |              |
| Backwards Compatibility SCPI  | [:SENSe]:SWEep:TIME:GATE[:STATe]<br>Available in SA and SCPILC Modes<br>ESA compatibility                                                                                                                                        |              |
| Backwards Compatibility Notes | In ESA, Trig Delay (On) and Gate (On) could not be active at the same time. This dependency does not exist in PSA or in X-Series                                                                                                 |              |

### 8.3.2 Gate View On/Off

Turning on **Gate View** puts the instrument into **Gate View**. When in **Gate View**, the regular view of the current measurement traces and results are reduced vertically to about 70% of the regular height. The **Zero Span** window, showing the positions of the Gate, is shown between the Measurement Bar and the reduced measurement window. By reducing the height of the measurement window, some of the annotation on the Data Display may not fit and is not shown.



## 8 Trigger

### 8.3 Gate Settings

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:SWEep:EGATe:VIEW ON   OFF   1   0</code><br><code>[ :SENSe]:SWEep:EGATe:VIEW?</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Example        | Turn on <b>Gate View</b> :<br><code>:SWE:EGAT:VIEW ON</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Dependencies   | <p>In the Swept SA measurement:</p> <p>In <b>Gate View</b>, the regular <b>Sweep Time</b> (or <b>Acquisition Time</b>) control is grayed-out, to avoid confusing the user who wants to set Gate View Sweep Time. When pressed, the grayed-out control displays the informational message "Use Gate View Sweep Time in the Gate menu"</p> <p>In other measurements:</p> <p>When you turn <b>Gate View</b> on, the lower window takes on the current state of the instrument. On leaving <b>Gate View</b>, the instrument takes on the state of the lower window</p> <p>When you turn <b>Gate View</b> on, the upper window <b>Sweep Time</b> (or <b>Acquisition Time</b>) is set to Gate View Sweep Time (or Gate View Acquisition Time)</p>                                                                                                                                                                                                                                                                                                                                                 |
| Couplings      | <p>These couplings apply to the Swept SA measurement:</p> <ul style="list-style-type: none"> <li>– When <b>Gate View</b> is turned on, the instrument is set to <b>Zero Span</b></li> <li>– <b>Gate View</b> automatically turns off whenever a <b>Span</b> other than Zero is selected</li> <li>– <b>Gate View</b> automatically turns off if you press the <b>Swept Span</b> toggle under <b>Freq</b> while in <b>Gate View</b>, and the instrument returns to the <b>Span</b> it was in before entering <b>Gate View</b> (even if that is <b>Zero Span</b>)</li> <li>– When <b>Gate View</b> is turned on, the sweep time used is the Gate View Sweep Time</li> <li>– When <b>Gate View</b> is turned off, <b>Sweep Time</b> is set to the normal Swept SA measurement sweep time</li> <li>– If <b>Gate View</b> is on and <b>Gate</b> is off, then turning on <b>Gate</b> turns off <b>Gate View</b></li> </ul>                                                                                                                                                                         |
| Preset         | <b>OFF</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| State Saved    | Saved in instrument state                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Range          | <b>ON OFF</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Annunciation   | <p>For Gate View to work properly, a gate signal must be present at the selected Gate Source. Therefore, in Gate View, any time more than 2 seconds passes with no gate signal, a pop-up message "Waiting for gate input" appears. This message goes away when a gate signal appears</p> <p>Turning Gate View off returns the instrument to the normal measurement view.</p> <p>In Swept SA, the normal measurement view is the single-window Swept SA view. When returning to this view, the Swept SA measurement returns to the <b>Span</b> it was in before entering <b>Gate View</b> (even if that is <b>Zero Span</b>).</p> <p>The <b>Gate View</b> window is triggered from the <b>Gate Source</b>, with zero trigger delay. Also, when updating the <b>Gate View</b> window, the Gate itself must not operate. So, it is internally shut off while the gate view window is being updated. For the Swept SA measurement, this means that the Gate is internally shut off whenever the <b>Gate View</b> window is displayed. The measurement bar and controls continue to show the</p> |

**Trigger** source for the main sweep window and give no indication that the Gate is shut off or that the **Gate View** window is triggered from the **Gate Source**.

When in **Gate View**, vertical lines are displayed in the **Gate View** window as follows:

Green lines labeled **GATESTART** and **GATE STOP** are displayed at the gate edges as follows: in Edge Gate, a line is shown for Delay and one for the end of the Gate period, defined by Length. In Level Gate a line is shown only for Delay. You can adjust the position of the green lines by adjusting the gate length and the gate delay or by dragging them with your finger or the mouse.. These lines update in the **Gate View** window as the active function changes, even if the window is not being updated. In Gated LO and Gated Video, these lines are positioned relative to the delay reference line (not relative to 0 time). In Gated FFT, their location is relative to the left edge of the screen.

A blue line is displayed showing the delay reference, that is, the reference point for the **Gate Delay** within the **Zero Span** window. The blue line represents where (in time) the effective location of the gate start would be if the gate were programmed to zero delay.

A second blue line is displayed at the location that represents the boundary between "compensated IF" and "compensated LO" operating modes. The second blue line is labeled **MIN FAST** because it represents the minimum **Gate Delay** for fast Gated LO operation. This line is only displayed in Gated LO. You cannot scroll (knob) or decrement (down key) "**Gate Delay**" on page 990 to less than that represented by the position of this line, it can only be set below this position manually, although once there it can be moved freely with the knob while below the line.

A yellow line in the Gated Video case only, is displayed at  $B_{length}$ , where  $B_{length}$  is the display point (bucket) length for the swept trace, which is given by the **Sweep Time** (or **Acquisition Time**) for that trace divided by number of Points - 1. So, it is referenced to 0 time, not to the delay reference. This line is labeled NEXT PT (it is not shown in the figure above because the figure above is for Gated LO). The yellow line represents the edge of a display point (bucket). Normally in Gated Video, the bucket length must be selected so that it exceeds the off time of the burst. There is another way to use the instrument in Gated Video measurements, and that is to set the bucket width much shorter than the off time of the burst. Then use the **Max Hold** trace function to fill in "missing" buckets more slowly. This lets you see some of the patterns of the Gated Video results earlier, though seeing a completely filled-in spectrum later.

### 8.3.3 Gate Delay

Controls the length of time from the time the gate condition goes True until the gate is turned on.

---

Remote [:SENSe]:SWEp:EGATe:DElay <time>

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### 8.3 Gate Settings

| Command                      | [:SENSe]:SWEep:EGATe:DElay?                                                                                                                                                                                   |  |      |       |          |        |      |        |       |      |        |         |
|------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|------|-------|----------|--------|------|--------|-------|------|--------|---------|
| Example                      | :SWE:EGAT:DElay 500ms<br>:SWE:EGAT:DElay?                                                                                                                                                                     |  |      |       |          |        |      |        |       |      |        |         |
| Notes                        | Units of time are required, or no units; otherwise, an invalid suffix error message is generated                                                                                                              |  |      |       |          |        |      |        |       |      |        |         |
| Preset                       | <table><tr><th>Mode</th><th>Value</th></tr><tr><td>GSM/EDGE</td><td>600 us</td></tr><tr><td>WLAN</td><td>500 us</td></tr><tr><td>5G NR</td><td>5 ms</td></tr><tr><td>Others</td><td>57.7 us</td></tr></table> |  | Mode | Value | GSM/EDGE | 600 us | WLAN | 500 us | 5G NR | 5 ms | Others | 57.7 us |
| Mode                         | Value                                                                                                                                                                                                         |  |      |       |          |        |      |        |       |      |        |         |
| GSM/EDGE                     | 600 us                                                                                                                                                                                                        |  |      |       |          |        |      |        |       |      |        |         |
| WLAN                         | 500 us                                                                                                                                                                                                        |  |      |       |          |        |      |        |       |      |        |         |
| 5G NR                        | 5 ms                                                                                                                                                                                                          |  |      |       |          |        |      |        |       |      |        |         |
| Others                       | 57.7 us                                                                                                                                                                                                       |  |      |       |          |        |      |        |       |      |        |         |
| State Saved                  | Saved in instrument state                                                                                                                                                                                     |  |      |       |          |        |      |        |       |      |        |         |
| Min                          | 0.0 us                                                                                                                                                                                                        |  |      |       |          |        |      |        |       |      |        |         |
| Max                          | 100 s                                                                                                                                                                                                         |  |      |       |          |        |      |        |       |      |        |         |
| Backwards Compatibility SCPI | [:SENSe]:SWEep:TIME:GATE:DElay<br>This backward compatibility command is available in SA and SCPI LC Modes<br>ESA compatibility                                                                               |  |      |       |          |        |      |        |       |      |        |         |

#### 8.3.4 Gate Length

Controls the length of time that the gate is on after it opens.

| Remote Command | <code>[ :SENSe]:SWEep:EGATe:LENGth &lt;time&gt;</code><br><code>[ :SENSe]:SWEep:EGATe:LENGth?</code>                                                                                                                                    |      |       |          |        |      |         |        |          |  |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-------|----------|--------|------|---------|--------|----------|--|
| Example        | <code>:SWE:EGAT:LENG 1</code><br><code>:SWE:EGAT:LENG?</code>                                                                                                                                                                           |      |       |          |        |      |         |        |          |  |
| Notes          | Units of time are required, or no units; otherwise, an invalid suffix error message is generated                                                                                                                                        |      |       |          |        |      |         |        |          |  |
| Dependencies   | Grayed-out when Gate Method is set to <b>FFT</b> , in which case the label changes to that shown below<br><div><p>Gate Length<br/>(=1.83/RBW)<br/>2.7 ms</p></div> <p>The control is also grayed-out if Gate Control = <b>LEVel</b></p> |      |       |          |        |      |         |        |          |  |
| Preset         | <table><thead><tr><th>Mode</th><th>Value</th></tr></thead><tbody><tr><td>GSM/EDGE</td><td>200 us</td></tr><tr><td>WLAN</td><td>1.54 ms</td></tr><tr><td>Others</td><td>461.6 us</td></tr></tbody></table>                               | Mode | Value | GSM/EDGE | 200 us | WLAN | 1.54 ms | Others | 461.6 us |  |
| Mode           | Value                                                                                                                                                                                                                                   |      |       |          |        |      |         |        |          |  |
| GSM/EDGE       | 200 us                                                                                                                                                                                                                                  |      |       |          |        |      |         |        |          |  |
| WLAN           | 1.54 ms                                                                                                                                                                                                                                 |      |       |          |        |      |         |        |          |  |
| Others         | 461.6 us                                                                                                                                                                                                                                |      |       |          |        |      |         |        |          |  |

|                    |                                                                                                               |
|--------------------|---------------------------------------------------------------------------------------------------------------|
| State Saved        | Saved in instrument state                                                                                     |
| Min                | 100 ns                                                                                                        |
| Max                | 5 s                                                                                                           |
| Backwards          | <a href="#">[:SENSe]:SWEep:TIME:GATE:LENGth</a>                                                               |
| Compatibility SCPI | <a href="#">This backward compatibility command is available in SA and SCPI LC Modes</a><br>ESA compatibility |

### 8.3.5 Gate Method

Lets you choose one of the three different types of gating. Not all types of gating are available for all measurements.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <a href="#">[:SENSe]:SWEep:EGATe:METHod LO   VIdEO   FFT</a><br>For option details, see <a href="#">"LO" on page 992</a> , <a href="#">"Video" on page 993</a> or <a href="#">"FFT" on page 993</a><br><a href="#">[:SENSe]:SWEep:EGATe:METHod?</a>                                                                                                                                                                                                             |
| Example        | <a href="#">:SWE:EGAT:METH FFT</a>                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Dependencies   | This function is only available in the Swept SA measurement in Spectrum Analyzer Mode<br>This control is unavailable when Gate is On and FFT Sweep Type manually selected<br>When selected, Sweep Type is forced to Swept, and the FFT selection in Sweep Type is grayed-out<br>Only the <a href="#">FFT</a> method is supported in non-SA products<br>Only the <a href="#">FFT</a> method is supported by VXT models M9410A/11A/15A/16A and M9410E/11E/15E/16E |
| Preset         | <a href="#">LO</a>                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| State Saved    | Saved in instrument state                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Range          | <a href="#">Video LO FFT</a>                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Annunciation   | In Meas Bar                                                                                                                                                                                                                                                                                                                                                                                                                                                     |

#### LO

In [LO](#) gating, when Gate is [ON](#), the LO sweeps whenever the gate conditions as specified in the Gate menu are satisfied by the signal at the Gate Source.

This form of gating is more sophisticated, and results in faster measurements. With Gated LO, the instrument only sweeps while the gate conditions are satisfied. This means that a sweep could take place over several gate events. It would start when the gate signal goes true and stop when it goes false, and then continue when it goes true again. But since the LO is sweeping as long as the gate conditions are satisfied, the sweep typically finishes much more quickly than with Gated Video.

When in zero span, there is no actual sweep performed. But data is only taken while the gate conditions are satisfied. So even though there is no sweep, the gate settings will impact when data is acquired.

## Video

In **Video** gating, when Gate is **ON**, the video signal is allowed to pass through whenever the gate conditions as specified in the Gate menu are satisfied by the signal at the Gate Source.

This form of gating may be thought of as a simple switch, which connects the signal to the input of the spectrum analyzer. When the gate conditions are satisfied, the switch is closed, and when the gate conditions are not satisfied, the switch is open. So, we only look at the signal while the gate conditions are satisfied.

With this type of gating, you usually set the instrument to sweep very slowly. In fact, a general rule is to sweep slowly enough that the gate is guaranteed to be closed at least once per data measurement interval (bucket). Then if the peak detector is used, each bucket will represent the peak signal as it looks with the gate closed.

## FFT

In **FFT** gating, when Gate is **ON**, an FFT is performed whenever the gate conditions as specified in the Gate menu are satisfied by the signal at the Gate Source. This is an FFT measurement that begins when the gate conditions are satisfied. Since the time period of an FFT is approximately  $1.83/\text{RBW}$ , you get a measurement that starts under predefined conditions and takes place over a predefined period. So, in essence, this is a gated measurement. You have limited control over the gate length, but it works in FFT sweeps, which the other two methods do not.

Gated FFT is not possible in zero span since the instrument is not sweeping, so in zero span the Gated LO method is used. Data is still only taken while the gate conditions are satisfied, so the gate settings do impact when data is acquired.

The Gate Length will be  $1.83/\text{RBW}$ .

This is a convenient way to make a triggered FFT measurement under control of an external gating signal.

### 8.3.6 Control Edge/Level

Sets the method of controlling the gating function from the gating signal.

- |              |                                                                                                                                                           |
|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>EDGE</b>  | The gate opens (after the Delay) on the selected edge (for example, positive) of the gate signal and closes on the alternate edge (for example, negative) |
| <b>LEVe1</b> | The gate opens (after the Delay) when the gate signal has achieved a certain level and                                                                    |

stays open as long as that level is maintained

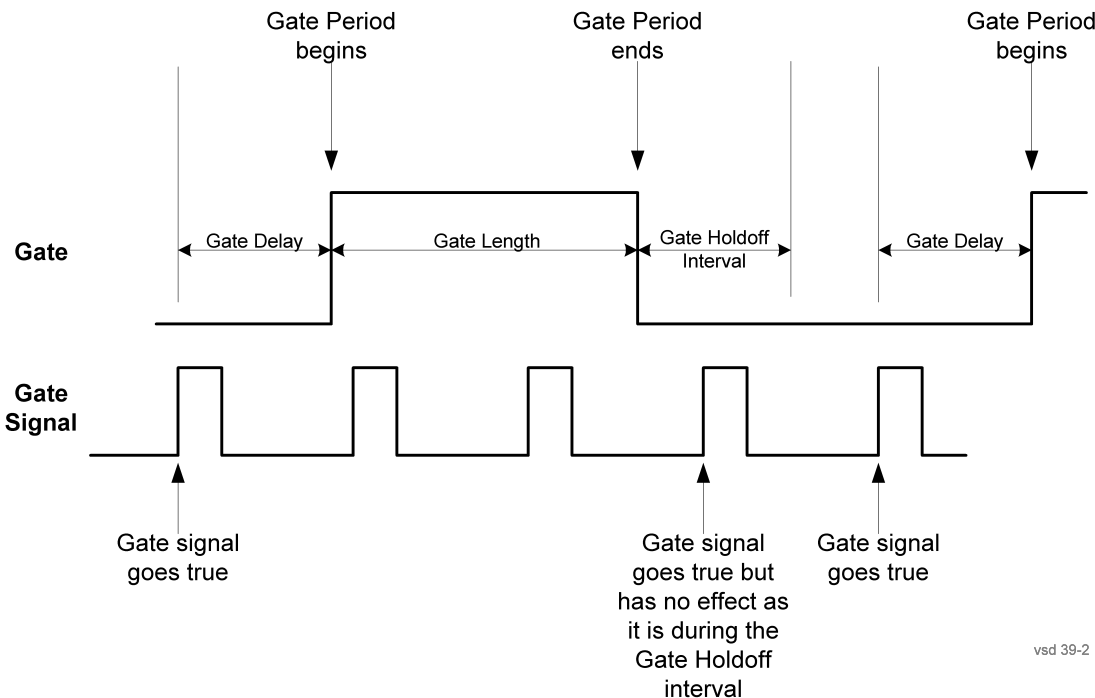
|                                 |                                                                                                                                                                                                                                                                                                |
|---------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command                  | <code>[ :SENSe]:SWEep:EGATe:CONTRol EDGE   LEVe1</code><br><code>[ :SENSe]:SWEep:EGATe:CONTRol?</code>                                                                                                                                                                                         |
| Example                         | <code>:SWE:EGAT:CONT EDGE</code>                                                                                                                                                                                                                                                               |
| Dependencies                    | If the Gate Method is <code>FFT</code> , this control is grayed-out and <code>EDGE</code> is selected<br>If the Gate Source is TV, Frame, or Line, this control is grayed-out and <code>EDGE</code> is selected                                                                                |
| Preset                          | <code>EDGE</code>                                                                                                                                                                                                                                                                              |
| State Saved                     | Saved in instrument state                                                                                                                                                                                                                                                                      |
| Backwards<br>Compatibility SCPI | <code>[ :SENSe]:SWEep:EGATe:TYPE</code><br><br>This backwards-compatibility command is available when the primary command is available<br><br><code>[ :SENSe]:SWEep:TIME:GATE:TYPE</code><br><br>This backwards-compatibility command is available in SA and SCPILC Modes<br>ESA Compatibility |

### 8.3.7 Gate Holdoff

Lets you increase or decrease the wait time after a gate event ends before the instrument will respond to the next gate signal.

After any Gate event finishes, the instrument must wait for the sweep system to settle before it can respond to another Gate signal. The instrument calculates a "wait time," taking into account a number of factors, including RBW and Phase Noise Optimization settings. The goal is to achieve the same accuracy when gated as in ungated operation. The figure below illustrates this concept:

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8.3 Gate Settings



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When **Gate Holdoff** is **Auto**, the wait time calculated by the instrument is used. When Gate Time is in **Manual**, the user may adjust the wait time, usually decreasing it in order to achieve greater speed, but at the risk of decreasing accuracy.

When the **Method** control is set to **Video** or **FFT**, the **Gate Holdoff** function has no effect.

In measurements that do not support **"Auto Function"** on page 996, the value shown when **Auto** is selected is "----" and the manually set holdoff is returned to a query.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:SWEep:EGATe:HOLDoff &lt;time&gt;</code><br><code>[ :SENSe]:SWEep:EGATe:HOLDoff?</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Example        | <code>:SWE:EGAT:HOLD 0.0002</code><br><code>:SWE:EGAT:HOLD?</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Couplings      | <p>When <b>Gate Holdoff</b> is <b>Auto</b>, the <b>Gate Holdoff</b> control shows the value calculated by the instrument for the wait time</p> <p>Pressing the <b>Gate Holdoff</b> control while it is in <b>Auto</b> and not selected, causes the control to become selected and lets you adjust the value. If the value is adjusted, the setting changes to <b>Man</b></p> <p>Pressing the <b>Gate Holdoff</b> key, while it is in <b>Auto</b> and selected, does not change the value of <b>Gate Holdoff</b>, but causes the setting to change to <b>Man</b>. Now the user can adjust the value</p> <p>Pressing the control while it is in <b>Man</b> and selected, cause the value to change back to <b>Auto</b></p> <p>Pressing the control while it is in <b>Man</b> and not selected, causes the control to become selected and lets you adjust the value</p> <p>When <b>Method</b> is set to <b>Video</b> or <b>FFT</b>, the <b>Gate Holdoff</b> function has no effect</p> |

|             |                           |
|-------------|---------------------------|
| Preset      | Auto                      |
| State Saved | Saved in instrument state |
| Min         | 1 $\mu$ sec               |
| Max         | 1 sec                     |

### Auto Function

|                |                                                                                                                      |
|----------------|----------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:SWEep:EGATe:HOLDoff:AUTO OFF   ON   0   1</code><br><code>[ :SENSe]:SWEep:EGATe:HOLDoff:AUTO?</code> |
| Example        | <code>:SWE:EGAT:HOLD:AUTO ON</code><br><code>:SWE:EGAT:HOLD:AUTO?</code>                                             |
| Preset         | ON                                                                                                                   |
| State Saved    | Saved in instrument state                                                                                            |
| Range          | Auto   Man                                                                                                           |

## 8.3.8 Gate View Sweep Time

Controls the Sweep Time in the Gate View window. To provide an optimal view of the gate signal, the instrument initializes **Gate View Sweep Time** based on the current settings of Gate Delay and Gate Length.

#### NOTE

Since **Gate View Sweep Time** is used to calculate Gate Delay and Gate Length increments, it is maintained even when not in **Gate View**.

#### NOTE

In instruments without sweeping hardware such as some modular analyzers, this control may be labeled **Gate View Acquisition Time**

|                |                                                                                                                                                                                               |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:SWEep:EGATe:TIME &lt;time&gt;</code><br><code>[ :SENSe]:SWEep:EGATe:TIME?</code>                                                                                              |
| Example        | <code>:SWE:EGAT:TIME 500 ms</code>                                                                                                                                                            |
| Dependencies   | Gate View Sweep Time is initialized: <ul style="list-style-type: none"> <li>– On Preset (after initializing delay and length)</li> <li>– Every time the Gate Method is set/changed</li> </ul> |

Additionally, in the Swept SA measurement, whenever you do a Preset, or leave Gate View, the instrument remembers the Gate Delay and Gate Length settings. Then, when returning to Gate View, if the current Gate Delay and/or Gate Length do not match the remembered values Gate View Sweep Time is re-initialized



## 8 Trigger

### 8.3 Gate Settings

|             |                                                                                         |              |
|-------------|-----------------------------------------------------------------------------------------|--------------|
| Preset      | <b>Mode</b>                                                                             | <b>Value</b> |
|             | GSM/EDGE                                                                                | 1 ms         |
|             | 5G NR                                                                                   | 10 ms        |
|             | Others                                                                                  | 800 $\mu$ s  |
| State Saved | Saved in instrument state                                                               |              |
| Min         | 1 $\mu$ s                                                                               |              |
| Max         | 6000 s                                                                                  |              |
| Annotation  | The gate view Sweep Time is displayed in the lower-right corner of the gate view window |              |

#### 8.3.9 Gate View Start Time

Controls the time at the left edge of the Gate View.

|                |                                                                                                              |
|----------------|--------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:SWEep:EGATe:VIEW:STARt &lt;time&gt;</code><br><code>[ :SENSe]:SWEep:EGATe:VIEW:STARt?</code> |
| Example        | <code>:SWE:EGAT:VIEW:STAR 10ms</code>                                                                        |
| Notes          | Units of time are required or no units; otherwise, an invalid suffix error message is generated              |
| Preset         | 0 ms                                                                                                         |
| State Saved    | Saved in instrument state                                                                                    |
| Min            | 0                                                                                                            |
| Max            | 500 ms                                                                                                       |

#### 8.3.10 Gate Delay Compensation

Lets you select an RBW-dependent value by which to adjust the gate delay, to compensate for changes in the delay caused by RBW effects. You can select between uncompensated operation and two types of compensation:

|                                |         |
|--------------------------------|---------|
| Uncompensated                  | OFF     |
| Delay Until RBW Settled        | SETTled |
| Compensate for RBW Group Delay | GDElay  |

For full details of these options, see ["More Information" on page 998](#)

|                |                                                                                                                                                  |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe]:SWEep:EGATe:DElay:COMPensation:TYPE OFF   SETTled   GDElay</code><br><code>[ :SENSe]:SWEep:EGATe:DElay:COMPensation:TYPE?</code> |
| Example        | <code>:SWE:EGAT:DEL:COMP:TYPE SETT</code>                                                                                                        |

| :SWE:EGAT:DEL:COMP:TYPE?      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      |       |                               |        |            |         |
|-------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-------|-------------------------------|--------|------------|---------|
| Notes                         | <p>Although this function is Meas Global, there are some measurements that do not support this function. In those measurements the control is not displayed, and the operation will be Uncompensated</p> <p>If some but not all measurements in a Mode support this function, then selecting a measurement that does not support it will not change the Meas Global selection; it will simply be “Uncompensated” while in that measurement. The SCPI command is still accepted while in that measurement</p> <p>If Gate Delay Compensation is not supported at all within a particular mode, the control is not displayed, and if the SCPI command is sent while in a measurement within that mode, an “Undefined Header” message is generated</p> <p>Note that, for modular products such as EXM and VXT, this function is not supported. In those products the control is not displayed and the SCPI is ignored, although it is accepted without error</p> |      |       |                               |        |            |         |
| Preset                        | <table> <tr> <th>Mode</th><th>Value</th></tr> <tr> <td>TD-SCDMA, LTEA FDD/TDD, 5G NR</td><td>GDELaY</td></tr> <tr> <td>All others</td><td>SETTled</td></tr> </table>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Mode | Value | TD-SCDMA, LTEA FDD/TDD, 5G NR | GDELaY | All others | SETTled |
| Mode                          | Value                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |      |       |                               |        |            |         |
| TD-SCDMA, LTEA FDD/TDD, 5G NR | GDELaY                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |      |       |                               |        |            |         |
| All others                    | SETTled                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |       |                               |        |            |         |
| State Saved                   | Saved in instrument state                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |      |       |                               |        |            |         |
| Range                         | OFF   SETTled   GDELaY                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |      |       |                               |        |            |         |

## More Information

Selecting **Uncompensated** means that the actual gate delay is as you set it.

Selecting **Delay Until RBW Settled** causes the gate delay to be increased above the user setting by an amount equal to  $3.06/\text{RBW}$ . This compensated delay causes the GATE START and GATE STOP lines on the display to move by the compensation amount, and the actual hardware gate delay to be increased by the same amount. All the other gate lines (for example, MIN FAST) are unaffected. If the RBW subsequently changes, the compensation is readjusted for the new RBW. The value shown on the **Gate Delay** control does *not* change.

**Delay Until RBW Settled** allows excellent measurements of gated signals, by allowing the IF to settle following any transient that affects the burst. Excellent measurements also require that the analysis region not extend into the region affected by the falling edge of the burst. Thus, excellent measurements can only be made over a width that declines with narrowing RBWs, which is achieved by decreasing the gate length below the user setting by an amount equal to  $2.53/\text{RBW}$ . Therefore, for general purpose compensation, you will still want to change the gate length with changes in RBW even if the gate delay is compensated. The compensated Gate Length is limited by the instrument so that it will never go below 10% of the value shown on the Gate Length key, as otherwise the sweep times could get very long. Anytime the **Gate Length** and **RBW** values combine in such a way that this limiting takes place, a warning is displayed. For measurements that contain

multiple sweeps with different RBW like SEM and SPUR, the smallest RBW is used for this limiting.

Selecting **Compensate for RBW Group Delay** causes the gate delay to be increased above the user setting by an amount equal to  $1.81/\text{RBW}$ . This compensated delay causes the GATE START, GATE STOP lines on the display to move by the compensation amount, and the actual hardware gate delay to be increased by the same amount. All the other gate lines (for example, MIN FAST) are unaffected. If the RBW subsequently changes, the compensation is readjusted for the new RBW. The value shown on the **Gate Delay** control does *not* change. **Compensate for RBW Group Delay** also includes gate length compensation; the gate length itself is adjusted as necessary to attempt to compensate for delay effects imposed by the RBW.

**Compensate for RBW Group Delay** is similar to **Delay Until RBW Settled** but compensates for the group delay of the RBW filter, rather than the filter settling time. As the RBW gets narrow, this can allow the settling tail of the RBW to affect the beginning part of the gated measurement and allow the beginning of the RBW settling transient to affect the end of the gated measurement. These two effects are symmetric because the RBW response is symmetric. Because the gate length is not automatically compensated, some users might find this compensation to be more intuitive than compensation for RBW settling.

8.3.11 Min Fast Position Query (Remote Query Only)

Queries the position of the MIN FAST line, relative to the delay reference (REF) line. See "Gate View On/Off" on page 988. If this query is sent while not in Gate view, the MinFast calculation is performed based on the current values of the appropriate parameters and the result is returned. Reading this value lets you set an optimal gate delay value for the current measurement setup.

|                                 |                                  |
|---------------------------------|----------------------------------|
| Example                         | :SWE:EGAT:MIN?                   |
| Backwards Compatibility<br>SCPI | [ :SENSe ] :SWEep:EGATe:MINFast? |

8.3.12 Gate Preset (Remote Command Only)

- Presets the time-gated spectrum analysis capability.
- This command sets gate parameter values to the ESA preset values, as follows:
- Gate trigger type = edge
  - Gate polarity = positive

- Gate delay = 1 us
- Gate length = 1 us

|                                 |                                                                    |
|---------------------------------|--------------------------------------------------------------------|
| Backwards Compatibility<br>SCPI | <code>[ :SENSe]:SWEep:TIME:GATE:PRESet</code><br>ESA Compatibility |
|---------------------------------|--------------------------------------------------------------------|

### 8.3.13 Gate Level (Remote Command Only)

Sets the gate input transition point level for the external **TRIGGER** inputs on the front and rear panel. This is a legacy command for PSA compatibility. It is simply an alias to the equivalent trigger level command.

|                                 |                                                                                                                                   |
|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|
| Notes                           | This command is simply an alias to<br><code>:TRIGger[:SEquence]:EXTernal[1] 2:LEVel</code>                                        |
| Backwards Compatibility<br>SCPI | <code>[ :SENSe]:SWEep:EGATe:EXTernal[1] 2:LEVel &lt;voltage&gt;</code><br><code>[ :SENSe]:SWEep:EGATe:EXTernal[1] 2:LEVel?</code> |

### 8.3.14 Gate Polarity (Remote Command Only)

Sets the polarity for the gate signal. This setup is now done using the gate trigger's slope setting.

When **POSitive** is selected, a positive-going edge (Edge) or a high voltage (Level) will satisfy the gate condition, after the delay set with the Gate Delay key. When **NEGative** is selected, a negative-going edge (Edge) or a low voltage (Level) will satisfy the gate condition after the delay.

|                                    |                                                                                                                                                                                                                                                                                                                                                                                 |
|------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Example                            | <code>:SWE:EGAT:POL NEG</code><br><code>:SWE:EGAT:POL?</code>                                                                                                                                                                                                                                                                                                                   |
| Preset                             | <b>POSitive</b>                                                                                                                                                                                                                                                                                                                                                                 |
| State Saved                        | Saved in instrument state                                                                                                                                                                                                                                                                                                                                                       |
| Backwards<br>Compatibility<br>SCPI | <code>[ :SENSe]:SWEep:EGATe:POLarity NEGative   POSitive</code><br><code>[ :SENSe]:SWEep:EGATe:POLarity?</code><br><br>This backwards-compatibility command is available in Modes that support Gate Polarity parameter<br><code>[ :SENSe]:SWEep:TIME:GATE:POLarity</code><br><br>This backwards-compatibility command is available in SA and SCPI LC Modes<br>ESA compatibility |
| Preset                             | <b>HIGH</b>                                                                                                                                                                                                                                                                                                                                                                     |
| Backwards Compatibility            | <code>[ :SENSe]:SWEep:TIME:GATE:LEVel HIGH   LOW</code>                                                                                                                                                                                                                                                                                                                         |

---

|      |                                                     |
|------|-----------------------------------------------------|
| SCPI | <code>[ :SENSe ] :SWEep :TIME :GATE :LEVel ?</code> |
|      | ESA compatibility                                   |

## 8.4 Hardware-accelerated Stepped FFT Gating (Display only)

Enables or disables the hardware-accelerated stepped FFT gating feature:

- Enabling the Hardware Acceleration feature means that the Stepped FFT algorithm will run on the FPGA for configurations where speed improvements are possible
- Disabling the hardware-accelerated stepped FFT gating means the Stepped FFT software algorithm will always run on the CPU instead of the FPGA

When enabled, it is only used when applicable and determined by the current sweep configuration.

The default value is **ON**, and its value is power-on persistent.

|                |                                                                                                                                                                                  |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>[ :SENSe ]:SWEEp:EGATe:HACCeLerate:ENABle OFF   ON   0   1</code>                                                                                                          |
| Example        | <code>:SWEEp:EGATe:HACCeLerate:ENABle ON</code>                                                                                                                                  |
| Notes          | Value <b>ON</b> means the hardware accelerated stepped FFT gating is used intelligently<br>Value <b>OFF</b> means the hardware accelerated stepped FFT gating is always disabled |
| Dependencies   | Only valid in ACP, CHP and SEM measurements                                                                                                                                      |
| State Saved    | Saved in instrument state                                                                                                                                                        |

## 8.5 Periodic Sync Src

Contains controls that let you select and configure the sync signal for the **Periodic Timer** Trigger.

For convenience controls for adjusting the level and slope of the selected sync source are provided here. Note that these settings match those in the **Trigger** and **Gate Source** menus; that is, each trigger source has only one value of level and slope, regardless of which menu it is accessed from.

### 8.5.1 Select Periodic Timer Sync Source

Selects a signal source for you to synchronize your periodic timer trigger to, otherwise you are triggering at some arbitrary location in the frame. Synchronization reduces the precision requirements on the setting of the period.

Note that, with Sync Source **OFF**, the timing will drift unless the signal source frequency is locked to the instrument frequency reference.

| Remote Command                    | <code>:TRIGger[:SEquence]:FRAMe:SYNC EXTeRnal1   EXTeRnal2   RFBurst   PXI   INTernal   OFF</code><br><code>:TRIGger[:SEquence]:FRAMe:SYNC?</code>                                                                                                                                                                                                                   |  |      |       |                                   |                |            |            |
|-----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|------|-------|-----------------------------------|----------------|------------|------------|
| Example                           | <code>:TRIG:FRAM:SYNC EXT1</code><br><code>:TRIG:FRAM:SYNC EXT2</code><br><code>:TRIG:FRAM:SYNC RFB</code><br><code>:TRIG:FRAM:SYNC OFF</code>                                                                                                                                                                                                                       |  |      |       |                                   |                |            |            |
| Dependencies                      | <p><b>PXI</b> and <b>INTernal</b> triggers are only found in modular analyzers such as VXT</p> <p>Not available in E7760 or UXM</p> <p>In some models, there is no second External input. In these models, the External 2 selection is not shown, and the <b>EXTeRnal2</b> parameter generates a “Hardware missing; Not available for this model number” message</p> |  |      |       |                                   |                |            |            |
| Preset                            | <table><tr><th>Mode</th><th>Value</th></tr><tr><td>GSM/EDGE, LTEAFDD, LTEATDD, 5G NR</td><td><b>RFBurst</b></td></tr><tr><td>All others</td><td><b>OFF</b></td></tr></table>                                                                                                                                                                                         |  | Mode | Value | GSM/EDGE, LTEAFDD, LTEATDD, 5G NR | <b>RFBurst</b> | All others | <b>OFF</b> |
| Mode                              | Value                                                                                                                                                                                                                                                                                                                                                                |  |      |       |                                   |                |            |            |
| GSM/EDGE, LTEAFDD, LTEATDD, 5G NR | <b>RFBurst</b>                                                                                                                                                                                                                                                                                                                                                       |  |      |       |                                   |                |            |            |
| All others                        | <b>OFF</b>                                                                                                                                                                                                                                                                                                                                                           |  |      |       |                                   |                |            |            |
| State Saved                       | Saved in instrument state                                                                                                                                                                                                                                                                                                                                            |  |      |       |                                   |                |            |            |
| Backwards Compatibility SCPI      | <code>:TRIGger[:SEquence]:FRAMe:SYNC EXTeRnal</code><br>For backwards-compatibility, the parameter <b>EXTeRnal</b> is mapped to <b>EXTeRnal1</b>                                                                                                                                                                                                                     |  |      |       |                                   |                |            |            |

## 8.6 Auto/Holdoff

Contains controls that let you adjust Auto Trigger and Trigger Holdoff parameters

This tab does not appear in Spectrum Analyzer Mode in VXT models M9420A/21A.

### 8.6.1 Trig Holdoff

Sets the holdoff time between triggers. When the trigger condition is satisfied, the trigger occurs, the delay begins, and the holdoff time begins. New trigger conditions will be ignored until the holdoff time expires. For a free-running trigger, the holdoff value is the minimum time between triggers.

| Remote Command                                               | <code>:TRIGger[:SEquence]:HOLDoff &lt;time&gt;</code><br><code>:TRIGger[:SEquence]:HOLDoff?</code>                                                                                                                                                                                                                              |  |                                                      |        |                     |       |                 |       |       |      |                                                              |      |            |        |
|--------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|------------------------------------------------------|--------|---------------------|-------|-----------------|-------|-------|------|--------------------------------------------------------------|------|------------|--------|
| Example                                                      | <code>:TRIG:HOLD:STAT ON</code><br><code>:TRIG:HOLD 100 ms</code>                                                                                                                                                                                                                                                               |  |                                                      |        |                     |       |                 |       |       |      |                                                              |      |            |        |
| Dependencies                                                 | Unavailable if the selected Input is <b>BBIQ</b> . If this is the case, the control is grayed-out if it is pressed the informational message “Feature not supported for this Input” is displayed. If the SCPI command is sent, the error “Settings conflict; Feature not supported for this Input” is generated                 |  |                                                      |        |                     |       |                 |       |       |      |                                                              |      |            |        |
| Preset                                                       | <table><tr><th>Mode</th><th>Value</th></tr><tr><td>GSM/EDGE, Bluetooth</td><td>10 μs</td></tr><tr><td>LTEATDD,LTEAFDD</td><td>19 ms</td></tr><tr><td>5G NR</td><td>4 ms</td></tr><tr><td>WLAN on VXT models M9410A/11A/15A/16A and M9410E/11E/15E/16E</td><td>2 us</td></tr><tr><td>All others</td><td>100 ms</td></tr></table> |  | Mode                                                 | Value  | GSM/EDGE, Bluetooth | 10 μs | LTEATDD,LTEAFDD | 19 ms | 5G NR | 4 ms | WLAN on VXT models M9410A/11A/15A/16A and M9410E/11E/15E/16E | 2 us | All others | 100 ms |
| Mode                                                         | Value                                                                                                                                                                                                                                                                                                                           |  |                                                      |        |                     |       |                 |       |       |      |                                                              |      |            |        |
| GSM/EDGE, Bluetooth                                          | 10 μs                                                                                                                                                                                                                                                                                                                           |  |                                                      |        |                     |       |                 |       |       |      |                                                              |      |            |        |
| LTEATDD,LTEAFDD                                              | 19 ms                                                                                                                                                                                                                                                                                                                           |  |                                                      |        |                     |       |                 |       |       |      |                                                              |      |            |        |
| 5G NR                                                        | 4 ms                                                                                                                                                                                                                                                                                                                            |  |                                                      |        |                     |       |                 |       |       |      |                                                              |      |            |        |
| WLAN on VXT models M9410A/11A/15A/16A and M9410E/11E/15E/16E | 2 us                                                                                                                                                                                                                                                                                                                            |  |                                                      |        |                     |       |                 |       |       |      |                                                              |      |            |        |
| All others                                                   | 100 ms                                                                                                                                                                                                                                                                                                                          |  |                                                      |        |                     |       |                 |       |       |      |                                                              |      |            |        |
| State Saved                                                  | Saved in instrument state                                                                                                                                                                                                                                                                                                       |  |                                                      |        |                     |       |                 |       |       |      |                                                              |      |            |        |
| Min                                                          | 0 s                                                                                                                                                                                                                                                                                                                             |  |                                                      |        |                     |       |                 |       |       |      |                                                              |      |            |        |
| Max                                                          | <table><tr><td>VXT models M9410A/11A/15A/16A and M9410E/11E/15E/16E</td><td>2.86 s</td></tr><tr><td>All others</td><td>0.5 s</td></tr></table>                                                                                                                                                                                  |  | VXT models M9410A/11A/15A/16A and M9410E/11E/15E/16E | 2.86 s | All others          | 0.5 s |                 |       |       |      |                                                              |      |            |        |
| VXT models M9410A/11A/15A/16A and M9410E/11E/15E/16E         | 2.86 s                                                                                                                                                                                                                                                                                                                          |  |                                                      |        |                     |       |                 |       |       |      |                                                              |      |            |        |
| All others                                                   | 0.5 s                                                                                                                                                                                                                                                                                                                           |  |                                                      |        |                     |       |                 |       |       |      |                                                              |      |            |        |

#### Auto Function

|                |                                                                                                                    |
|----------------|--------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:TRIGger[:SEquence]:HOLDoff:STATe OFF   ON   0   1</code><br><code>:TRIGger[:SEquence]:HOLDoff:STATe?</code> |
|----------------|--------------------------------------------------------------------------------------------------------------------|



| Preset | Mode                | Value |
|--------|---------------------|-------|
|        | GSM/EDGE, Bluetooth | ON    |
|        | All others          | OFF   |

### 8.6.2 Auto Trig

Sets the time that the instrument will wait for the trigger conditions to be met. If they are not met after that much time, then the instrument is triggered anyway.

|                |                                                                                                                                                                                                                                                          |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:TRIGger[:SEquence]:ATRigger &lt;time&gt;</code><br><code>:TRIGger[:SEquence]:ATRigger?</code>                                                                                                                                                     |
| Example        | <code>:TRIG:ATR:STAT ON</code><br><code>:TRIG:ATR 100 ms</code>                                                                                                                                                                                          |
| Notes          | The "time that the instrument will wait" starts when the instrument is ready for a trigger, which may be hundreds of ms after the data acquisition for a sweep is done. The "time" ends when the trigger condition is satisfied, not when the delay ends |
| Dependencies   | Not available in Real Time Spectrum Analyzer Mode                                                                                                                                                                                                        |
| Preset         | Off, 100 ms                                                                                                                                                                                                                                              |
| State Saved    | Saved in instrument state                                                                                                                                                                                                                                |
| Min            | 1 ms                                                                                                                                                                                                                                                     |
| Max            | 100 s                                                                                                                                                                                                                                                    |
| Auto Function  |                                                                                                                                                                                                                                                          |
| Remote Command | <code>:TRIGger[:SEquence]:ATRigger:STATe OFF   ON   0   1</code><br><code>:TRIGger[:SEquence]:ATRigger:STATe?</code>                                                                                                                                     |
| Preset         | OFF                                                                                                                                                                                                                                                      |

### 8.6.3 Holdoff Type

Lets you set the Trigger **Holdoff Type**.

|      |                                                                                                                                                                                                                                                                                                                                                                                       |
|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| NOTE | <b>Holdoff Type</b> is not supported by all measurements. If the current measurement does not support it, this control does not appear, and <b>Holdoff Type</b> is Normal. If <b>Holdoff Type</b> SCPI is sent while in such a measurement, the SCPI is accepted and the setting remembered, but it has no effect until a measurement is in force that supports <b>Holdoff Type</b> . |
|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Trigger Holdoff Type functionality

|               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>NORMa1</b> | This is the “oscilloscope” type of trigger holdoff and is the setting when the <b>Holdoff Type</b> control does not appear. In this type of holdoff, no new trigger will be accepted until the holdoff interval has expired after the previous trigger                                                                                                                                                                                                                                                                    |
| <b>ABOVe</b>  | If the trigger slope is positive, a trigger event is generated only if the signal characteristic of interest crosses the trigger threshold (with positive slope) and then remains above the threshold for at least the holdoff time. For negative slope, the trigger event is generated if the signal characteristic crosses the threshold (with negative slope) after having been above the threshold for at least the holdoff time. In either case, the trigger event is associated with the time the level was crossed |
| <b>BELOW</b>  | If the trigger slope is positive, a trigger event is generated only if the signal characteristic of interest crosses the trigger threshold (with positive slope) after having been below the threshold for at least the holdoff time. For negative slope, the trigger event is generated if the signal characteristic crosses the threshold (with negative slope) and then remains below the threshold for at least the holdoff time. In either case, the trigger event is associated with the time the level was crossed |

|                |                                                                                              |  |         |
|----------------|----------------------------------------------------------------------------------------------|--|---------|
| Remote Command | :TRIGger[:SEquence]:HOLDoff:TYPE NORMa1   ABOVe   BELOW<br>:TRIGger[:SEquence]:HOLDoff:TYPE? |  |         |
| Example        | :TRIG:HOLD:TYPE NORM                                                                         |  |         |
| Preset         | Modes                                                                                        |  | Setting |
|                | GSM/EDGE                                                                                     |  | BELOW   |
|                | Bluetooth                                                                                    |  |         |
|                | WLAN on VXT models M9410A/11A/15A/16A and M9410E/11E/15E/16E                                 |  |         |
|                | All others                                                                                   |  | NORMa1  |
| State Saved    | Saved in instrument state                                                                    |  |         |

## 9 Programming the Instrument

This section provides information about the instrument's SCPI programming interface. You can also operate the instrument remotely using some legacy programming languages by running the N9061C Remote Language Compatibility measurement application and the N9062C SCPI Language Compatibility measurement application.

## 9.1 List of Supported SCPI Commands

The SCPI commands available while using this application are listed below.

To find a command in the list, search according to its first alphanumeric character, ignoring any leading ":" or "[" characters. The sole exception to this is the asterisk [\*] prefix, identifying IEEE 488.2 Common commands and queries; all these appear at the start of the list.

Note that most commands also have query forms. In cases where a command and its query are described in the same topic, the list below includes the command and query as a *single* item, with no suffix.

| Suffix    | Interpretation                                                                                        |
|-----------|-------------------------------------------------------------------------------------------------------|
| No suffix | Command & Query, <i>or</i> Command only<br>For details, click the link to view the command definition |
| ?         | Query only                                                                                            |

\*

\*CAL  
\*CAL  
\*CLS  
\*ESE  
\*ESR?  
\*IDN?  
\*OPC  
\*OPT?  
\*RCL  
\*RST  
\*SAV  
\*SRE  
\*STB?  
\*TRG  
\*TST?  
\*WAI

C

CALCulate:CLIMits:FAIL?  
CALCulate:DATA<n>:COMPRESS?  
CALCulate:DATA[1]|2|...|6:PEAKs?  
CALCulate:FPOWer:POWer[1,2,...,999]?  
CALCulate:FPOWer:POWer[1,2,...,999]:CONFIgure  
CALCulate:FPOWer:POWer[1,2,...,999]:DEFine

```

CALCulate:FPOWer:POWer[1,2,...,999]:DEFine?
CALCulate:FPOWer:POWer[1,2,...,999]:FETCh?
CALCulate:FPOWer:POWer[1,2,...,999]:INITiate
CALCulate:FPOWer:POWer[1,2,...,999]:READ?
CALCulate:FPOWer:POWer[1,2,...,999]:READ1?
CALCulate:FPOWer:POWer[1,2,...,999]:READ2?
CALCulate:FPOWer:POWer[1,2,...,999]:RESet
CALCulate:LLINe[1]|2|...|4:TYPE
CALCulate[:NFIGure]:LLINe[1]|2|...|4:COUNt?
CALCulate[:NFIGure]:LLINe[1]|2|...|4:DELeTe
CALCulate:NFIGure:LLINe[1]|2|...|4:DISPlay
CALCulate:NFIGure:LLINe[1]|2|...|4:TRACe
CALCulate:NFIGure:LLINe:ALL:DELeTe
CALCulate:NFIGure:LLINe:TEST
CALCulate:NFIGure:MARKer[1]|2|...|12:MAXimum
CALCulate:NFIGure:MARKer[1]|2|...|12:MAXimum:LEFT
CALCulate:NFIGure:MARKer[1]|2|...|12:MAXimum:NEXT
CALCulate:NFIGure:MARKer[1]|2|...|12:MAXimum:RIGHT
CALCulate:NFIGure:MARKer[1]|2|...|12:MINimum
CALCulate:NFIGure:MARKer[1]|2|...|12:MODE
CALCulate:NFIGure:MARKer[1]|2|...|12:PTPeak
CALCulate:NFIGure:MARKer[1]|2|...|12:REFeRence
CALCulate:NFIGure:MARKer[1]|2|...|12:X
CALCulate:NFIGure:MARKer[1]|2|...|12:X:POSition
CALCulate:NFIGure:MARKer[1]|2|...|12:Y?
CALCulate:NFIGure:MARKer[1]|2|...|4:CPEak[:STATe]
CALCulate:NFIGure:MARKer[1]|2|...|4:TRACe
CALCulate:NFIGure:MARKer:AOff
CALCulate[:NFIGure]:MARKer:COMPatible
CALCulate:NFIGure:MARKer:COUPle[:STATe]
CALCulate:NFIGure:MARKer:SEARch:TYPE
CALCulate:NFIGure:MARKer:TABLE[:STATe]
CALCulate:UNCertainty:DUT
CALCulate:UNCertainty:DUT:GAIN
CALCulate:UNCertainty:DUT:MATCH[:INPut]
CALCulate:UNCertainty:DUT:MATCH[:INPut]:DISTriBution
CALCulate:UNCertainty:DUT:MATCH[:INPut]:SPEC:STYLE
CALCulate:UNCertainty:DUT:MATCH:OUTPut
CALCulate:UNCertainty:DUT:MATCH:OUTPut:DISTriBution
CALCulate:UNCertainty:DUT:MATCH:OUTPut:SPEC:STYLE
CALCulate:UNCertainty:DUT:NFIGure
CALCulate:UNCertainty:EXTeRnal:PREamp
CALCulate:UNCertainty:EXTeRnal:PREamp:GAIN
CALCulate:UNCertainty:EXTeRnal:PREamp:MATCH
CALCulate:UNCertainty:EXTeRnal:PREamp:MATCH:DISTriBution
CALCulate:UNCertainty:EXTeRnal:PREamp:MATCH:SPEC:STYLE
CALCulate:UNCertainty:EXTeRnal:PREamp:NFIGure?
CALCulate:UNCertainty:EXTeRnal:PREamp:NFIGure<value>
CALCulate:UNCertainty:INSTRument
CALCulate:UNCertainty:INSTRument:FREQuency
CALCulate:UNCertainty:INSTRument:GAIN

```

9 Programming the Instrument  
9.1 List of Supported SCPI Commands

CALCulate:UNCertainty:INSTrument:MATCH:DISTRibution?  
CALCulate:UNCertainty:INSTrument:MATCH[:INPut]  
CALCulate:UNCertainty:INSTrument:MATCH[:INPut]:DISTRibution  
CALCulate:UNCertainty:INSTrument:MATCH[:INPut]:SPEC:STYLE  
CALCulate:UNCertainty:INSTrument:MATCH:SPEC:STYLE?  
CALCulate:UNCertainty:INSTrument:NFE[:IMPRovement]  
CALCulate:UNCertainty:INSTrument:NFIGure  
CALCulate:UNCertainty:INSTrument:NFIGure:UNCertainty  
CALCulate:UNCertainty:INTernal?  
CALCulate:UNCertainty:PARAmeter:AUTO  
CALCulate:UNCertainty:PARAmeter:FREQuency:CENter:UPDate  
CALCulate:UNCertainty:PARAmeter:FREQuency:SElected  
CALCulate:UNCertainty:PARAmeter:FREQuency:SElected:UPDate  
CALCulate:UNCertainty:SOURce  
CALCulate:UNCertainty:SOURce:ENR  
CALCulate:UNCertainty:SOURce:FREQuency  
CALCulate:UNCertainty:SOURce:MATCH  
CALCulate:UNCertainty:SOURce:MATCH:DISTRibution  
CALCulate:UNCertainty:SOURce:MATCH:SPEC:STYLE  
CALCulate:UNCertainty:SWEEp:ARRay:USER|INTernal|UNCal?  
CALCulate:UNCertainty:SWEEp:PARAmeter  
CALCulate:UNCertainty:SWEEp:POINts  
CALCulate:UNCertainty:SWEEp:STARt  
CALCulate:UNCertainty:SWEEp:STOP  
CALCulate:UNCertainty:UNCal?  
CALCulate:UNCertainty:USER?  
CALibration[:ALL]  
CALibration[:ALL]:NPENding  
CALibration:AUTO  
CALibration:AUTO:ALERT  
CALibration:AUTO:MODE  
CALibration:AUTO:TIME:OFF?  
CALibration:DATA:BACKup  
CALibration:DATA:DEFault  
CALibration:DATA:INTernal:BACKup  
CALibration:DATA:INTernal:RESTore  
CALibration:DATA:RESTore  
CALibration:EMIXer  
CALibration:EXPIred  
CALibration:FREQuency:REFerence:COARse  
CALibration:FREQuency:REFerence:FINE  
CALibration:FREQuency:REFerence:MODE  
CALibration:INTernal:ASFRanges?  
CALibration:INTernal:ASFRanges:EXTend[:STATe]  
CALibration:INTernal:ASFRanges:FRANges  
CALibration:INTernal:ASFRanges[:STATe]  
CALibration:INTernal:EMPath  
CALibration:INTernal:FAST[:ALL]  
CALibration:INTernal:HBAND[:ALL]  
CALibration:INTernal:LBAND[:ALL]

```

CALibration:INTernal:LOLeakage
CALibration:INTernal:RECeiver[:ALL]
CALibration:INTernal:RRHead:AMPLitude
CALibration:INTernal:RRHead:AMPLitude:FAST
CALibration:INTernal:RRHead:IFCable
CALibration:INTernal:RRHead:LOPower
CALibration:INTernal:RRHead:LOSync
CALibration:INTernal:SOURce[:ALL]
CALibration:INTernal:SOURce[:ALL]:NPending
CALibration:INTernal:VXT:TRANSceiver
CALibration:IQ:FLATness:I
CALibration:IQ:FLATness:I|IBAR|Q|QBAR:TIME?
CALibration:IQ:FLATness:IBAR
CALibration:IQ:FLATness:Q
CALibration:IQ:FLATness:QBAR
CALibration:IQ:ISOLation
CALibration:IQ:ISOLation:TIME?
CALibration:IQ:PROBe:I
CALibration:IQ:PROBe:I|:TIME?
CALibration:IQ:PROBe:IBar
CALibration:IQ:PROBe:IBAR:TIME?
CALibration:IQ:PROBe:I:CLEar
CALibration:IQ:PROBe:Q
CALibration:IQ:PROBe:QBar
CALibration:IQ:PROBe:QBAR:TIME?
CALibration:IQ:PROBe:Q:CLEar
CALibration:IQ:PROBe:Q:TIME?
CALibration:NFLoor
CALibration:NRF
CALibration:NRF:NPending
CALibration:NRFSelector
CALibration:PDElay:CORRection
CALibration:PDElay:SOURce
CALibration:PRESelector
CALibration:REFerence:CLOCK?
CALibration:REFerence:CLOCK:END?
CALibration:REFerence:CLOCK:INITialize?
CALibration:RF
CALibration:RF:NPending
CALibration:RFSelector:ALERT
CALibration:RFSelector:CONDUCTed
CALibration:RFSelector:FULL
CALibration:RFSelector:ONLY
CALibration:RFSelector:RADiated
CALibration:RFSelector:SCHeduler:RECurrence
CALibration:RFSelector:SCHeduler:RECurrence:DAY
CALibration:RFSelector:SCHeduler:RECurrence:WEEK
CALibration:RFSelector:SCHeduler:STATe
CALibration:RFSelector:SCHeduler:TASK
CALibration:RFSelector:SCHeduler:TIME:NEXT?
CALibration:RFSelector:SCHeduler:TIME:START

```

9 Programming the Instrument  
9.1 List of Supported SCPI Commands

CALibration:RRHead:TDCorrection[:STATe]  
CALibration:TDS  
CALibration:TEMPerature:AGO?  
CALibration:TEMPerature:CURREnt?  
CALibration:TEMPerature:CURREnt:RRHead?  
CALibration:TEMPerature:CURREnt:RRHead:LO?  
CALibration:TEMPerature:INTernal:EMPath?  
CALibration:TEMPerature:INTernal:FAST?  
CALibration:TEMPerature:INTernal:HBAND?  
CALibration:TEMPerature:INTernal:LBAND?  
CALibration:TEMPerature:INTernal:LOLeakage?  
CALibration:TEMPerature:INTernal:RECeiver?  
CALibration:TEMPerature:INTernal:RRHead:AMPLitude?  
CALibration:TEMPerature:INTernal:RRHead:AMPLitude:FAST?  
CALibration:TEMPerature:INTernal:RRHead:IFCable?  
CALibration:TEMPerature:INTernal:RRHead:LOPower?  
CALibration:TEMPerature:INTernal:RRHead:LOSync?  
CALibration:TEMPerature:INTernal:SOURce?  
CALibration:TEMPerature:INTernal:VXT:TRANsceiver?  
CALibration:TEMPerature:LALL?  
CALibration:TEMPerature:LIF?  
CALibration:TEMPerature:LPReselector?  
CALibration:TEMPerature:LRF?  
CALibration:TEMPerature:MAXimum?  
CALibration:TEMPerature:MINimum?  
CALibration:TEMPerature:NFLoor?  
CALibration:TEMPerature:OLDest:SEConds?  
CALibration:TEMPerature:OLDest[:TEMPerature]?  
CALibration:TEMPerature:PDElay:SOURce?  
CALibration:TEMPerature:RFPSelector:LCONducted?  
CALibration:TEMPerature:RFPSelector:LRADiated?  
CALibration:TEMPerature:UPDown:CONVerter?  
CALibration:TEMPerature:UPDown:CONVerter:FAST?  
CALibration:TIME:ELAPsed:NFLoor?  
CALibration:TIME:INTernal:EMPath?  
CALibration:TIME:INTernal:FAST?  
CALibration:TIME:INTernal:HBAN?  
CALibration:TIME:INTernal:LBAND?  
CALibration:TIME:INTernal:LOLeakage?  
CALibration:TIME:INTernal:RECeiver?  
CALibration:TIME:INTernal:RRHead:AMPLitude?  
CALibration:TIME:INTernal:RRHead:AMPLitude:FAST?  
CALibration:TIME:INTernal:RRHead:IFCable?  
CALibration:TIME:INTernal:RRHead:LOPower?  
CALibration:TIME:INTernal:RRHead:LOSync?  
CALibration:TIME:INTernal:SOURce?  
CALibration:TIME:INTernal:VXT:TRANsceiver?  
CALibration:TIME:LALL?  
CALibration:TIME:LIF?  
CALibration:TIME:LPReselector?



CALibration:TIME:LRF?  
 CALibration:TIME:NFLoor?  
 CALibration:TIME:PDElay:SOURce?  
 CALibration:TIME:REfERENCE:CLOCK?  
 CALibration:TIME:RFPSelector:LCONducted?  
 CALibration:TIME:RFPSelector:LRADiated?  
 CALibration:TIME:UPDown:CONVerter?  
 CALibration:TIME:UPDown:CONVerter:FAST?  
 CALibration:UPDown:CONVerter  
 CALibration:UPDown:CONVerter  
 CALibration:UPDown:CONVerter:FAST  
 CALibration:YTF  
 CALibration:YTF:NPENDING  
 CONFigure?  
 CONFigure?  
 CONFigure:<measurement>[:NDEFault]  
 CONFigure:CATalog?  
 CONFigure:NFIGure  
 CONFigure:NFIGure  
 CONFigure:NFIGure:NDEFault

## D

DISPlay:ACTivefunc[:STATe]  
 DISPlay:ANNotation:MBAR[:STATe]  
 DISPlay:ANNotation:SCReen[:STATe]  
 DISPlay:ANNotation:TRACe[:STATe]  
 DISPlay:BACKlight  
 DISPlay:ENABLE  
 DISPlay:FSCReen[:STATe]  
 DISPlay:GRATICule[:STATe]  
 DISPlay:NFIGure:DATA:TRACe[1]|2  
 DISPlay:NFIGure:DATA:TRACe3  
 DISPlay:NFIGure:FORMat  
 DISPlay:NFIGure:FORMat  
 DISPlay:NFIGure:FORMat:AUTO  
 DISPlay:NFIGure:TRACe:<window>Y[:SCALE]:RLEVel  
 DISPlay:NFIGure:TRACe:COMBined[:STATe]  
 DISPlay:NFIGure:TRACe:GAIN:Y[:SCALE]:PDIVision  
 DISPlay:NFIGure:TRACe:GAIN:Y[:SCALE]:RPOSition  
 DISPlay:NFIGure:TRACe:METER:Y[:SCALE]:PDIVision  
 DISPlay:NFIGure:TRACe:NFACTOR:Y[:SCALE]:PDIVision  
 DISPlay:NFIGure:TRACe:NFACTOR:Y[:SCALE]:RPOSition  
 DISPlay:NFIGure:TRACe:NFIGure:Y[:SCALE]:PDIVision  
 DISPlay:NFIGure:TRACe:NFIGure:Y[:SCALE]:RPOSition  
 DISPlay:NFIGure:TRACe:PCOLD:Y[:SCALE]:PDIVision  
 DISPlay:NFIGure:TRACe:PCOLD:Y[:SCALE]:RPOSition  
 DISPlay:NFIGure:TRACe:PHOT:Y[:SCALE]:PDIVision  
 DISPlay:NFIGure:TRACe:PHOT:Y[:SCALE]:RPOSition

9 Programming the Instrument  
9.1 List of Supported SCPI Commands

DISPlay:NFIGure:TRACe:TEFFective:Y[:SCALE]:PDIVision  
DISPlay:NFIGure:TRACe:TEFFective:Y[:SCALE]:RPOSition  
DISPlay:NFIGure:TRACe:YFACTOR:Y[:SCALE]:PDIVision  
DISPlay:NFIGure:TRACe:YFACTOR:Y[:SCALE]:RPOSition  
DISPlay:NFIGure:VIEW[1]:WINDow[1]|2:TRACe:Y[:SCALE]:COUPle  
DISPlay:NFIGure:VIEW3:WINDow[1]:TRACe:Y[:SCALE]:COUPle  
DISPlay:THEME  
DISPlay:UINterface:CSIZE  
DISPlay:UINterface:HTABs  
DISPlay:UINterface:STAB  
DISPlay:UINterface:STFScreen  
DISPlay:UINterface:TYPE?  
DISPlay:WINDow[1]:ANNOtation[:ALL]

**F**

FETCh|MEASure|READ:NFIGure?  
FETCh|MEASure|READ:NFIGure[:ARRAY]  
[:DATA]:CORRected:NFIGure|NFACTOR|GAIN|TEFFective|PHOT|PCOLD?  
FETCh|MEASure|READ:NFIGure[:ARRAY][:DATA]:TCOLD?  
FETCh|MEASure|READ:NFIGure[:ARRAY]  
[:DATA]:UNCORRected:NFIGure|NFACTOR|YFACTOR|TEFFective|PHOT|PCOLD?  
FETCh|MEASure|READ:NFIGure:SCALAR  
[:DATA]:CORRected:NFIGure|NFACTOR|GAIN|TEFFective|PHOT|PCOLD?  
FETCh|MEASure|READ:NFIGure:SCALAR[:DATA]:TCOLD?  
FETCh|MEASure|READ:NFIGure:SCALAR  
[:DATA]:UNCORRected:NFIGure|NFACTOR|YFACTOR|TEFFective|PHOT|PCOLD?  
FETCh|READ[:NFIGure]:METer?  
FETCh|READ[:NFIGure]:METer:MINimum?  
FETCh:<measurement>[n]?  
FORMat:BORDER  
FORMat[:TRACe][:DATA]

**H**

HCOPy:ABORt  
HCOPy[:IMMediate]

**I**

INITiate:<measurement>  
INITiate:CONTinuous  
INITiate[:IMMediate]  
INITiate:NFIGure  
INITiate:REStart

INPut[1]:IQ[:I]:IMPedance  
INPut[1]:IQ:Q:IMPedance  
INPut:COUPling  
INPut:COUPling:I  
INPut:COUPling:Q  
INPut:FEXTender:CABLe:CORRection  
INPut:IMPedance:REFeRence  
INPut:IQ[:I]:DIFFerential  
INPut:IQ:MIRRored  
INPut:IQ:Q:DIFFerential  
INPut:OFFSet:I  
INPut:OFFSet:Q  
INSTRument:CATalog?  
INSTRument:CONFigure:<mode\_id>:<meas>  
INSTRument:COUPlE:SCReen:INPut  
INSTRument:DEFault  
INSTRument:NSElect  
INSTRument:SCReen:CATalog?  
INSTRument:SCReen:CREate  
INSTRument:SCReen:DELeTe  
INSTRument:SCReen:DELeTe:ALL  
INSTRument:SCReen:MULTiple?  
INSTRument:SCReen:MULTiple[:STATe]  
INSTRument:SCReen:ORientation  
INSTRument:SCReen:REName  
INSTRument:SCReen:SElect  
INSTRument:SCReen:STAB?  
INSTRument[:SElect]  
INSTRument[:SElect]  
INSTRument[:SElect]  
INSTRument[:SElect]  
INSTRument[:SElect]  
INSTRument[:SElect]  
INSTRument[:SElect]  
INSTRument:UNLoad

## L

LXI:IDENtify[:STATe]

## M

MEASure:<measurement>[n]?  
MMEMory:CATalog?  
MMEMory:CDIRectory  
MMEMory:COPI  
MMEMory:COPI:DEVIce  
MMEMory:DATA

9 Programming the Instrument  
9.1 List of Supported SCPI Commands

MMEMemory:DELeTe  
MMEMemory:HEADer:ID?  
MMEMemory:LOAD:CCORrection  
MMEMemory:LOAD:CORRection  
MMEMemory:LOAD:ENR  
MMEMemory:LOAD:FREQuency  
MMEMemory:LOAD:LIMit  
MMEMemory:LOAD:LIMit  
MMEMemory:LOAD:LOSS  
MMEMemory:LOAD:RTYPE  
MMEMemory:LOAD:SCONfig  
MMEMemory:LOAD:STATe  
MMEMemory:LOAD:TRACe  
MMEMemory:LOAD:TRACe:DATA  
MMEMemory:LOAD:TRACe:REGister  
MMEMemory:LOAD:VCORrection  
MMEMemory:MDIRectory  
MMEMemory:MOVE  
MMEMemory:RDIRectory  
MMEMemory:REGister:STATe:LABel  
MMEMemory:REGister:TRACe:LABel  
MMEMemory:RMEDia:LABel  
MMEMemory:RMEDia:LIST?  
MMEMemory:RMEDia:SIZE?  
MMEMemory:RMEDia:WProtect?  
MMEMemory:STORe:CORRection  
MMEMemory:STORe:ENR  
MMEMemory:STORe:FREQuency  
MMEMemory:STORe:LIMit  
MMEMemory:STORe:LIMit  
MMEMemory:STORe:LOSS  
MMEMemory:STORe:PSCFactor  
MMEMemory:STORe:PSCFactor  
MMEMemory:STORe:QSAVe  
MMEMemory:STORe:RESults  
MMEMemory:STORe:SCONfig  
MMEMemory:STORe:SCReen  
MMEMemory:STORe:SCReen:BLOCKed  
MMEMemory:STORe:SCReen:THEMe  
MMEMemory:STORe:STATe  
MMEMemory:STORe:TRACe  
MMEMemory:STORe:TRACe:REGister

O

OUTPut:ANALog  
OUTPut:ANALog:AUTO  
OUTPut:ANALog:SVIDeo  
OUTPut:AUX

```
OUTPut:AUX:AIF
OUTPut:AUX:IO
OUTPut:AUX:IO:DATA<n>
OUTPut:DBUS[1][:STATe]
OUTPut:DBUS2:DATA
OUTPut:DBUS2[:STATe]
OUTPut:EIF
OUTPut:EREference:OUTPut
OUTPut[:EXternal][:STATe]
OUTPut:IF2
OUTPut:IQ:OUTPut
OUTPut:MODulation[:STATe]
OUTPut:ROSCillator:LO:OUTPut
```

## R

```
READ:<measurement>[n]?
```

## S

```
[:SENSe]:AFINput[1]|2:COUPling
[:SENSe]:AFINput[1]|2:IMPedance
[:SENSe]:AFINput[1]|2:LOW
[:SENSe]:CCORrection:CSET:COMMeNt
[:SENSe]:CCORrection:CSET:ALL:DELeTe
[:SENSe]:CCORrection:CSET:DATA
[:SENSe]:CCORrection:CSET:DELeTe
[:SENSe]:CCORrection:CSET:DESCRiption
[:SENSe]:CCORrection:CSET:DIRection
[:SENSe]:CCORrection:CSET:PORT
[:SENSe]:CCORrection:CSET:SELeCt
[:SENSe]:CCORrection:CSET[:STATe]
[:SENSe]:CCORrection:CSET:X:SPACing
[:SENSe]:CCORrection:DATA?
[:SENSe]:CORRection:BTS[:RF]:GAIN
[:SENSe]:CORRection:CSET[1]|2|...|16:ANTenna[:UNIT]
[:SENSe]:CORRection:CSET[1]|2|...|16:COMMeNt
[:SENSe]:CORRection:CSET[1]|2|...|16:DATA
[:SENSe]:CORRection:CSET[1]|2|...|16:DATA:MERGe
[:SENSe]:CORRection:CSET[1]|2|...|16:DELeTe
[:SENSe]:CORRection:CSET[1]|2|...|16:DESCRiption
[:SENSe]:CORRection:CSET[1]|2|...|16:DIRection
[:SENSe]:CORRection:CSET[1]|2|...|16:RF:PORT
[:SENSe]:CORRection:CSET[1]|2|...|16[:STATe]
[:SENSe]:CORRection:CSET[1]|2|...|16:X:SPACing
[:SENSe]:CORRection:CSET:ALL:DELeTe
[:SENSe]:CORRection:CSET:ALL[:STATe]
[:SENSe]:CORRection:CSET:GRUp[1]|2|...|10:DATA
```

## 9 Programming the Instrument

### 9.1 List of Supported SCPI Commands

```
[ :SENSe]:CORRection:CSET:GROup:BReark
[ :SENSe]:CORRection:CSET:GROup:COMMeNt
[ :SENSe]:CORRection:CSET:GROup:DELeTe
[ :SENSe]:CORRection:CSET:GROup:DESCRiption
[ :SENSe]:CORRection:CSET:GROup:RELoad
[ :SENSe]:CORRection:CSET:GROup[:STATe]
[ :SENSe]:CORRection:IMPedance[:INPut][:MAGNitude]
[ :SENSe]:CORRection:IQ:I:ATTenuation
[ :SENSe]:CORRection:IQ:I:ATTenuation:RATio
[ :SENSe]:CORRection:IQ:I:GAIN
[ :SENSe]:CORRection:IQ[:I]:SKEW
[ :SENSe]:CORRection:IQ:Q:ATTenuation
[ :SENSe]:CORRection:IQ:Q:ATTenuation:RATio
[ :SENSe]:CORRection:IQ:Q:GAIN
[ :SENSe]:CORRection:IQ:Q:GAIN:COUPle
[ :SENSe]:CORRection:IQ:Q:SKEW
[ :SENSe]:CORRection:MS[:RF]:GAIN
[ :SENSe]:CORRection:SA[:RF]:GAIN
[ :SENSe]:FEED
[ :SENSe]:FEED:AFALign
[ :SENSe]:FEED:AFINput:PORT
[ :SENSe]:FEED:AREFeRence
[ :SENSe]:FEED:DATA
[ :SENSe]:FEED:DATA:STORe
[ :SENSe]:FEED:IQ:TYPE
[ :SENSe]:FEED[:RF]:PORT:INFormation?
[ :SENSe]:FEED[:RF]:PORT[:INPut]
[ :SENSe]:FEED:RF:PORT:OUTPut
[ :SENSe]:FEED:RF:PORT:TR:HPower:ATTenuator[:STATe]
[ :SENSe]:HDUPlex:PORT:INPut
[ :SENSe]:HDUPlex:PORT:OUTPut
[ :SENSe]:MIXer:BAND
[ :SENSe]:MIXer:BIAS
[ :SENSe]:MIXer:BIAS:STATe
[ :SENSe]:MIXer:CIFLoss
[ :SENSe]:MIXer:HARMonic
[ :SENSe]:MIXer:LODoubler
[ :SENSe]:MIXer:MPATH
[ :SENSe]:MIXer:TTYPE
[ :SENSe]:MIXer:TTYPE?
[ :SENSe]:MIXer:UIFFreq
[ :SENSe]:NFIGure:AVERage:COUNT
[ :SENSe]:NFIGure:AVERage[:STATe]
[ :SENSe]:NFIGure:BWIDth|BANDwidth[:RESolution]
[ :SENSe]:NFIGure:BWIDth|BANDwidth[:RESolution]:AUTO
[ :SENSe]:NFIGure:CALibration:CONDition?
[ :SENSe]:NFIGure:CALibration:DELeTe
[ :SENSe]:NFIGure:CALibration:INITiate
[ :SENSe]:NFIGure:CALibration:STATe
[ :SENSe]:NFIGure:CALibration:TYPE
```

```
[ :SENSe]:NFIGure:CALibration:USER:ATTenuation:MAXimum
[ :SENSe]:NFIGure:CALibration:USER:ATTenuation:MINimum
[ :SENSe]:NFIGure:CALibration:USER:RANGe:MAXimum
[ :SENSe]:NFIGure:CALibration:USER:RANGe:MINimum
[ :SENSe]:NFIGure:CORRection:ENR:AUTO[:STATe]
[ :SENSe]:NFIGure:CORRection:ENR:CALibration:TABLE:COUNT?
[ :SENSe]:NFIGure:CORRection:ENR:CALibration:TABLE:DATA
[ :SENSe]:NFIGure:CORRection:ENR:CALibration:TABLE:DATA:DELeTe
[ :SENSe]:NFIGure:CORRection:ENR:CALibration:TABLE:ID:DATA
[ :SENSe]:NFIGure:CORRection:ENR:CALibration:TABLE:Serial:DATA
[ :SENSe]:NFIGure:CORRection:ENR:CALibration:TABLE:SNS
[ :SENSe]:NFIGure:CORRection:ENR:COMMOn[:STATe]
[ :SENSe]:NFIGure:CORRection:ENR:MEASurement:TABLE:COUNT?
[ :SENSe]:NFIGure:CORRection:ENR:MEASurement:TABLE:DATA
[ :SENSe]:NFIGure:CORRection:ENR[:MEASurement]:TABLE:DATA:DELeTe
[ :SENSe]:NFIGure:CORRection:ENR:MEASurement:TABLE:ID:DATA
[ :SENSe]:NFIGure:CORRection:ENR:MEASurement:TABLE:Serial:DATA
[ :SENSe]:NFIGure:CORRection:ENR:MEASurement:TABLE:SNS
[ :SENSe]:NFIGure:CORRection:ENR:MODE
[ :SENSe]:NFIGure:CORRection:ENR:PREFeRence
[ :SENSe]:NFIGure:CORRection:ENR:SPOT
[ :SENSe]:NFIGure:CORRection:ENR:THOT
[ :SENSe]:NFIGure:CORRection:LOSS:BEFore|AFter:MODE
[ :SENSe]:NFIGure:CORRection:LOSS:BEFore|AFter:TABLE:COUNT?
[ :SENSe]:NFIGure:CORRection:LOSS:BEFore|AFter:TABLE:DATA
[ :SENSe]:NFIGure:CORRection:LOSS:BEFore|AFter:TABLE:DATA:DELeTe
[ :SENSe]:NFIGure:CORRection:LOSS:BEFore|AFter:VALue
[ :SENSe]:NFIGure:CORRection:SPOT:MODE
[ :SENSe]:NFIGure:CORRection:TCOLd
[ :SENSe]:NFIGure:CORRection:TCOLd:SNS[:STATe]
[ :SENSe]:NFIGure:CORRection:TCOLd:USER:SET
[ :SENSe]:NFIGure:CORRection:TCOLd:USER:VALue
[ :SENSe]:NFIGure:CORRection:TEMPerature:BEFore|AFter
[ :SENSe]:NFIGure:FREQuency:CENTer
[ :SENSe]:NFIGure:FREQuency:FIXed
[ :SENSe]:NFIGure:FREQuency:LIST
[ :SENSe]:NFIGure:FREQuency:LIST:DATA:DELeTe
[ :SENSe]:NFIGure:FREQuency:MODE
[ :SENSe]:NFIGure:FREQuency:SPAN
[ :SENSe]:NFIGure:FREQuency:STARt
[ :SENSe]:NFIGure:FREQuency:STARt
[ :SENSe]:NFIGure:FREQuency:STARt
[ :SENSe]:NFIGure:FREQuency:STARt
[ :SENSe]:NFIGure:FREQuency:STOP
[ :SENSe]:NFIGure:FREQuency:STOP
[ :SENSe]:NFIGure:FREQuency:STOP
[ :SENSe]:NFIGure:FREQuency:STOP
[ :SENSe]:NFIGure:MANual:ABORt
[ :SENSe]:NFIGure:MANual:CALibration:INITiate
[ :SENSe]:NFIGure:MANual:CONTinue
[ :SENSe]:NFIGure:MANual:MEASurement:INITiate
```

9 Programming the Instrument  
9.1 List of Supported SCPI Commands

```
[ :SENSe]:NFIGure:MODE:DOWNconv|UPConv:IF:FREQuency
[ :SENSe]:NFIGure:MODE:DOWNconv|UPConv:LOSCillator:FREQuency
[ :SENSe]:NFIGure:MODE:DOWNconv|UPConv:LOSCillator:OFFSet
[ :SENSe]:NFIGure:MODE:DOWNconv|UPConv:RF:FREQuency
[ :SENSe]:NFIGure:MODE:DUT
[ :SENSe]:NFIGure:MODE:DUT:LOSCillator
[ :SENSe]:NFIGure:MODE:FREQuency:CONText
[ :SENSe]:NFIGure:MODE:LOSCillator:DUT:COMManD:AUXiliary
[ :SENSe]:NFIGure:MODE:LOSCillator:DUT:COMManD:FREQuency:PREFix
[ :SENSe]:NFIGure:MODE:LOSCillator:DUT:COMManD:FREQuency:SUFFix
[ :SENSe]:NFIGure:MODE:LOSCillator:DUT:COMManD:POWEr:PREFix
[ :SENSe]:NFIGure:MODE:LOSCillator:DUT:COMManD:POWEr:SUFFix
[ :SENSe]:NFIGure:MODE:LOSCillator:DUT:CONTRol[:STATe]
[ :SENSe]:NFIGure:MODE:LOSCillator:DUT:PARAmeter:MAXimum
[ :FREQuency]
[ :SENSe]:NFIGure:MODE:LOSCillator:DUT:PARAmeter:MINimum
[ :FREQuency]
[ :SENSe]:NFIGure:MODE:LOSCillator:DUT:PARAmeter:MULTiplier:DENomi
nator
[ :SENSe]:NFIGure:MODE:LOSCillator:DUT:PARAmeter:MULTiplier:NUMera
tor
[ :SENSe]:NFIGure:MODE:LOSCillator:DUT:PARAmeter:POWEr[:LEVEl]
[ :SENSe]:NFIGure:MODE:LOSCillator:DUT:PARAmeter:SETTling[:TIME]
[ :SENSe]:NFIGure:MODE:LOSCillator:DUT:TYPE
[ :SENSe]:NFIGure:MODE:LOSCillator:SYSTem:COMManD:AUXiliary
[ :SENSe]:NFIGure:MODE:LOSCillator:SYSTem:COMManD:FREQuency:PREFix
[ :SENSe]:NFIGure:MODE:LOSCillator:SYSTem:COMManD:FREQuency:SUFFix
[ :SENSe]:NFIGure:MODE:LOSCillator:SYSTem:COMManD:POWEr:PREFix
[ :SENSe]:NFIGure:MODE:LOSCillator:SYSTem:COMManD:POWEr:SUFFix
[ :SENSe]:NFIGure:MODE:LOSCillator:SYSTem:CONTRol[:STATe]
[ :SENSe]:NFIGure:MODE:LOSCillator:SYSTem:PARAmeter:MAXimum
[ :FREQuency]
[ :SENSe]:NFIGure:MODE:LOSCillator:SYSTem:PARAmeter:MINimum
[ :FREQuency]
[ :SENSe]:NFIGure:MODE:LOSCillator:SYSTem:PARAmeter:MULTiplier:DEN
ominator
[ :SENSe]:NFIGure:MODE:LOSCillator:SYSTem:PARAmeter:MULTiplier:NUM
erator
[ :SENSe]:NFIGure:MODE:LOSCillator:SYSTem:PARAmeter:POWEr[:LEVEl]
[ :SENSe]:NFIGure:MODE:LOSCillator:SYSTem:PARAmeter:SETTling
[:TIME]
[ :SENSe]:NFIGure:MODE:LOSCillator:SYSTem:TYPE
[ :SENSe]:NFIGure:MODE:MCONverter:IF:FREQuency
[ :SENSe]:NFIGure:MODE:MCONverter:IF:FREQuency:START
[ :SENSe]:NFIGure:MODE:MCONverter:IF:FREQuency:STOP
[ :SENSe]:NFIGure:MODE:MCONverter:LOSCillator:FREQuency
[ :SENSe]:NFIGure:MODE:MCONverter:LOSCillator:FREQuency:START
[ :SENSe]:NFIGure:MODE:MCONverter:LOSCillator:FREQuency:STOP
[ :SENSe]:NFIGure:MODE:MCONverter:RF:FREQuency
[ :SENSe]:NFIGure:MODE:MCONverter:RF:FREQuency:START
```



```
[ :SENSe]:NFIGure:MODE:MCONverter:RF:FREQuency:STOP
[ :SENSe]:NFIGure:MODE:PROFile
[ :SENSe]:NFIGure:MODE:SYSTem:DOWNconv[:STATe]
[ :SENSe]:NFIGure:MODE:SYSTem:IF:FREQuency
[ :SENSe]:NFIGure:MODE:SYSTem:LOSCillator
[ :SENSe]:NFIGure:MODE:SYSTem:LOSCillator:FREQuency
[ :SENSe]:NFIGure:MODE:SYSTem:LOSCillator:OFFSet
[ :SENSe]:NFIGure:NSSTime
[ :SENSe]:NFIGure:PCHot:UNIT
[ :SENSe]:NFIGure:PCH:UNIT?
[ :SENSe]:NFIGure:POWer[:RF]:ATTenuation
[ :SENSe]:NFIGure:POWer[:RF]:GAIN:AUTO
[ :SENSe]:NFIGure:POWer[:RF]:GAIN[:STATe]
[ :SENSe]:NFIGure:PRESelector:OPTimize
[ :SENSe]:NFIGure:SWEp:POINts
[ :SENSe]:NFIGure:SWEp:POINts
[ :SENSe]:NFIGure:SWEp:TIME
[ :SENSe]:NFIGure:SWEp:TIME:AUTO
[ :SENSe]:POWer[:RF]:GAIN:LNA[:STATe]
[ :SENSe]:POWer[:RF]:RANGe
[ :SENSe]:POWer[:RF]:RANGe:MIXer:OFFSet
[ :SENSe]:POWer[:RF]:RANGe:OPTimize
[ :SENSe]:POWer[:RF]:RANGe:OPTimize:ATTenuation
[ :SENSe]:POWer[:RF]:RANGe:PARatio
[ :SENSe]:POWer[:RF]:RFPSelector:NFIltter[:STATe]
[ :SENSe]:POWer[:RF]:RFPSelector[:STATe]
[ :SENSe]:ROSCillator:BANDwidth
[ :SENSe]:ROSCillator:EXternal:FREQuency
[ :SENSe]:ROSCillator:EXternal:FREQuency:DEFault
[ :SENSe]:ROSCillator:LO:INPut
[ :SENSe]:ROSCillator:PXIReference:EXternal:FREQuency
[ :SENSe]:ROSCillator:PXIReference:EXternal:LOCK?
[ :SENSe]:ROSCillator:PXIReference:SElect
[ :SENSe]:ROSCillator:PXIReference:SOURce
[ :SENSe]:ROSCillator:SOURce?
[ :SENSe]:ROSCillator:SOURce:TYPE
[ :SENSe]:SIDentify:MODE
[ :SENSe]:SIDentify[:STATe]
[ :SENSe]:SWEp:EGATe:CONTRol
[ :SENSe]:SWEp:EGATe:DELay
[ :SENSe]:SWEp:EGATe:DELay:COMPensation:TYPE
[ :SENSe]:SWEp:EGATe:HACcelerate:ENABle
[ :SENSe]:SWEp:EGATe:HOLDoff
[ :SENSe]:SWEp:EGATe:HOLDoff:AUTO
[ :SENSe]:SWEp:EGATe:LENGth
[ :SENSe]:SWEp:EGATe:METHod
[ :SENSe]:SWEp:EGATe:SOURce
[ :SENSe]:SWEp:EGATe[:STATe]
[ :SENSe]:SWEp:EGATe:TIME
[ :SENSe]:SWEp:EGATe:VIEW
[ :SENSe]:SWEp:EGATe:VIEW:START
```

## 9 Programming the Instrument

### 9.1 List of Supported SCPI Commands

```

[:SENSe]:VCORection:DELeTe
[:SENSe]:VCORection:SELeCt
Service[:PRODUCTION]:SOURCE:MCONTROL:MPLicense[:STATE]
SOURCE:AM[:DEPTH][:LINEar]
SOURCE:AM:INTERNAL:FREQUENCY
SOURCE:AM:INTERNAL:FREQUENCY:STEP[:INCREMENT]
SOURCE:AM:STATE
SOURCE:FM[:DEVIation]
SOURCE:FM:INTERNAL:FREQUENCY
SOURCE:FM:INTERNAL:FREQUENCY:STEP[:INCREMENT]
SOURCE:FM:STATE
SOURCE:FREQUENCY:CHANNELS:BAND
SOURCE:FREQUENCY:CHANNELS:NUMBER
SOURCE:FREQUENCY:COUPLing
SOURCE:FREQUENCY:COUPLing:OFFSet
SOURCE:FREQUENCY[:CW]
SOURCE:FREQUENCY:OFFSet
SOURCE:FREQUENCY:REFerence
SOURCE:FREQUENCY:REFerence:SET
SOURCE:FREQUENCY:REFerence:STATE
SOURCE:FREQUENCY:STEP[:INCREMENT]
SOURCE:LIST:INITiation:ARMed?
SOURCE:LIST:NUMBER:STEPS
SOURCE:LIST:REPetition:TYPE
SOURCE:LIST:SETup:AMPLitude
SOURCE:LIST:SETup:CLEar
SOURCE:LIST:SETup:CNFRrequency
SOURCE:LIST:SETup:DURATION:TYPE
SOURCE:LIST:SETup:INPut:TRIGger
SOURCE:LIST:SETup:OUTPut:TRIGger
SOURCE:LIST:SETup:RADio:BAND
SOURCE:LIST:SETup:RADio:BAND:LINK
SOURCE:LIST:SETup:TOCount
SOURCE:LIST:SETup:TRANSition:TIME
SOURCE:LIST:SETup:WAVEform
SOURCE:LIST[:STATE]
SOURCE:LIST:STEP[1]|2|...|1000:SETup
SOURCE:LIST:STEP[1]|2|...|1000:SETup:AMPLitude
SOURCE:LIST:STEP[1]|2|...|1000:SETup:CNFRrequency
SOURCE:LIST:STEP[1]|2|...|1000:SETup:DURATION:TCOUNT
SOURCE:LIST:STEP[1]|2|...|1000:SETup:DURATION:TCOUNT
SOURCE:LIST:STEP[1]|2|...|1000:SETup:DURATION:TYPE
SOURCE:LIST:STEP[1]|2|...|1000:SETup:INPut:TRIGger
SOURCE:LIST:STEP[1]|2|...|1000:SETup:OUTPut:TRIGger
SOURCE:LIST:STEP[1]|2|...|1000:SETup:RADio:BAND
SOURCE:LIST:STEP[1]|2|...|1000:SETup:RADio:BAND:LINK
SOURCE:LIST:STEP[1]|2|...|1000:SETup:TRANSition:TIME
SOURCE:LIST:STEP[1]|2|...|1000:SETup:WAVEform
SOURCE:LIST:TRIGger[:IMMediate]
SOURCE:LIST:TRIGger:INITiate[:IMMediate]

```

```

SOURce:LIST:TRIGger:OUTPut:TYPE
SOURce:LIST:TRIGger:OUTPut:TYPE:MARKer
SOURce:NFIGure:NOISe:StAtE
SOURce:PM[:DEVIation]
SOURce:PM:INTernal:FREQuency
SOURce:PM:INTernal:FREQuency:STEP[:INCRement]
SOURce:PM:StAtE
SOURce:POWer[:LEVel][:IMMediate][:AMPLitude]
SOURce:POWer[:LEVel][:IMMediate][:AMPLitude]:UNIT
SOURce:POWer[:LEVel][:IMMediate]:OFFSet
SOURce:POWer:REFErence
SOURce:POWer:REFErence:StAtE
SOURce:POWer:STEP[:INCRement]
SOURce:PRESet
SOURce:RADio:ARB:BASEband:FREQuency:OFFSet
SOURce:RADio:ARB:BASEband:POWer
SOURce:RADio:ARB:CATalog?
SOURce:RADio:ARB:CATalog?
SOURce:RADio:ARB:DEFault:DIRectory
SOURce:RADio:ARB:DELeTe
SOURce:RADio:ARB:DELeTe:ALL
SOURce:RADio:ARB:FCATalog?
SOURce:RADio:ARB:FCATalog?
SOURce:RADio:ARB:HEADer:CLEAr
SOURce:RADio:ARB:HEADer:INFormation?
SOURce:RADio:ARB:HEADer:SAVE
SOURce:RADio:ARB:IQADjustment:DELay
SOURce:RADio:ARB:IQADjustment:GAIN
SOURce:RADio:ARB:IQADjustment:[StAtE]
SOURce:RADio:ARB:LOAD
SOURce:RADio:ARB:LOAD:ALL
SOURce:RADio:ARB:MARKer:CLEAr
SOURce:RADio:ARB:MDEStination:ALCHold
SOURce:RADio:ARB:MDEStination:PULSe
SOURce:RADio:ARB:MPLicensed:NAME:LOCKed?
SOURce:RADio:ARB:MPLicensed:UID:LOCKed?
SOURce:RADio:ARB:MPOLarity:MARKer1|...|4
SOURce:RADio:ARB:NR5G:PHASe:FILTer:BANDwidth
SOURce:RADio:ARB:NR5G:PHASe:FILTer[:StAtE]
SOURce:RADio:ARB:NR5G:PHASe:SCS
SOURce:RADio:ARB:NR5G:PHASe[:StAtE]
SOURce:RADio:ARB:RETRigger
SOURce:RADio:ARB:RMS
SOURce:RADio:ARB:RMS:CALCulate
SOURce:RADio:ARB:RMS:CALCulation:MODE
SOURce:RADio:ARB:RSCaling
SOURce:RADio:ARB:SCLock:RATE
SOURce:RADio:ARB:SEQuence[:MWAVEform]
SOURce:RADio:ARB:SEQuence:SYNC
SOURce:RADio:ARB[:StAtE]
SOURce:RADio:ARB:TRIGger:INITiate

```

## 9 Programming the Instrument

### 9.1 List of Supported SCPI Commands

SOURce:RADio:ARB:TRIGger[:SOURce]  
SOURce:RADio:ARB:TRIGger[:SOURce]:EXternal:DElay  
SOURce:RADio:ARB:TRIGger[:SOURce]:EXternal:DElay:STATe  
SOURce:RADio:ARB:TRIGger[:SOURce]:EXternal:SLOPe  
SOURce:RADio:ARB:TRIGger[:SOURce]:PXI:DElay  
SOURce:RADio:ARB:TRIGger[:SOURce]:PXI:DElay:STATe  
SOURce:RADio:ARB:TRIGger[:SOURce]:PXI:LINE  
SOURce:RADio:ARB:TRIGger[:SOURce]:PXI:SLOPe  
SOURce:RADio:ARB:TRIGger:SYNC[:STATe]  
SOURce:RADio:ARB:TRIGger:TYPE  
SOURce:RADio:ARB:TRIGger:TYPE:CONTinuous[:TYPE]  
SOURce:RADio:ARB:TRIGger:TYPE:SADVance[:TYPE]  
SOURce:RADio:ARB:WAVEform  
SOURce:RADio:BAND:LINK  
SOURce:SYNC:CONFig  
SOURce:SYNC:CONNEcted?  
SOURce:SYNC:REMOte:ADDReSS  
SOURce:SYNC:REMOte:ADDReSS:ADD  
SOURce:SYNC:REMOte:ADDReSS:DELeTe  
SOURce:SYNC:REMOte:IPPort  
SOURce:SYNC:REMOte:SEC<integer>?  
SOURce:SYNC:REMOte:SECOndary<integer>  
SOURce:SYNC:RTSetting:STATe  
SOURce:SYNC:SETTings:ENABle  
SOURce:SYNC:SETTings:SEGment2:ENABle  
SOURce:SYNC:SETTings:SEGment2:FREQuency  
SOURce:SYNC:START  
SOURce:SYNC:STOP  
SOURce:SYNC:TYPE  
STATus:OPERation:CONDItion?  
STATus:OPERation:ENABle  
STATus:OPERation[:EVENT]?  
STATus:OPERation:INSTrument:CONDItion?  
STATus:OPERation:INSTrument:ENABle  
STATus:OPERation:INSTrument[:EVENT]?  
STATus:OPERation:INSTrument:NTRansition  
STATus:OPERation:INSTrument:PTRansition  
STATus:OPERation:NTRansition  
STATus:OPERation:PTRansition  
STATus:PRESet  
STATus:QUESTionable:CALibration:CONDItion?  
STATus:QUESTionable:CALibration:ENABle  
STATus:QUESTionable:CALibration[:EVENT]?  
STATus:QUESTionable:CALibration:EXTended:FAILure:CONDItion?  
STATus:QUESTionable:CALibration:EXTended:FAILure:ENABle  
STATus:QUESTionable:CALibration:EXTended:FAILure[:EVENT]?  
STATus:QUESTionable:CALibration:EXTended:FAILure:NTRansition  
STATus:QUESTionable:CALibration:EXTended:FAILure:PTRansition  
STATus:QUESTionable:CALibration:EXTended:NEEDed:CONDItion?  
STATus:QUESTionable:CALibration:EXTended:NEEDed:ENABle

```

STATus:QUESTionable:CALibration:EXTended:NEEDed[:EVENT]?
STATus:QUESTionable:CALibration:EXTended:NEEDed:NTRansition
STATus:QUESTionable:CALibration:EXTended:NEEDed:PTRansition
STATus:QUESTionable:CALibration:NTRansition
STATus:QUESTionable:CALibration:PTRansition
STATus:QUESTionable:CALibration:SKIPped:CONDition?
STATus:QUESTionable:CALibration:SKIPped:ENABle
STATus:QUESTionable:CALibration:SKIPped[:EVENT]?
STATus:QUESTionable:CALibration:SKIPped:NTRansition
STATus:QUESTionable:CALibration:SKIPped:PTRansition
STATus:QUESTionable:CONDition?
STATus:QUESTionable:ENABle
STATus:QUESTionable[:EVENT]?
STATus:QUESTionable:FREQuency:CONDition?
STATus:QUESTionable:FREQuency:ENABle
STATus:QUESTionable:FREQuency[:EVENT]?
STATus:QUESTionable:FREQuency:NTRansition
STATus:QUESTionable:FREQuency:PTRansition
STATus:QUESTionable:INTEgrity:CONDition?
STATus:QUESTionable:INTEgrity:ENABle
STATus:QUESTionable:INTEgrity[:EVENT]?
STATus:QUESTionable:INTEgrity:NTRansition
STATus:QUESTionable:INTEgrity:OUTPut:CONDition?
STATus:QUESTionable:INTEgrity:OUTPut:ENABle
STATus:QUESTionable:INTEgrity:OUTPut[:EVENT]?
STATus:QUESTionable:INTEgrity:OUTPut:NTRansition
STATus:QUESTionable:INTEgrity:OUTPut:PTRansition
STATus:QUESTionable:INTEgrity:PTRansition
STATus:QUESTionable:INTEgrity:SIGNAL:CONDition?
STATus:QUESTionable:INTEgrity:SIGNAL:ENABle
STATus:QUESTionable:INTEgrity:SIGNAL[:EVENT]?
STATus:QUESTionable:INTEgrity:SIGNAL:NTRansition
STATus:QUESTionable:INTEgrity:SIGNAL:PTRansition
STATus:QUESTionable:INTEgrity:UNCalibrated:CONDition?
STATus:QUESTionable:INTEgrity:UNCalibrated:ENABle
STATus:QUESTionable:INTEgrity:UNCalibrated[:EVENT]?
STATus:QUESTionable:INTEgrity:UNCalibrated:NTRansition
STATus:QUESTionable:INTEgrity:UNCalibrated:PTRansition
STATus:QUESTionable:NTRansition
STATus:QUESTionable:POWER:CONDition?
STATus:QUESTionable:POWER:ENABle
STATus:QUESTionable:POWER[:EVENT]?
STATus:QUESTionable:POWER:NTRansition
STATus:QUESTionable:POWER:PTRansition
STATus:QUESTionable:POWER:PTRansition?>
STATus:QUESTionable:PTRansition
STATus:QUESTionable:TEMPerature:CONDition?
STATus:QUESTionable:TEMPerature:ENABle
STATus:QUESTionable:TEMPerature[:EVENT]?
STATus:QUESTionable:TEMPerature:NTRansition
STATus:QUESTionable:TEMPerature:PTRansition

```

## 9 Programming the Instrument

### 9.1 List of Supported SCPI Commands

```
SYSTem:APPLication:CATalog[:NAME]?
SYSTem:APPLication:CATalog[:NAME]:COUNT?
SYSTem:APPLication:CATalog:OPTion?
SYSTem:APPLication:CATalog:REVision?
SYSTem:APPLication[:CURRent][:NAME]?
SYSTem:APPLication[:CURRent]:OPTion?
SYSTem:APPLication[:CURRent]:REVision?
SYSTem:APPLication:LOADed?
SYSTem:CALibration:ABORt
SYSTem:CALibration:CGRoup
SYSTem:CALibration:CGRoup:APPLy
SYSTem:CALibration:CGRoup:APPLy:AOFF
SYSTem:CALibration:CGRoup:COPIY
SYSTem:CALibration:CGRoup:COPIY:FROM
SYSTem:CALibration:DELeTe:ALL
SYSTem:CALibration:DESCRiption
SYSTem:CALibration:FREQuency:OFFSet
SYSTem:CALibration:INITiate:SELeCted
SYSTem:CALibration:INPUt
SYSTem:CALibration:MODUle[1]|2|...|10:SNUMber?
SYSTem:CALibration:MODUle:SELeCt
SYSTem:CALibration:REFerence
SYSTem:CALibration:ROW[1]|2|...|100:APPLy:STATe
SYSTem:CALibration:ROW[1]|2|...|100:ATTenuation:START
SYSTem:CALibration:ROW[1]|2|...|100:ATTenuation:STEP
SYSTem:CALibration:ROW[1]|2|...|100:ATTenuation:STOP
SYSTem:CALibration:ROW[1]|2|...|100:ATTenuation:TYPE
SYSTem:CALibration:ROW[1]|2|...|100:CALibrate:STATe
SYSTem:CALibration:ROW[1]|2|...|100:CAPPLied?
SYSTem:CALibration:ROW[1]|2|...|100:COUPLing
SYSTem:CALibration:ROW[1]|2|...|100:DELeTe
SYSTem:CALibration:ROW[1]|2|...|100:DUPLicate
SYSTem:CALibration:ROW[1]|2|...|100:EATTenuation:START
SYSTem:CALibration:ROW[1]|2|...|100:EATTenuation:STEP
SYSTem:CALibration:ROW[1]|2|...|100:EATTenuation:STOP
SYSTem:CALibration:ROW[1]|2|...|100:EATTenuation:TYPE
SYSTem:CALibration:ROW[1]|2|...|100:FATTenuation:START
SYSTem:CALibration:ROW[1]|2|...|100:FATTenuation:STOP
SYSTem:CALibration:ROW[1]|2|...|100:FATTenuation:TYPE
SYSTem:CALibration:ROW[1]|2|...|100:FEATTenuation:START
SYSTem:CALibration:ROW[1]|2|...|100:FEATTenuation:STEP
SYSTem:CALibration:ROW[1]|2|...|100:FEATTenuation:STOP
SYSTem:CALibration:ROW[1]|2|...|100:FEATTenuation:TYPE
SYSTem:CALibration:ROW[1]|2|...|100:FREQuency:POINts
SYSTem:CALibration:ROW[1]|2|...|100:FREQuency:START
SYSTem:CALibration:ROW[1]|2|...|100:FREQuency:STEP
SYSTem:CALibration:ROW[1]|2|...|100:FREQuency:STOP
SYSTem:CALibration:ROW[1]|2|...|100:FREQuency:SYNThesis:ALL[:STATe]
SYSTem:CALibration:ROW[1]|2|...|100:FREQuency:SYNThesis[:STATe]
SYSTem:CALibration:ROW[1]|2|...|100:IF:GAIN[:STATe]?
```



```

SYSTem:CALibration:ROW[1]|2|...|100:IF:GAIN
[:STATe]AUTO|HIGH|LOW|ALL
SYSTem:CALibration:ROW[1]|2|...|100:IF:PATH
SYSTem:CALibration:ROW[1]|2|...|100:INSert
SYSTem:CALibration:ROW[1]|2|...|100:LAST?
SYSTem:CALibration:ROW[1]|2|...|100:LO:MMode
SYSTem:CALibration:ROW[1]|2|...|100:MATCH[:STATe]
SYSTem:CALibration:ROW[1]|2|...|100:NAME
SYSTem:CALibration:ROW[1]|2|...|100:POWer:GAIN:BAND?
SYSTem:CALibration:ROW[1]|2|...|100:POWer[:RF]:GAIN:BAND
SYSTem:CALibration:ROW[1]|2|...|100:POWer[:RF]:GAIN:LNA[:STATe]
SYSTem:CALibration:ROW[1]|2|...|100:POWer[:RF]:MW:PATH
SYSTem:CALibration:ROW[1]|2|...|100:STATus?
SYSTem:CALibration:ROW[1]|2|...|100:TSMultiplier
SYSTem:CALibration:ROW[1]|2|...|100:TYPE
SYSTem:CALibration:ROW[1]|2|...|100:UCMeas
SYSTem:CALibration:STATus:ALL?
SYSTem:CALibration:TUNE:FREQuency
SYSTem:CALibration:TUNE:OUTput[:STATe]
SYSTem:CALibration:TUNE:REFeRence
SYSTem:CALibration:TUNE[:SELeCted]
SYSTem:CALibration:TUNE:SPACing
SYSTem:CALibration:TUNE:TYPE
SYSTem:COMMunicate:GPIB[1][:SELf]:ADDReSS
SYSTem:COMMunicate:GPIB[1][:SELf]:CONTRoller[:ENABle]
SYSTem:COMMunicate:LAN:INSTrument:PORT?
SYSTem:COMMunicate:LAN:IPV4:CONFig
SYSTem:COMMunicate:LAN:IPV6:CONFig
SYSTem:COMMunicate:LAN:MULTiple:NIC:ENABled?
SYSTem:COMMunicate:LAN:PHYSical:IPAdDress:LIST?
SYSTem:COMMunicate:LAN:SCPI:EOSession:DCLEAr:ENABle
SYSTem:COMMunicate:LAN:SCPI:HISLip:ENABle
SYSTem:COMMunicate:LAN:SCPI:SIcL:ENABle
SYSTem:COMMunicate:LAN:SCPI:SOCKeT:CONTRol?
SYSTem:COMMunicate:LAN:SCPI:SOCKeT:ENABle
SYSTem:COMMunicate:LAN:SCPI:TELNet:ENABle
SYSTem:COMMunicate:LAN:SOURce:EXTeRnal:IP
SYSTem:COMMunicate:SOURce:DUT:ADDReSS
SYSTem:COMMunicate:SOURce:SYSTem:ADDReSS
SYSTem:COMMunicate:USB:CONNection?
SYSTem:COMMunicate:USB:PACKets?
SYSTem:COMMunicate:USB:STATus?
SYSTem:CONFigure[:SYSTem]?
SYSTem:CSYSTem?
SYSTem:DATE
SYSTem:DEFault
SYSTem:DISPlay:BACKlight:INTensity
SYSTem:DISPlay:CFORmat
SYSTem:DISPlay:HINTs?
SYSTem:DISPlay:HINTs[:STATe]

```

## 9 Programming the Instrument

### 9.1 List of Supported SCPI Commands

SYSTem:DISPlay:LANGuage  
SYSTem:DISPlay:MPPosition  
SYSTem:DISPlay:MPTab  
SYSTem:DISPlay:NEPImmediate  
SYSTem:ERRor[:NEXT]?  
SYSTem:ERRor:OVERload[:STATe]  
SYSTem:ERRor:PUP?  
SYSTem:ERRor:VERBoSe  
SYSTem:HELP:HEADers?  
SYSTem:HID?  
SYSTem:IDN  
SYSTem:IDN:CONFigure  
SYSTem:KLOCK  
SYSTem:LICense[:FPACK]:WAVEform:ADD  
SYSTem:LICense[:FPACK]:WAVEform:CLEar  
SYSTem:LICense[:FPACK]:WAVEform:FREE?  
SYSTem:LICense[:FPACK]:WAVEform:LOCK  
SYSTem:LICense[:FPACK]:WAVEform:NAME?  
SYSTem:LICense[:FPACK]:WAVEform:REPLace  
SYSTem:LICense[:FPACK]:WAVEform:STATus?  
SYSTem:LICense[:FPACK]:WAVEform:UID?  
SYSTem:LICense[:FPACK]:WAVEform:USED?  
SYSTem:LKEY  
SYSTem:LKEY?  
SYSTem:LKEY:BORRow  
SYSTem:LKEY:BORRow:LIST?  
SYSTem:LKEY:BORRow:NETWork:COU:ENABle  
SYSTem:LKEY:BORRow:RETurn  
SYSTem:LKEY:COU?  
SYSTem:LKEY:COU:LIST?  
SYSTem:LKEY:DELeTe  
SYSTem:LKEY:LIST?  
SYSTem:LKEY:SOFTware:SUPPort:EXPIration:DATE?  
SYSTem:LKEY:WAVEform:ADD  
SYSTem:LKEY:WAVEform:CLEar  
SYSTem:LKEY:WAVEform:FREE?  
SYSTem:LKEY:WAVEform:LOCK  
SYSTem:LKEY:WAVEform:NAME?  
SYSTem:LKEY:WAVEform:REPLace  
SYSTem:LKEY:WAVEform:STATus?  
SYSTem:LKEY:WAVEform:UID?  
SYSTem:LKEY:WAVEform:USED?  
SYSTem:LOCK:NAME?  
SYSTem:LOCK:OWNer?  
SYSTem:LOCK:RELease  
SYSTem:LOCK:REQuest?  
SYSTem:LOFF  
SYSTem:LWSTation  
SYSTem:METRics:FPANel?  
SYSTem:METRics:SCPI?



SYSTem:METRics:STIME?  
 SYSTem:MRELay:COUNt?  
 SYSTem:OPTions?  
 SYSTem:PDOWn  
 SYSTem:PERSonA:DEFault  
 SYSTem:PERSonA:MANufacturer  
 SYSTem:PERSonA:MANufacturer:DEFault  
 SYSTem:PERSonA:MODEl  
 SYSTem:PERSonA:MODEl:DEFault  
 SYSTem:PON:APPLication:LLISt  
 SYSTem:PON:APPLication:VMEMory[:AVAIlable]?  
 SYSTem:PON:APPLication:VMEMory:TOTal?  
 SYSTem:PON:APPLication:VMEMory:USED?  
 SYSTem:PON:APPLication:VMEMory:USED:NAME?  
 SYSTem:PON:ETIME?  
 SYSTem:PON:FPGA:LOAD  
 SYSTem:PON:FPGA:PREference  
 SYSTem:PON:MODE  
 SYSTem:PON:TIME?  
 SYSTem:PON:TYPE  
 SYSTem:PRESet  
 SYSTem:PRESet:FULL  
 SYSTem:PRESet:TYPE  
 SYSTem:PRESet:USER  
 SYSTem:PRESet:USER:ALL  
 SYSTem:PRESet:USER:SAVE  
 SYSTem:PRINt:THEME  
 SYSTem:PUP  
 SYSTem:PUP:PROcEss  
 SYSTem:SECurity:USB:WPRotect[:ENABle]  
 SYSTem:SEQuencer  
 SYSTem:SET  
 SYSTem:SHOW  
 SYSTem:SOFTware:VERSion:DATE?  
 SYSTem:TEMPerature:HEXTreme?  
 SYSTem:TEMPerature:LEXTreme?  
 SYSTem:TIME  
 SYSTem:VERSion?

## T

TRACe[1]|2|3:<meas>:DISPlay[:STATe]  
 TRACe[1]|2|3:<meas>:UPDate[:STATe]  
 TRACe:CLEAr  
 TRACe[:DATA]  
 TRIGger:<measurement>[:SEQuence]:IQ:SOURce  
 TRIGger:<measurement>[:SEQuence]:RF:SOURce  
 TRIGger:<measurement>[:SEQuence]:SOURce  
 TRIGger[1]|2|...|4[:SEQuence]:OUTPut

9 Programming the Instrument  
9.1 List of Supported SCPI Commands

TRIGger[1]|2|...|4[:SEQuence]:OUTPut:DIRection  
TRIGger[1]|2|...|4[:SEQuence]:OUTPut:POLarity  
TRIGger:PXIE:ANALyzer[:SEQuence]:OUTPut  
TRIGger:PXIE:ANALyzer[:SEQuence]:OUTPut:LINE  
TRIGger:PXIE:ANALyzer[:SEQuence]:OUTPut:POLarity  
TRIGger:PXIE:SOURce[:SEQuence]:OUTPut  
TRIGger:PXIE:SOURce[:SEQuence]:OUTPut:LINE  
TRIGger:PXIE:SOURce[:SEQuence]:OUTPut:POLarity  
TRIGger[:SEQuence]:<trig\_source>:DELay  
TRIGger[:SEQuence]:<trig\_source>:DELay:STATe  
TRIGger[:SEQuence]:<trig\_source>:LEVel  
TRIGger[:SEQuence]:<trig\_source>:SLOPe  
TRIGger[:SEQuence]:AIQMag:BANDwidth  
TRIGger[:SEQuence]:AIQMag:CENTer  
TRIGger[:SEQuence]:ATRigger  
TRIGger[:SEQuence]:ATRigger:STATe  
TRIGger[:SEQuence]:EXternal1|EXternal2|RFBurst:DELay:COMPensation  
TRIGger[:SEQuence]:FRAME:ADJust  
TRIGger[:SEQuence]:FRAME:OFFSet  
TRIGger[:SEQuence]:FRAME:OFFSet:DISPlay:RESet  
TRIGger[:SEQuence]:FRAME:PERiod  
TRIGger[:SEQuence]:FRAME:SMONitor:RESet  
TRIGger[:SEQuence]:FRAME:SYNC  
TRIGger[:SEQuence]:FRAME:SYNC:HOLDoff  
TRIGger[:SEQuence]:FRAME:SYNC:HOLDoff:STATe  
TRIGger[:SEQuence]:HOLDoff  
TRIGger[:SEQuence]:HOLDoff:STATe  
TRIGger[:SEQuence]:HOLDoff:TYPE  
TRIGger[:SEQuence]:INTernal:SOURce:OUTPut  
TRIGger[:SEQuence]:INTernal:SOURce:OUTPut:POLarity  
TRIGger[:SEQuence]:OFFSet:STATe  
TRIGger[:SEQuence]:OPTimize:MODE  
TRIGger[:SEQuence]:PXI:LINE  
TRIGger[:SEQuence]:RFBurst:LEVel:ABSolute  
TRIGger[:SEQuence]:RFBurst:LEVel:RELative  
TRIGger[:SEQuence]:RFBurst:LEVel:TYPE  
TRIGger[:SEQuence]:SOURce  
TRIGger[:SEQuence]:TV:FMODe  
TRIGger[:SEQuence]:TV:LINE  
TRIGger[:SEQuence]:TV:STANdard

## 9.2 IEEE 488.2 Common Commands

The instrument supports the following subset of IEEE 488.2 Common Commands, as defined in Chapter 10 of [IEEE Standard 488.2–1992](#). As indicated below, some of these commands correspond directly to instrument front-panel functionality, while others are available only as remote commands.

- ["\\*CAL? - Calibration Query" on page 1031](#) (Align Now All equivalent)
- ["\\*CLS - Clear Status" on page 1032](#)
- ["\\*ESE - Standard Event Status Enable" on page 1032](#)
- ["\\*ESR? - Standard Event Status Register Query" on page 1033](#)
- ["\\*IDN? - Identification Query" on page 1033](#)
- ["\\*OPC? - Operation Complete" on page 1034](#)
- ["\\*OPT? - Query Instrument Options" on page 1035](#)
- ["\\*RCL - Recall Instrument State" on page 1035](#) (Recall State equivalent)
- ["\\*RST - Reset" on page 1035](#) (Mode Preset equivalent)
- ["\\*SAV - Save Instrument State" on page 1036](#) (Save State equivalent)
- ["\\*SRE - Service Request Enable" on page 1036](#)
- ["\\*STB? - Status Byte Query" on page 1037](#)
- ["\\*TRG - Trigger" on page 1037](#)
- ["\\*TST? - Self Test Query" on page 1037](#)
- ["\\*WAI - Wait-to-Continue" on page 1038](#)

### 9.2.1 \*CAL? - Calibration Query

[\\*CAL?](#) Performs a full alignment and returns a number indicating the success of the alignment. A zero is returned if the alignment is successful. A one is returned if any part of the alignment fails. The equivalent SCPI command is [:CALibrate\[:ALL\]?](#)

|                |                                                                                         |
|----------------|-----------------------------------------------------------------------------------------|
| Remote Command | <a href="#">*CAL</a>                                                                    |
| Example        | <a href="#">*CAL?</a><br>Runs a full alignment and returns 0 if no problems encountered |

|                              |                                 |
|------------------------------|---------------------------------|
| Status Bits/OPC dependencies | See "Align Now All" on page 436 |
|------------------------------|---------------------------------|

9.2.2 \*CLS - Clear Status

Clears the "Status Byte Register" on page 1069, by emptying the error queue and clearing all bits in all the event registers, and consequently all bits in the Status Byte Register.

The Status Byte Register summarizes the states of the other registers. It is also responsible for generating service requests.

|                              |                                                                                                                                                             |
|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command               | *CLS                                                                                                                                                        |
| Example                      | *CLS<br>Clears the error queue and the Status Byte Register                                                                                                 |
| Notes                        | For related commands, see :SYSTem:ERRor[:NEXT]?<br>See also :STATus:PRESet and all commands in the "Status Register System & STATus Subsystem" on page 1060 |
| Status Bits/OPC dependencies | Resets all bits in all event registers to 0, which resets all the Status Byte Register bits to 0 also                                                       |

9.2.3 \*ESE - Standard Event Status Enable

Sets the desired bits in the Event Enable sub-register of the "Standard Event Status Register" on page 1073, which enables the corresponding bits in the Standard Event Status Register. This register monitors I/O errors and synchronization conditions such as operation complete, request control, query error, device-dependent error, status execution error, command error, and power on. The selected bits are ORed to become a summary bit (bit 5) in the "Status Byte Register" on page 1069, which can be queried.

The query returns the state of this register.

Numeric values for bit patterns can be entered using decimal or hexadecimal representations (0 to 32767, equivalent to #H0 to #H7FFF).

|                |                                                                                                                                                                                                |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | *ESE <integer><br>*ESE?                                                                                                                                                                        |
| Example        | *ESE 36<br>Enables the Standard Event Status Register to monitor query and command errors (bits 2 and 5)<br>*ESE?<br>Returns 36, indicating that the query and command status bits are enabled |

|             |                                                                                                                  |
|-------------|------------------------------------------------------------------------------------------------------------------|
| Notes       | For related commands, see the "Status Register System & STATus Subsystem" on page 1060 and :SYSTem:ERRor[:NEXT]? |
| Preset      | 255                                                                                                              |
| State Saved | Not saved in state                                                                                               |
| Min         | 0                                                                                                                |
| Max         | 255                                                                                                              |

### 9.2.4 \*ESR? - Standard Event Status Register Query

Queries and clears the "Standard Event Status Register" on page 1073. (This is a destructive read.) The value returned is a hexadecimal number that reflects the current state (0/1) of all the bits in the register.

|                              |                                                                                        |
|------------------------------|----------------------------------------------------------------------------------------|
| Remote Command               | *ESR?                                                                                  |
| Example                      | *ESR?<br>Returns 1 if there is either a query or command error, otherwise returns zero |
| Notes                        | For related commands, see "Status Register System & STATus Subsystem" on page 1060     |
| Min                          | 0                                                                                      |
| Max                          | 255                                                                                    |
| Status Bits/OPC dependencies | Standard Event Status Register (bits 0 – 7)                                            |

### 9.2.5 \*IDN? - Identification Query

Returns a string of instrument identification information. The string contains the model number, serial number, and firmware revision.

The response is organized into four fields separated by commas. The field definitions are as follows:

1. Manufacturer
2. Model
3. Serial number
4. Firmware version

|                |       |
|----------------|-------|
| Remote Command | *IDN? |
| Example        | *IDN? |

|                                    |                                                                                                                                                                                                                                              |
|------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                    | Returns instrument identification information, such as:<br><code>Keysight Technologies,N9040B,US01020004,A.15.02</code>                                                                                                                      |
| Example                            | <code>:ID?</code><br>Returns model number, such as:<br><code>N9040B</code>                                                                                                                                                                   |
| Notes                              | Provided for backwards compatibility:<br>In <b>Remote Language Compatibility</b> Mode, <code>ID?</code> returns the model number of the emulated instrument<br>In any other Mode, the returned model number is that of the actual instrument |
| Backwards<br>Compatibility<br>SCPI | <code>:ID?</code>                                                                                                                                                                                                                            |

## 9.2.6 \*OPC? - Operation Complete

Sets bit 0 in the "Standard Event Status Register" on page 1073 (SESR) to "1" when pending operations have finished, that is when all overlapped commands are complete. It does not hold off subsequent operations. You can determine when the overlapped commands have completed either by polling the OPC bit in SESR, or by setting up the status system so that a service request (SRQ) is asserted when the OPC bit is set.

`*OPC?` returns "1" after all the current overlapped commands are complete, so it holds off subsequent commands until the "1" is returned, then the program continues. This query can be used to synchronize events of other instruments on the external bus.

|                   |                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote<br>Command | <code>*OPC</code><br><code>*OPC?</code>                                                                                                                                                                                                                                                                                                                                                                                                 |
| Example           | <code>:INIT:CONT 0</code><br>Selects single sweeping<br><code>:INIT:IMM</code><br>Initiates a sweep<br><code>*OPC?</code><br>Holds off any further commands until the sweep is complete                                                                                                                                                                                                                                                 |
| Notes             | Not global to all remote ports or front panel. <code>*OPC</code> only affects operations that were initiated on the same port that the <code>*OPC</code> command was issued from<br><code>*OPC</code> is an overlapped command, but <code>*OPC?</code> is sequential<br><code>*OPC?</code> does <i>not</i> holdoff the completion of GUI update commands , such as <code>:MMEM:LOAD:SCON</code><br><code>"myScreenConfig.screen"</code> |

### 9.2.7 \*OPT? - Query Instrument Options

Returns a string of all installed instrument options. It is a comma separated list with quotes, such as:

"550,B25,B40,BBA,CRP,CRW,EA3,EDP,ESC,EXM,FBP,LNP,MPB,NF2,RTS,EMC,FP2"

|                |              |
|----------------|--------------|
| Remote Command | <b>*OPT?</b> |
|----------------|--------------|

### 9.2.8 \*RCL - Recall Instrument State

Recalls the instrument state from the specified instrument memory register.

- If the state being loaded has a newer firmware revision than that of the instrument, no state is recalled, and an error is reported
- If the state being loaded has the same firmware revision as that of the instrument, the state will be loaded
- If the state being loaded has an older firmware revision than that of the instrument, then the instrument will only load the parts of the state that apply to the older revision

|                              |                                                                                                                                                    |
|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command               | <b>*RCL &lt;register #&gt;</b>                                                                                                                     |
| Example                      | <b>*RCL 7</b><br>Recalls the instrument state that is currently stored in register 7 (register 8 in the UI)                                        |
| Notes                        | Registers 0 through 15 are accessible from the front panel in menu keys for Recall Registers. Register 0 corresponds to the front panel Register 1 |
| Min                          | 0                                                                                                                                                  |
| Max                          | 127                                                                                                                                                |
| Status Bits/OPC dependencies | The command is sequential                                                                                                                          |

### 9.2.9 \*RST - Reset

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

**\*RST** clears all pending OPC bits and sets the Status Byte to 0.

|                              |                                                                                                                                                                                                            |
|------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command               | <b>*RST</b>                                                                                                                                                                                                |
| Notes                        | Sequential                                                                                                                                                                                                 |
| Couplings                    | <b>*RST</b> causes the currently running measurement to be aborted and causes the default measurement to be active. <b>*RST</b> gets the mode to a consistent state, with all of the default couplings set |
| Status Bits/OPC dependencies | Clears all pending OPC bits. The "Status Byte Register" on page 1069 is set to 0                                                                                                                           |

### 9.2.10 \*SAV - Save Instrument State

Saves the current instrument state and mode to the specified instrument memory register.

|                              |                                                                                                                                                  |
|------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command               | <b>*SAV &lt;register #&gt;</b>                                                                                                                   |
| Example                      | <b>*SAV 9</b><br>Saves the instrument state in register 9 (register 10 in the UI)                                                                |
| Notes                        | Registers 0 through 15 are accessible from the front panel in menu keys for Save Registers. Register 0 corresponds to the front panel Register 1 |
| Min                          | 0                                                                                                                                                |
| Max                          | 127                                                                                                                                              |
| Status Bits/OPC dependencies | The command is sequential                                                                                                                        |

### 9.2.11 \*SRE - Service Request Enable

Enables the desired bits of the "Service Request Enable Register" on page 1072.

The query returns the value of the register, indicating which bits are currently enabled.

Numeric values for bit patterns can be entered using decimal or hexadecimal representations (0 to 32767, equivalent to #H0 to #H7FFF).

|                |                                                                                                                     |
|----------------|---------------------------------------------------------------------------------------------------------------------|
| Remote Command | <b>*SRE &lt;integer&gt;</b><br><b>*SRE?</b>                                                                         |
| Example        | <b>*SRE 22</b><br>Enables bits 1, 2, and 4 in the Service Request Enable Register                                   |
| Notes          | For related commands, see "Status Register System & STATUS Subsystem" on page 1060 and <b>:SYSTEM:ERROR[:NEXT]?</b> |



|                              |                                                   |
|------------------------------|---------------------------------------------------|
| Preset                       | 0                                                 |
| Min                          | 0                                                 |
| Max                          | 255                                               |
| Status Bits/OPC dependencies | Service Request Enable Register (all bits, 0 – 7) |

### 9.2.12 \*STB? - Status Byte Query

Returns the value of the "Status Byte Register" on page 1069 without erasing its contents.

|                              |                                                                                                                                                                                                                              |
|------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command               | *STB?                                                                                                                                                                                                                        |
| Example                      | *STB?<br>Returns a decimal value for the bits in the Status Byte Register<br>For example, if 16 is returned, it indicates that bit 5 is set and one of the conditions monitored in the Standard Event Status Register is set |
| Notes                        | See related command " <b>*CLS - Clear Status</b> " on page 1032                                                                                                                                                              |
| Status Bits/OPC dependencies | Status Byte Register (all bits, 0 – 7)                                                                                                                                                                                       |

### 9.2.13 \*TRG - Trigger

Triggers the instrument. Use :TRIGger[:SEquence]:SOURce to select the trigger source.

|                |                                                                                                                      |
|----------------|----------------------------------------------------------------------------------------------------------------------|
| Remote Command | *TRG                                                                                                                 |
| Example        | *TRG<br>Triggers the instrument to take a sweep or start a measurement, depending on the current instrument settings |
| Notes          | See related command<br>:INITiate:IMMediate                                                                           |

### 9.2.14 \*TST? - Self Test Query

Performs the internal self-test routines and returns a number indicating the success of the testing. The value returned is 0 if the test is successful, or 1 if it fails.

|                |                                                                                            |
|----------------|--------------------------------------------------------------------------------------------|
| Remote Command | <code>*TST?</code>                                                                         |
| Example        | <code>*TST?</code><br>Runs the self-test routines and returns 0=passed, 1=some part failed |

9.2.15 **\*WAI - Wait-to-Continue**

Causes the instrument to wait until all overlapped commands are completed before executing any additional commands. There is no query form.

|                              |                                                                                                                                                                                  |
|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command               | <code>*WAI</code>                                                                                                                                                                |
| Example                      | <code>:INIT:CONT OFF; INIT;*WAI</code><br>Sets the instrument to single sweep. Starts a sweep and waits for its completion                                                       |
| Notes                        | <code>*WAI</code> does <i>not</i> wait for the completion of user-interface-related commands, such as <code>:MMEM:LOAD:SCON "myScreenConfig.screen"</code>                       |
| Status Bits/OPC dependencies | Not global to all remote ports or front panel. <code>*OPC</code> only considers operation that was initiated on the same port that the <code>*OPC</code> command was issued from |

## 9.3 SCPI Operation and Results Query

You can use SCPI commands for remote control of measurements and querying of measurement results data. There are several alternative commands you can use to control the measurement, depending on how you wish to operate the instrument. There are also a number of queries that you can use to extract the measurement data.

In this section, **Mode** refers to a Measurement Application, for example, Spectrum Analyzer or 5G NR.

### 9.3.1 Mode Control

Use either `:INSTrument:SElect` or `:INSTrument:NSElect` to select the "Mode" on page 56.

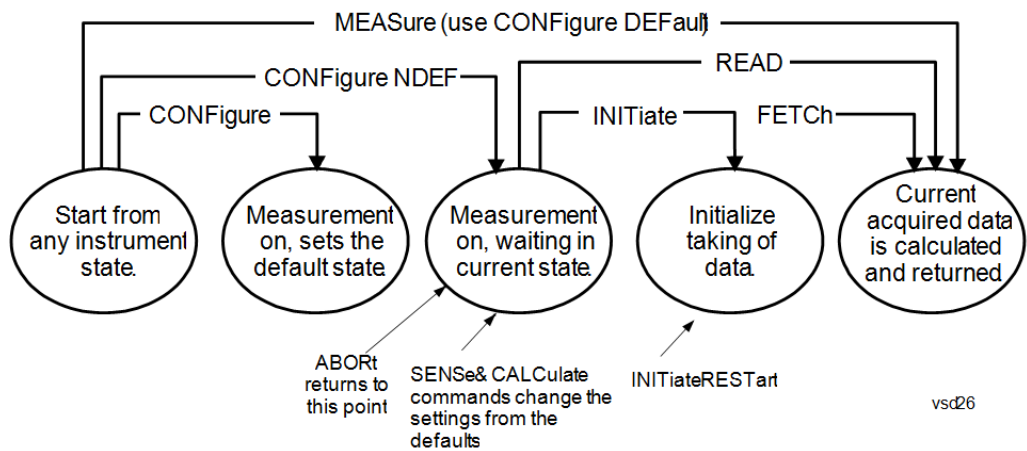
`:INSTrument:CONFigure` causes a Mode and Measurement switch at the same time. This results in faster overall switching than sending `:INSTrument:SElect` and `:CONFigure` separately, as described in **Mode**.

### 9.3.2 Measurement Control

This section describes the measurement control commands listed below, and their functions.

|                          |                                                                                                                                            |
|--------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|
| "CONFigure" on page 1040 | Switches to the desired measurement. Presets all measurement settings to their defaults, <i>unless</i> <code>:NDEFault</code> is specified |
| "INITiate" on page 1041  | Starts the measurement                                                                                                                     |
| "FETCh" on page 1041     | Queries the data without starting the measurement. If a measurement is already in progress, waits for completion                           |
| "READ" on page 1042      | Starts the measurement with the current settings and queries the data                                                                      |
| "MEASure" on page 1043   | Switches to the desired measurement, presets all measurement settings to their defaults, starts the measurement and queries the data       |

The relationship between the command forms is illustrated in the diagram below. `:FETCh`, `:READ` and `:MEASure` are queries that return measurement data.



9.3.2.1 CONFIgure

Stops the current measurement (if any) and sets up the instrument for the specified measurement using the measurement’s default settings. Does not initiate the collection of measurement data unless `:INIT:CONT` is `ON`. If you change any measurement settings after using `:CONFIgure`, "READ" on page 1042 can be used to initiate a measurement without changing the settings back to their defaults.

Normally `:CONFIgure` presets the measurement after selecting it; but, if sent with the `NDEFault` parameter, it selects it without performing a Preset.

|                |                                                                                                                                                                                                                                     |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:CONFIgure:&lt;measurement&gt;[:NDEFault]</code><br><code>:CONFIgure?</code>                                                                                                                                                  |
| Example        | Select and preset the Swept SA measurement:<br><code>:CONF:SAN</code><br><br>Select the Swept SA measurement <i>without</i> presetting:<br><code>:CONF:SAN:NDEF</code><br><br>Query the current measurement:<br><code>:CONF?</code> |
| Remote Command | <code>:CONFIgure:CATalog?</code>                                                                                                                                                                                                    |
| Example        | <code>:CONF:CATalog?</code><br><br>returns a quoted string of all licensed measurement names in the current mode. For example, "SAN, CHP, OBW, ACP, PST, TXP, SPUR, SEM, LIST" for the Spectrum Analyzer mode                       |

### 9.3.2.2 INITiate

Initiates a trigger cycle for the specified measurement, but does not output any data. You must then use `:FETCh<meas>` to return data. If a measurement other than the current one is specified, the instrument will switch to that measurement and then initiate it.

---

Remote Command      `:INITiate:<measurement>`

---

Example      Switch to the `SANalyzer` (Swept SA) measurement if not already there, then start the measurement:  
`:INIT:SAN`

`:INITiate` does not change any of the measurement settings. For example, if you have already run the ACP measurement and you send `:INIT:ACP?` it initiates a new ACP measurement using the same instrument settings as the last time ACP was run.

If another measurement is running, `:INIT` switches to the specified measurement. For example, suppose you are running the channel power measurement. If you send `:INIT:ACP?` it changes from channel power to ACP and initiates an ACP measurement.

If your selected measurement is currently in the idle state, it restarts the measurement. Depending upon the measurement and the number of averages, there may be multiple data acquisitions, with multiple trigger events, for one full trigger cycle.

**CAUTION**      `:INIT` allows additional commands *while* the measurement is in progress.

Be aware that such additional commands may change measurement settings. They may cause the measurement in progress to be discarded, and a new measurement may start.

---

To wait for the completion of a measurement after sending `:INITiate`, send `"*WAI - Wait-to-Continue"` on page 1038, or `"*OPC? - Operation Complete"` on page 1034, or use `"FETCh"` on page 1041.

### 9.3.2.3 FETCh

Places selected data from the most recent measurement into the output buffer. Use `:FETCh` if you have already made a valid measurement and you want to retrieve data. You can issue `:FETCh` multiple times with differing `[n]` values without restarting or re-making the measurement, for example, both scalars and trace data from a single measurement.

---

Remote Command      `:FETCh:<measurement>[n]?`

---

|         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|---------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Example | <p>Fetch item 2 (Trace 2) from the <b>SAN</b> (Swept SA) measurement when the measurement completes. If not in the Swept SA measurement, returns an error:</p> <p><b>:FETCh:SAN2?</b></p> <p><b>:FETCh</b> does not change any of the measurement settings, it simply reads the results of the current measurement. <b>:FETCh</b> may be used to return results other than those specified with the original <b>:READ</b> or <b>:MEASure</b> query that you sent.</p> <p>You can only <b>:FETCh</b> results from the measurement that is currently active, it does not change to a different measurement. An error message is reported if a measurement other than the current one is specified.</p> <p>If you need to get new measurement data, use <b>"READ"</b> on page 1042, which is equivalent to <b>"INITiate"</b> on page 1041 followed by <b>:FETCh</b>.</p> <p>The measurement results for <b>n = 1</b> (usually the scalar result) will be returned if the optional <b>[n]</b> value is not included, or is set to 1. If the <b>[n]</b> value is set to a value other than 1, the selected data results will be returned. See each measurement for details of what types of scalar results or trace data results are available. The binary data formats should be used for handling large blocks of data since they are smaller and transfer faster than the ASCII format. See <b>"Format Data: Numeric Data (Remote Command Only)"</b> on page 1047.</p> <p>Note that the data returned by <b>:FETCh?</b> uses the data setting specified by <b>"Format Data: Numeric Data (Remote Command Only)"</b> on page 1047 and <b>"Format Data: Byte Order (Remote Command Only)"</b> on page 1048 commands ,and can return real or ASCII data. If the format is set to <b>INT, 32</b>, it returns <b>REAL, 32</b> data.</p> |
|---------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

9.3.2.4 READ

Initiates a trigger cycle for the specified measurement and outputs the requested data. If a measurement other than the current one is specified, the instrument will switch to that measurement before it initiates the measurement and returns results.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <b>:READ:&lt;measurement&gt;[n]?</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Example        | <p>Switch to the <b>SANalyzer</b> (Swept SA) measurement if not already there, start the measurement, and return item 2 (Trace 2) from the measurement when the measurement completes:</p> <p><b>:READ:SAN2?</b></p> <p><b>:READ</b> does not change any of the measurement settings. For example, if you have already run the ACP measurement and you send <b>:READ:ACP?</b>, it initiates a new ACP measurement using the same instrument settings as the last time ACP was run.</p> <p><b>:READ</b> switches to the specified measurement if the instrument is not already there. For example, suppose you have already run the ACP measurement but now you are running the Channel Power measurement. When you send <b>:READ:ACP?</b>, it changes</p> |

from Channel Power back to ACP and, using the previous ACP settings, initiates the measurement and return results.

The measurement results for  $n = 1$  (usually the scalar result) will be returned if the optional `[n]` value is not included, or is set to 1. If the `[n]` value is set to a value other than 1, the selected data results will be returned. See each measurement for details of what types of scalar results or trace data results are available. The binary data formats should be used for handling large blocks of data since they are smaller and transfer faster than the ASCII format. See ["Format Data: Numeric Data \(Remote Command Only\)" on page 1047](#).

Note that the data returned by `:READ?` uses the data setting specified by ["Format Data: Byte Order \(Remote Command Only\)" on page 1048](#) and ["Format Data: Numeric Data \(Remote Command Only\)" on page 1047](#), and can return real or ASCII data. If the format is set to `INT,32` it returns `REAL,32` data.

`:READ` blocks other SCPI communication, waiting until the measurement is complete before returning results.

For more details of how measurements proceed, see also ["INITiate" on page 1041](#).

### 9.3.2.5 MEASure

Stops the current measurement (if any) and sets up the instrument for the specified measurement using the measurement's default settings, initiates a trigger cycle for the specified measurement, and outputs the requested data.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:MEASure:&lt;measurement&gt;[n]?</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Example        | <p>Switch to the <code>SANalyzer</code> (Swept SA) measurement, start the measurement, and read back item 2 (Trace 2) when the measurement completes</p> <p><code>:MEAS:SAN2?</code></p> <p>This is a fast single-command way to make a measurement using the measurement's default settings. These are the settings and units that conform to the Mode Setup settings (for example, Radio Standard) that you have currently selected.</p> <p>Stops the current measurement (if any) and sets up the instrument for the specified measurement using the measurement's defaults.</p> <p>Initiates the data acquisition for the measurement.</p> <p>Blocks other SCPI communication, waiting until the measurement is complete before returning results.</p> <p>Depending on the measurement and the number of averages, there may be multiple data acquisitions, with multiple trigger events.</p> |

After the data is valid, returns the scalar results, or the trace data, for the specified measurement. The type of data returned may be defined by an `[n]` value that is sent with the command.

If the optional `[n]` value is not included, or is set to 1, scalar measurement results will be returned. If the `[n]` value is other than 1, the selected trace data results will be returned. See each command for details of which types of scalar results or trace data results are available.

The default format for data output is ASCII. (Older versions of Spectrum Analysis and Phase Noise mode measurements only use ASCII.) The binary data formats should be used for handling large blocks of data, because transfers are smaller and faster than when using the ASCII format. See ["Format Data: Numeric Data \(Remote Command Only\)" on page 1047](#) for more information.

If you need to change some of the measurement parameters from the measurement's default settings, you can set up the measurement with `:CONFigure`. Use the commands in the `:SENSe:<measurement>` and `:CALCulate:<measurement>` subsystems to change the settings, then you can use `:READ?` to initiate the measurement and query the results.

Measurement settings persist if you initiate a different measurement and then return to a previous one. Use `:READ?` if you want to use those persistent settings. If you want to go back to the default settings, use `:MEASure?`.

Note that the data returned to `:MEASure?` uses the data setting specified by ["Format Data: Byte Order \(Remote Command Only\)" on page 1048](#) and ["Format Data: Numeric Data \(Remote Command Only\)" on page 1047](#), and can return real or ASCII data. If the format is set to `INT,32` it returns `REAL,32` data.

### 9.3.2.6 Unselected Measurements' Parameter Values

Changing parameter values of unselected measurements keeps those changes pending until the measurement is next selected. Querying such values may or may not return expected value. To ensure the appropriate value is returned, first select the measurement.

## 9.3.3 Trace Formatting Commands

The following commands and queries are available to format and manipulate trace data.

### 9.3.3.1 Clear Trace (Remote Command Only)

Clears the selected trace (from the front panel) or the specified trace (from SCPI). Does not affect the state of any function or variable in the instrument. Loads



mintracevalue into all of the points in the selected trace, unless the trace is in Min Hold in which case it loads maxtracevalue. This occurs even if Update = Off.

|                |                                                 |
|----------------|-------------------------------------------------|
| Remote Command | <code>:TRACe:CLEAr TRACE1   ...   TRACE6</code> |
| Example        | Clear Trace 1:<br><code>:TRAC:CLE TRACE1</code> |

### 9.3.3.2 Send/Query Trace Data (Remote Command Only)

Allows trace data to be sent to the instrument or queried from the instrument. The response to the query is a list of the amplitude points which comprise the requested trace in the current Y Axis Unit of the instrument. The X Axis Unit is that of the destination trace (for send) or the source trace (for query).

See:

- ["Query Trace Data" on page 1045](#)
- ["More Information" on page 1046](#)

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:TRACe[:DATA] TRACE1   ...   TRACE6, &lt;data&gt;</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Notes          | <p>The <code>:TRACe[:DATA]</code> command is of the form:</p> <p><code>:TRACe:DATA &lt;trace&gt;,&lt;data&gt;</code></p> <p>where <code>&lt;trace&gt;</code> can be one of the following parameters:<br/><code>TRACE1, TRACE2, TRACE3, TRACE4, TRACE5, TRACE6</code></p> <p>and where <code>&lt;data&gt;</code> can be</p> <ul style="list-style-type: none"> <li>– ASCII data, which consists of a string of values separated by comma</li> <li>or</li> <li>– <code>REAL</code> or <code>INTEger</code> sent as a definite length block, with a header describing the data to follow</li> </ul> |
| Couplings      | <p>Sweep points will affect the amount of data</p> <p><code>:FORMat:DATA</code> describes the different types of data formats that can be used with trace data</p> <p>Use <code>:FORMat:BORDer</code> to set the byte order</p>                                                                                                                                                                                                                                                                                                                                                                  |

### Query Trace Data

|                |                                                                                                                                                                                                                                                                                                                          |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:TRACe[:DATA]? TRACE1   ...   TRACE6</code>                                                                                                                                                                                                                                                                        |
| Example        | <p>Send five points to Trace 1. Assuming that <code>:FORMat:DATA</code> is set to <code>ASCIi</code>, Y Axis Unit is set to dBm, and sweep points is set to 5, this will result in Trace 1 consisting of the five points -1 dBm, -2 dBm, -3 dBm, -4 dBm, and -5 dBm:</p> <p><code>:TRAC TRACE1,-1,-2,-3,-4,-5</code></p> |

---

|                                     |                                                                                                                 |
|-------------------------------------|-----------------------------------------------------------------------------------------------------------------|
|                                     | Query the instrument for the contents of trace 2:<br><b>:TRAC? TRACE2</b>                                       |
| Backwards<br>Compatibility<br>Notes | In X-Series, the legacy <b>RAWTRACE, LLINE1, LLINE2</b> parameters for trace data query are no longer available |

---

## More Information

The format and byte order of the sent or received data depend on **"Format Data: Numeric Data (Remote Command Only)" on page 1047** and **"Format Data: Byte Order (Remote Command Only)" on page 1048**. **ASCII** data consists of a string of comma separated values. **REAL** or **INTEGER** data is sent as a definite length block, with a header describing the data to follow.

For example, a four-point trace might look like this if in ASCII (**FORMat:DATA ASCii**):

```
-5.87350E+01, -5.89110E+01, -5.87205E+01, -5.12345E+01<NL><END>
```

and like this if in **INTeger** with 4 bytes per point (**FORMat:DATA INT,32**):

```
#216<16 bytes of data><NL><END>
```

where the 2 in the #216 means "2 digits of numeric data to follow", and the 16 is the 2 digits and means "16 binary bytes to follow" (this is the definite length block format).

Note that the data is terminated with **<NL><END>**. (For GPIB this is newline, or linefeed, followed by EOI set true. For LAN, this is newline only.)

The data format set by **"Format Data: Numeric Data (Remote Command Only)" on page 1047** and **"Format Data: Byte Order (Remote Command Only)" on page 1048** is used both for sending data to the instrument and receiving data from the instrument.

When sending data to the instrument, the data block must contain exactly the number of points currently specified in **Sweep, Points** or an error message will be generated and there will be no change to the target trace.

No units terminator (for example, dB or V) is used when sending data; the data is taken as being in the current Y Axis Unit of the instrument.

When a trace is sent to the instrument, it immediately overwrites all of the data in the target trace. Consequently, the trace should be inactive in order to achieve predictable results. If you send trace data while a trace is active, and particularly if a sweep or an **Average** or **Max/Min Hold** sequence is already in progress, you may end up with a trace that combines the data you sent with measurement data. Similarly, when querying trace data, it is best if the instrument is not sweeping during the query.

Therefore, it is generally advisable to be in **Single** sweep, or have the trace in **View**, when sending trace data to the instrument or querying trace data from the instrument.

### 9.3.3.3 Format Data: Numeric Data (Remote Command Only)

Specifies the format of the trace data input and output.

Specifies the formats used for trace data during data transfer across any remote port. Affects only the data format for setting and querying trace data for **:TRACe[:DATA]**, **:TRACe[:DATA]?**, **:CALCulate:DATA[n]?** and **:FETCh:SANalyzer[n]?**.

|                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|-------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command                | <b>:FORMat[:TRACe][:DATA] ASCii   INTeger,32   REAL,32   REAL,64</b><br><b>:FORMat[:TRACe][:DATA]?</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Notes                         | <p>The query response is:</p> <p><b>ASCii</b>: ASC,8</p> <p><b>REAL,32</b>: REAL,32</p> <p><b>REAL,64</b>: REAL,64</p> <p><b>INTeger,32</b>: INT,32</p> <p>When the numeric data format is REAL or ASCii, data is output in the current Y Axis unit. When the data format is INTeger, data is output in units of m dBm (.001 dBm)</p> <p>The <b>INT,32</b> format returns binary 32-bit integer values in internal units (m dBm), in a definite length block</p>                                                                                          |
| Dependencies                  | <p>Sending a data format spec with an invalid number (for example, <b>INT,48</b>) generates no error. The instrument simply uses the default (8 for <b>ASCii</b>, 32 for <b>INTeger</b>, 32 for <b>REAL</b>)</p> <p>Sending data to the instrument which does not conform to the current <b>FORMat</b> specified, results in an error. Sending ASCII data when a definite block is expected generates message -161 "Invalid Block Data" and sending a definite block when ASCII data is expected generates message -121 "Invalid Character in Number"</p> |
| Preset                        | <b>ASCii</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Backwards Compatibility Notes | Note that the <b>INT,32</b> format is only applicable to <b>:TRACe:DATA</b> . This preserves backwards compatibility for the Swept SA measurement. For all other commands/queries that honor <b>:FORMat:DATA</b> , if <b>INT,32</b> is sent the instrument will behave as though it were set to <b>REAL,32</b>                                                                                                                                                                                                                                            |

The specifications for each output type are:

**ASCii**      Amplitude values are in ASCII, in the current Y Axis Unit, one ASCII character per digit, values separated by commas, each value in the form: **SX.YYYYEsZZ**, where:

- S = sign (+ or -)
- X = one digit to left of decimal point
- Y = 5 digits to right of decimal point
- E = E, exponent header

|          |                                                                                  |
|----------|----------------------------------------------------------------------------------|
|          | s = sign of exponent (+ or -)                                                    |
|          | ZZ = two-digit exponent                                                          |
| REAL, 32 | Binary 32-bit real values in the current Y Axis Unit, in a definite length block |
| REAL, 64 | Binary 64-bit real values in the current Y Axis Unit, in a definite length block |

9.3.3.4 Format Data: Byte Order (Remote Command Only)

Selects the binary data byte order for data transfer and other queries.

Controls whether binary data is transferred in normal or swapped mode. Affects only the byte order for setting and querying trace data for :TRACe[:DATA], :TRACe[:DATA]? , :CALCulate:DATA[n]? and :FETCh:SANalyzer[n]?.

By definition, any command that depends on this setting uses any format supported by :FORMat:DATA.

- NORMa1 order is a byte sequence that begins with the most significant byte (MSB) first, and ends with the least significant byte (LSB) last in the sequence: 1|2|3|4
- SWAPped order is when the byte sequence begins with the LSB first, and ends with the MSB last in the sequence: 4|3|2|1

|                |                                                    |
|----------------|----------------------------------------------------|
| Remote Command | :FORMat:BORDER NORMa1   SWAPped<br>:FORMat:BORDER? |
| Preset         | NORMa1                                             |

9.3.3.5 Calculate/Compress Trace Data Query (Remote Command Only)

Returns compressed data for the currently selected measurement and sub-opcode [n].

n = any valid sub-opcode for that measurement. See the :MEASure:<measurement>? query description of your specific measurement for information on the data that can be returned.

The data is returned in the current Y Axis Unit of the instrument. The command is used with a sub-opcode <n> (default = 1) to specify the trace. With trace queries, it is best if the instrument is not sweeping during the query. Therefore, it is generally advisable to be in Single sweep, or Update = Off.

This command is used to compress or decimate a long trace to extract and return only the desired data. A typical example would be to acquire N frames of GSM data and return the mean power of the first burst in each frame. The command can also be used to identify the best curve fit for the data.

|                |                                                                                                                                                                                                             |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALCulate:DATA&lt;n&gt;:COMPRESS? BLOCK   CFIT   MAXimum   MINimum   MEAN   DMEan   RMS   SAMPLE   SDEVIation   PPHase [,&lt;soffset&gt;[,&lt;length&gt;[,&lt;roffset&gt;[,&lt;rlimit&gt;]]]]</code> |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Notes The command supports 5 parameters, but the last 4 (<soffset>, <length>, <roffset>, <rlimit>) are optional. The optional parameters must be entered in the specified order. For example, if you want to specify <length>, then you must also specify <soffset>. See details below for a definition of each of these parameters

This command uses the data in the format specified by "Format Data: Byte Order (Remote Command Only)" on page 1048, returning either binary or ASCII data

As an example, to query the mean power of a set of GSM bursts:

- Supply a signal that is a set of GSM bursts
- Select the IQ Waveform measurement (in IQ Analyzer Mode)
- Set the sweep time to acquire at least one burst
- Set the triggers such that acquisition happens at a known position relative to a burst
- Query the mean burst levels using, `:CALC:DATA2:COMP? MEAN,24e-6,526e-6` (These parameter values correspond to GSM signals, where 526e-6 is the length of the burst in the slot and you just want 1 burst)

### BLOCK or block data

Returns all the data points from the region of the trace data that you specify. For example, it could be used to return the data points of an input signal over several timeslots, excluding the portions of the trace data that you do not want. (This is x,y pairs for trace data and I,Q pairs for complex data.)

### CFIT or curve fit

Applies curve fitting routines to the data. <soffset> and <length> are required to define the data that you want. <roffset> is an optional parameter for the desired order of the curve equation. The query will return the following values: the x-offset (in seconds) and the curve coefficients ((order + 1) values).

MIN, MAX, MEAN, DME, RMS, SAMP, SDEV and PPH return one data value for each specified region (or <length>) of trace data, for as many regions as possible until you run out of trace data (using <roffset> to specify regions), or they return the number of regions you specify (using <rlimit>) ignoring any data beyond that.

### MINimum

Returns the minimum data point (y value) for the specified region(s) of trace data. For I/Q trace data, the minimum magnitude of the I/Q pairs is returned.

## MAXimum

Returns the maximum data point (y value) for the specified region(s) of trace data. For I/Q trace data, the maximum magnitude of the I/Q pairs is returned.

## MEAN

Returns a single value that is the arithmetic mean of the data point values (in dB/ dBm) for the specified region(s) of trace data. For I/Q trace data, the mean of the magnitudes of the I/Q pairs is returned. See the following equations.

### NOTE

If the original trace data is in dB, this function returns the arithmetic mean of those log values, not log of the mean power which is a more useful value. The mean of the log is the better measurement technique when measuring CW signals in the presence of noise. The mean of the power, expressed in dB, is useful in power measurements such as Channel Power. To achieve the mean of the power, use the RMS option.

---

Equation 1: Mean Value of Data Points for Specified Region(s)

$$\text{MEAN} = \frac{1}{n} \sum_{X_i \in \text{region}(s)} X_i$$

where  $X_i$  is a data point value, and  $n$  is the number of data points in the specified region(s).

Equation 2: Mean Value of I/Q Data Pairs for Specified Region(s)

$$\text{MEAN} = \frac{1}{n} \sum_{X_i \in \text{region}(s)} |X_i|$$

where  $|X_i|$  is the magnitude of an I/Q pair, and  $n$  is the number of I/Q pairs in the specified region(s).

## DMEan

Returns a single value that is the mean power (in dB/ dBm) of the data point values for the specified region(s) of trace data. See the following equation:

Equation 3: DMEan Value of Data Points for Specified Region(s)

$$\text{DME} = 10 \times \log_{10} \left( \frac{1}{n} \sum_{X_i \in \text{region}(s)} 10^{\frac{X_i}{10}} \right)$$

## RMS

Returns a single value that is the average power on a root-mean-squared voltage scale (arithmetic rms) of the data point values for the specified region(s) of trace data. See the following equation.

**Equation 4: RMS Value of Data Points for Specified Region(s)**

$$\text{RMS} = \sqrt{\frac{1}{n} \sum_{X_i \in \text{region}(s)} X_i^2}$$

where  $X_i$  is a data point value, and  $n$  is the number of data points in the specified region(s).

For I/Q trace data, the rms of the magnitudes of the I/Q pairs is returned. See the following equation.

### NOTE

**This function is very useful for I/Q trace data. However, if the original trace data is in dB, this function returns the rms of the log values which is not usually needed.**

**Equation 5: RMS Value of I/Q Data Pairs for Specified Region(s)**

$$\text{RMS} = \sqrt{\frac{1}{n} \sum_{X_i \in \text{region}(s)} X_i X_i^*}$$

where  $X_i$  is the complex value representation of an I/Q pair,  $X_i^*$  its conjugate complex number, and  $n$  is the number of I/Q pairs in the specified region(s).

Once you have the rms value for a region of trace data (linear or I/Q), you may want to calculate the mean power. You must convert this rms value (peak volts) to power in dBm:

$$10 \times \log[10 * (\text{rms value})^2]$$

### **SAMPlE**

Returns the first data value (x,y pair) for the specified region(s) of trace data. For I/Q trace data, the first I/Q pair is returned.

### **SDEViation**

Returns a single value that is the arithmetic standard deviation for the data point values for the specified region(s) of trace data. See the following equation.

**Equation 6: Standard Deviation of Data Point Values for Specified Region(s)**

$$\text{SDEV} = \sqrt{\frac{1}{n} \sum_{X_i \in \text{region}(s)} (X_i - \bar{X})^2}$$

where  $X_i$  is a data point value,  $\bar{X}$  is the arithmetic mean of the data point values for the specified region(s), and  $n$  is the number of data points in the specified region(s).

For I/Q trace data, the standard deviation of the magnitudes of the I/Q pairs is returned. See the following equation.

**Equation 7: Standard Deviation of I/Q Data Pair Values for Specified Region(s)**

$$\text{SDEV} = \sqrt{\frac{1}{n} \sum_{X_i \in \text{region}(s)} (|X_i| - \bar{X})^2}$$

where  $|X_i|$  is the magnitude of an I/Q pair,  $\bar{X}$  is the mean of the magnitudes for the specified region(s), and  $n$  is the number of data points in the specified region(s).

### **PPHase**

Returns the x,y pairs of both rms power (dBm) and arithmetic mean phase (radian) for every specified region and frequency offset (Hz). The number of pairs is defined by the specified number of regions. This parameter can be used for I/Q vector ( $n=0$ ) in Waveform (time domain) measurement and all parameters are specified by data point in [PPHase](#).

The rms power of the specified region may be expressed as:

$$\text{Power} = 10 \times \log [10 \times (\text{RMS I/Q value})] + 10.$$

The RMS I/Q value (peak volts) is:



$$\sqrt{\frac{1}{n} \sum_{X_i \in \text{region}} X_i X_i^*}$$

where  $X_i$  is the complex value representation of an I/Q pair,  $X_i^*$  its conjugate complex number, and  $n$  is the number of I/Q pairs in the specified region.

The arithmetic mean phase of the specified region may be expressed as:

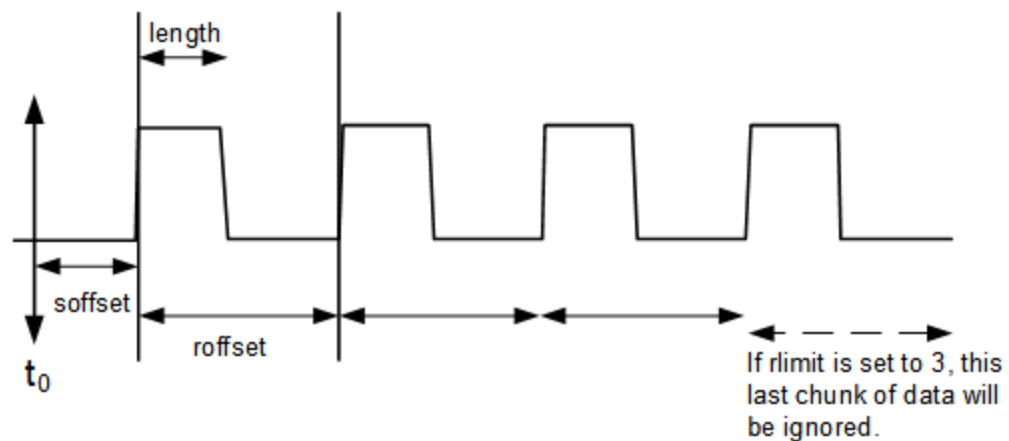
$$\frac{1}{n} \sum_{Y_i \in \text{region}} Y_i$$

where  $Y_i$  is the unwrapped phase of I/Q pair with applying frequency correction and  $n$  is the number of I/Q pairs in the specified region.

The frequency correction is made by the frequency offset calculated by the arithmetic mean of every specified region's frequency offset. Each frequency offset is calculated by the least square method against the unwrapped phase of I/Q pair.

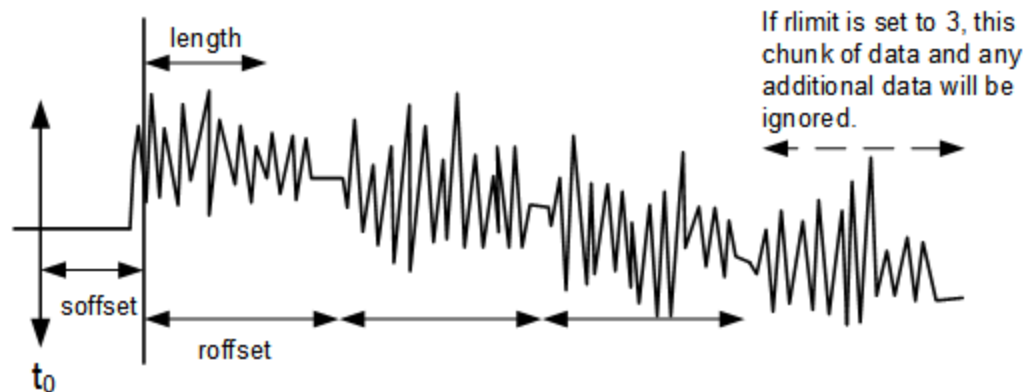
### Sample Trace Data - Constant Envelope

(See below for explanation of variables.)



### Sample Trace Data - Not Constant Envelope

(See below for explanation of variables.)



- <offset>** Optional real number, in seconds for time-domain traces, and is a dimensionless index 0 to Npoints – 1, for frequency-domain traces  
Specifies the amount of data at the beginning of the trace that will be ignored before the decimation process starts. It is the time or frequency change from the start of the trace to the point where you want to start using the data. The default value is zero
- <length>** Optional real number, in seconds for time-domain traces, and is a dimensionless index 0 to Npoints – 1, for frequency-domain traces  
Defines how much data will be compressed into one value. This parameter has a default value equal to the current trace length
- <roffset>** Optional real number, in seconds for time-domain traces, and is a dimensionless index 0 to Npoints – 1, for frequency-domain traces  
Defines the beginning of the next field of trace elements to be compressed. This is relative to the beginning of the previous field. This parameter has a default value equal to the **<length>** variable. Note that this parameter is used for a completely different purpose when curve fitting (see "CFIT or curve fit" on page 1049 above)
- <rlimit>** Optional integer  
Specifies the number of data items that you want returned. Ignores any additional items beyond that number. You can use the Start offset and the Repeat limit to pick out exactly what part of the data you want to use. The default value is all the data

### 9.3.3.6 Calculate Peaks of Trace Data (Remote Command Only)

Returns a list of all the peaks for the currently selected measurement and sub-opcode [n]. The peaks must meet the requirements of the peak threshold and excursion values.

**n** = any valid sub-opcode for the current measurement. See the [:MEASure:<measurement>](#) command description of your specific measurement for information on the data that can be returned.

The command can only be used with specific sub-opcodes with measurement results that are trace data. Both real and complex traces can be searched, but complex traces are converted to magnitude in dBm. In many measurements the sub-opcode **n** = 0, is the raw trace data, which cannot be searched for peaks, and sub-opcode **n** = 1, is often calculated results values which also cannot be searched for peaks.

This command uses the data setting specified by "[Format Data: Byte Order \(Remote Command Only\)](#)" on page 1048 and "[Format Data: Numeric Data \(Remote Command Only\)](#)" on page 1047, and can return real or ASCII data. If the format is set to [INT, 32](#), it returns [REAL, 32](#) data.

The command has four types of parameters:

1. Threshold (in dBm)
2. Excursion (in dB)
3. Sorting order (amplitude, frequency, time)
4. Optional in some measurements: Display line use (all, > display line, < display line)

|                |                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <p>For Swept SA measurement:</p> <pre>:CALCulate:DATA[1] 2 ... 6:PEAKs? &lt;threshold&gt;,&lt;excursion&gt;[,AMPLitude   FREQuency   TIME[,ALL   GTDLine   LTDLine]]</pre> <p>For most other measurements:</p> <pre>:CALCulate:DATA[1] 2 ... 6:PEAKs? &lt;threshold&gt;,&lt;excursion&gt;[,AMPLitude   FREQuency   TIME]</pre> |                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Notes          | Parameters:                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|                | <n>                                                                                                                                                                                                                                                                                                                            | <p>The trace that will be used:</p> <p><a href="#">[1] 2 ... 6</a></p>                                                                                                                                                                                                                                                                                                                                                                         |
|                | <threshold>                                                                                                                                                                                                                                                                                                                    | <p>The level below which trace data peaks are ignored</p> <p>Note that the threshold value is required and is always used as a peak criterion. To effectively disable the threshold criterion for this command, provide a substantially low threshold value such as -200 dBm</p> <p>Note also that the threshold value used in this command is independent of and has no effect on the threshold value stored under the Peak Criteria menu</p> |
|                | <excursion>                                                                                                                                                                                                                                                                                                                    | <p>The minimum amplitude variation (rise and fall) required for a signal to be identified as peak</p>                                                                                                                                                                                                                                                                                                                                          |

Note that the excursion value is required and is always used as a peak criterion. To effectively disable the excursion criterion for this command, provide the minimum value of 0.0 dB

Note also that the excursion value used in this command is independent of and has no effect on the excursion value stored under the Peak Criteria menu

Values must be provided for threshold and excursion. The sorting and display line parameters are optional (defaults are **AMPLitude** and **ALL**)

Note that there is always a Y-axis value for the display line, regardless of whether the display line state is on or off. It is the current Y-axis value of the display line which is used by this command to determine whether a peak should be reported

Sorting order:

|                  |                                                                                                                                           |
|------------------|-------------------------------------------------------------------------------------------------------------------------------------------|
| <b>AMPLitude</b> | Lists the peaks in order of descending amplitude, with the highest peak first<br>If this optional parameter not sent, this is the default |
| <b>FREQuency</b> | Lists the peaks in order of occurrence, left to right across the x-axis                                                                   |
| <b>TIME</b>      | Lists the peaks in order of occurrence, left to right across the x-axis                                                                   |

Peaks vs. Display Line:

|                |                                                                                  |
|----------------|----------------------------------------------------------------------------------|
| <b>ALL</b>     | Lists all of the peaks found (default if optional parameter not sent)            |
| <b>GTDLine</b> | Lists all of the peaks found above the display line<br>Greater than display line |
| <b>LTDLine</b> | Lists all of the peaks found below the display line<br>Less than display line    |

For example, for Swept SA measurement in Spectrum Analyzer Mode:

**:CALC:DATA4:PEAK? -40,10,FREQ,GTDL**

Identifies the peaks of trace 4 that are above -40 dBm, with excursions of at least 10 dB. The peaks are returned in order of increasing frequency, starting with the lowest frequency. Only the peaks that are above the display line are returned

Query Results:

If **:FORMat:DATA REAL,32** is selected, returns a list of floating-point numbers. The first value in the list is the number of peak points that are in the following list. A peak point consists of two values: a peak amplitude followed by its corresponding frequency (or time)

If no peaks are found, the peak list consists of only the number of peaks, (0)

**9.3.3.7 Smooth Trace Data (Remote Command Only)**

Included for ESA compatibility. Not recommended for new designs. Use **:CALCulate:DATA:COMPRESS** instead.

Smooths the trace according to the number of points specified in `:TRACe:MATH:SMOoth:POINts`. There is no equivalent front panel function.

The purpose of this function is to perform a spatial video averaging, as compared to the temporal version supplied by the video-average command `[ :SENSe]:AVERage:TYPE VIDEo`. The functions of `:TRACe:MATH:SMOoth <trace>` and `[ :SENSe]:AVERage:TYPE VIDEo|POWer` are not interchangeable.

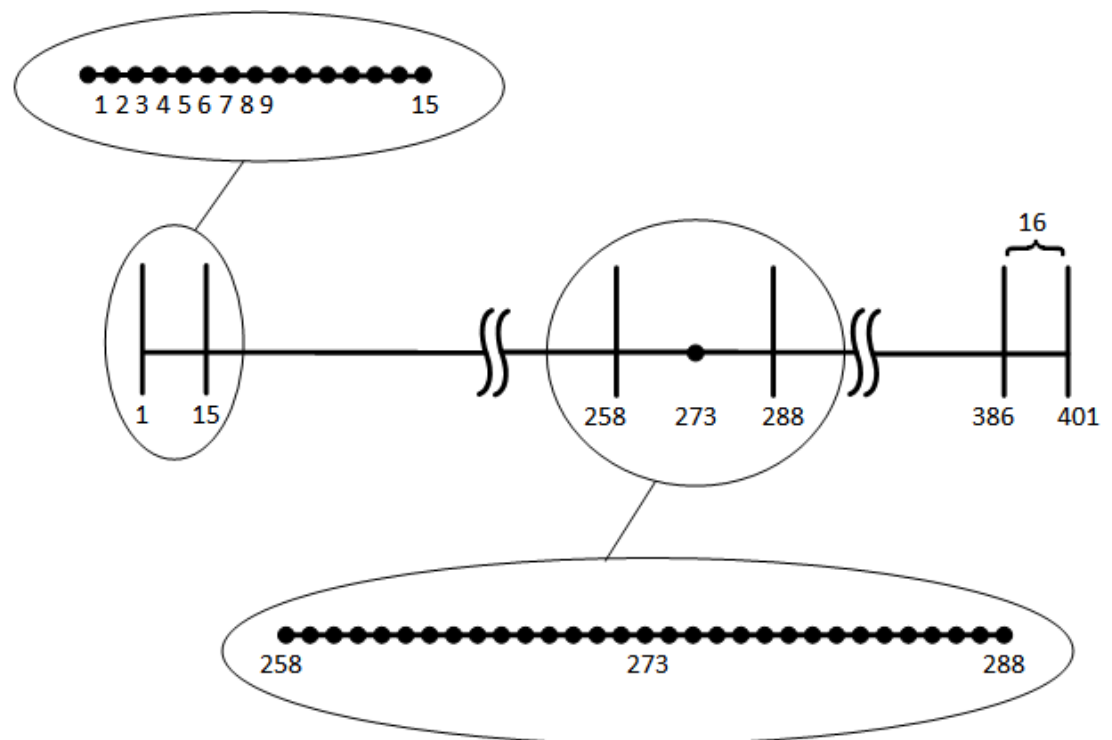
Backwards Compatibility  
SCPI

`:TRACe:MATH:SMOoth TRACE1 | ... | TRACE6`

Each point value is replaced with the average of the values of the selected number of points, with half of those points located on each side of any particular point (when possible). Refer to the illustration below, which shows a 401-point trace with a smoothing number of 31. Think of the trace points as “buckets” of data. To smooth (arbitrary) point 273, the instrument averages buckets 258 through 288 and applies that value to point 273.

Increasing the number of points increases smoothing at the cost of decreasing resolution.

The amount of smoothing decreases at the end points. Because `:TRACe:MATH:SMOoth <trace>` averages values that occur before and after the data point in time, display irregularities can be caused at the start and stop frequencies. To avoid possible irregularities (signal distortion) at the ends of the trace, use small values for the smooth parameter.



Smoothing With 401 Trace Points and 31 Smoothing Points

Refer to the illustration above for a discussion of this end-point smoothing phenomena. With 31 smoothing points and a 401-point trace, point 16 will be the first point to have full 31-bucket smoothing. Likewise, point 386 will be the last point with full 31-bucket smoothing. Under the conditions stated, points 2 through 15 will be smoothed as follows: Point 2 is derived from averaging buckets 1 through 3. Point 3 is derived from averaging buckets 1 through 5, Point 4 is derived from averaging buckets 1 through 7, and so forth until point 16 is reached. The quantity of buckets used for the smoothing running average increases at the rate of 2 buckets per point, from point 1 to point  $([\text{smoothing number}+1]/2)$ , at which time the full number of smoothing points is utilized. The same characteristic occurs at the completion of the trace, beginning at point 386, beyond which the number of averaging buckets begins to decrease until point 401 is reached.

By replacing the value of each point in a trace with the average of the values of a number of points centered about that point, any rapid variations in noise or signals are smoothed into more gradual variations. It thereby performs a function similar to reducing the video bandwidth without the corresponding changes in sweep time; as such, frequency resolution is decreased. Also, signal peaks are reduced with large smoothing values. This can cause the amplitude to appear to be less than its actual value.

9.3.3.8 Number of Points for Smoothing (Remote Command Only)

Included for ESA compatibility. Not recommended for new designs. Use `:CALCulate:DATA:COMPRESS` instead.

Specifies the number of points that will be smoothed. Increasing the number of points increases smoothing at the cost of decreasing resolution. If the number of points is an even number, then the number of points is increased by one. If the number of points is larger than the number of sweep points, then the number of sweep points is used, unless the number of sweep points is even, in which case the number of points will be the sweep points minus one. The number of points smoothed is always an odd number.

|                         |                                                                                                                                                                                                                                         |
|-------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Example                 | <code>:TRAC:MATH:SMO:POIN 501</code>                                                                                                                                                                                                    |
| Notes                   | Only odd values are allowed<br>If an even value of <code>&lt;integer&gt;</code> is specified, adds 1 unless <code>&lt;integer&gt;</code> = number of sweep points, in which case subtract 1<br>Used with <code>TRACe:MATH:SMOoth</code> |
| Preset                  | 11                                                                                                                                                                                                                                      |
| Min                     | 3                                                                                                                                                                                                                                       |
| Max                     | Number of sweep points                                                                                                                                                                                                                  |
| Backwards Compatibility | <code>:TRACe:MATH:SMOoth:POINTs &lt;integer&gt;</code>                                                                                                                                                                                  |

SCPI

:TRACe:MATH:SMOoth:POINts?

9.3.3.9 Mean Trace Data (Remote Command Only)

Included for ESA compatibility. Not recommended for new designs. Use :CALCulate:DATA:COMPRESS instead.

Returns the mean of the amplitudes of the trace amplitude elements in measurement units.

|                                 |                                         |
|---------------------------------|-----------------------------------------|
| Example                         | :TRAC:MATH:MEAN? TRACE2                 |
| Backwards Compatibility<br>SCPI | :TRACe:MATH:MEAN? TRACE1   ...   TRACE6 |

## 9.4 Status Register System & STATus Subsystem

This section provides an overview of the X-Series SCPI status register system, and how to manage the registers. For detailed programming information on each status register, see ["Status Subsystem Registers and Commands" on page 1069](#).

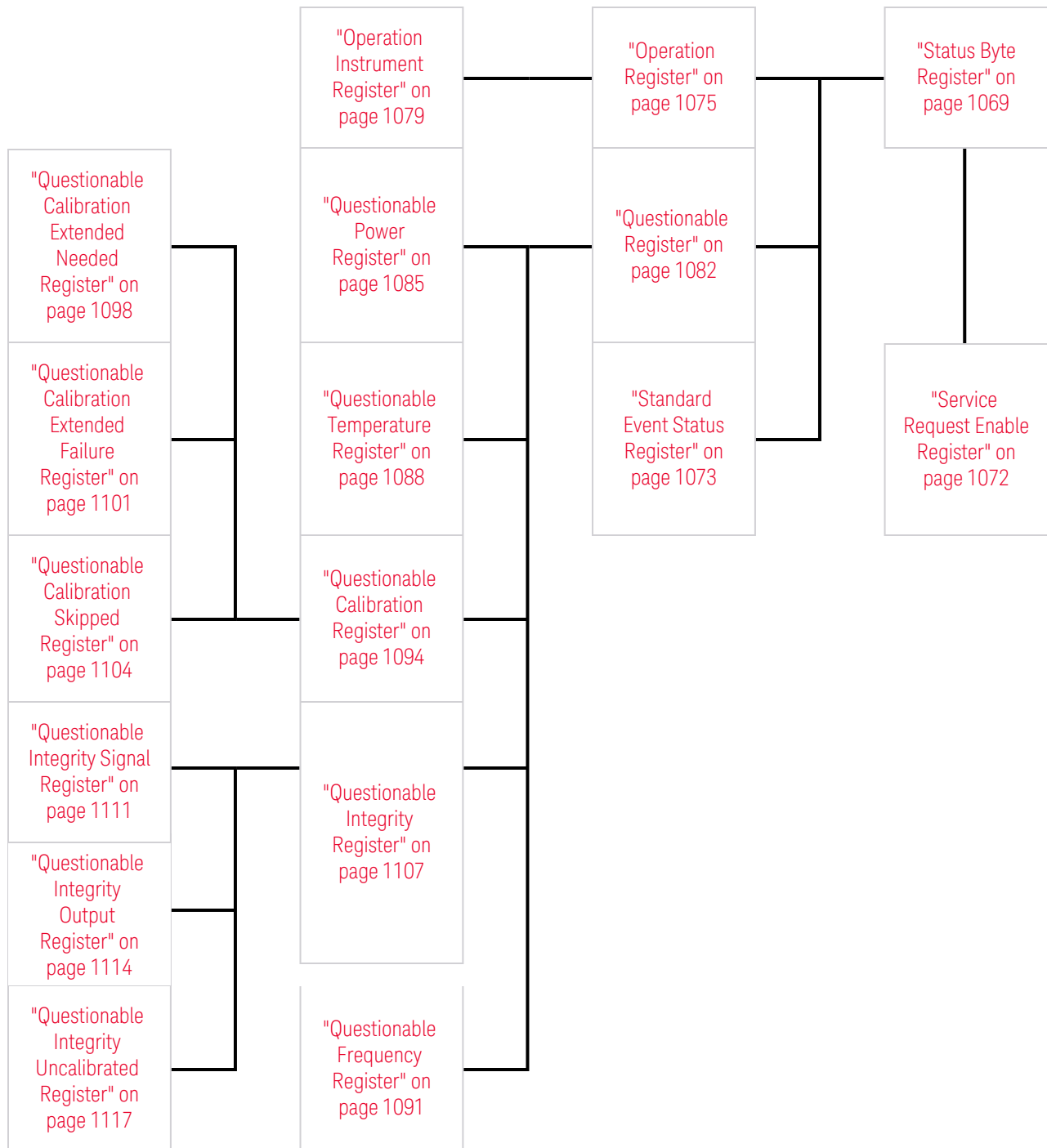
The SCPI **STATus** Subsystem allows you to monitor a number of status conditions within the instrument through the use of a hierarchy of status registers containing bits which go true or false depending on various conditions.

### 9.4.1 Status Register System Diagram

The diagram below provides a top-level overview of all the Status Registers and their interconnections.

To navigate to detailed information about each Register, click on a register name:





Detailed System Diagram

As from the **X-Apps 2023** update, the fully-detailed system diagram that previously appeared here is still available, but, for improved readability, it is now published as a separate high-resolution PDF. You can download the document from Keysight's web site at:

<http://literature.cdn.keysight.com/litweb/pdf/N9040-90056.pdf>

9.4.2 Status Register Hierarchy

The Status Register system contains multiple registers, arranged in a hierarchy. The lower-level registers propagate their data to the higher-level registers in the data structures by means of summary bits.

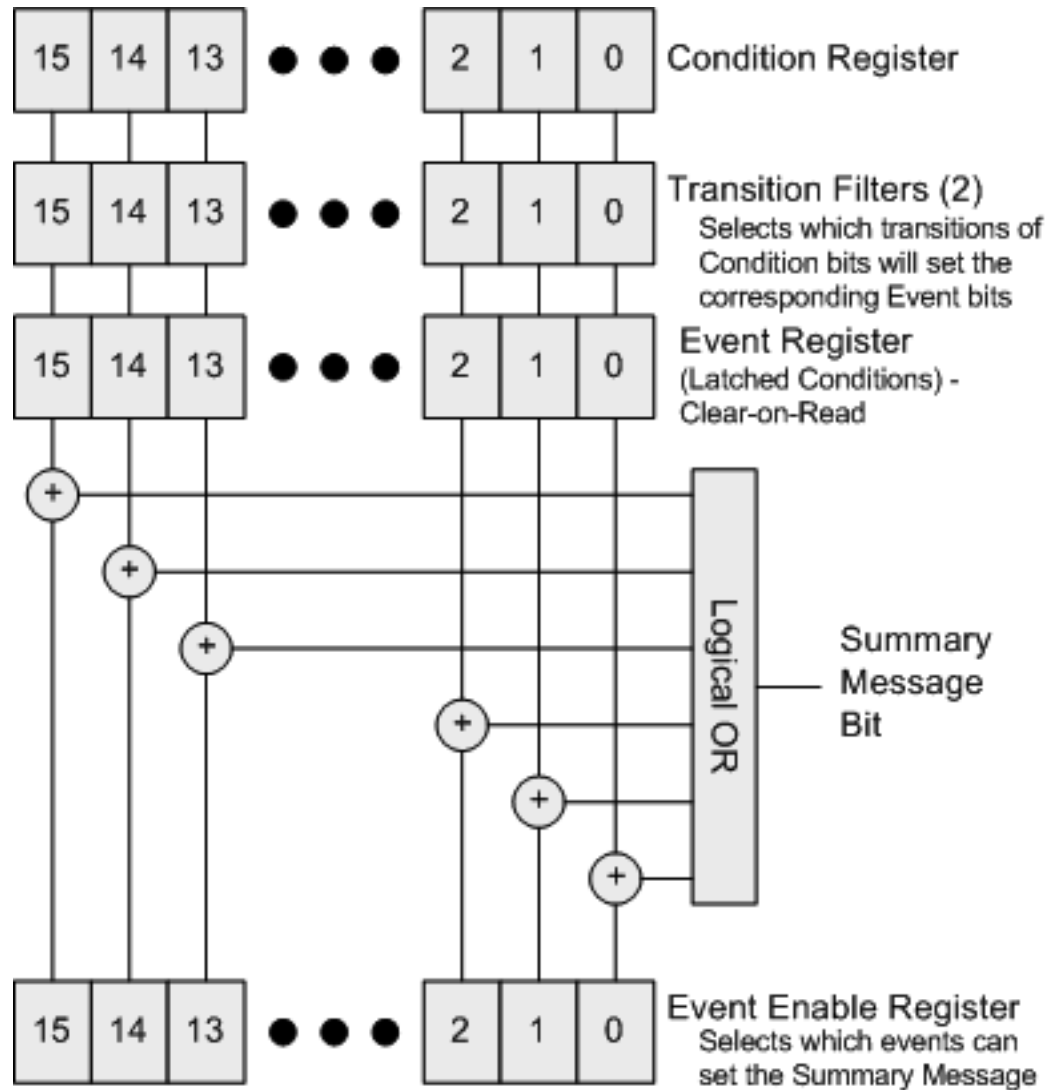
The "Status Byte Register" on page 1069 is at the top of the hierarchy and contains general status information for the instrument's events and conditions. All other individual registers are used to determine the specific events or conditions.

The "Operation Register" on page 1075 and "Questionable Register" on page 1082 are sets of registers that monitor the overall instrument condition. They are accessed using :STATus:OPERation and :STATus:QUEStionable commands in the STATus subsystem. Each composite status register set consists of five sub-registers:

|   |                              |                                                                                                                                                                                                                                                             |
|---|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | Condition Register           | Reports the real-time state of the signals monitored by this register set. There is no latching or buffering for a condition register                                                                                                                       |
| 2 | Positive Transition Register | Transition Filter Register<br>Controls which signals will set a bit in the event register when the signal makes a low to high transition (when the condition bit changes from 0 to 1)                                                                       |
| 3 | Negative Transition Register | Transition Filter Register<br>Controls which signals will set a bit in the event register when the signal makes a high to low transition (when the condition bit changes from 1 to 0)                                                                       |
| 4 | Event Register               | Latches any signal state changes, in the way specified by the filter registers. Bits in the event register are never cleared by signal state changes. Event registers are cleared when read. They are also cleared by *CLS and by presetting the instrument |
| 5 | Event Enable Register        | Controls which of the bits, being set in the event register, will be summarized as a single output for the register set. Summary bits are then used by the next higher register                                                                             |

Each status register produces a summary message bit.

The diagram below shows how the sub-registers relate to each other.



The settings of the Transition Filter registers determine whether or not a bit set in a Condition register ripples through to the Event register, as follows:

- If a bit is set in the Positive Transition Register, then the corresponding bit in the Event register is set when the condition bit goes from low to high (false to true, off to on)
- Conversely, if a bit is set in the Negative Transition Register then the Event register bit is set when the condition bit goes from high to low
- If *both* Transition Filter registers are set true, then the event bit for that condition is set whenever there is any change in the bit. If an event bit is set, the Event Enable Register determines whether or not it will **OR** into the summary bit that is sent to the next level of register. If this bit is set, then the corresponding event bit will be included

Note that the Event Register is "Clear-on-Read": when any bit is read, it is automatically cleared.

Questionable Registers

These registers report abnormal operating conditions. The status register hierarchy is:

- The summary outputs from the six [QUESTionable:<keyword>](#) detail registers are inputs to the ["Questionable Register" on page 1082](#)
- The summary output from the ["Questionable Register" on page 1082](#) is an input to the Status Byte Register
- The summary output from the is an input to the ["Operation Register" on page 1075](#). The inputs to the ["Operation Condition Query" on page 1076](#) Register indicate the real time state of the instrument. The ["Operation Event Query" on page 1077](#) Register summary output is an input to the Status Byte Register

Note that, in E4406A only, the ["Operation Enable" on page 1077](#) Register has an additional function. It is [ANDed](#) with the ["Operation Condition Query" on page 1076](#) Register to determine the instrument busy state, which is checked by ["\\*OPC? - Operation Complete" on page 1034](#) and ["\\*WAI - Wait-to-Continue" on page 1038](#) . If the [ANDed](#) result is non-zero, the instrument is considered busy.

9.4.3 Status Register SCPI Commands

Monitoring of instrument conditions is done at the highest level using the following IEEE 488.2 common commands.

For complete command descriptions, see ["IEEE 488.2 Common Commands" on page 1031](#) . Individual status registers can be set and queried using the commands described in ["Status Subsystem Registers and Commands" on page 1069](#) .

|                       |                       |                                                                                                                                                                                                       |
|-----------------------|-----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <a href="#">*CLS</a>  | Clear Status          | Clears the status byte by emptying the error queue and clearing all the event registers                                                                                                               |
| <a href="#">*ESE</a>  | Event Status          | Sets and queries the bits in the enable register part of the Standard Event Status Register                                                                                                           |
| <a href="#">*ESE?</a> | Enable                |                                                                                                                                                                                                       |
| <a href="#">*ESR?</a> | Event Status Register | Queries and clears the event register part of the Standard Event Status Register                                                                                                                      |
| <a href="#">*OPC</a>  | Operation             | Sets the Standard Event Status Register to monitor the completion of all commands. The query stops any new commands from being processed until the current processing is complete, then returns a '1' |
| <a href="#">*OPC?</a> | Complete              |                                                                                                                                                                                                       |
| <a href="#">*PSC</a>  | Power-on              | Sets the power-on state so that it clears the Service Request Enable Register and the event status enable register at power on                                                                        |
| <a href="#">*PSC?</a> | State Clear           |                                                                                                                                                                                                       |

|       |                   |                                                                            |
|-------|-------------------|----------------------------------------------------------------------------|
| *SRE  | Service           | Sets and queries the value of the Service Request Enable Register          |
| *SRE? | Request<br>Enable |                                                                            |
| *STB? | Status Byte       | Queries the value of the Status Byte Register without erasing its contents |

## 9.4.4 How to Use Status Registers

A program often needs to be able to detect and manage error conditions or changes in instrument status.

There are two methods you can use to programmatically access the information in status registers:

- The ["Polling Method" on page 1065](#)
- The ["Service Request \(SRQ\) Method" on page 1066](#)

The Polling Method works well if you do not need to know about changes the moment they occur. To detect a change using this method, the program must repeatedly read the registers.

Use the SRQ Method if you must know immediately when a condition changes.

Either method allows you to monitor one or more conditions.

### 9.4.4.1 Polling Method

In this method, the instrument has a passive role. It only tells the controller that conditions have changed when the controller asks the right question.

Use this method when:

- your programming language/development environment does not support SRQ interrupts
- you want to write a simple, single-purpose program and don't want the added complexity of setting up an SRQ handler

To monitor a condition:

- Determine which register contains the bit that reports the condition
- Send the unique SCPI query to read that register
- Examine the bit to see if the condition has changed

## Monitoring Options

You can monitor conditions in various ways:

- |   |                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|---|-----------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | Check the current instrument hardware and firmware status | <p>Do this by querying the condition registers, which continuously monitor status. These registers represent the current state of the instrument. Bits in a condition register are updated in real time</p> <p>When the condition monitored by a particular bit becomes true, the bit is set to 1. When the condition becomes false, the bit is reset to 0</p>                                                                                                                                                                                                         |
| 2 | Monitor a particular condition (bit)                      | <p>You can enable a particular bit(s), using the <a href="#">"Standard Event Status Enable Register" on page 1074</a>. The instrument will then monitor that particular condition. If the bit becomes true (0 to 1 transition) in the Event Register, it will stay set until the Event Register is cleared. Querying the Event Register allows you to detect that this condition occurred, even if the condition no longer exists. The Event Register can only be cleared by querying it, or by sending <a href="#">*CLS</a></p>                                       |
| 3 | Monitor a particular type of change in a condition (bit)  | <p>By default, the Transition Registers are set if the condition goes from 0 to 1 (false to true, or a positive transition), but you can change this behavior so the selected condition is detected if the bit goes from 1 to 0 (true to false, or a negative transition)</p> <p>You can also detect <i>both</i> types of transitions, or neither</p> <p>If both Transition Registers are set to 0 for a particular bit position, that bit is <i>not</i> set in the <a href="#">"Standard Event Status Enable Register" on page 1074</a> for either type of change</p> |

### 9.4.4.2 Service Request (SRQ) Method

In this method, the instrument takes a more active role, by informing the controller when there has been a condition change, without the controller asking.

Use this method when:

- you need time-critical notification of changes
- you are monitoring more than one device which supports SRQs
- you need to have the controller do something else while waiting
- you can't afford the performance penalty inherent to polling

### Using the Service Request (SRQ) Method

Your language, bus, and programming environment must be able to support SRQ interrupts, for example, BASIC used with VXI-11.3 (GPIB over LAN). When you monitor a condition with the SRQ method, you must:

- Determine which bit monitors the condition
- Determine how that bit reports to the request service (**RQS**) bit of the status byte
- Send SCPI commands to enable the bit that monitors the condition and to enable the summary bits that report the condition to the **RQS** bit
- Enable the controller to respond to service requests

When the condition changes, the instrument sets its **RQS** bit. The controller is informed of the change as soon as it occurs. As a result, the time the controller would otherwise have used to monitor the condition can be used to perform other tasks. Your program determines how the controller responds to the SRQ.

Bit 6 of the "Status Byte Register" on page 1069 is the request service (**RQS**) bit. Use **\*SRE** to configure the **RQS** bit to report changes in instrument status. When such a change occurs, the **RQS** bit is set. It is cleared when the Status Byte Register is queried using **\*SRE?** (with a serial poll.) It can be queried *without* erasing the contents by using **\*STB?**.

When a register being set causes a summary bit in the status byte to change from 0 to 1, the instrument can initiate the service request (SRQ) process. However, the process is only initiated if *both* the following conditions are true:

The corresponding bit of the Service Request Enable Register is also set to 1

The instrument does not have a service request pending. (A service request is considered to be pending between the time the instrument's SRQ process is initiated and the time the controller reads the Status Byte Register)

The SRQ process sets the SRQ true. It also sets the status byte's request service (**RQS**) bit to 1. Both actions are necessary to inform the controller that the instrument requires service. Setting the SRQ line *only* informs the controller that some device on the bus requires service. Setting the **RQS** bit allows the controller to determine which instrument requires service.

If your program enables the controller to detect and respond to service requests, it should instruct the controller to perform a serial poll when the SRQ is set true. Each device on the bus returns the contents of its Status Byte Register in response to this poll. The device whose **RQS** bit is set to 1 is the device that requested service.

NOTE

**When you read the instrument's Status Byte Register using a serial poll, the **RQS** bit is reset to 0. Other bits in the register are not affected.**

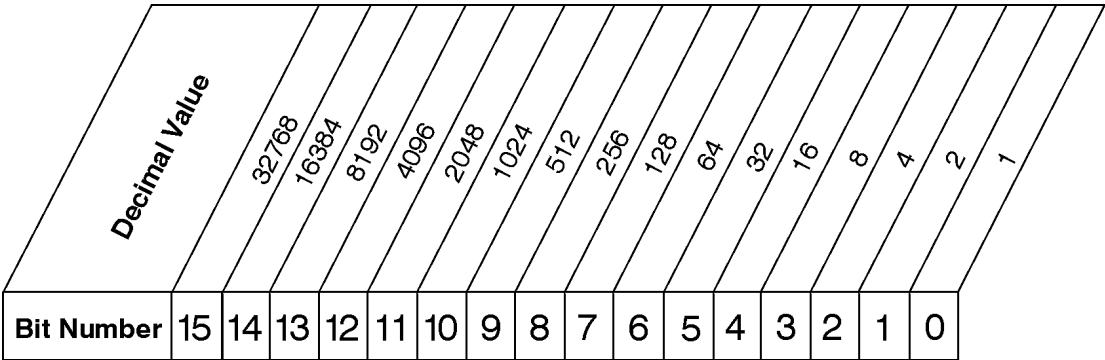
---

If the Status Byte Register is configured to SRQ on end-of-measurement, and the measurement is in **Continuous** mode, then restarting a measurement (via **:INIT**) can cause the measuring bit to pulse low. This causes an SRQ even though you have not actually reached the "end-of-measurement" condition. To avoid this:

- Set `:INITiate:CONTinuous OFF`
- Set/enable the status registers
- Restart the measurement (send `:INIT`)

9.4.5 Status Register Bit Parameters

The diagram below shows a typical status register, in this case the "Operation Enable" on page 1077 Register. Each bit in a register is represented by a numerical value based on its location. When a command requires a bit pattern to be sent as its parameter, that can be entered as a numeric value using decimal or hexadecimal representations. (where 0 to 32767 is equivalent to `#H0` to `#H7FFF`). If you want to enable more than one bit, you send the sum of all the bits that you want to monitor.



STATus:OPERation:ENABLE <num>  
STATus:OPERation:ENABLE?

Standard Operation Event Enable Register

ck730a

NOTE Bit 15 is not used to report status.

Example 1

To enable bit 0 and bit 6 of the Standard Event Status Register, you would send the command `*ESE 65` because  $1 + 64 = 65$

The results of a query are evaluated in a similar way. If the `*STB?` command returns a decimal value of 140, ( $140 = 128 + 8 + 4$ ) then bit 7 is true, bit 3 is true and bit 2 is true

Example 2

Suppose you want to know if an Auto-trigger Timeout occurs, but you only cared about that specific condition. So, you would want to know what was happening with bit 10 in the Status Questionable Integrity Register, and not about any other bits



It is usually a good idea to start by clearing all the status registers, using **\*CLS**

Sending **:STAT:QUES:INT:ENAB 1024** lets you monitor only bit 10 events, instead of the default monitoring all the bits in the register. The register default is for positive transition events (0 to 1 transition), that is, when an auto-trigger timeout occurs. If instead, you want to know when the Auto-trigger timeout condition is cleared, then you set **:STAT:QUES:INT:PTR 0** and **:STAT:QUES:INT:NTR 32767**

Now, the only output from the "Questionable Integrity Register" on page 1107 will come from a bit 10 positive transition, and goes to the Integrity Sum bit 9 of the "Questionable Register" on page 1082

If you want only to monitor bit 9 of the same register, send **:STAT:QUES:ENAB 512**

The "Questionable Register" on page 1082 output goes to the "Status Questionable Summary" bit 3 of the "Status Byte Register" on page 1069. The output from this register can be enabled using **\*SRE 8**.

Finally, you can use the serial polling functionality available for the particular bus/software that you are using to monitor the Status Byte Register, or you could use **\*STB?** to poll the Status Byte Register.

## 9.4.6 Status Subsystem Registers and Commands

The Status Subsystem registers monitor various events and conditions in the instrument. Software written to control the instrument may need to monitor some of these events and conditions.

To set and query status registers, you can use the **STATus** subsystem SCPI commands and queries.

### NOTE

All status register commands are sequential. You can send them in the middle of an ongoing overlapped command to get the current status. You can also send them following a sequential command. In this case, the status register command waits for the completion of the previously-sent sequential command before performing the action.

*Most commands are sequential commands; only a few are overlapped.*

If a command is overlapped, then that is explicitly stated in the command description.

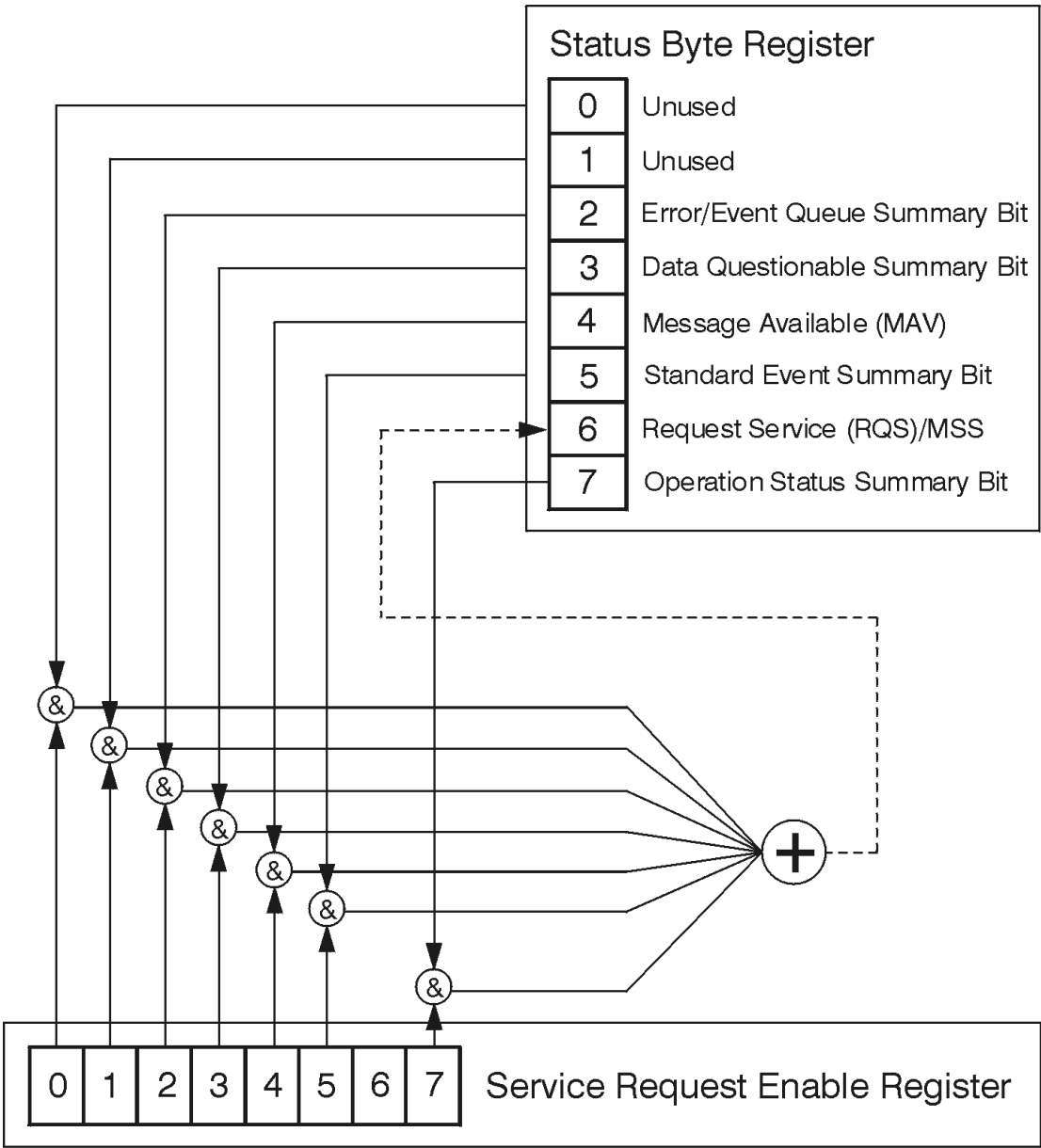
---

See also the **Keysight X-Series Signal Analyzers Instrument Messages** manual for more detail on the instrument conditions that can cause these bits to be set.

### 9.4.6.1 Status Byte Register

Provides a one-byte overview of the entire **STATus** subsystem. All the other registers funnel into this register via summary bits, as shown in the "Status Register System

Diagram" on page 1060.



ck776a

| Description |   | Standard Operation Status Summary Bit |   | Request Service (RQS) Summary Bit |   | Standard Event Status Summary Bit |   | Message Available (MAV) |  | Data Questionable Status Summary Bit |  | Error/Event Queue Summary Bit |  | Unused |  | Unused |  |
|-------------|---|---------------------------------------|---|-----------------------------------|---|-----------------------------------|---|-------------------------|--|--------------------------------------|--|-------------------------------|--|--------|--|--------|--|
| Bit Number  | 7 | 6                                     | 5 | 4                                 | 3 | 2                                 | 1 | 0                       |  |                                      |  |                               |  |        |  |        |  |

\*STB?

### Status Byte Register

ck725a

| Bit  | Description                                                                                                                                                                                                        |
|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0, 1 | These bits are always set to 0                                                                                                                                                                                     |
| 2    | A 1 in this bit position indicates that the SCPI error queue is not empty which means that it contains at least one error message                                                                                  |
| 3    | A 1 in this bit position indicates that the data questionable summary bit has been set. The Data Questionable Event Register can then be read to determine the specific condition that caused this bit to be set   |
| 4    | A 1 in this bit position indicates that the instrument has data ready in the output queue. There are no lower status groups that provide input to this bit                                                         |
| 5    | A 1 in this bit position indicates that the standard event summary bit has been set. The Standard Event Status Register can then be read to determine the specific event that caused this bit to be set            |
| 6    | A 1 in this bit position indicates that the instrument has at least one reason to report a status change. This bit is also called the master summary status bit (MSS)                                              |
| 7    | A 1 in this bit position indicates that the standard operation summary bit has been set. The Standard Operation Event Register can then be read to determine the specific condition that caused this bit to be set |

To query the Status Byte Register, send **"\*STB? - Status Byte Query"** on page 1037. The response will be the decimal sum of the bits that are set to 1. For example, if bit number 7 and bit number 3 are set to 1, the decimal sum of the 2 bits is 128 plus 8, so the decimal value 136 is returned.

**\*STB** does *not* clear the status register.

The **RQS** bit is read and reset by a serial poll. The same bit position (**MSS**) is read non-destructively by **\*STB?**. If you serial-poll bit 6, it is read as **RQS**, but if you send **\*STB**, it reads bit 6 as **MSS**. For more information refer to Section 11 of: **IEEE Standard 488.2-1992**

In addition to the Status Byte Register, the status byte group also contains the "Service Request Enable Register" on page 1072, which lets you select which bits in the Status Byte Register will trigger a service request.

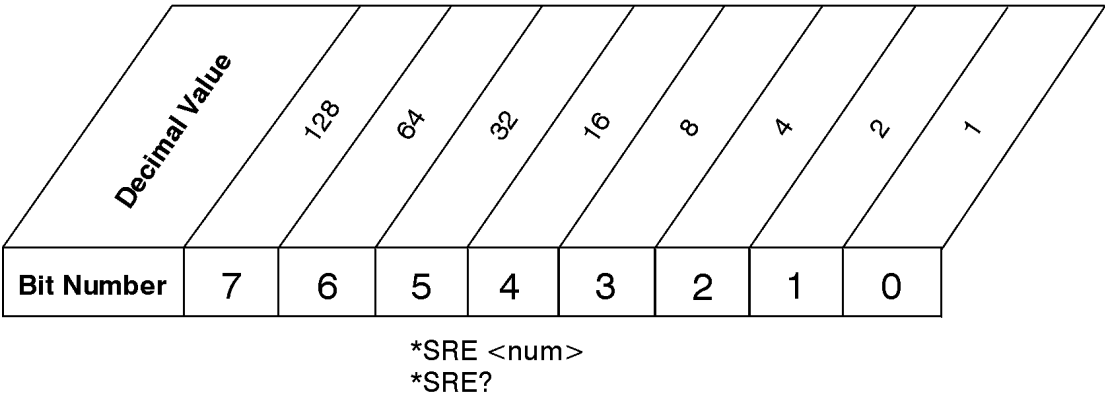
Service Request Enable Register

Enables the desired bits of the Service Request (SRQ) subsystem.

Send **\*SRE <integer>**, where **<integer>** is the sum of the decimal values of the bits you want to enable plus the decimal value of bit 6. For example, assume that you want to enable bit 7 so that whenever the Standard Operation Status Register summary bit is set to 1 it will trigger a service request. Send the command **\*SRE 192** (because  $192 = 128 + 64$ ). You must always add 64 (the numeric value of RQS bit 6) to your numeric sum when you enable any bits for a service request.

**\*SRE?** returns the decimal value of the sum of the bits previously enabled with **\*SRE <integer>**.

This register presets to zeros (0).



Service Request Enable Register

ck726a

See also **"\*SRE - Service Request Enable"** on page 1036

Preset the Status Byte

Sets bits in most of the enable and transition registers to their default state.

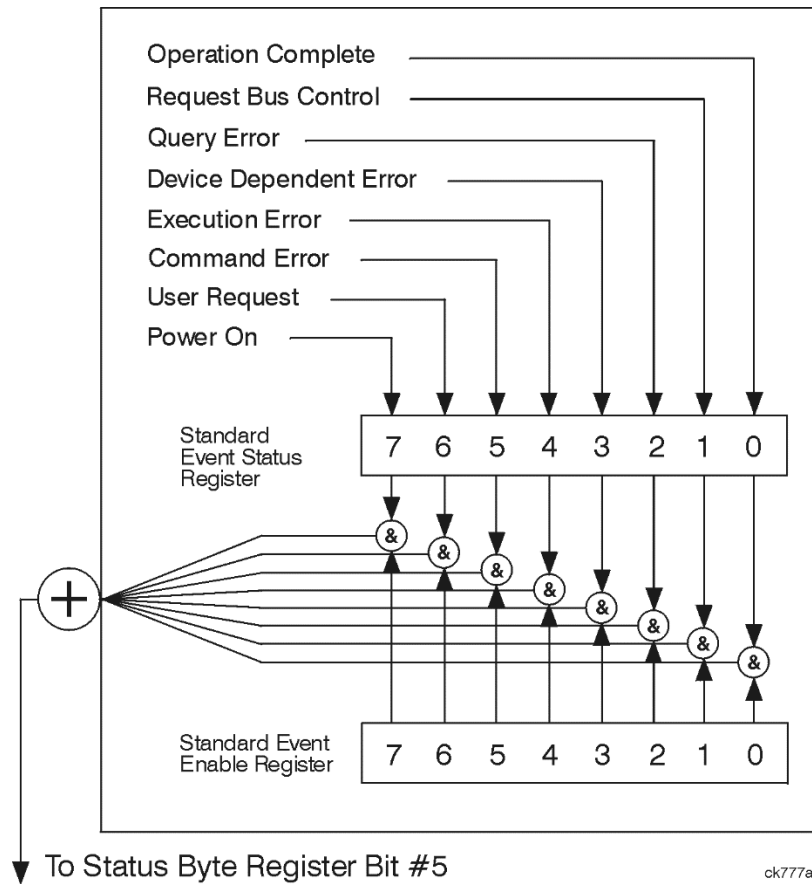
- Presets:
- All Transition Filters
- All Enable Registers
- Error/Event Queue Enable

Has no effect on Event Registers, Error/Event QUEue, IEEE 488.2 ESE, and SRE Registers, as described in: [IEEE Standard 488.2-1992](#)

Remote Command :STATus:PRESet

Example :STAT:PRES

### 9.4.6.2 Standard Event Status Register



The Standard Event Status Register contains the following bits:

| Description              |   |   |   |   |   |   |   |   |
|--------------------------|---|---|---|---|---|---|---|---|
| Power On                 |   |   |   |   |   |   |   |   |
| User Request Key (Local) |   |   |   |   |   |   |   |   |
| Command Error            |   |   |   |   |   |   |   |   |
| Execution Error          |   |   |   |   |   |   |   |   |
| Device Dependent Error   |   |   |   |   |   |   |   |   |
| Query Error              |   |   |   |   |   |   |   |   |
| Request Control          |   |   |   |   |   |   |   |   |
| Operation Complete       |   |   |   |   |   |   |   |   |
| Bit Number               | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

\*ESR?

Standard Event Status Register

ck727a

| Bit | Description                                                                                                                                                     |
|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0   | A 1 in this bit position indicates that all pending operations were completed following execution of the *OPC command                                           |
| 1   | For GPIB handshaking to request control. Currently it is set to 0, because there are no implementations where the spectrum analyzer controls another instrument |
| 2   | A 1 in this bit position indicates that a query error has occurred. Query errors have SCPI error numbers from -499 to -400                                      |
| 3   | A 1 in this bit position indicates that a device dependent error has occurred. Device dependent errors have SCPI error numbers from -399 to -300 and 1 to 32767 |
| 4   | A 1 in this bit position indicates that an execution error has occurred. Execution errors have SCPI error numbers from -299 to -200                             |
| 5   | A 1 in this bit position indicates that a command error has occurred. Command errors have SCPI error numbers from -199 to -100                                  |
| 6   | A 1 in this bit position indicates that the LOCAL key has been pressed. This is true even if the instrument is in local lockout mode                            |
| 7   | A 1 in this bit position indicates that the instrument has been turned off and then on                                                                          |

The Standard Event Status Register is used to determine the specific events that set bit 5 in the "Status Byte Register" on page 1069. To query this register, send \*ESR?. The response will be the decimal sum of the bits that are enabled (set to 1). For example, if bit number 7 and bit number 3 are enabled, the decimal sum of the 2 bits is 128 plus 8, so the decimal value 136 is returned. See also "\*ESR? - Standard Event Status Register Query" on page 1033

Standard Event Status Enable Register

In addition to the "Standard Event Status Register" on page 1073, the Standard Event status group also contains a Standard Event Status Enable Register. This

register lets you choose which bits in the Standard Event Status Register will set the summary bit (bit 5 of the Status Byte Register) to 1. Send **\*ESE <integer>**, where **<integer>** is the sum of the decimal values of the bits you want to enable. For example, to enable bit 7 and bit 6 so that whenever either of those bits is set to 1, the standard event status summary bit of the Status Byte Register will be set to 1, send **\*ESE 192** (128 + 64). **\*ESE?** returns the decimal value of the sum of the bits previously enabled with **\*ESE <integer>**.

The standard event status enable register presets to zeros (0).

| Decimal Value | 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 |
|---------------|-----|----|----|----|---|---|---|---|
| Bit Number    | 7   | 6  | 5  | 4  | 3 | 2 | 1 | 0 |

**\*ESE <num>**

**\*ESE?**

### Standard Event Status Enable Register

ck728a

See also **"\*ESE - Standard Event Status Enable" on page 1032**

#### 9.4.6.3 Operation Register

This register and the **"Questionable Register" on page 1082** are sets of registers that monitor the overall instrument condition. They are accessed using **:STATus:OPERation** and **:STATus:QUEStionable**.

This register monitors the current instrument measurement state and various instrument operations for a quick summary of what is happening within the instrument. It checks to see if the instrument is calibrating, sweeping, or waiting for a trigger (see also **"\*OPC? - Operation Complete" on page 1034**).

| Description | Always 0 | Unused | Unused | Source waiting for trigger | Instrument Summary | DC Coupled | Source sweeping | Paused | Unused | Waiting for Periodic Sync Source | Waiting for trigger | Measuring | Sweeping | Unused | Settling | Calibrating |
|-------------|----------|--------|--------|----------------------------|--------------------|------------|-----------------|--------|--------|----------------------------------|---------------------|-----------|----------|--------|----------|-------------|
| Bit #       | 15       | 14     | 13     | 12                         | 11                 | 10         | 9               | 8      | 7      | 6                                | 5                   | 4         | 3        | 2      | 1        | 0           |

**STATus:OPERation Register**

## 9 Programming the Instrument

### 9.4 Status Register System & STATus Subsystem

| Bit | Condition                        | Operation                                                                                                                                                                                                                                          |
|-----|----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0   | Calibrating                      | The instrument is busy executing its Align Now process                                                                                                                                                                                             |
| 1   | Settling                         | The instrument circuitry is settling                                                                                                                                                                                                               |
| 3   | Sweeping                         | The instrument is busy taking a sweep                                                                                                                                                                                                              |
| 4   | Measuring                        | The instrument is busy making a measurement. Measurements often require multiple sweeps. They are initiated by user-interface keys or with the <b>MEASure</b> group of commands<br>The bit is valid for most X-Series Modes                        |
| 5   | Waiting for trigger              | The instrument is waiting for the trigger conditions to be met, then it will trigger a sweep or measurement                                                                                                                                        |
| 6   | Waiting for Periodic Sync Source | The instrument is waiting for the Periodic trigger Sync Source conditions to be met, then the sweep or measurement period will be synchronized                                                                                                     |
| 8   | Paused                           | The measurement is paused                                                                                                                                                                                                                          |
| 9   | Source Sweeping                  | The List Sequencer is running, or Freq Scan results are available<br>The List Sequencer or Waveform Sequences are running, specifically, in VXT models: M9410A/11A/15A/16A, M9410E/11E/15E/16E, E6680A/80E/81A, S9110A/01A/06A/08A/15A/30A, M8920B |
| 10  | DC Coupled                       | The instrument is DC coupled                                                                                                                                                                                                                       |
| 11  | Instrument Summary               | The summary bit for the "Operation Instrument Register" on page 1079                                                                                                                                                                               |
| 12  | Source Waiting for Trigger       | The built in source is waiting for a trigger                                                                                                                                                                                                       |

#### Filter Registers

- "Operation Condition Query" on page 1076
- "Operation Enable" on page 1077
- "Operation Event Query" on page 1077
- "Operation Negative Transition" on page 1078
- "Operation Positive Transition" on page 1078

### Operation Condition Query

Returns the decimal value of the sum of the bits in the Status Operation Condition Register.

#### NOTE

The data in this register is continuously updated and reflects the current conditions.



|                              |                                           |
|------------------------------|-------------------------------------------|
| Remote Command               | <code>:STATus:OPERation:CONDition?</code> |
| Example                      | <code>:STAT:OPER:COND?</code>             |
| Preset                       | 0                                         |
| Status Bits/OPC dependencies | Sequential command                        |

## Operation Enable

Determines which bits in the "Operation Event Query" on page 1077 Register will set the Operation Status Summary bit (bit 7) in the "Status Byte Register" on page 1069.

The variable `<integer>` is the sum of the decimal values of the bits you want to enable.

### NOTE

The preset condition is to have all bits in this enable register set to 0. To have any Operation Events reported to the Status Byte Register, one or more bits need to be set to 1.

|                              |                                                                                                                           |
|------------------------------|---------------------------------------------------------------------------------------------------------------------------|
| Remote Command               | <code>:STATus:OPERation:ENABle &lt;integer&gt;</code><br><code>:STATus:OPERation:ENABle?</code>                           |
| Example                      | <code>:STAT:OPER:ENAB 1</code><br>Sets the register so that Align Now events will be reported to the Status Byte Register |
| Preset                       | 0                                                                                                                         |
| Min                          | 0                                                                                                                         |
| Max                          | 32767                                                                                                                     |
| Status Bits/OPC dependencies | Sequential command                                                                                                        |

## Operation Event Query

Returns the decimal value of the sum of the bits in the Operation Event Register.

### NOTE

The register requires that the associated PTRansition or NTRansition filters be set before a condition register bit can set a bit in the event register. The data in this register is latched until it is queried. Once queried, the register is cleared.

|                |                                         |
|----------------|-----------------------------------------|
| Remote Command | <code>:STATus:OPERation[:EVENT]?</code> |
| Example        | <code>:STAT:OPER?</code>                |

|                              |                    |
|------------------------------|--------------------|
| Preset                       | 0                  |
| Status Bits/OPC dependencies | Sequential command |

## Operation Negative Transition

Determines which bits in the "Operation Condition Query" on page 1076 Register will set the corresponding bit in the "Operation Event Query" on page 1077 Register when the condition register bit has a negative transition (1 to 0).

The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

|                              |                                                                                                            |
|------------------------------|------------------------------------------------------------------------------------------------------------|
| Remote Command               | <code>:STATus:OPERation:NTRansition &lt;integer&gt;</code><br><code>:STATus:OPERation:NTRansition?</code>  |
| Example                      | <code>:STAT:OPER:NTR 1</code><br>Align Now operation complete will be reported to the Status Byte Register |
| Preset                       | 0                                                                                                          |
| Min                          | 0                                                                                                          |
| Max                          | 32767                                                                                                      |
| Status Bits/OPC dependencies | Sequential command                                                                                         |

## Operation Positive Transition

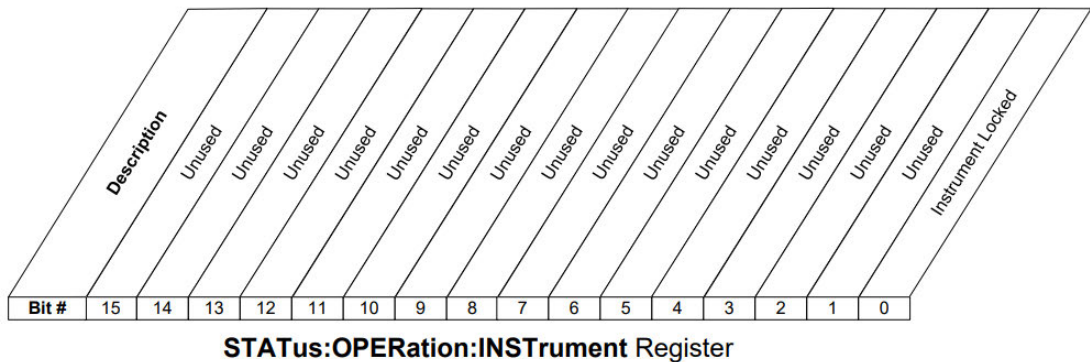
Determines which bits in the "Operation Condition Query" on page 1076 Register will set the corresponding bit in the "Operation Event Query" on page 1077 Register when the condition register bit has a positive transition (0 to 1).

The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

|                              |                                                                                                             |
|------------------------------|-------------------------------------------------------------------------------------------------------------|
| Remote Command               | <code>:STATus:OPERation:PTRansition &lt;integer&gt;</code><br><code>:STATus:OPERation:PTRansition?</code>   |
| Example                      | <code>:STAT:OPER:PTR 1</code><br>Align Now operation beginning will be reported to the Status Byte Register |
| Preset                       | 32767                                                                                                       |
| Min                          | 0                                                                                                           |
| Max                          | 32767                                                                                                       |
| Status Bits/OPC dependencies | Sequential command                                                                                          |

9.4.6.4 Operation Instrument Register

Monitors instrument-related operations and summarizes them in bit 11 of the "Operation Register" on page 1075.



| Bit | Condition         | Operation                |
|-----|-------------------|--------------------------|
| 0   | Instrument Locked | The instrument is locked |

Filter Registers

- "Operation Instrument Condition" on page 1079
- "Operation Instrument Enable" on page 1080
- "Operation Instrument Event Query" on page 1080
- "Operation Instrument Negative Transition" on page 1081
- "Operation Instrument Positive Transition" on page 1081

Operation Instrument Condition

Returns the decimal value of the sum of the bits in the Status Operation Instrument Condition Register.

NOTE

The data in this register is continuously updated and reflects the current conditions.

|                              |                                         |
|------------------------------|-----------------------------------------|
| Remote Command               | :STATus:OPERation:INSTrument:CONDition? |
| Example                      | :STAT:OPER:INST:COND?                   |
| Preset                       | 0                                       |
| Status Bits/OPC dependencies | Sequential command                      |

Operation Instrument Enable

Determines which bits in the "Operation Instrument Condition" on page 1079 Register will set bits in the "Operation Instrument Event Query" on page 1080 Register, which also sets the Instrument Summary bit (bit 11) in the "Operation Instrument Register" on page 1079.

The variable <integer> is the sum of the decimal values of the bits you want to enable.

**NOTE** The preset condition is to have all bits in this enable register set to 0. To have any Instrument Events reported to the Status Byte Register, one or more bits need to be set to 1.

|                              |                                                                                                                    |
|------------------------------|--------------------------------------------------------------------------------------------------------------------|
| Remote Command               | :STATus:OPERation:INSTrument:ENABle <integer><br>:STATus:OPERation:INSTrument:ENABle?                              |
| Example                      | :STAT:OPER:INST:ENAB 1<br>Sets the register so that Instrument Locked will be reported to the Status Byte Register |
| Preset                       | 32767                                                                                                              |
| Min                          | 0                                                                                                                  |
| Max                          | 32767                                                                                                              |
| Status Bits/OPC dependencies | Sequential command                                                                                                 |

Operation Instrument Event Query

Returns the decimal value of the sum of the bits in the Operation Instrument Event Register.

**NOTE** The register requires that the associated PTRransition or NTRransition filters be set before a condition register bit can set a bit in the event register. The data in this register is latched until it is queried. Once queried, the register is cleared.

|                              |                                       |
|------------------------------|---------------------------------------|
| Remote Command               | :STATus:OPERation:INSTrument[:EVENT]? |
| Example                      | :STAT:OPER:INST?                      |
| Preset                       | 0                                     |
| Status Bits/OPC dependencies | Sequential command                    |

## Operation Instrument Negative Transition

Determines which bits in the "Operation Condition Query" on page 1076 Register will set the corresponding bit in the "Operation Event Query" on page 1077 Register when the condition register bit has a negative transition (1 to 0).

The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

|                              |                                                                                                                                                   |
|------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command               | <code>:STATus:OPERation:INSTrument:NTRansition &lt;integer&gt;</code><br><code>:STATus:OPERation:INSTrument:NTRansition?</code>                   |
| Example                      | <code>:STAT:OPER:INST:NTR 1</code><br>Instrument Locked being cleared will be reported to the Instrument Summary of the Status Operation Register |
| Preset                       | 0                                                                                                                                                 |
| Min                          | 0                                                                                                                                                 |
| Max                          | 32767                                                                                                                                             |
| Status Bits/OPC dependencies | Sequential command                                                                                                                                |

## Operation Instrument Positive Transition

Determines which bits in the "Operation Condition Query" on page 1076 Register will set the corresponding bit in the "Operation Event Query" on page 1077 Register when the condition register bit has a positive transition (0 to 1).

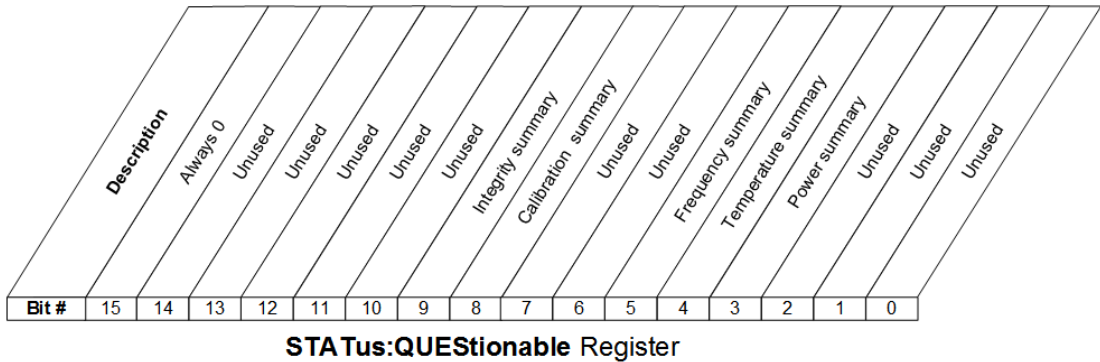
The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

|                              |                                                                                                                                               |
|------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command               | <code>:STATus:OPERation:INSTrument:PTRansition &lt;integer&gt;</code><br><code>:STATus:OPERation:INSTrument:PTRansition?</code>               |
| Example                      | <code>:STAT:OPER:INST:PTR 1</code><br>Instrument Locked being set will be reported to the Instrument Summary of the Status Operation Register |
| Preset                       | 32767                                                                                                                                         |
| Min                          | 0                                                                                                                                             |
| Max                          | 32767                                                                                                                                         |
| Status Bits/OPC dependencies | Sequential command                                                                                                                            |

9.4.6.5 Questionable Register

This register and the "Operation Register" on page 1075 monitor the overall instrument condition. They are accessed using :STATus:OPERation and :STATus:QUEStionable.

This register monitors the instrument's condition to see if anything questionable has happened. It detects anything that might cause an error or a bad measurement, such as a hardware problem, an out-of-calibration situation, or an unusual signal. All the bits are summary bits from lower-level event registers.



| Bit | Condition           | Operation                                                        |
|-----|---------------------|------------------------------------------------------------------|
| 3   | Power summary       | Summary bit for "Questionable Power Register" on page 1085       |
| 4   | Temperature summary | Summary bit for "Questionable Temperature Register" on page 1088 |
| 5   | Frequency summary   | Summary bit for "Questionable Frequency Register" on page 1091   |
| 8   | Calibration summary | Summary bit for "Questionable Calibration Register" on page 1094 |
| 9   | Integrity summary   | Summary bit for "Questionable Integrity Register" on page 1107   |

Filter Registers

- "Questionable Condition" on page 1083
- "Questionable Enable" on page 1083
- "Questionable Event Query" on page 1084
- "Questionable Negative Transition" on page 1084
- "Questionable Positive Transition" on page 1084

## Questionable Condition

Returns the decimal value of the sum of the bits in the Questionable Condition Register.

**NOTE** The data in this register is continuously updated and reflects current conditions.

|                              |                                              |
|------------------------------|----------------------------------------------|
| Remote Command               | <code>:STATus:QUEStionable:CONDition?</code> |
| Example                      | <code>:STAT:QUES:COND?</code>                |
| Preset                       | 0                                            |
| Status Bits/OPC dependencies | Sequential command                           |

## Questionable Enable

Determines which bits in the "Questionable Event Query" on page 1084 Register will set the Questionable Status Summary bit (bit3) in the "Status Byte Register" on page 1069.

The variable `<integer>` is the sum of the decimal values of the bits you want to enable.

**NOTE** The preset condition is all bits in this enable register set to 0. To report any Questionable Events to the Status Byte Register, one or more bits need to be set to 1. The "Standard Event Status Register" on page 1073 should be queried after each measurement to check the Questionable Status Summary (bit 3). If it is equal to 1, a condition during the test may have made the test results invalid. If it is equal to 0, this indicates that no hardware problem or measurement problem was detected by the analyzer.

|                              |                                                                                                                                           |
|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command               | <code>:STATus:QUEStionable:ENABLE &lt;integer&gt;</code><br><code>:STATus:QUEStionable:ENABLE?</code>                                     |
| Example                      | <code>:STAT:QUES:ENAB 16</code><br>Sets the register so that questionable temperature events will be reported to the Status Byte Register |
| Preset                       | 0                                                                                                                                         |
| Min                          | 0                                                                                                                                         |
| Max                          | 32767                                                                                                                                     |
| Status Bits/OPC dependencies | Sequential command                                                                                                                        |

Questionable Event Query

Returns the decimal value of the sum of the bits in the Questionable Event Register.

NOTE

The register requires that the associated PTRansition or NTRansition filters be set before a condition register bit can set a bit in the event register. The data in this register is latched until it is queried. Once queried, the register is cleared.

|                              |                               |
|------------------------------|-------------------------------|
| Remote Command               | :STATus:QUEStionable[:EVENT]? |
| Example                      | :STAT:QUES?                   |
| Preset                       | 0                             |
| Status Bits/OPC dependencies | Sequential command            |

Questionable Negative Transition

Determines which bits in the "Questionable Condition" on page 1083 Register will set the corresponding bit in the "Questionable Event Query" on page 1084 Register when the condition register bit has a negative transition (1 to 0).

The variable <integer> is the sum of the decimal values of the bits that you want to enable.

|                              |                                                                                                              |
|------------------------------|--------------------------------------------------------------------------------------------------------------|
| Remote Command               | :STATus:QUEStionable:NTRansition <integer><br>:STATus:QUEStionable:NTRansition?                              |
| Example                      | :STAT:QUES:NTR 16<br>Temperature summary 'questionable cleared' will be reported to the Status Byte Register |
| Preset                       | 0                                                                                                            |
| Min                          | 0                                                                                                            |
| Max                          | 32767                                                                                                        |
| Status Bits/OPC dependencies | Sequential command                                                                                           |

Questionable Positive Transition

Determines which bits in the "Questionable Condition" on page 1083 Register will set the corresponding bit in the "Questionable Event Query" on page 1084 Register when the condition register bit has a positive transition (0 to 1).

The variable <integer> is the sum of the decimal values of the bits that you want to enable.



|                              |                                                                                                                            |
|------------------------------|----------------------------------------------------------------------------------------------------------------------------|
| Remote Command               | <code>:STATus:QuesTionable:PTRansition &lt;integer&gt;</code><br><code>:STATus:QuesTionable:PTRansition?</code>            |
| Example                      | <code>:STAT:QUES:PTR 16</code><br>Temperature summary 'questionable asserted' will be reported to the Status Byte Register |
| Preset                       | 32767                                                                                                                      |
| Min                          | 0                                                                                                                          |
| Max                          | 32767                                                                                                                      |
| Status Bits/OPC dependencies | Sequential command                                                                                                         |

### 9.4.6.6 Questionable Power Register

Monitors power-related conditions within the instrument and summarizes them in bit 3 of the "Questionable Register" on page 1082.

| Description | Always 0 | Unused | Unused | Unused | Unused | Input Caution | Full Bypass Enabled | Unused | Unused | Input Port Overload | Unused | Unused | LO unleveled | Source LO unleveled | Source unleveled | RPP tripped |
|-------------|----------|--------|--------|--------|--------|---------------|---------------------|--------|--------|---------------------|--------|--------|--------------|---------------------|------------------|-------------|
| Bit #       | 15       | 14     | 13     | 12     | 11     | 10            | 9                   | 8      | 7      | 6                   | 5      | 4      | 3            | 2                   | 1                | 0           |

**STATus:QuesTionable:POWer Register**

| Bit | Condition           | Operation                                                                  |
|-----|---------------------|----------------------------------------------------------------------------|
| 0   | RPP tripped         | (not currently in use)                                                     |
| 1   | Source Unleveled    | The built-in source is not properly leveled                                |
| 2   | Source LO Unleveled | (not currently in use)                                                     |
| 3   | LO Unleveled        | (not currently in use)                                                     |
| 6   | Input Port Overload | A power overload condition exists at an input port                         |
| 9   | Full Bypass Enabled | Frontend circuitry is bypassed, use caution to protect the mixer           |
| 10  | Input Caution       | Input circuitry is configured such that care is required to prevent damage |

Filter Registers

- "Questionable Power Condition" on page 1086
- "Questionable Power Enable" on page 1086
- "Questionable Power Event Query" on page 1087
- "Questionable Power Negative Transition" on page 1087
- "Questionable Power Positive Transition" on page 1087

Questionable Power Condition

Returns the decimal value of the sum of the bits in the Questionable Power Condition Register.

NOTE

The data in this register is continuously updated and reflects the current conditions.

|                              |                                       |
|------------------------------|---------------------------------------|
| Remote Command               | :STATus:QUESTionable:POWer:CONDition? |
| Example                      | :STAT:QUES:POW:COND?                  |
| Preset                       | 0                                     |
| Status Bits/OPC dependencies | Sequential command                    |

Questionable Power Enable

Determines which bits in the "Questionable Power Condition" on page 1086 Register will set bits in the Questionable Power Event Register, which also sets the Power Summary bit (bit 3) in the "Questionable Register" on page 1082.

The variable <integer> is the sum of the decimal values of the bits you want to enable.

|                              |                                                                                                                      |
|------------------------------|----------------------------------------------------------------------------------------------------------------------|
| Remote Command               | :STATus:QUESTionable:POWer:ENABle <integer><br>:STATus:QUESTionable:POWer:ENABle?                                    |
| Example                      | :STAT:QUES:POW:ENAB 2<br>Source Unlevelled will be reported to the Power Summary of the Status Questionable Register |
| Preset                       | 32767                                                                                                                |
| Min                          | 0                                                                                                                    |
| Max                          | 32767                                                                                                                |
| Status Bits/OPC dependencies | Sequential command                                                                                                   |

## Questionable Power Event Query

Returns the decimal value of the sum of the bits in the Questionable Power Event Query Register.

### NOTE

The register requires that the associated PTRansition or NTRansition filters be set before a condition register bit can set a bit in the event register. The data in this register is latched until it is queried. Once queried, the register is cleared.

|                              |                                                  |
|------------------------------|--------------------------------------------------|
| Remote Command               | <code>:STATus:QUESTionable:POWer[:EVENT]?</code> |
| Example                      | <code>:STAT:QUES:POW?</code>                     |
| Preset                       | 0                                                |
| Status Bits/OPC dependencies | Sequential command                               |

## Questionable Power Negative Transition

Determines which bits in the "Questionable Power Condition" on page 1086 Register will set the corresponding bit in the "Questionable Power Event Query" on page 1087 Register when the condition register bit has a negative transition (1 to 0).

The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

|                              |                                                                                                                                                |
|------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command               | <code>:STATus:QUESTionable:POWer:NTRansition &lt;integer&gt;</code><br><code>:STATus:QUESTionable:POWer:NTRansition?</code>                    |
| Example                      | <code>:STAT:QUES:POW:NTR 2</code><br>Source Unlevelled being cleared will be reported to the Power Summary of the Status Questionable Register |
| Preset                       | 0                                                                                                                                              |
| Min                          | 0                                                                                                                                              |
| Max                          | 32767                                                                                                                                          |
| Status Bits/OPC dependencies | Sequential command                                                                                                                             |

## Questionable Power Positive Transition

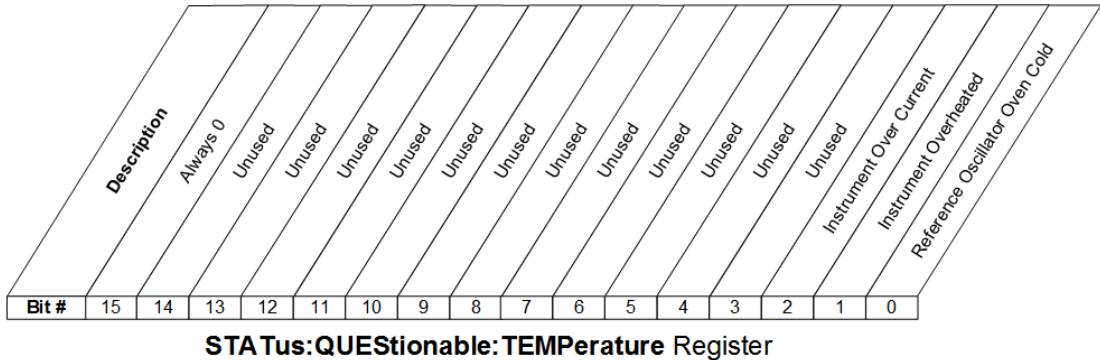
Determines which bits in the "Questionable Power Condition" on page 1086 Register will set the corresponding bit in the "Questionable Power Event Query" on page 1087 Register when the condition register bit has a positive transition (0 to 1).

The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

|                              |                                                                                                                                                 |
|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command               | <code>:STATus:QUEStionable:POWer:PTRansition &lt;integer&gt;</code><br><code>:STATus:QUEStionable:POWer:PTRansition?&gt;</code>                 |
| Example                      | <code>:STAT:QUES:POW:PTR 32</code><br><br>Source Unlevelled being set will be reported to the Power Summary of the Status Questionable Register |
| Preset                       | 32767                                                                                                                                           |
| Min                          | 0                                                                                                                                               |
| Max                          | 32767                                                                                                                                           |
| Status Bits/OPC dependencies | Sequential command                                                                                                                              |

9.4.6.7 Questionable Temperature Register

Monitors temperature-related conditions within the instrument and summarizes them in bit 4 of the "Questionable Register" on page 1082.



| Bit | Condition                                | Operation                                                                                           |
|-----|------------------------------------------|-----------------------------------------------------------------------------------------------------|
| 0   | Reference Oscillator Oven Cold           | (not currently in use)                                                                              |
| 1   | Instrument overheated (over temperature) | Excessive heat has been detected in some part of the instrument                                     |
| 2   | Instrument over current                  | Excessive heat has been detected in some part of the instrument; the instrument should be restarted |

Filter Registers

- "Questionable Temperature Condition" on page 1089
- "Questionable Temperature Enable" on page 1089

- "Questionable Temperature Event Query" on page 1090
- "Questionable Temperature Negative Transition" on page 1090
- "Questionable Temperature Positive Transition" on page 1090

## Questionable Temperature Condition

Returns the decimal value of the sum of the bits in the Questionable Temperature Condition Register.

### NOTE

The data in this register is continuously updated and reflects the current conditions.

|                              |                                                          |
|------------------------------|----------------------------------------------------------|
| Remote Command               | <code>:STATus:QUEStionable:TEMPerature:CONDition?</code> |
| Example                      | <code>:STAT:QUES:TEMP:COND?</code>                       |
| Preset                       | 0                                                        |
| Status Bits/OPC dependencies | Sequential command                                       |

## Questionable Temperature Enable

Determines which bits in the "Questionable Temperature Condition" on page 1089 Register will set bits in the "Questionable Temperature Event Query" on page 1090 Register, which also sets the Temperature Summary bit (bit 4) in the "Questionable Register" on page 1082.

The variable `<integer>` is the sum of the decimal values of the bits you want to enable.

|                              |                                                                                                                                       |
|------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command               | <code>:STATus:QUEStionable:TEMPerature:ENABle &lt;integer&gt;</code><br><code>:STATus:QUEStionable:TEMPerature:ENABle?</code>         |
| Example                      | <code>:STAT:QUES:TEMP:ENAB 2</code><br>Instrument Overheated will be reported to the Temperature Summary of the Questionable Register |
| Preset                       | 32767                                                                                                                                 |
| Min                          | 0                                                                                                                                     |
| Max                          | 32767                                                                                                                                 |
| Status Bits/OPC dependencies | Sequential command                                                                                                                    |

Questionable Temperature Event Query

Returns the decimal value of the sum of the bits in the Questionable Temperature Event Register.

**NOTE** The register requires that the associated PTRansition or NTRansition filters be set before a condition register bit can set a bit in the event register. The data in this register is latched until it is queried. Once queried, the register is cleared.

|                              |                                           |
|------------------------------|-------------------------------------------|
| Remote Command               | :STATus:QUESTionable:TEMPerature[:EVENT]? |
| Example                      | :STAT:QUES:TEMP?                          |
| Preset                       | 0                                         |
| Status Bits/OPC dependencies | Sequential command                        |

Questionable Temperature Negative Transition

Determines which bits in the "Questionable Temperature Condition" on page 1089 Register will set bits in the "Questionable Temperature Event Query" on page 1090 Register, when the condition register bit has a negative transition (1 to 0).

The variable <integer> is the sum of the decimal values of the bits that you want to enable.

|                              |                                                                                                                                                  |
|------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command               | :STATus:QUESTionable:TEMPerature:NTRansition <integer><br>:STATus:QUESTionable:TEMPerature:NTRansition?                                          |
| Example                      | :STAT:QUES:TEMP:NTR 2<br><br>Instrument Overheated being cleared will be reported to the Temperature Summary of the Status Questionable Register |
| Preset                       | 0                                                                                                                                                |
| Min                          | 0                                                                                                                                                |
| Max                          | 32767                                                                                                                                            |
| Status Bits/OPC dependencies | Sequential command                                                                                                                               |

Questionable Temperature Positive Transition

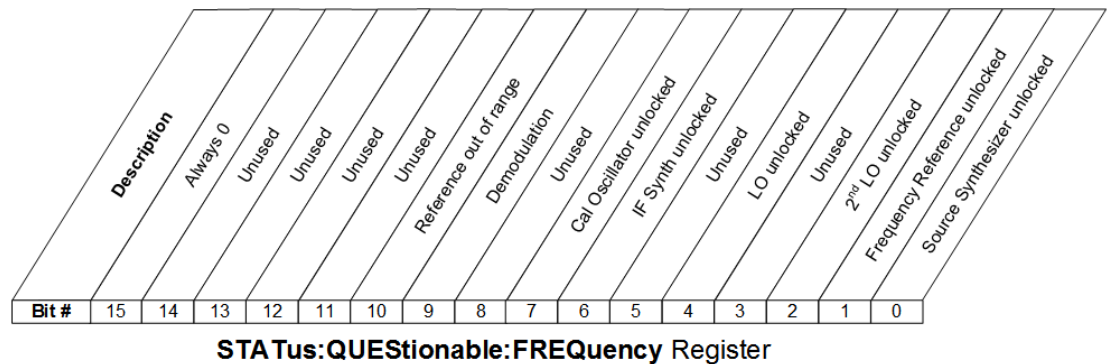
Determines which bits in the "Questionable Temperature Condition" on page 1089 Register will set bits in the "Questionable Temperature Event Query" on page 1090 Register, when the condition register bit has a positive transition (0 to 1).

The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

|                              |                                                                                                                                                |
|------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command               | <code>:STATus:QUESTionable:TEMPerature:PTRansition &lt;integer&gt;</code><br><code>:STATus:QUESTionable:TEMPerature:PTRansition?</code>        |
| Example                      | <code>:STAT:QUES:TEMP:PTR 2</code><br>Instrument Overheated being set will be reported to the Temperature Summary of the Questionable Register |
| Preset                       | 32767                                                                                                                                          |
| Min                          | 0                                                                                                                                              |
| Max                          | 32767                                                                                                                                          |
| Status Bits/OPC dependencies | Sequential command                                                                                                                             |

#### 9.4.6.8 Questionable Frequency Register

Monitors frequency-related conditions within the instrument and summarizes them in bit 5 of the ["Questionable Register" on page 1082](#).



| Bit | Condition                    | Operation                                                         |
|-----|------------------------------|-------------------------------------------------------------------|
| 0   | Source Synth Unlocked        | The synthesizer in the built-in source is not locked              |
| 1   | Frequency Reference Unlocked | The instrument's frequency reference is unlocked                  |
| 2   | 2 <sup>nd</sup> LO Unlocked  | The instrument's second LO (local oscillator) is unlocked         |
| 4   | LO Unlocked                  | The instrument's main LO (local oscillator) is unlocked           |
| 6   | IF Synth Unlocked            | The synthesizer in the IF is not locked                           |
| 7   | Cal Osc Unlocked             | The oscillator used for internal calibrations is not locked       |
| 9   | Demodulation                 | Demodulation cannot be performed due to an out-of-range frequency |

| Bit | Condition                         | Operation                                                                                                      |
|-----|-----------------------------------|----------------------------------------------------------------------------------------------------------------|
| 10  | Reference missing or out of range | The signal being fed to a reference input is missing or too high or low in frequency for the reference to lock |

Filter Registers

- "Questionable Frequency Condition" on page 1092
- "Questionable Frequency Enable" on page 1092
- "Questionable Frequency Event Query" on page 1093
- "Questionable Frequency Negative Transition" on page 1093
- "Questionable Frequency Positive Transition" on page 1094

Questionable Frequency Condition

Returns the decimal value of the sum of the bits in the Questionable Frequency Condition Register.

NOTE

The data in this register is continuously updated and reflects the current conditions.

|                              |                                           |
|------------------------------|-------------------------------------------|
| Remote Command               | :STATus:QUEStionable:FREQuency:CONDition? |
| Example                      | :STAT:QUES:FREQ:COND?                     |
| Preset                       | 0                                         |
| Status Bits/OPC dependencies | Sequential command                        |

Questionable Frequency Enable

Determines which bits in the "Questionable Frequency Condition" on page 1092 Register will set bits in the "Questionable Temperature Event Query" on page 1090 Register, which also sets the Frequency Summary bit (bit 5) in the "Questionable Register" on page 1082.

The variable <integer> is the sum of the decimal values of the bits you want to enable.

|                |                                                                                                                             |
|----------------|-----------------------------------------------------------------------------------------------------------------------------|
| Remote Command | :STATus:QUEStionable:FREQuency:ENABLE <integer><br>:STATus:QUEStionable:FREQuency:ENABLE?                                   |
| Example        | :STAT:QUES:FREQ:ENAB 2<br>Frequency Reference Unlocked will be reported to the Frequency Summary of the Status Questionable |



|                              |                    |
|------------------------------|--------------------|
|                              | Register           |
| Preset                       | 32767              |
| Min                          | 0                  |
| Max                          | 32767              |
| Status Bits/OPC dependencies | Sequential command |

### Questionable Frequency Event Query

Returns the decimal value of the sum of the bits in the Questionable Frequency Event Register.

#### NOTE

The register requires that the associated PTRansition or NTRansition filters be set before a condition register bit can set a bit in the event register. The data in this register is latched until it is queried. Once queried, the register is cleared.

|                              |                                                      |
|------------------------------|------------------------------------------------------|
| Remote Command               | <code>:STATus:QUESTionable:FREQuency[:EVENT]?</code> |
| Example                      | <code>:STAT:QUES:FREQ?</code>                        |
| Preset                       | 0                                                    |
| Status Bits/OPC dependencies | Sequential command                                   |

### Questionable Frequency Negative Transition

Determines which bits in the "Questionable Frequency Condition" on page 1092 Register will set the corresponding bit in the "Questionable Frequency Event Query" on page 1093 Register when the condition register bit has a negative transition (1 to 0).

The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

|                |                                                                                                                                                         |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:STATus:QUESTionable:FREQuency:NTRansition &lt;integer&gt;</code><br><code>:STATus:QUESTionable:FREQuency:NTRansition?</code>                     |
| Example        | <code>:STAT:QUES:FREQ:NTR 2</code><br>Frequency Reference 'regained lock' will be reported to the Frequency Summary of the Status Questionable Register |
| Preset         | 0                                                                                                                                                       |
| Min            | 0                                                                                                                                                       |
| Max            | 32767                                                                                                                                                   |

|                              |                    |
|------------------------------|--------------------|
| Status Bits/OPC dependencies | Sequential command |
|------------------------------|--------------------|

Questionable Frequency Positive Transition

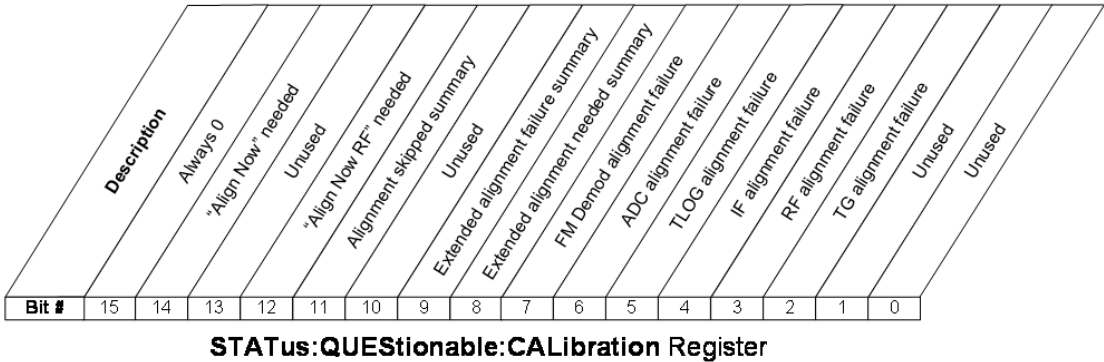
Determines which bits in the "Questionable Frequency Condition" on page 1092 Register will set the corresponding bit in the "Questionable Frequency Event Query" on page 1093 Register when the condition register bit has a positive transition (0 to 1).

The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

|                              |                                                                                                                                                               |
|------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command               | <code>:STATus:QUES:Frequency:PTRansition &lt;integer&gt;</code><br><code>:STATus:QUES:Frequency:PTRansition?</code>                                           |
| Example                      | <code>:STAT:QUES:FREQ:PTR 2</code><br><br>Frequency Reference 'became unlocked' will be reported to the Frequency Summary of the Status Questionable Register |
| Preset                       | 32767                                                                                                                                                         |
| Min                          | 0                                                                                                                                                             |
| Max                          | 32767                                                                                                                                                         |
| Status Bits/OPC dependencies | Sequential command                                                                                                                                            |

9.4.6.9 Questionable Calibration Register

Monitors calibration-related conditions within the instrument and summarizes them in bit 8 of the "Questionable Register" on page 1082. Three of the bits are summary bits from lower-level event registers.



| Bit | Condition                      | Operation                                                                                             |
|-----|--------------------------------|-------------------------------------------------------------------------------------------------------|
| 2   | TG Alignment Failure           | The Tracking Generator failed to align properly                                                       |
| 3   | RF Alignment Failure           | The RF section (frontend) failed to align properly                                                    |
| 4   | IF Alignment Failure           | The IF section failed to align properly                                                               |
| 5   | LO Alignment Failure           | The LO (local oscillator) failed to align properly                                                    |
| 6   | ADC Alignment Failure          | The ADC section failed to align properly                                                              |
| 7   | FM Demod Alignment Failure     | The FM Demod section failed to align properly                                                         |
| 8   | Extended Align Needed Summary  | Summary bit for "Questionable Calibration Extended Needed Register" on page 1098                      |
| 9   | Extended Align Failure Summary | Summary bit for "Questionable Calibration Extended Failure Register" on page 1101                     |
| 11  | Align Skipped Sum Summary      | Summary bit for "Questionable Calibration Skipped Register" on page 1104                              |
| 12  | "Align Now RF" required        | Go to the System, Alignments, Align Now menu and perform an "Align Now RF"                            |
| 14  | "Align Now" required           | Go to the System, Alignments, Align Now menu and perform an "Align Now All" or an "Align Now Expired" |

#### Filter Registers

- "Questionable Calibration Condition" on page 1095
- "Questionable Calibration Enable" on page 1096
- "Questionable Calibration Event Query" on page 1096
- "Questionable Calibration Negative Transition" on page 1097
- "Questionable Calibration Positive Transition" on page 1097

### Questionable Calibration Condition

Returns the decimal value of the sum of the bits in the Questionable Calibration Condition Register.

#### NOTE

The data in this register is continuously updated and reflects the current conditions.

|                              |                                                          |
|------------------------------|----------------------------------------------------------|
| Remote Command               | <code>:STATus:QUESTionable:CALibration:CONDition?</code> |
| Example                      | <code>:STAT:QUES:CAL:COND?</code>                        |
| Preset                       | 0                                                        |
| Status Bits/OPC dependencies | Sequential command                                       |

## Questionable Calibration Enable

Determines which bits in the "Questionable Calibration Condition" on page 1095 Register will set bits in the "Questionable Calibration Event Query" on page 1096 Register, which also sets the Calibration Summary bit (bit 8) in the "Questionable Register" on page 1082.

The variable `<integer>` is the sum of the decimal values of the bits you want to enable.

|                              |                                                                                                                                                  |
|------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command               | <code>:STATus:QUESTionable:CALibration:ENABle &lt;integer&gt;</code><br><code>:STATus:QUESTionable:CALibration:ENABle?</code>                    |
| Example                      | <code>:STAT:QUES:CAL:ENAB 16384</code><br>Can be used to query if an alignment is needed, if you have turned off the automatic alignment process |
| Min                          | 0                                                                                                                                                |
| Max                          | 32767                                                                                                                                            |
| Status Bits/OPC dependencies | Sequential command                                                                                                                               |

## Questionable Calibration Event Query

Returns the decimal value of the sum of the bits in the Questionable Calibration Event Register.

### NOTE

The register requires that the associated PTRansition or NTRansition filters be set before a condition register bit can set a bit in the event register. The data in this register is latched until it is queried. Once queried, the register is cleared.

|                              |                                                        |
|------------------------------|--------------------------------------------------------|
| Remote Command               | <code>:STATus:QUESTionable:CALibration[:EVENT]?</code> |
| Example                      | <code>:STAT:QUES:CAL?</code>                           |
| Preset                       | 0                                                      |
| Status Bits/OPC dependencies | Sequential command                                     |

## Questionable Calibration Negative Transition

Determines which bits in the "Questionable Calibration Condition" on page 1095 Register will set the corresponding bit in the "Questionable Calibration Event Query" on page 1096 Register when the condition register bit has a negative transition (1 to 0).

The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

|                              |                                                                                                                                                               |
|------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command               | <code>:STATus:QUESTionable:CALibration:NTRansition &lt;integer&gt;</code><br><code>:STATus:QUESTionable:CALibration:NTRansition?</code>                       |
| Example                      | <code>:STAT:QUES:CAL:NTR 16384</code><br>"Align All Now Needed" being cleared will be reported to the Calibration Summary of the Status Questionable Register |
| Preset                       | 0                                                                                                                                                             |
| Min                          | 0                                                                                                                                                             |
| Max                          | 32767                                                                                                                                                         |
| Status Bits/OPC dependencies | Sequential command                                                                                                                                            |

## Questionable Calibration Positive Transition

Determines which bits in the "Questionable Calibration Condition" on page 1095 Register will set the corresponding bit in the "Questionable Calibration Event Query" on page 1096 Register when the condition register bit has a positive transition (0 to 1).

The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

|                              |                                                                                                                                                           |
|------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command               | <code>:STATus:QUESTionable:CALibration:PTRansition &lt;integer&gt;</code><br><code>:STATus:QUESTionable:CALibration:PTRansition?</code>                   |
| Example                      | <code>:STAT:QUES:CAL:PTR 16384</code><br>"Align All Now Needed" being set will be reported to the Calibration Summary of the Status Questionable Register |
| Preset                       | 32767                                                                                                                                                     |
| Min                          | 0                                                                                                                                                         |
| Max                          | 32767                                                                                                                                                     |
| Status Bits/OPC dependencies | Sequential command                                                                                                                                        |

9.4.6.10 Questionable Calibration Extended Needed Register

Monitors conditions that occur because a calibration or alignment is required to guarantee accurate measurements. It summarizes them in bit 8 of the "Questionable Calibration Register" on page 1094.

| Bit #       | 15       | 14     | 13     | 12                                | 11                                | 10     | 9      | 8                  | 7      | 6      | 5                                      | 4                                | 3      | 2                           | 1                           | 0      |
|-------------|----------|--------|--------|-----------------------------------|-----------------------------------|--------|--------|--------------------|--------|--------|----------------------------------------|----------------------------------|--------|-----------------------------|-----------------------------|--------|
| Description | Always 0 | Unused | Unused | Characterize Noise Floor required | Characterize Preselector required | Unused | Unused | MPA Align required | Unused | Unused | Align current frequency range required | Input attenuation not calibrated | Unused | Align 30 MHz-1 GHz required | Align 9 kHz-30 MHz required | Unused |

**STATus:QUESTIONable:CALibration:EXTended:NEEDED Register**

| Bit | Condition                              | Operation                                                                                                                                |
|-----|----------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|
| 1   | Align 9kHz-30MHz required              | EMI receiver alignment required, 9kHz-30 MHz (conducted band)                                                                            |
| 2   | Align 30MHz-1GHz required              | EMI receiver alignment required, 30 MHz-1 GHz (radiated band)                                                                            |
| 4   | Input Attenuation not calibrated       | The input attenuator is uncalibrated                                                                                                     |
| 5   | Align current frequency range required | Alignment for current set frequency range is needed. It is suggested to process Align Selected Freq Range for the frequency range in use |
| 8   | MPA Align required                     | The Multiport Adaptor must be calibrated (EXT only)                                                                                      |
| 11  | Characterize Preselector required      | Go to the System, Alignments, Advanced menu and perform a "Characterize Preselector"                                                     |
| 12  | Characterize Noise Floor required      | Go to the System, Alignments, Advanced menu and perform a "Characterize Noise Floor"                                                     |

Filter Registers

- "Questionable Calibration Extended Needed Condition" on page 1099
- "Questionable Calibration Extended Needed Enable" on page 1099
- "Questionable Calibration Extended Needed Event Query" on page 1100

- "Questionable Calibration Extended Needed Negative Transition" on page 1100
- "Questionable Calibration Extended Needed Positive Transition" on page 1100

## Questionable Calibration Extended Needed Condition

Returns the decimal value of the sum of the bits in the Questionable Calibration Extended Needed Condition Register.

### NOTE

The data in this register is continuously updated and reflects the current conditions.

|                              |                                                                          |
|------------------------------|--------------------------------------------------------------------------|
| Remote Command               | <code>:STATus:QUESTionable:CALibration:EXTended:NEEDed:CONDition?</code> |
| Example                      | <code>:STAT:QUES:CAL:EXT:NEED:COND?</code>                               |
| Preset                       | 0                                                                        |
| Status Bits/OPC dependencies | Sequential command                                                       |

## Questionable Calibration Extended Needed Enable

Determines which bits in the "Questionable Calibration Extended Needed Condition" on page 1099 will set bits in the "Questionable Calibration Extended Needed Event Query" on page 1100 Register, which also sets bit 14 of the "Questionable Calibration Register" on page 1094.

The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

|                              |                                                                                                                                                               |
|------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command               | <code>:STATus:QUESTionable:CALibration:EXTended:NEEDed:ENABle &lt;integer&gt;</code><br><code>:STATus:QUESTionable:CALibration:EXTended:NEEDed:ENABle?</code> |
| Example                      | <code>:STAT:QUES:CAL:EXT:NEED:ENAB 2</code><br>Can be used to query if an EMI conducted alignment is needed                                                   |
| Preset                       | 32767                                                                                                                                                         |
| Min                          | 0                                                                                                                                                             |
| Max                          | 32767                                                                                                                                                         |
| Status Bits/OPC dependencies | Sequential command                                                                                                                                            |

## Questionable Calibration Extended Needed Event Query

Returns the decimal value of the sum of the bits in the Questionable Calibration Extended Needed Event Register.

### NOTE

The register requires that the associated PTRansition or NTRansition filters be set before a condition register bit can set a bit in the event register. The data in this register is latched until it is queried. Once queried, the register is cleared.

|                              |                                                                        |
|------------------------------|------------------------------------------------------------------------|
| Remote Command               | <code>:STATus:QUESTionable:CALibration:EXTended:NEEDed[:EVENT]?</code> |
| Example                      | <code>:STAT:QUES:CAL:EXT:NEED?</code>                                  |
| Preset                       | 0                                                                      |
| Status Bits/OPC dependencies | Sequential command                                                     |

## Questionable Calibration Extended Needed Negative Transition

Determines which bits in the "Questionable Calibration Extended Needed Condition" on page 1099 Register will set the corresponding bit in the "Questionable Calibration Extended Needed Event Query" on page 1100 Register when the condition register bit has a negative transition (1 to 0).

The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

|                              |                                                                                                                                                                         |
|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command               | <code>:STATus:QUESTionable:CALibration:EXTended:NEEDed:NTRansition &lt;integer&gt;</code><br><code>:STATus:QUESTionable:CALibration:EXTended:NEEDed:NTRansition?</code> |
| Example                      | <code>:STAT:QUES:CAL:EXT:NEED:NTR 2</code><br>Conducted alignment required bit being cleared will be reported                                                           |
| Preset                       | 0                                                                                                                                                                       |
| Min                          | 0                                                                                                                                                                       |
| Max                          | 32767                                                                                                                                                                   |
| Status Bits/OPC dependencies | Sequential command                                                                                                                                                      |

## Questionable Calibration Extended Needed Positive Transition

Determines which bits in the "Questionable Calibration Extended Needed Condition" on page 1099 Register will set the corresponding bit in the "Questionable



**Calibration Extended Needed Event Query" on page 1100** Register when the condition register bit has a positive transition (0 to 1).

The variable **<integer>** is the sum of the decimal values of the bits that you want to enable.

|                              |                                                                                                                                                             |
|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command               | <b>:STATus:QUEStionable:CALibration:EXTended:NEEded:PTRansition &lt;integer&gt;</b><br><b>:STATus:QUEStionable:CALibration:EXTended:NEEded:PTRansition?</b> |
| Example                      | <b>:STAT:QUES:CAL:EXT:NEED:PTR 2</b><br>Conducted alignment required bit being set will be reported                                                         |
| Preset                       | 32767                                                                                                                                                       |
| Min                          | 0                                                                                                                                                           |
| Max                          | 32767                                                                                                                                                       |
| Status Bits/OPC dependencies | Sequential command                                                                                                                                          |

#### 9.4.6.11 Questionable Calibration Extended Failure Register

Monitors conditions that occur because a calibration or alignment has failed to complete properly. It summarizes them in bit 9 of the **"Questionable Calibration Register" on page 1094**.

| Bit #       | 15       | 14                            | 13     | 12                           | 11                                       | 10                                                | 9                                     | 8                                | 7      | 6      | 5                                | 4      | 3      | 2                                | 1      | 0      |
|-------------|----------|-------------------------------|--------|------------------------------|------------------------------------------|---------------------------------------------------|---------------------------------------|----------------------------------|--------|--------|----------------------------------|--------|--------|----------------------------------|--------|--------|
| Description | Always 0 | Misc/System Alignment Failure | Unused | RCal Multiple Groups Applied | RCal Calibrations Missing, Part of Trace | RCal Multiple Calibrations Applied, Part of Trace | RCal Apply Warning, Check RCal Status | MPAdapter Preamp Charact Failure | Unused | Unused | Align Selected Freq Range failed | Unused | Unused | Characterize Preselector Failure | Unused | Unused |

**STATus:QUEStionable:CALibration:EXTended:FAILure Register**

| Bit | Condition                             | Operation                                              |
|-----|---------------------------------------|--------------------------------------------------------|
| 2   | Characterize Preselector Failure      | The preselector characterization failed                |
| 5   | Align Selected Freq Range failed      | The alignment for selected frequency range failed      |
| 8   | MPAdapter Preamp Charact Failure      | The Multiport Adaptor must be calibrated (EXT only)    |
| 9   | RCal Apply Warning, Check RCal Status | The calibration request sent to the RCal module failed |

| Bit | Condition                                         | Operation                                                                                          |
|-----|---------------------------------------------------|----------------------------------------------------------------------------------------------------|
| 10  | RCal Multiple Calibrations Applied, Part of Trace | More than one calibration is being applied to part of the trace for current measurement            |
| 11  | RCal Calibrations Missing, Part of Trace          | The calibration being applied is not being applied to all of the trace for the current measurement |
| 12  | RCal Multiple Groups Applied                      | More than one calibrated row is being applied to the current measurement                           |
| 14  | Misc/System Alignment Failure                     | Miscellaneous/System alignments have failed                                                        |

#### Filter Registers

- "Questionable Calibration Extended Failure Condition" on page 1102
- "Questionable Calibration Extended Failure Enable" on page 1102
- "Questionable Calibration Extended Failure Event Query" on page 1103
- "Questionable Calibration Extended Failure Negative Transition" on page 1103
- "Questionable Calibration Extended Failure Positive Transition" on page 1104

### Questionable Calibration Extended Failure Condition

Returns the decimal value of the sum of the bits in the Questionable Calibration Extended Failure Condition Register.

#### NOTE

The data in this register is continuously updated and reflects the current conditions.

|                              |                                                                           |
|------------------------------|---------------------------------------------------------------------------|
| Remote Command               | <code>:STATus:QUEStionable:CALibration:EXtended:FAILure:CONDition?</code> |
| Example                      | <code>:STAT:QUES:CAL:EXT:FAIL:COND?</code>                                |
| Preset                       | 0                                                                         |
| Status Bits/OPC dependencies | Sequential command                                                        |

### Questionable Calibration Extended Failure Enable

Determines which bits in the "Questionable Calibration Extended Failure Condition" on page 1102 Register will set bits in the "Questionable Calibration Extended Failure Event Query" on page 1103 Register, which also sets bit 9 of the "Questionable Calibration Register" on page 1094.

The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

|                              |                                                                                                                                                                 |
|------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command               | <code>:STATus:QUESTionable:CALibration:EXTended:FAILure:ENABle &lt;integer&gt;</code><br><code>:STATus:QUESTionable:CALibration:EXTended:FAILure:ENABle?</code> |
| Example                      | <code>:STAT:QUES:CAL:EXT:FAIL:ENAB 1</code><br>Can be used to query if an EMI conducted alignment failed                                                        |
| Preset                       | 32767                                                                                                                                                           |
| Min                          | 0                                                                                                                                                               |
| Max                          | 32767                                                                                                                                                           |
| Status Bits/OPC dependencies | Sequential command                                                                                                                                              |

### Questionable Calibration Extended Failure Event Query

Returns the decimal value of the sum of the bits in the Questionable Calibration Extended Failure Event Register.

#### NOTE

The register requires that the associated PTRansition or NTRansition filters be set before a condition register bit can set a bit in the event register. The data in this register is latched until it is queried. Once queried, the register is cleared.

|                              |                                                                         |
|------------------------------|-------------------------------------------------------------------------|
| Remote Command               | <code>:STATus:QUESTionable:CALibration:EXTended:FAILure[:EVENT]?</code> |
| Example                      | <code>:STAT:QUES:CAL:EXT:FAIL?</code>                                   |
| Preset                       | 0                                                                       |
| Status Bits/OPC dependencies | Sequential command                                                      |

### Questionable Calibration Extended Failure Negative Transition

Determines which bits in the "Questionable Calibration Extended Failure Condition" on page 1102 Register will set the corresponding bit in the "Questionable Calibration Extended Failure Event Query" on page 1103 Register when the condition register bit has a negative transition (1 to 0).

The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

|                |                                                                                                                                                                           |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:STATus:QUESTionable:CALibration:EXTended:FAILure:NTRansition &lt;integer&gt;</code><br><code>:STATus:QUESTionable:CALibration:EXTended:FAILure:NTRansition?</code> |
| Example        | <code>:STAT:QUES:CAL:EXT:FAIL:NTR 1</code>                                                                                                                                |

|                              |                                                               |
|------------------------------|---------------------------------------------------------------|
|                              | Conducted alignment failed bit being cleared will be reported |
| Preset                       | 0                                                             |
| Min                          | 0                                                             |
| Max                          | 32767                                                         |
| Status Bits/OPC dependencies | Sequential command                                            |

### Questionable Calibration Extended Failure Positive Transition

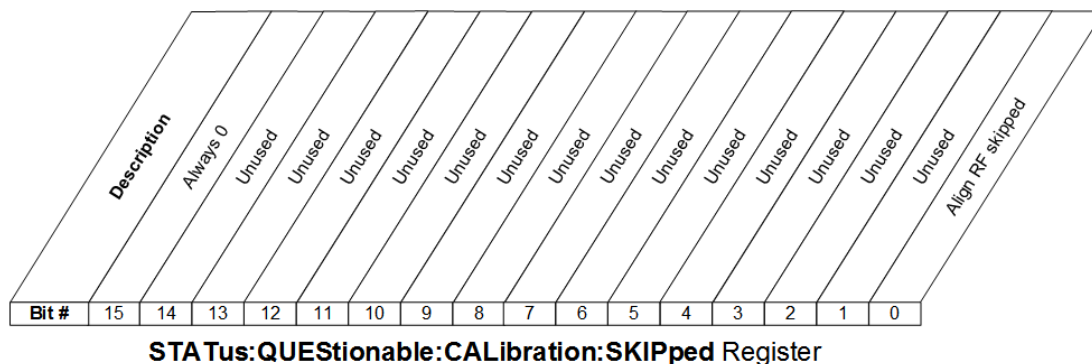
Determines which bits in the "Questionable Calibration Extended Failure Condition" on page 1102 Register will set the corresponding bit in the "Questionable Calibration Extended Failure Event Query" on page 1103 Register when the condition register bit has a positive transition (0 to 1).

The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

|                              |                                                                                                                                                                           |
|------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command               | <code>:STATus:QUESTionable:CALibration:EXTended:FAILure:PTRansition &lt;integer&gt;</code><br><code>:STATus:QUESTionable:CALibration:EXTended:FAILure:PTRansition?</code> |
| Example                      | <code>:STAT:QUES:CAL:EXT:FAIL:PTR 1</code><br>Conducted alignment failed bit being set will be reported                                                                   |
| Preset                       | 32767                                                                                                                                                                     |
| Min                          | 0                                                                                                                                                                         |
| Max                          | 32767                                                                                                                                                                     |
| Status Bits/OPC dependencies | Sequential command                                                                                                                                                        |

#### 9.4.6.12 Questionable Calibration Skipped Register

Monitors conditions that occur because a calibration or alignment has been skipped due to various settings or conditions. It summarizes them in bit 11 of the "Questionable Calibration Register" on page 1094.



| Bit | Condition        | Operation                                                                                                                                                                                                                                       |
|-----|------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0   | Align RF skipped | During an alignment, the calibration of the RF section (frontend) of the instrument was not performed. This can be caused by an interfering user signal present at the RF Input<br>See "Align Now" on page 434, and "Align Now All" on page 436 |

#### Filter Registers

- "Questionable Calibration Skipped Condition" on page 1105
- "Questionable Calibration Skipped Enable" on page 1106
- "Questionable Calibration Skipped Event Query" on page 1106
- "Questionable Calibration Skipped Negative Transition" on page 1106
- "Questionable Calibration Skipped Positive Transition" on page 1107

### Questionable Calibration Skipped Condition

Returns the decimal value of the sum of the bits in the Questionable Calibration Skipped Condition Register.

#### NOTE

The data in this register is continuously updated and reflects the current conditions.

|                              |                                                                  |
|------------------------------|------------------------------------------------------------------|
| Remote Command               | <code>:STATus:QUESTIONable:CALibration:SKIPPed:CONDition?</code> |
| Example                      | <code>:STAT:QUES:CAL:SKIP:COND?</code>                           |
| Preset                       | 0                                                                |
| Status Bits/OPC dependencies | Sequential command                                               |

## Questionable Calibration Skipped Enable

Determines which bits in the "Questionable Calibration Skipped Condition" on page 1105 Register will set bits in the "Questionable Calibration Skipped Event Query" on page 1106 Register, which also sets bit 11 of the "Questionable Calibration Register" on page 1094.

The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

|                              |                                                                                                                                               |
|------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command               | <code>:STATus:QUESTionable:CALibration:SKIPped:ENABle &lt;integer&gt;</code><br><code>:STATus:QUESTionable:CALibration:SKIPped:ENABle?</code> |
| Example                      | <code>:STAT:QUES:CAL:SKIP:ENAB 1</code><br>Can be used to query if an RF alignment skipped condition is detected                              |
| Preset                       | 32767                                                                                                                                         |
| Min                          | 0                                                                                                                                             |
| Max                          | 32767                                                                                                                                         |
| Status Bits/OPC dependencies | Sequential command                                                                                                                            |

## Questionable Calibration Skipped Event Query

Returns the decimal value of the sum of the bits in the Questionable Calibration Event Register.

### NOTE

The register requires that the associated PTRansition or NTRansition filters be set before a condition register bit can set a bit in the event register. The data in this register is latched until it is queried. Once queried, the register is cleared.

|                              |                                                                 |
|------------------------------|-----------------------------------------------------------------|
| Remote Command               | <code>:STATus:QUESTionable:CALibration:SKIPped[:EVENTt]?</code> |
| Example                      | <code>:STAT:QUES:CAL:SKIP?</code>                               |
| Preset                       | 0                                                               |
| Status Bits/OPC dependencies | Sequential command                                              |

## Questionable Calibration Skipped Negative Transition

Determines which bits in the "Questionable Calibration Skipped Condition" on page 1105 Register will set the corresponding bit in the "Questionable Calibration

**Skipped Event Query" on page 1106** Register when the condition register bit has a negative transition (1 to 0).

The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

|                              |                                                                                                                                                         |
|------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command               | <code>:STATus:QUESTionable:CALibration:SKIPped:NTRansition &lt;integer&gt;</code><br><code>:STATus:QUESTionable:CALibration:SKIPped:NTRansition?</code> |
| Example                      | <code>:STAT:QUES:CAL:SKIP:NTR 1</code><br>RF Align Skipped bit being cleared will be reported                                                           |
| Preset                       | 0                                                                                                                                                       |
| Min                          | 0                                                                                                                                                       |
| Max                          | 32767                                                                                                                                                   |
| Status Bits/OPC dependencies | Sequential command                                                                                                                                      |

### Questionable Calibration Skipped Positive Transition

Determines which bits in the **"Questionable Calibration Skipped Condition" on page 1105** Register will set the corresponding bit in the **"Questionable Calibration Skipped Event Query" on page 1106** Register when the condition register bit has a positive transition (0 to 1).

The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

|                              |                                                                                                                                                         |
|------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command               | <code>:STATus:QUESTionable:CALibration:SKIPped:PTRansition &lt;integer&gt;</code><br><code>:STATus:QUESTionable:CALibration:SKIPped:PTRansition?</code> |
| Example                      | <code>:STAT:QUES:CAL:SKIP:PTR 1</code><br>RF Align Skipped bit being set will be reported                                                               |
| Preset                       | 32767                                                                                                                                                   |
| Min                          | 0                                                                                                                                                       |
| Max                          | 32767                                                                                                                                                   |
| Status Bits/OPC dependencies | Sequential command                                                                                                                                      |

#### 9.4.6.13 Questionable Integrity Register

Monitors measurement integrity-related conditions within the instrument and summarizes them in bit 9 of the **"Questionable Register" on page 1082**. Two of the bits are summary bits from lower-level event registers.

## 9 Programming the Instrument

### 9.4 Status Register System & STATus Subsystem

| Bit #       | 15       | 14               | 13             | 12           | 11            | 10        | 9            | 8          | 7                 | 6           | 5          | 4              | 3                    | 2              | 1                    | 0              |
|-------------|----------|------------------|----------------|--------------|---------------|-----------|--------------|------------|-------------------|-------------|------------|----------------|----------------------|----------------|----------------------|----------------|
| Description | Always 0 | Setting modified | Settings alert | Invalid data | Trigger error | I/O Error | Memory error | Meas error | Insufficient data | Under range | Over range | Input overload | Uncalibrated summary | Output Summary | No results available | Signal summary |

**STATus:QUESTIONable:INTEGRity Register**

| Bit | Condition            | Operation                                                                                                                                               |
|-----|----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0   | Signal Summary       | The summary bit for the "Questionable Integrity Signal Register" on page 1111                                                                           |
| 1   | No Result            | The current measurement is incompatible with a setting or combination of settings, such as the selected Input, Radio Standard, etc.                     |
| 2   | Output Summary       | The summary bit for the "Questionable Integrity Output Register" on page 1114                                                                           |
| 3   | Uncalibrated Summary | The summary bit for the "Questionable Integrity Uncalibrated Register" on page 1117                                                                     |
| 4   | Input Overload       | A signal overload condition exists                                                                                                                      |
| 5   | Over Range           | The signal at the input for this measurement is too high. You should increase the attenuation or decrease the signal level                              |
| 6   | Under Range          | The signal at the input for this measurement is too low. You should decrease the attenuation or increase the signal level                               |
| 7   | Insufficient Data    | Signal or settings conditions did not allow enough data to be taken during an acquisition for a valid measurement                                       |
| 8   | Meas Error           | (not currently in use)                                                                                                                                  |
| 9   | Memory Error         | There is not enough memory to perform the desired operation                                                                                             |
| 10  | I/O Error            | I/O settings are preventing communication with an instrument or peripheral                                                                              |
| 11  | Trigger Error        | Signal or settings conditions did not allow enough data to be taken during an acquisition for a valid measurement                                       |
| 12  | Invalid data         | The Invalid Data indicator (* in upper right of display) is on, indicating that onscreen data may be stale and not match the current settings           |
| 13  | Settings Alert       | Settings are not right for a valid measurement, but the instrument is nonetheless allowing a measurement to be taken                                    |
| 14  | Setting Modified     | Settings are not right for a valid measurement, and the instrument is using different settings than the ones you entered in order to take a measurement |

#### Filter Registers



- "Questionable Integrity Condition" on page 1109
- "Questionable Integrity Enable" on page 1109
- "Questionable Integrity Event Query" on page 1110
- "Questionable Integrity Negative Transition" on page 1110
- "Questionable Integrity Positive Transition" on page 1110

## Questionable Integrity Condition

Returns the decimal value of the sum of the bits in the Questionable Integrity Condition Register.

### NOTE

The data in this register is continuously updated and reflects the current conditions.

|                              |                                                        |
|------------------------------|--------------------------------------------------------|
| Remote Command               | <code>:STATus:QUESTionable:INTEgrity:CONDition?</code> |
| Example                      | <code>:STAT:QUES:INT:COND?</code>                      |
| Preset                       | 0                                                      |
| Status Bits/OPC dependencies | Sequential command                                     |

## Questionable Integrity Enable

Determines which bits in the "Questionable Integrity Condition" on page 1109 Register will set bits in the "Questionable Integrity Event Query" on page 1110 Register, which also sets the Integrity Summary bit (bit 9) in the "Questionable Register" on page 1082.

The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

|                              |                                                                                                                                          |
|------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command               | <code>:STATus:QUESTionable:INTEgrity:ENABLE &lt;integer&gt;</code><br><code>:STATus:QUESTionable:INTEgrity:ENABle?</code>                |
| Example                      | <code>:STAT:QUES:INT:ENAB 8</code><br>Uncalibrated Summary will be reported to the Integrity Summary of the Status Questionable Register |
| Preset                       | 32767                                                                                                                                    |
| Min                          | 0                                                                                                                                        |
| Max                          | 32767                                                                                                                                    |
| Status Bits/OPC dependencies | Sequential command                                                                                                                       |

## Questionable Integrity Event Query

Returns the decimal value of the sum of the bits in the Questionable Integrity Event Register.

### NOTE

The register requires that the associated PTRansition or NTRansition filters be set before a condition register bit can set a bit in the event register. The data in this register is latched until it is queried. Once queried, the register is cleared.

|                              |                                                      |
|------------------------------|------------------------------------------------------|
| Remote Command               | <code>:STATus:QUESTionable:INTEgrity[:EVENT]?</code> |
| Example                      | <code>:STAT:QUES:INT?</code>                         |
| Preset                       | 0                                                    |
| Status Bits/OPC dependencies | Sequential command                                   |

## Questionable Integrity Negative Transition

Determines which bits in the "Questionable Integrity Condition" on page 1109 Register will set the corresponding bit in the "Questionable Integrity Event Query" on page 1110 Register when the condition register bit has a negative transition (1 to 0).

The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

|                              |                                                                                                                                                       |
|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command               | <code>:STATus:QUESTionable:INTEgrity:NTRansition &lt;integer&gt;</code><br><code>:STATus:QUESTionable:INTEgrity:NTRansition?</code>                   |
| Example                      | <code>:STAT:QUES:INT:NTR 8</code><br>Uncalibrated Summary being cleared will be reported to the Integrity Summary of the Status Questionable Register |
| Preset                       | 0                                                                                                                                                     |
| Min                          | 0                                                                                                                                                     |
| Max                          | 32767                                                                                                                                                 |
| Status Bits/OPC dependencies | Sequential command                                                                                                                                    |

## Questionable Integrity Positive Transition

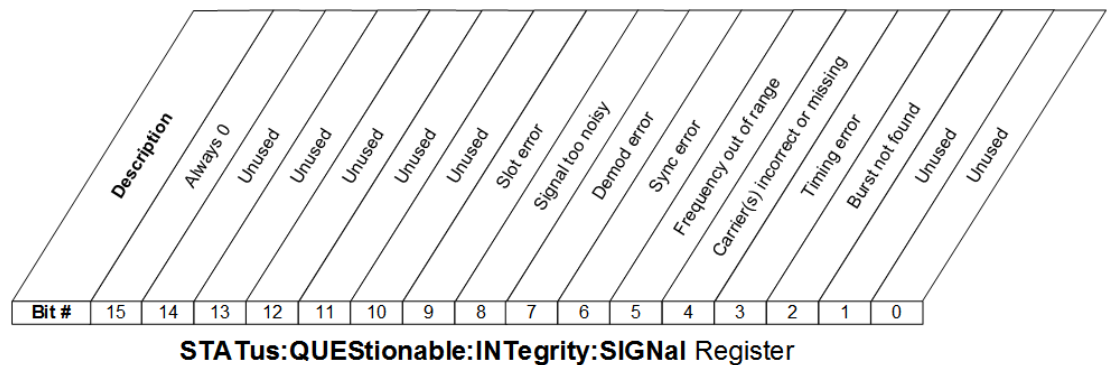
Determines which bits in the "Questionable Integrity Condition" on page 1109 Register will set the corresponding bit in the "Questionable Integrity Event Query" on page 1110 Register when the condition register bit has a positive transition (0 to 1).

The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

|                              |                                                                                                                                                   |
|------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command               | <code>:STATus:QUEStionable:INTEgrity:PTRansition &lt;integer&gt;</code><br><code>:STATus:QUEStionable:INTEgrity:PTRansition?</code>               |
| Example                      | <code>:STAT:QUES:INT:PTR 8</code><br>Uncalibrated Summary being set will be reported to the Integrity Summary of the Status Questionable Register |
| Preset                       | 32767                                                                                                                                             |
| Min                          | 0                                                                                                                                                 |
| Max                          | 32767                                                                                                                                             |
| Status Bits/OPC dependencies | Sequential command                                                                                                                                |

#### 9.4.6.14 Questionable Integrity Signal Register

Monitors conditions that occur because a measurement may not be able to return an accurate or valid result due to signal conditions. It summarizes them in bit 0 of the "Questionable Integrity Register" on page 1107.



| Bit | Condition                       | Operation                                                                                                                                                  |
|-----|---------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2   | Burst not found                 | The instrument is expecting a bursted signal, but such a signal cannot be detected because of inappropriate parameter settings or incorrect signal content |
| 3   | Timing Error                    | The instrument cannot establish appropriate timing from the signal                                                                                         |
| 4   | Carrier(s) incorrect or missing | The instrument cannot find the expected carrier(s) within the frequency ranges in which it is looking                                                      |
| 5   | Frequency out of range          | One or more system or signal input frequencies are out of range                                                                                            |
| 6   | Sync error                      | The instrument cannot establish sync with the measured signal                                                                                              |
| 7   | Demod error                     | The instrument cannot demodulate the signal due to inappropriate                                                                                           |

| Bit | Condition        | Operation                                                                |
|-----|------------------|--------------------------------------------------------------------------|
|     |                  | signal or settings conditions                                            |
| 8   | Signal Too Noisy | The instrument cannot measure the desired signal because it is too noisy |
| 9   | Slot Error       | No valid signal slot found in captured data                              |

Filter Registers

- "Questionable Integrity Signal Condition" on page 1112
- "Questionable Integrity Signal Enable" on page 1112
- "Questionable Integrity Signal Event Query" on page 1113
- "Questionable Integrity Signal Negative Transition" on page 1113
- "Questionable Integrity Signal Positive Transition" on page 1114

Questionable Integrity Signal Condition

Returns the decimal value of the sum of the bits in the Questionable Integrity Signal Condition Register.

NOTE

The data in this register is continuously updated and reflects the current conditions.

|                              |                                                  |
|------------------------------|--------------------------------------------------|
| Remote Command               | :STATus:QUEStionable:INTEgrity:SIGNAL:CONDition? |
| Example                      | :STAT:QUES:INT:SIGN:COND?                        |
| Preset                       | 0                                                |
| Status Bits/OPC dependencies | Sequential command                               |

Questionable Integrity Signal Enable

Determines which bits in the "Questionable Integrity Signal Condition" on page 1112 Register will set bits in the "Questionable Integrity Signal Event Query" on page 1113 Register, which also sets the Integrity Summary bit (bit 9) in the "Questionable Register" on page 1082.

The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

|        |                                                        |
|--------|--------------------------------------------------------|
| Remote | :STATus:QUEStionable:INTEgrity:SIGNAL:ENABLE <integer> |
|--------|--------------------------------------------------------|

|                              |                                                                                                                                          |
|------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|
| Command                      | <code>:STATus:QUESTIONable:INTEgrity:SIGNal:ENABle?</code>                                                                               |
| Example                      | <code>:STAT:QUES:INT:SIGN:ENAB 4</code><br>Burst Not Found will be reported to the Integrity Summary of the Status Questionable Register |
| Preset                       | 32767                                                                                                                                    |
| Min                          | 0                                                                                                                                        |
| Max                          | 32767                                                                                                                                    |
| Status Bits/OPC dependencies | Sequential command                                                                                                                       |

### Questionable Integrity Signal Event Query

Returns the decimal value of the sum of the bits in the Questionable Integrity Signal Event Register.

#### NOTE

The register requires that the associated PTRansition or NTRansition filters be set before a condition register bit can set a bit in the event register. The data in this register is latched until it is queried. Once queried, the register is cleared.

|                              |                                                             |
|------------------------------|-------------------------------------------------------------|
| Remote Command               | <code>:STATus:QUESTIONable:INTEgrity:SIGNal[:EVENT]?</code> |
| Example                      | <code>:STAT:QUES:INT:SIGN?</code>                           |
| Preset                       | 0                                                           |
| Status Bits/OPC dependencies | Sequential command                                          |

### Questionable Integrity Signal Negative Transition

Determines which bits in the "Questionable Integrity Signal Condition" on page 1112 Register will set the corresponding bit in the "Questionable Integrity Signal Event Query" on page 1113 Register when the condition register bit has a negative transition (1 to 0).

The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

|                |                                                                                                                                                       |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:STATus:QUESTIONable:INTEgrity:SIGNal:NTRansition &lt;integer&gt;</code><br><code>:STATus:QUESTIONable:INTEgrity:SIGNal:NTRansition?</code>     |
| Example        | <code>:STAT:QUES:INT:SIGN:NTR 4</code><br>Burst not found being cleared will be reported to the Integrity Summary of the Status Questionable Register |
| Preset         | 0                                                                                                                                                     |

|                              |                    |
|------------------------------|--------------------|
| Min                          | 0                  |
| Max                          | 32767              |
| Status Bits/OPC dependencies | Sequential command |

Questionable Integrity Signal Positive Transition

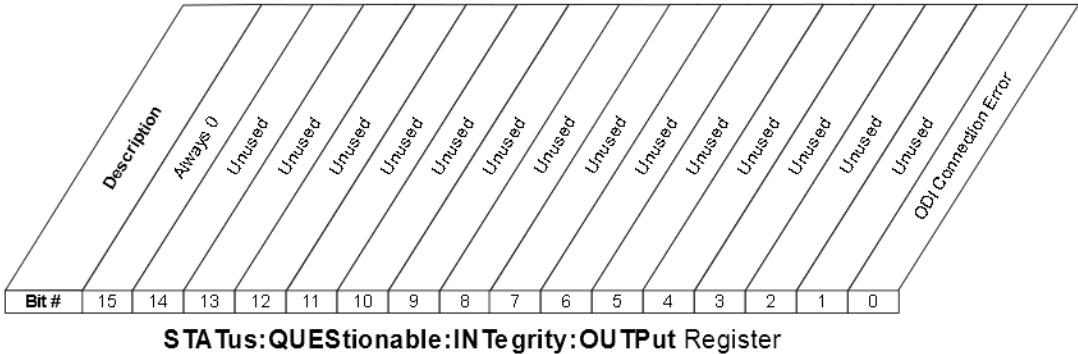
Determines which bits in the "Questionable Integrity Signal Condition" on page 1112 Register will set the corresponding bit in the "Questionable Integrity Signal Event Query" on page 1113 Register when the condition register bit has a positive transition (0 to 1).

The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

|                              |                                                                                                                                                       |
|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command               | <code>:STATus:QUEStionable:INTEgrity:SIGNAL:PTRansition &lt;integer&gt;</code><br><code>:STATus:QUEStionable:INTEgrity:SIGNAL:PTRansition?</code>     |
| Example                      | <code>:STAT:QUES:INT:SIGN:PTR 4</code><br><br>Burst not found being set will be reported to the Integrity Summary of the Status Questionable Register |
| Preset                       | 32767                                                                                                                                                 |
| Min                          | 0                                                                                                                                                     |
| Max                          | 32767                                                                                                                                                 |
| Status Bits/OPC dependencies | Sequential command                                                                                                                                    |

9.4.6.15 Questionable Integrity Output Register

Monitors conditions that occur in connection status currently limited to ODI streaming . It summarizes them in bit 2 of the "Questionable Integrity Register" on page 1107.



| Bit | Condition            | Operation                                                                 |
|-----|----------------------|---------------------------------------------------------------------------|
| 0   | ODI Connection Error | ODI Connection Error<br>This bit is never triggered, only its aliases are |

#### Filter Registers

- "Questionable Integrity Output Condition" on page 1115
- "Questionable Integrity Output Enable" on page 1115
- "Questionable Integrity Output Event Query" on page 1116
- "Questionable Integrity Output Negative Transition" on page 1116
- "Questionable Integrity Output Positive Transition" on page 1117

### Questionable Integrity Output Condition

Returns the decimal value of the sum of the bits in the Questionable Integrity Output Condition Register.

#### NOTE

The data in this register is continuously updated and reflects the current conditions.

|                              |                                                               |
|------------------------------|---------------------------------------------------------------|
| Remote Command               | <code>:STATus:QUESTionable:INTEgrity:OUTPut:CONDition?</code> |
| Example                      | <code>:STAT:QUES:INT:OUTP:COND?</code>                        |
| Preset                       | 0                                                             |
| Status Bits/OPC dependencies | Sequential command                                            |

### Questionable Integrity Output Enable

Determines which bits in the "Questionable Integrity Output Condition" on page 1115 Register will set the corresponding bit in the "Questionable Integrity Output Event Query" on page 1116 Register, which also sets the Data Output Summary bit (bit 2) in the "Questionable Integrity Register" on page 1107.

The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

|                |                                                                                                                         |
|----------------|-------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:STATus:QUESTionable:INTEgrity:OUTPut:ENABLE</code><br><code>:STATus:QUESTionable:INTEgrity:OUTPut:ENABLE?</code> |
| Example        | <code>:STAT:QUES:INT:OUTP:ENAB 1</code>                                                                                 |

|                              |                                                                                                 |
|------------------------------|-------------------------------------------------------------------------------------------------|
|                              | Oversweep (Meas Uncal) is reported to the Integrity Summary of the Status Questionable Register |
| Preset                       | 32767                                                                                           |
| Min                          | 0                                                                                               |
| Max                          | 32767                                                                                           |
| Status Bits/OPC dependencies | Sequential command                                                                              |

### Questionable Integrity Output Event Query

Returns the decimal value of the sum of the bits in the "Questionable Integrity Output Condition" on page 1115 Register.

#### NOTE

The register requires that the associated PTRansition or NTRansition filters be set before a condition register bit can set a bit in the event register. The data in this register is latched until it is queried. Once queried, the register is cleared.

|                              |                                                |
|------------------------------|------------------------------------------------|
| Remote Command               | :STATus:QUESTionable:INTEgrity:OUTPut[:EVENT]? |
| Example                      | :STAT:QUES:INT:OUTP?                           |
| Preset                       | 0                                              |
| Status Bits/OPC dependencies | Sequential command                             |

### Questionable Integrity Output Negative Transition

Determines which bits in the "Questionable Integrity Output Condition" on page 1115 Register will set the corresponding bit in the "Questionable Integrity Output Event Query" on page 1116 Register when the condition register bit has a negative transition (1 to 0).

The variable <integer> is the sum of the decimal values of the bits that you want to enable.

|                              |                                                                                                                   |
|------------------------------|-------------------------------------------------------------------------------------------------------------------|
| Remote Command               | :STATus:QUESTionable:INTEgrity:OUTPut:NTRansition <integer><br>:STATus:QUESTionable:INTEgrity:OUTPut:NTRansition? |
| Example                      | :STAT:QUES:INT:OUTP:NTR 1                                                                                         |
|                              | Oversweep cleared is reported to the Integrity Summary of the Status Questionable Register                        |
| Preset                       | 0                                                                                                                 |
| Min                          | 0                                                                                                                 |
| Max                          | 32767                                                                                                             |
| Status Bits/OPC dependencies | Sequential command                                                                                                |



## Questionable Integrity Output Positive Transition

Determines which bits in the "Questionable Integrity Output Condition" on page 1115 Register will set the corresponding bit in the "Questionable Integrity Output Event Query" on page 1116 Register when the condition register bit has a positive transition (0 to 1).

The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

|                              |                                                                                                                                                   |
|------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command               | <code>:STATus:QUESTionable:INTEgrity:OUTPut:PTRansition &lt;integer&gt;</code><br><code>:STATus:QUESTionable:INTEgrity:OUTPut:PTRansition?</code> |
| Example                      | <code>:STAT:QUES:INT:OUTP:PTR 1</code><br>Oversweep set is reported to the Integrity Summary of the Status Questionable Register                  |
| Preset                       | 32767                                                                                                                                             |
| Min                          | 0                                                                                                                                                 |
| Max                          | 32767                                                                                                                                             |
| Status Bits/OPC dependencies | Sequential command                                                                                                                                |

### 9.4.6.16 Questionable Integrity Uncalibrated Register

Monitors conditions that occur because a measurement may not be able to return an accurate or valid result due to a mismatch between instrument settings and the signal, placing the instrument in an uncalibrated state for that signal. It summarizes them in bit 3 of the "Questionable Integrity Register" on page 1107.

| Bit #       | 15       | 14     | 13     | 12     | 11     | 10     | 9      | 8      | 7      | 6                           | 5            | 4                 | 3              | 2                       | 1                  | 0         |            |
|-------------|----------|--------|--------|--------|--------|--------|--------|--------|--------|-----------------------------|--------------|-------------------|----------------|-------------------------|--------------------|-----------|------------|
| Description | Always 0 | Unused | Unused | Unused | Unused | Unused | Unused | Unused | Unused | Preamp accuracy unspecified | Source uncal | Calibration issue | User cal issue | AC Coupled below 10 MHz | No long code phase | Sig ID on | Meas Uncal |

**STATus:QUESTionable:INTEgrity:UNCalibrated Register**

| Bit | Condition    | Operation                                                                                                          |
|-----|--------------|--------------------------------------------------------------------------------------------------------------------|
| 0   | Meas Uncal   | A Meas Uncal warning is being displayed; generally, this means the sweep time must be reduced or the RBW increased |
| 1   | Signal ID on | In external mixing, the Sig ID function is on, which will impact the                                               |

| Bit | Condition                                | Operation                                                                                                                                                |
|-----|------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
|     |                                          | trace results                                                                                                                                            |
| 2   | No Long Code Phase                       | The long code phase that identifies an access channel cannot be found (WCDMA)                                                                            |
| 3   | AC coupled: Accy unspec'd <10 MHz        | The instrument is AC coupled but is operating below 10 MHz, where the blocking capacitor will impact measurement accuracy                                |
| 4   | User cal issue                           | In noise figure measurements, the User Cal has not been performed or has been invalidated                                                                |
| 5   | Calibration issue                        | In noise figure measurements, one or more calibration or measurement frequency point exceeds the currently loaded Cal or Meas ENR Table frequency ranges |
| 6   | Source uncal                             | While using a Tracking Source, settings are putting it into an uncalibrated operational state                                                            |
| 7   | Preamp accuracy unspecified below XX MHz | The preamp is being used but is operating below frequencies for which its accuracy is specified                                                          |

#### Filter Registers

- "Questionable Integrity Uncalibrated Condition" on page 1118
- "Questionable Integrity Uncalibrated Enable" on page 1119
- "Questionable Integrity Uncalibrated Event Query" on page 1119
- "Questionable Integrity Uncalibrated Negative Transition" on page 1119
- "Questionable Integrity Uncalibrated Positive Transition" on page 1120

### Questionable Integrity Uncalibrated Condition

Returns the decimal value of the sum of the bits in the Questionable Integrity Uncalibrated Condition Register.

#### NOTE

The data in this register is continuously updated and reflects the current conditions.

|                              |                                                                     |
|------------------------------|---------------------------------------------------------------------|
| Remote Command               | <code>:STATus:QUEStionable:INTegrity:UNCalibrated:CONDition?</code> |
| Example                      | <code>:STAT:QUES:INT:UNC:COND?</code>                               |
| Preset                       | 0                                                                   |
| Status Bits/OPC dependencies | Sequential command                                                  |

## Questionable Integrity Uncalibrated Enable

Determines which bits in the "Questionable Integrity Uncalibrated Condition" on page 1118 Register will set bits in the "Questionable Integrity Uncalibrated Event Query" on page 1119 Register, which also sets the Data Uncalibrated Summary bit (bit 3) in the "Questionable Integrity Register" on page 1107.

The variable `<integer>` is the sum of the decimal values of the bits that you want to enable.

|                              |                                                                                                                                           |
|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command               | <code>:STATus:QUESTionable:INTEgrity:UNCalibrated:ENABle</code><br><code>:STATus:QUESTionable:INTEgrity:UNCalibrated:ENABle?</code>       |
| Example                      | <code>:STAT:QUES:INT:UNC:ENAB 1</code><br>Oversweep (Meas Uncal) is reported to the Integrity Summary of the Status Questionable Register |
| Preset                       | 32767                                                                                                                                     |
| Min                          | 0                                                                                                                                         |
| Max                          | 32767                                                                                                                                     |
| Status Bits/OPC dependencies | Sequential command                                                                                                                        |

## Questionable Integrity Uncalibrated Event Query

Returns the decimal value of the sum of the bits in the "Questionable Integrity Uncalibrated Condition" on page 1118 Register.

### NOTE

The register requires that the associated PTRansition or NTRansition filters be set before a condition register bit can set a bit in the event register. The data in this register is latched until it is queried. Once queried, the register is cleared.

|                              |                                                                    |
|------------------------------|--------------------------------------------------------------------|
| Remote Command               | <code>:STATus:QUESTionable:INTEgrity:UNCalibrated[:EVENTt]?</code> |
| Example                      | <code>:STAT:QUES:INT:UNC?</code>                                   |
| Preset                       | 0                                                                  |
| Status Bits/OPC dependencies | Sequential command                                                 |

## Questionable Integrity Uncalibrated Negative Transition

Determines which bits in the "Questionable Integrity Uncalibrated Condition" on page 1118 Register will set the corresponding bit in the "Questionable Integrity

**Uncalibrated Event Query" on page 1119** Register when the condition register bit has a negative transition (1 to 0).

The variable **<integer>** is the sum of the decimal values of the bits that you want to enable.

|                              |                                                                                                                                                   |
|------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command               | <b>:STATus:QUESTionable:INTEgrity:UNCalibrated:NTRansition &lt;integer&gt;</b><br><b>:STATus:QUESTionable:INTEgrity:UNCalibrated:NTRansition?</b> |
| Example                      | <b>:STAT:QUES:INT:UNC:NTR 1</b><br>Oversweep cleared is reported to the Integrity Summary of the Status Questionable Register                     |
| Preset                       | 0                                                                                                                                                 |
| Min                          | 0                                                                                                                                                 |
| Max                          | 32767                                                                                                                                             |
| Status Bits/OPC dependencies | Sequential command                                                                                                                                |

### Questionable Integrity Uncalibrated Positive Transition

Determines which bits in the **"Questionable Integrity Uncalibrated Condition" on page 1118** Register will set the corresponding bit in the **"Questionable Integrity Uncalibrated Event Query" on page 1119** Register when the condition register bit has a positive transition (0 to 1).

The variable **<integer>** is the sum of the decimal values of the bits that you want to enable.

|                              |                                                                                                                                                   |
|------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command               | <b>:STATus:QUESTionable:INTEgrity:UNCalibrated:PTRansition &lt;integer&gt;</b><br><b>:STATus:QUESTionable:INTEgrity:UNCalibrated:PTRansition?</b> |
| Example                      | <b>:STAT:QUES:INT:UNC:PTR 1</b><br>Oversweep set is reported to the Integrity Summary of the Status Questionable Register                         |
| Preset                       | 32767                                                                                                                                             |
| Min                          | 0                                                                                                                                                 |
| Max                          | 32767                                                                                                                                             |
| Status Bits/OPC dependencies | Sequential command                                                                                                                                |

## 10 Hardware-Accelerated Fast Power Measurement (Remote Command Only)

The **Fast Power** option (FP2) enables very fast channel power measurements for instruments with the prerequisite hardware (DP2 and/or B40). It accomplishes this by performing real-time overlapped FFTs at the hardware layer, using software for basic post-processing before returning the result. The upshot of this approach is improved throughput for user applications that require many sequential power measurements.

The analysis bandwidth of FP2 may be limited by the licenses in the instrument.

NOTE

**FP2 is remote-only, which means the instrument does not switch to any particular Mode or measurement. FP2 commands can be sent while another application is in use on the front panel.**

---

Each Fast Power measurement can be predefined using an array index, and up to 1000 measurements can be stored. In the following documentation, instances of [1,2,...,999] can be substituted with a particular measurement index, for example, `:CALC:FPOW:POW1?`, `:CALC:FPOW:POW2?`, `:CALC:FPOW:POW134?`. In this way, power measurements can be defined one time in a batch, and then executed multiple times without having to redefine them, similar to “list mode” on other measurements.

In addition to basic channel power measurements, there are several other measurement “functions” for each channel, including peak power, peak frequency, and power spectral density.

## 10.1 Reset Fast Power Measurement (Remote Command Only)

Resets the measurement configuration to the defaults.

|                |                                            |
|----------------|--------------------------------------------|
| Remote Command | :CALCulate:FPOWer:POWer[1,2,...,999]:RESet |
| Example        | :CALC:FPOW:POW1:RES                        |
| Notes          | Option FP2 is required                     |

## 10.2 Define Fast Power Measurement (Remote Command Only)

Fast Power acquisitions are configured using this command, which accepts a comma-delimited string of configuration parameters and their appropriate values.

All parameters are specified in the subsections below.

|                |                                                                                                                   |
|----------------|-------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALCulate:FPOWer:POWer[1,2,...,999]:DEFine "configuration string"</code>                                   |
| Example        | <code>:CALC:FPOW:POW1:DEF "CenterFrequency=2e9,AcquisitionTime=0.005"</code>                                      |
| Notes          | See the following subsections for a list of measurement variables that can be defined in the configuration string |

### 10.2.1 Acquisition Time

|         |                                                                                                                                                |
|---------|------------------------------------------------------------------------------------------------------------------------------------------------|
| Example | <code>:CALC:FPOW:POW1:DEF "AcquisitionTime=0.002"</code>                                                                                       |
| Notes   | Sets the time in which the entire spectrum is measured. An increase in the acquisition time yields an improvement in measurement repeatability |
| Preset  | 0.001 s                                                                                                                                        |
| Range   | 0 s to 1 s                                                                                                                                     |

### 10.2.2 Center Frequency

|         |                                                                                                                                                                                                |
|---------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Example | <code>:CALC:FPOW:POW1:DEF "CenterFrequency=2e9"</code>                                                                                                                                         |
| Notes   | Sets the frequency in which the measurement is centered around. " <a href="#">Channel Offset Frequency Array</a> " on <a href="#">page 1131</a> is calculated relative to the center frequency |
| Preset  | 1 GHz                                                                                                                                                                                          |
| Range   | 0 Hz to maximum instrument frequency                                                                                                                                                           |

### 10.2.3 DC Coupled

|              |                                                                                                                            |             |            |              |            |
|--------------|----------------------------------------------------------------------------------------------------------------------------|-------------|------------|--------------|------------|
| Example      | <code>:CALC:FPOW:POW1:DEF "DCCoupled=True"</code>                                                                          |             |            |              |            |
| Notes        | Lets you specify whether the DC blocking capacitor is utilized. Set to <b>True</b> when measuring frequencies below 10 MHz |             |            |              |            |
| Preset       | <b>False</b>                                                                                                               |             |            |              |            |
| Range        | <table> <tr> <td><b>True</b></td><td>DC Coupled</td></tr> <tr> <td><b>False</b></td><td>AC Coupled</td></tr> </table>      | <b>True</b> | DC Coupled | <b>False</b> | AC Coupled |
| <b>True</b>  | DC Coupled                                                                                                                 |             |            |              |            |
| <b>False</b> | AC Coupled                                                                                                                 |             |            |              |            |

## 10.2.4 Detector Type

|         |                                                                                                                |  |
|---------|----------------------------------------------------------------------------------------------------------------|--|
| Example | :CALC:FPOW:POW1:DEF "DetectorType=Peak"                                                                        |  |
| Notes   | Option FP2 is required<br>Lets you specify whether an RMS average or peak value is used during the measurement |  |
| Preset  | RmsAverage                                                                                                     |  |
| Range   | RmsAverage, Peak                                                                                               |  |

## 10.2.5 Do Noise Correction

|         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                          |
|---------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|
| Example | :CALC:FPOW:POW1:DEF "DoNoiseCorrection=True"                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                          |
| Notes   | <p>When noise correction is enabled, the linear noise power contributed by the instrument is subtracted from all measurements. This effectively lowers the noise floor of the instrument</p> <p>When noise correction is enabled, the first measurement for a given set of input parameters will take extra time. This is because the instrument takes an extra acquisition with the RF input disconnected from the instrument's front end to measure the noise of just the instrument. The measured noise floor is stored in a cache so the noise acquisition will occur only once for the same state settings. In other words, if noise correction was turned on and the instrument made an acquisition at frequency A, then frequency B, and back again to frequency A, the hidden initial noise floor acquisition would only occur for the first acquisition at frequency A and the cached noise floor would be used the second time frequency A was measured</p> |                          |
| Preset  | False                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                          |
| Range   | True                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Enable noise correction  |
|         | False                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Disable noise correction |

## 10.2.6 Do Spur Suppression

|         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |
|---------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| Example | :CALC:FPOW:POW1:DEF "DoSpurSuppression=True"                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |
| Notes   | <p>When measuring very low-level signals, or when large out-of-band inputs are input into the instrument, sometimes unwanted spurs and residuals can appear in the measured spectrum. Spur suppression is a method to help minimize the levels of these internally generated spurs and residuals</p> <p>When spur suppression is enabled, the instrument will automatically take two acquisitions using two different internal analog LO frequencies. The FFT spectrums from both acquisitions are combined by taking the minimum power between both traces on a per FFT bin basis. External signals will have the same amplitude for both traces and therefore will return the expected amplitudes. However, low level spurs and residuals generated internally to the instrument tend to move to different FFT bins depending</p> |  |



|        |                                                                                                                                                                                                                                                                                                        |                          |
|--------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|
|        | on the internal analog LO frequency used, and therefore tend to be suppressed using this spur suppression method<br>Because two acquisitions, rather than a single acquisition, are made when spur suppression is enabled, the measurement time will always be slower when spur suppression is enabled |                          |
| Preset | <b>False</b>                                                                                                                                                                                                                                                                                           |                          |
| Range  | <b>True</b>                                                                                                                                                                                                                                                                                            | Enable spur suppression  |
|        | <b>False</b>                                                                                                                                                                                                                                                                                           | Disable spur suppression |

### 10.2.7 Electronic Attenuator Bypass

|         |                                                                                                                                                                                                                                            |                              |
|---------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|
| Example | <b>:CALC:FPOW:POW1:DEF "ElecAttBypass =False"</b>                                                                                                                                                                                          |                              |
| Notes   | Lets you either utilize or bypass the electronic attenuator. The electronic attenuator is only available for frequencies up to 3.6 GHz. Set to <b>True</b> when using frequencies above 3.6 GHz. Set to <b>False</b> when using the preamp |                              |
| Preset  | <b>True</b>                                                                                                                                                                                                                                |                              |
| Range   | <b>True</b>                                                                                                                                                                                                                                | Bypass electronic attenuator |
|         | <b>False</b>                                                                                                                                                                                                                               | Use electronic attenuator    |

### 10.2.8 Electronic Attenuation

|         |                                                                                                                   |  |
|---------|-------------------------------------------------------------------------------------------------------------------|--|
| Example | <b>:CALC:FPOW:POW1:DEF "ElecAttenuation=10"</b>                                                                   |  |
| Notes   | Option EA3 is required                                                                                            |  |
|         | The electronic attenuation value parameter sets the amount of electrical attenuation from 0 to 24 dB (1 dB steps) |  |
|         | Set <b>ElecAttBypass = False</b> to make sure the electronic attenuator path is enabled                           |  |
| Preset  | 0 dB                                                                                                              |  |
| Range   | 0 – 24 dB (1 dB steps)                                                                                            |  |

### 10.2.9 External Reference Frequency

|         |                                                                                                                                                                                                                                                                                                                                                |  |
|---------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| Example | <b>:CALC:FPOW:POW1:DEF "ExternalReferenceFrequency=10"</b>                                                                                                                                                                                                                                                                                     |  |
| Notes   | This is the user-specified frequency of the external reference. Used when " <b>Frequency Reference Source</b> " on page 1126 is set to <b>ExternalFrequencyReference</b> , or <b>AutoExternalFrequencyReference</b> when the external source is present. Unused if <b>FrequencyReferenceSource</b> is set to <b>InternalFrequencyReference</b> |  |

|        |        |
|--------|--------|
| Preset | 10 MHz |
|--------|--------|

## 10.2.10 Frequency Reference Source

|         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|---------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Example | <code>:CALC:FPOW:POW1:DEF "FrequencyReferenceSource= InternalFrequencyReference"</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Notes   | Specifies which frequency reference source should be used for this request: <ul style="list-style-type: none"> <li>- If <code>ExternalFrequencyReference</code> is selected and no external reference is present, the frequency reference unlocks but the data acquisition will continue</li> <li>- If <code>AutoExternalFrequencyReference</code> is selected, the hardware senses whether an external source is present before starting the data acquisition. If no external source is present then the internal source is selected, and the data acquisition will continue</li> </ul> |
| Preset  | <code>InternalFrequencyReference</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Range   | <code>InternalFrequencyReference, ExternalFrequencyReference, AutoExternalFrequencyReference</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |

## 10.2.11 IF Gain

|         |                                                                                                                                                                               |
|---------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Example | <code>:CALC:FPOW:POW1:DEF "IFGain=10"</code>                                                                                                                                  |
| Notes   | Lets you specify the gain at the IF stage anywhere from -6 to 16 dB (1 dB steps). This is an advanced feature; for most cases this should remain at its default value of 0 dB |
| Preset  | 0 dB                                                                                                                                                                          |
| Range   | -6 to 16 dB (1 dB steps)                                                                                                                                                      |

## 10.2.12 IF Type

|         |                                                                                                                                                                                                     |
|---------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Example | <code>:CALC:FPOW:POW1:DEF "IFType=B25M"</code>                                                                                                                                                      |
| Notes   | Lets you select between different IF paths. For example, if the signal is less than 25 MHz wide, then you can select the B25M path to take advantage of additional filtering on this analog IF path |
| Preset  | <code>B40M</code>                                                                                                                                                                                   |
| Range   | <code>B10M, B25M, B40M</code>                                                                                                                                                                       |

## 10.2.13 Include Power Spectrum

|         |                                                                                                                                                                                                                                      |
|---------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Example | <code>:CALC:FPOW:POW1:DEF "IncludePowerSpectrum=True"</code>                                                                                                                                                                         |
| Notes   | Lets you read data on the entire spectrum for diagnostic purposes. It is not recommended for production use<br>For details of the binary format of the response, see <a href="#">"Diagnostic Binary Read Fast Power Measurement"</a> |

|        |                                     |                                                    |
|--------|-------------------------------------|----------------------------------------------------|
|        | (Remote Command Only)" on page 1139 |                                                    |
| Preset | False                               |                                                    |
| Range  | True                                | Returns both channel power and full power spectrum |
|        | False                               | Returns only channel power                         |

### 10.2.14 Mechanical Attenuation

|         |                                                                                 |  |
|---------|---------------------------------------------------------------------------------|--|
| Example | :CALC:FPOW:POW1:DEF "MechAttenuation=10"                                        |  |
| Notes   | Sets the amount of mechanical attenuation anywhere from 0 to 70 dB (2 dB steps) |  |
| Preset  | 0 dB                                                                            |  |
| Range   | 0 to 70 dB (2 dB steps)                                                         |  |

### 10.2.15 Preamp Mode

|         |                                                                                                                                                                                                                                                                                       |  |
|---------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| Example | :CALC:FPOW:POW1:DEF "PreAmpMode=Low"                                                                                                                                                                                                                                                  |  |
| Notes   | The license for the appropriate preamp is required<br>Specifies whether the preamps are being utilized. Low allows any preamps up to 3.6 GHz, and Full allows all licensed preamps. Set ElecAttBypass = True to utilize any preamps (see "Electronic Attenuator Bypass" on page 1125) |  |
| Preset  | Off                                                                                                                                                                                                                                                                                   |  |
| Range   | Off, Low, Full                                                                                                                                                                                                                                                                        |  |

### 10.2.16 Resolution Bandwidth Mode

|         |                                                                                                                                                                                                                                                                                                                                          |  |
|---------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| Example | :CALC:FPOW:POW1:DEF "PreAmpMode=Low"                                                                                                                                                                                                                                                                                                     |  |
| Notes   | Lets you specify whether the RBW filter is automatically or manually set. The BestSpeed value minimizes measurement time, while the Narrowest value minimizes RBW size (minimum of two FFT bins per RBW)<br>To manually specify an RBW, set this parameter to Explicit, and set "Resolution Bandwidth" on page 1128 to the desired value |  |
| Preset  | BestSpeed                                                                                                                                                                                                                                                                                                                                |  |
| Range   | BestSpeed, Narrowest, Explicit                                                                                                                                                                                                                                                                                                           |  |

## 10.2.17 Resolution Bandwidth

|         |                                                                                                                                            |
|---------|--------------------------------------------------------------------------------------------------------------------------------------------|
| Example | <code>:CALC:FPOW:POW1:DEF "ResolutionBW=25e3"</code>                                                                                       |
| Notes   | Sets the 3-dB bandwidth of the RBW filter. "Resolution Bandwidth Mode" on page 1127 must be set to <b>Explicit</b> to manually set the RBW |
| Preset  | 0 Hz                                                                                                                                       |

## 10.2.18 Trigger Delay

|         |                                                                                        |
|---------|----------------------------------------------------------------------------------------|
| Example | <code>:CALC:FPOW:POW1:DEF "TriggerDelay=0.025"</code>                                  |
| Notes   | Sets the time after an external trigger is detected until the measurement is performed |
| Preset  | 0 s                                                                                    |
| Range   | 0 to 1 s                                                                               |

## 10.2.19 Trigger Level

|         |                                                                 |
|---------|-----------------------------------------------------------------|
| Example | <code>:CALC:FPOW:POW1:DEF "TriggerLevel=2"</code>               |
| Notes   | Sets the voltage value at which an external trigger is detected |
| Preset  | 1.2 V                                                           |
| Range   | -5 to 5 V                                                       |

## 10.2.20 Trigger Slope

|         |                                                                   |
|---------|-------------------------------------------------------------------|
| Example | <code>:CALC:FPOW:POW1:DEF "TriggerSlope=Negative"</code>          |
| Notes   | Specifies the direction of the edge trigger voltage for detection |
| Preset  | <b>Positive</b>                                                   |
| Range   | <b>Positive</b> , <b>Negative</b>                                 |

## 10.2.21 Trigger Source

|         |                                                                                                                                                                           |
|---------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Example | <code>:CALC:FPOW:POW1:DEF "TriggerSource=Ext1"</code>                                                                                                                     |
| Notes   | Lets you select whether the measurement triggers freely, or is controlled by an external input<br>Ext1 and Ext2 correspond to Trigger 1 In and Trigger 2 In, respectively |
| Preset  | <b>Free</b>                                                                                                                                                               |
| Range   | <b>Free</b> , <b>Ext1</b> , <b>Ext2</b>                                                                                                                                   |

## 10.2.22 Trigger Timeout

|         |                                                                                                               |
|---------|---------------------------------------------------------------------------------------------------------------|
| Example | <code>:CALC:FPOW:POW1:DEF "TriggerTimeout=0.1"</code>                                                         |
| Notes   | Sets the time in which the instrument will wait for a trigger before automatically performing the measurement |
| Preset  | 1 s                                                                                                           |
| Range   | 0 to 1 s                                                                                                      |

## 10.2.23 Signal Input

|         |                                                                                                          |
|---------|----------------------------------------------------------------------------------------------------------|
| Example | <code>:CALC:FPOW:POW1:DEF "SignalInput=Fp50MHzCW"</code>                                                 |
| Notes   | Lets you select between using the main RF input or the internal instrument reference CW signal of 50 MHz |
| Preset  | <code>FpMainRf</code>                                                                                    |
| Range   | <code>FpMainRf, Fp50MHzCW</code>                                                                         |

## 10.2.24 Use Preselector

|         |                                                                                                                                                                                                                                                      |
|---------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Example | <code>:CALC:FPOW:POW1:DEF "UsePreSelector=True"</code>                                                                                                                                                                                               |
| Notes   | Lets you either utilize or bypass the front-end tunable filter at frequencies above 3.6 GHz. For frequencies below 3.6 GHz, the preselector is automatically bypassed, so you do not need to set this parameter to <code>False</code> in those cases |
| Preset  | <code>False</code>                                                                                                                                                                                                                                   |
| Range   | <code>True</code> Use preselector above 3.6 GHz                                                                                                                                                                                                      |
|         | <code>False</code> Preselector bypassed                                                                                                                                                                                                              |

## 10.2.25 Channel Bandwidth Array

|         |                                                                                                                                                                                                                                                                 |
|---------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Example | <code>:CALC:FPOW:POW1:DEF "Bandwidth=[3.84e6, 5e6, 3.84e6]"</code>                                                                                                                                                                                              |
| Notes   | Defines the bandwidth of each channel that will be measured<br>All array parameters should have the same number of elements. Alternatively, if all the elements are the same value, a single number with no square brackets can be used to define the parameter |
| Preset  | <code>[1e6]</code>                                                                                                                                                                                                                                              |
| Range   | 0 to 40 MHz                                                                                                                                                                                                                                                     |

## 10.2.26 Channel Filter Type Array

|         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|---------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Example | <code>:CALC:FPOW:POW1:DEF "FilterType=[RRC, IBW, RRC]"</code>                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Notes   | Lets you select either an integration bandwidth (IBW) filter, or a root-raised-cosine (RRC) filter. The integration bandwidth filter weighs all frequencies within the bandwidth equally. The root-raised-cosine filter has an associated shape parameter, defined by the FilterAlpha parameter<br><br>All array parameters should have the same number of elements. Alternatively, if all the elements are the same value, a single value with no square brackets can be used to define the parameter |
| Preset  | <code>[IBW]</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Range   | <code>IBW, RRC</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |

## 10.2.27 Channel Filter Alpha Array

|         |                                                                                                                                                                                                                                                                                                                                                                               |
|---------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Example | <code>:CALC:FPOW:POW1:DEF "FilterAlpha=[0.5, 0.0, 0.5]"</code>                                                                                                                                                                                                                                                                                                                |
| Notes   | Lets you adjust the alpha value associated with the root-raised-cosine (RRC) filter type<br>Set <code>FilterType</code> to <code>RRC</code> to utilize this parameter<br><br>All array parameters should have the same number of elements. Alternatively, if all the elements are the same value, a single number with no square brackets can be used to define the parameter |
| Preset  | <code>[0.22]</code>                                                                                                                                                                                                                                                                                                                                                           |
| Range   | <code>0.0 to 1.0</code>                                                                                                                                                                                                                                                                                                                                                       |

## 10.2.28 Channel Measurement Function Array

|         |                                                                                                                                                                                                                                                                                                                                                                |
|---------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Example | <code>:CALC:FPOW:POW1:DEF "Function=[BandPower, PeakPower, BandPower]"</code>                                                                                                                                                                                                                                                                                  |
| Notes   | Defines what measurement is being made for each individually-specified channel. For details, see <a href="#">"Parameter Options" on page 1130</a><br><br>All array parameters should have the same number of elements<br><br>Alternatively, if all the elements are the same value, a single value with no square brackets can be used to define the parameter |
| Preset  | <code>BandPower</code>                                                                                                                                                                                                                                                                                                                                         |
| Range   | <code>BandPower, BandDensity, PeakPower, PeakFrequency, XdBBandwidth, OccupiedBandwidth</code>                                                                                                                                                                                                                                                                 |

### Parameter Options

| Option                 | Description                                               | Unit |
|------------------------|-----------------------------------------------------------|------|
| <code>BandPower</code> | Total power within the specified bandwidth of the channel | dBm  |

| Option                            | Description                                                                                                                                                                                 | Unit   |
|-----------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|
| <a href="#">BandDensity</a>       | Total power density within the specified bandwidth of the channel                                                                                                                           | dBm/Hz |
| <a href="#">PeakPower</a>         | The peak power value within the specified bandwidth of the channel                                                                                                                          | dBm    |
| <a href="#">PeakFrequency</a>     | The frequency that corresponds to the peak power value within the specified bandwidth of the channel. This frequency is relative to the center frequency                                    | Hz     |
| <a href="#">XdBBandwidth</a>      | The half power (–3.01 dB) bandwidth of the highest amplitude signal that resides within the channel<br>dB is configurable using <a href="#">"Channel x-dB Bandwidth Array" on page 1131</a> | Hz     |
| <a href="#">OccupiedBandwidth</a> | The bandwidth at which 99% of the total power resides within the channel<br>Percentage is configurable using <a href="#">"Channel Occupied Bandwidth Percent Array" on page 1131</a>        | Hz     |

### 10.2.29 Channel Offset Frequency Array

|         |                                                                                                                                                             |
|---------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Example | <code>:CALC:FPOW:POW1:DEF "OffsetFrequency=[-5e6, 0, 5e6]"</code>                                                                                           |
| Notes   | Defines the difference between the center frequency to the center frequency of each channel<br>All array parameters should have the same number of elements |
| Preset  | [0]                                                                                                                                                         |
| Range   | 0 to 20 MHz                                                                                                                                                 |

### 10.2.30 Channel Occupied Bandwidth Percent Array

|         |                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|---------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Example | <code>:CALC:FPOW:POW1:DEF "OccupiedBandwidthPercent =[0.95, 0.95, 0.95]"</code>                                                                                                                                                                                                                                                                                                                                                                   |
| Notes   | Only applies to channels whose <a href="#">"Channel Measurement Function Array" on page 1130</a> is set to <a href="#">OccupiedBandwidth</a> . The occupied bandwidth percent parameter specifies the percent of total power in these channels. The valid range for this parameter is 0.0 to 1.0, where 1.0 represents 100%. The default for this parameter is 0.99, which will return the bandwidth that contains 99% of the total channel power |
| Preset  | [0.99]                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Range   | 0 – 1.0                                                                                                                                                                                                                                                                                                                                                                                                                                           |

### 10.2.31 Channel x-dB Bandwidth Array

|         |                                                                                                                                                                                                                                                                                                                              |
|---------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Example | <code>:CALC:FPOW:POW1:DEF " XdBBandwidth =[-6.02, -3.01, -1.0]"</code>                                                                                                                                                                                                                                                       |
| Notes   | Only applies to channels whose <a href="#">"Channel Measurement Function Array" on page 1130</a> is set to <a href="#">XdBBandwidth</a> . The X dB bandwidth parameter is used to specify the power relative to the peak channel power over which the bandwidth is calculated. The parameter value must be a negative number |

10 Hardware-Accelerated Fast Power Measurement (Remote Command Only)  
10.2 Define Fast Power Measurement (Remote Command Only)

|        |              |
|--------|--------------|
| Preset | [-3.01]      |
| Range  | -200 to 0 dB |



### 10.3 Define Fast Power Measurement Query (Remote Query Only)

Retrieves a list of all defined parameters in an ASCII string format

The following is an example of returned results:

```
"DCCoupled=False,ElecAttBypass=True,ElecAttenuation=0,IFGain=0,MechAttenuation=0,PreAmpMode=Off,PreSelectorOffset=0,UsePreSelector=False,ExternalReferenceFrequency=10000000,FrequencyReferenceSource=AutoExternalFrequencyReference,IFType=B40M,LOMode=SLW,SignalInput=FpMainRf,AcquisitionTime=0.001,CenterFrequency=1000000000,ResolutionBW=0,ResolutionBWMode=BestSpeed,DetectorType=RmsAverage,Bandwidth=[1000000],OffsetFrequency=[0],Function=[BandPower],FilterType=[IBW],FilterAlpha=[0.22],OccupiedBandwidthPercent=[0.99],XdBBandwidth=[3.01],DoNoiseCorrection=False,DoSpurSuppression=False,MeasurementMethod=HardwareFFT,IncludePowerSpectrum=False,TriggerDelay=0,TriggerLevel=1.2,TriggerSlope=Positive,TriggerSource=Free,TriggerTimeout=1,Trigger1Output=Off,Trigger1OutputPolarity=Positive,Trigger2Output=Off,Trigger2OutputPolarity=Positive"
```

|                |                                                               |
|----------------|---------------------------------------------------------------|
| Remote Command | :CALCulate:FPOWer:POWer[1,2,...,999]:DEFine?                  |
| Example        | :CALC:FPOW:POW1:DEF?                                          |
| Notes          | Retrieves a list of all defined parameters in an ASCII format |

## 10.4 Configure Fast Power Measurement (Remote Command Only)

Begins hardware setup and returns immediately, with no acquisition made. This can be used in parallel with other hardware operations to effectively hide the hardware setup time.

|                |                                                |
|----------------|------------------------------------------------|
| Remote Command | :CALCulate:FPOWer:POWer[1,2,...,999]:CONFigure |
| Example        | :CALC:FPOW:POW1:CONF                           |
| Notes          | Option FP2 is required                         |

## 10.5 Initiate Fast Power Measurement (Remote Command Only)

Begins an acquisition and returns immediately. The results of the measurement can be retrieved using [:FETCh](#).

|                |                                                               |
|----------------|---------------------------------------------------------------|
| Remote Command | <a href="#">:CALCulate:FPOWer:POWer[1,2,...,999]:INITiate</a> |
| Example        | <a href="#">:CALC:FPOW:POW1:INIT</a>                          |
| Notes          | Option FP2 is required                                        |

## 10.6 Fetch Fast Power Measurement (Remote Command Only)

Used to retrieve the results of an acquisition initiated by `:INIT`. The returned results are in *ASCII string* format. The string begins and ends with quotation marks.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALCulate:FPOWer:POWer[1,2,...,999]:FETCh?</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Example        | <code>:CALC:FPOW:POW1:FETC?</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Notes          | <p>Option FP2 is required</p> <p>Returns m comma-separated ASCII values, where m corresponds to the number of bandwidths defined</p> <ol style="list-style-type: none"><li>1. Declared function return in the 1st specified channel</li><li>2. Declared function return in the 2nd specified channel</li><li>...</li><li>m. Declared function return in the last specified channel</li></ol> <p>The <code>INIT</code> and <code>FETC?</code> command sequence has the same effect as a single <code>CALC:FPOW:POW[n]?</code> query. Units of the returned values depend on "Channel Measurement Function Array" on page 1130 for each channel</p> |

## 10.7 Execute Fast Power Measurement (Remote Command Only)

Shorthand for `:INIT` immediately followed by `:FETC?`. The returned results are in *ASCII string* format. The string begins and ends with quotation marks.

|                |                                                                                                                                              |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALCulate:FPOWer:POWer[1,2,...,999]?</code>                                                                                           |
| Example        | <code>:CALC:FPOW:POW1?</code>                                                                                                                |
| Notes          | Option FP2 is required<br>For return format, see notes for <a href="#">"Fetch Fast Power Measurement (Remote Command Only)"</a> on page 1136 |

## 10.8 Binary Read Fast Power Measurement (Remote Command Only)

Shorthand for `:INIT` immediately followed by `:FETC?`. The returned results are in *binary format*.

|                |                                                                                                                                                  |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| Remote Command | <code>:CALCulate:FPOWer:POWer[1,2,...,999]:READ?</code><br><code>:CALCulate:FPOWer:POWer[1,2,...,999]:READ1?</code>                              |
| Example        | <code>:CALC:FPOW:POW1:READ?</code><br><code>:CALC:FPOW:POW1:READ1?</code>                                                                        |
| Notes          | Option FP2 is required<br>Returns m 4-byte floating point binary values (Little-Endian), where m corresponds to the number of bandwidths defined |

## 10.9 Diagnostic Binary Read Fast Power Measurement (Remote Command Only)

Shorthand for `:INIT` immediately followed by `:FETC?`. The returned results are in *binary format*. This command is used primarily for diagnostic purposes, to test for ADC overloads and to visibly inspect the spectrum.

For details of the data returned, see ["Results Format" on page 1139](#).

|                |                                                          |
|----------------|----------------------------------------------------------|
| Remote Command | <code>:CALCulate:FPOWer:POWer[1,2,...,999]:READ2?</code> |
| Example        | <code>:CALC:FPOW:POW1:READ2?</code>                      |
| Notes          | Option FP2 is required                                   |

### Results Format

Spectrum data is only returned if `IncludePowerSpectrum` is set to `True` (see ["Include Power Spectrum" on page 1126](#)). If `IncludePowerSpectrum` is `False`, the number of spectrum points is zero (0).

Units of the returned values are dependent on the `Function` parameter per channel (e.g., dBm for `BandPower`, Hz for `PeakFrequency`).

Returns binary data (Little-Endian) that contains information on number of channels  $m$ , along with ADC over range and full spectrum data.

The following is the binary format of the response:

#### Bandwidth Return Value

- 1 Number of channels specified,  $m$  [4-byte int]
- 2 Declared function result for the 1st specified channel [4-byte float]
- 3 Declared function result for the 2nd specified channel [4-byte float]
- ...
- $m + 1$  Declared function result for the last ( $m$ th) specified channel [4-byte float]

#### ADC Over Range

- 1 ADC over-range occurred (1: true, 0: false) [2 byte short]

#### Spectrum Data

- 1 Number of points in the spectrum data,  $k$  [4-byte int]
- 2 Start frequency of spectrum data (Hz) [8-byte double]
- 3 Step frequency of spectrum data (Hz) [8-byte double]

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10.9 Diagnostic Binary Read Fast Power Measurement (Remote Command Only)

|         |                                                  |
|---------|--------------------------------------------------|
| 4       | FFT bin at 1st point (dBm) [4-byte float]        |
| 5       | FFT bin at 2nd point (dBm) [4-byte float]        |
| ...     |                                                  |
| $k + 3$ | FFT bin at last (kth) point (dBm) [4-byte float] |



