Basic Mode Guide

Agilent Technologies
PSA Series Spectrum Analyzers

Option B7J

This manual provides documentation for the following instruments:

E4440A (3 Hz – 26.5 GHz)
E4443A (3 Hz – 6.7 GHz)
E4445A (3 Hz – 13.2 GHz)

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1 Setting Up the Basic Mode

The digital demod hardware, Option B7J, is required for many of the optional measurement personalities. The addition of this hardware also adds some measurement capability that is available by accessing the Basic Mode. These measurements are especially good for measuring digitally modulated signals and can return the measured I/Q data.

Accessing the Mode

At initial power up, the instrument will come up in the Spectrum Analysis Mode with default measurement conditions. To access the Basic measurement mode, press the **MODE** key and select the **Basic** key.

If you want to set the mode to a known factory default state, press **Preset**. This will preset the mode setup and all of the measurement settings to the factory default parameters.

NOTE Pressing the **Preset** key does not switch instrument modes, if the Mode type of preset is selected under **System**, **Power On/Preset**.

You may want to install a new personality, reinstall a previous personality, or uninstall a personality option. Instructions can be found in “Installing Optional Measurement Personalities” later in this chapter.

Mode settings are persistent. When you switch from one mode to another mode, the settings you have chosen for the modes will remain active until you change them. This allows you to switch back and forth between modes without having to reset settings each time. Presetting the instrument or powering the instrument off and on will return all mode settings to their default values.

Making a Measurement

This instrument enables you to make a wide variety of measurements on digital communications equipment using the `Spectrum Analysis Mode` measurement capabilities. It also has optional measurement personalties that make measurements based on established industry standards.

To set up the instrument to make measurements, you need to:

1. Select a **Mode** or personality which corresponds to a digital communications format, like cdma2000, W-CDMA, or EDGE. Or use the Basic mode to make measurements on signals with non-standard formats. After selection of the mode, make any required adjustments to the mode settings.
2. Press **Measure** to select a specific measurement to be performed, like Spectrum or Waveform. After selection of a measurement, make any required adjustments to the measurement settings.

   Depending on the current **Meas Control** settings, the instrument will begin making the selected measurement. The resulting data will be shown on the display or available for export.
3. Select a front panel View to display the data from the current measurement. Depending on the mode and measurement selected, various graphical and tabular presentations are available.

If you have a problem, and get an error message, see the “If You Have a Problem” information in each measurement description.

The main keys used in the three steps are shown in the table below.

Step	Primary Key	Setup Keys	Related Keys
1. Select & setup a mode	**MODE**	**Mode Setup**, **Input**, **FREQUENCY/ Channel**	**System**
2. Select & setup a measurement	**MEASURE**	**Meas Setup**	**Meas Control**, **Restart**
3. Select & setup a view	**Trace/View**	**SPAN X Scale**, **AMPLITUDE Y Scale**, **Display**, **Zoom**, **Next Window**	**File**, **Save**, **Print**, **Print Setup**, **Marker**, **Search**

A setting may be reset at any time, and will be in effect on the next measurement cycle or View.

Changing the Mode Setup

Numerous settings can be changed at the mode level by pressing the **Mode Setup** key. This will access a menu with the selections listed below. These settings affect all the measurements in the cdmaOne mode.

Input Keys

By pressing the **Input** key you access menus that select an input port, adjust input attenuation, and adjust the IF align signal.

Activate an Input Port and Adjust Input Power

- **Input Port** key. The **Input Port** menu key accesses a menu which allows you to select one of the following input keys: **RF**, **50 MHz Ref**, and **IF Align**. These keys are explained below.

  RF key. Use the **RF** key to reactivate the RF input after a different input has been activated. This is a 50 Ω connector.

  50 MHz Ref key. Selects the internal 50 MHz CW reference signal. The displayed signal amplitude will be –25 dBm.

  IF Align key. The IF align signal is an internal calibration signal used during the auto align process.

Adjust Input Attenuation and Input Power.

- **Max Total Pwr** key. The **Max Total Pwr** key can be activated only when **Input Port** is set to **RF**. **Max Total Pwr** allows you to enter maximum power levels (–15 dBm is the default value) for the RF input. The maximum total power setting is coupled to the input attenuation setting.
- **I/Q Input Z** key. The **I/Q Input Z** key can be activated only when **Input Port** is set to **I/Q**. The **I/Q Input Z** key enables you to choose an input impedance of either 50 Ω or 600 Ω. An input impedance of 600 Ω may be needed for certain telecommunications applications.
- **Input Atten** key. The **Input Atten** feature can be activated only when **Port** is set to **RF**. The **Input Atten** feature allows you to enter the attenuation value. The input attenuation can be set at values from 0 to 40 dB in increments of 1 dB. The input attenuation setting is coupled to the maximum total power setting.

NOTE The **Max Total Pwr** and **Input Atten** settings are coupled together. When you switch to a different measurement, the **Max Total Pwr** is kept constant, but the **Input Atten** may change if the two measurements have different mixer margins. Thus, you can directly set the transmitter tester input attenuation, or you can set it indirectly by specifying the maximum expected power at the UUT (**Max Total Pwr** setting).

Adjust the IF Align Signal.

NOTE The IF align signal adjustments are advanced features. IF align rate, amplitude and type should not be modified unless you are familiar with IF align functionality.

- **Signal Rate** - The signal is modulated by a digital sequence that can be set to 1 of 13 positions (rate 0 through 12) to cause the comb spacing (or pulse timing) of the alignment signal to widen or narrow. At the position of 1 the signal rate is set at its maximum value of 234.375 kHz. This frequency rate value will appear in the softkey label. Each time the position integer is incriminated, the signal rate is halved. For example, at a position of 2 the signal rate is 117.188 kHz.
- **Signal Amptd** key. To modify the signal amplitude you will enter a DAC value between 0 - 4095. The amplitude range is 0 to 50 dB. Incrementing the DAC value increases the amplitude of the signal in a linear fashion, and will be visible on screen. The default DAC value is 500.
- **Signal Type** key. This menu allows you to select a CW (a tone that appears in the center of the IF), comb, or pulse type signal as the IF align signal.

Trigger Keys

The Trigger key accesses the mode setup menu for the following trigger sources. See “Trigger Source” on page 37 for a description of trigger sources including:

- **RF Burst (Wideband)**
- **Video (IF Envlp)**
- **Ext Front**
- **Ext Rear**

Pressing one of the trigger source keys will access the mode setup menu. This menu is used to set the **Delay**, **Level**, and **Slope** for each trigger source. Note that the actual trigger source is selected separately for each measurement (under the **Meas Setup** key).

- **Delay** key. This key is used to set the delay time for trigger sources. For trigger delay use positive values. For pre-trigger delay use negative values. The range of the trigger delay is –500 ms to +500 ms.
- **Level** key. For the **RF Burst (Wideband)** selection the level is relative to the peak level of the RF signal (for the **RF Burst** trigger you will enter a peak level value with a key labelled **Peak Level**, rather than **Level**). For the **Video** selection the level is the value, in dBm at the RF input, that will cause the trigger. For the **Ext Front** and **Ext Rear** selections, the level range is –5 to +5 volts.
- **Slope** key. This key allows you to trigger off of the positive-going edge (**Pos**) or the negative-going edge (**Neg**) of the trigger source signal.

Other keys accessed under the **Trigger** key:

- **Trig Holdoff** key. Sets the period of time before the next trigger can occur.
- **Auto Trig** key. Acts as a trigger timeout. If no trigger occurs by the specified time, a trigger is automatically generated. When set to On the instrument will take data when it receives a signal from the current trigger source; if no signal is received in the expected time period, the time period will default to the Free Run trigger default time period. When set to Off (the default setting) data will only be taken if a trigger has been set, and the Free Run trigger will not be automatically activated.
- **Frame Timer** key. The frame timer feature uses the internal frame clock to generate a trigger signal.
  - — **Period** key. Sets the period of the frame clock. Values between 33 ns and 559 ms can be entered.
  - — **Offset** key. Allows entry of offset values between 33 ns and 10 s.
  - — **Reset Offset Display** key. Resets the display of the **Offset** key to 0 s.
  - — **Sync Source** menu key. See keys listed below.
- **Sync Source** key menu.
  - — **Off** key. Deactivates any sync source trigger that has been selected and returns you to the frame timer menu.
  - — **Ext Front** key. Synchronizes the measurement to an external sync source, such as a frame clock signal. The starting point is the point coinciding with the external trigger point plus the external trigger delay.

— **Ext Rear** key. Synchronizes the measurement to an external sync source, such as a frame clock signal. The starting point is the point coinciding with the external trigger point plus the external trigger delay.

Changing the Frequency/Channel

Use the **FREQUENCY/Channel** front panel key to set the center frequency or select the channel for the measurement you want to make.

Basic Measurement Key Flow

The key flow diagrams, shown in a hierarchical manner on the following pages, will help you grasp the overall functional relationships for the front-panel keys and the softkeys displayed at the extreme right side of the screen. The diagrams are:

"Spectrum (Freq Domain) Measurement Key Flow (1 of 3)" on page 23.

"Waveform (Time Domain) Measurement Key Flow (1 of 2)" on page 26.

Figure 1-1 Spectrum (Freq Domain) Measurement Key Flow (1 of 3)

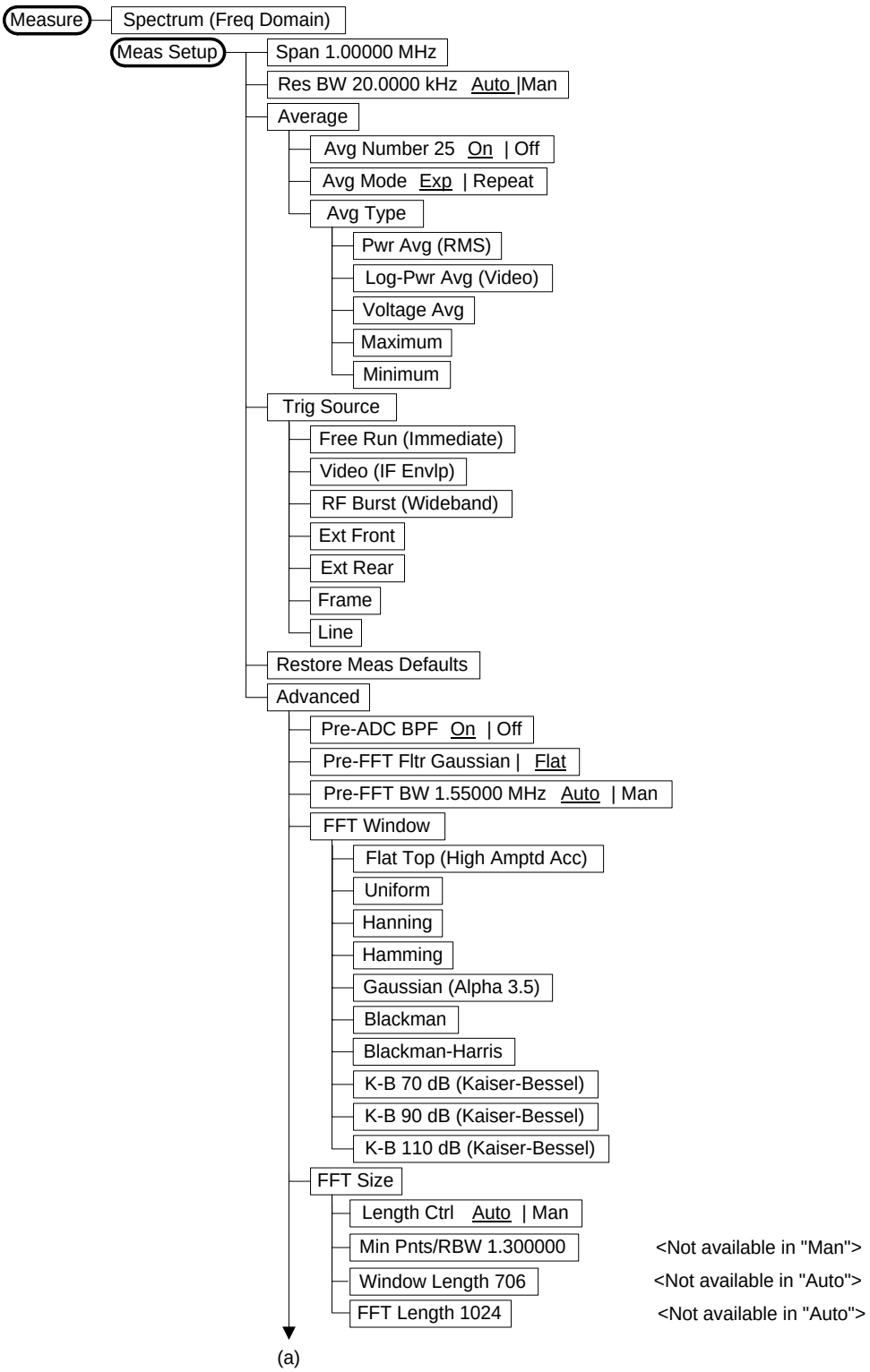


Figure 1-2 Spectrum (Freq Domain) Measurement Key Flow (2 of 3)

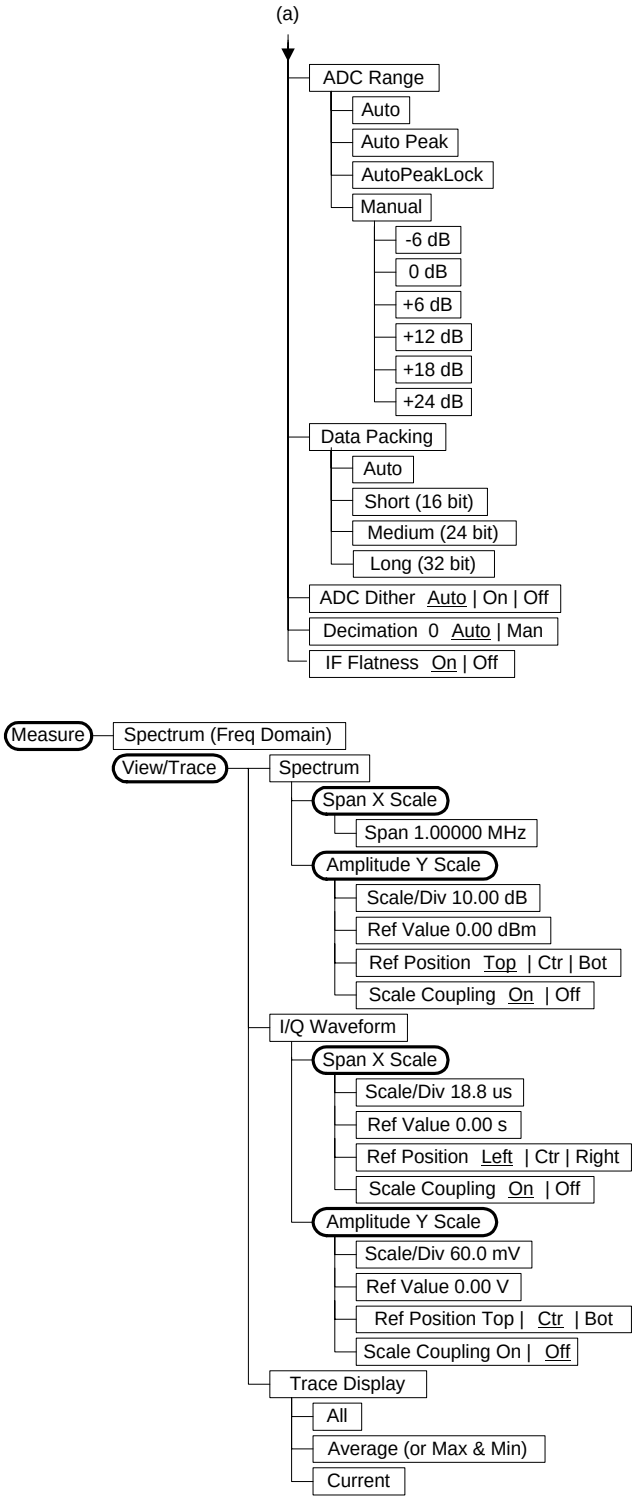


Figure 1-3 Spectrum (Freq Domain) Measurement Key Flow (3 of 3)

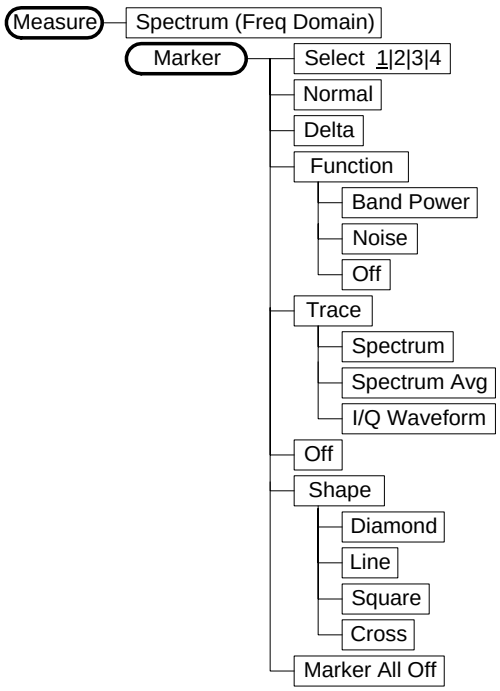


Figure 1-4 Waveform (Time Domain) Measurement Key Flow (1 of 2)

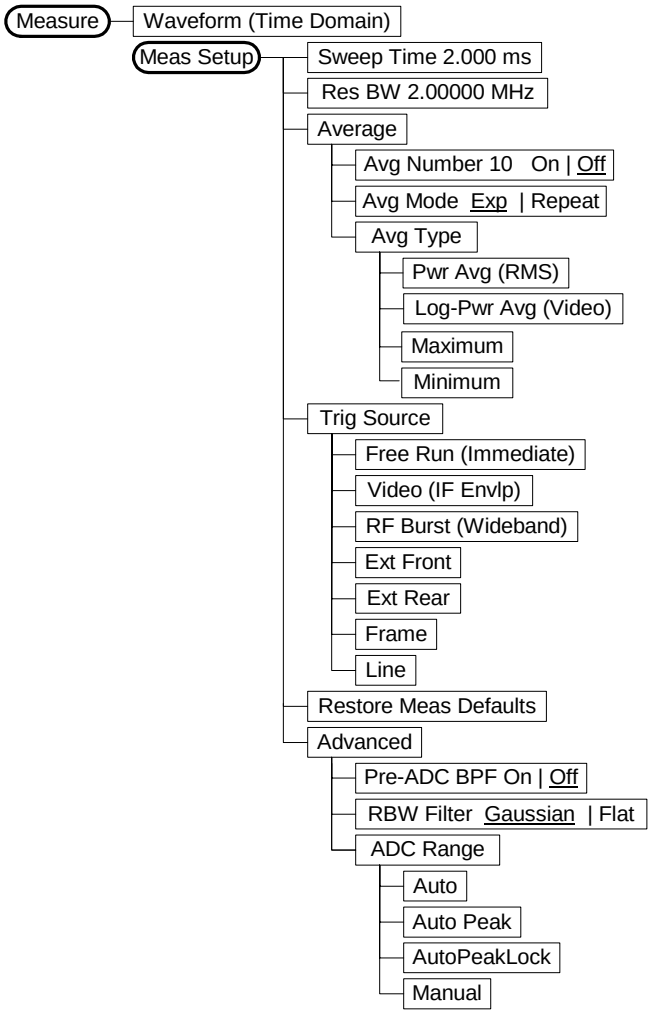
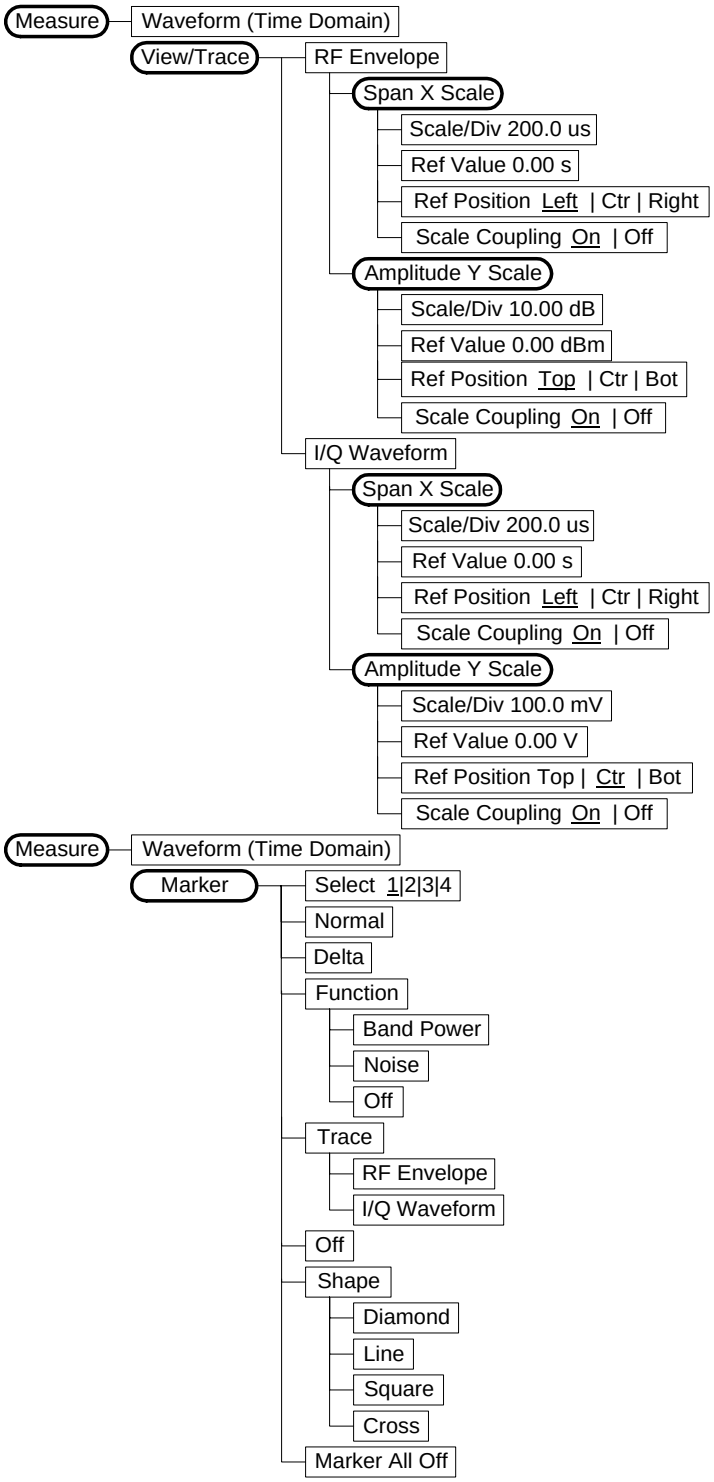


Figure 1-5 Waveform (Time Domain) Measurement Key Flow (2 of 2)



Installing Optional Measurement Personalities

When you **install** a measurement personality, you follow a two step process.

1. Install the measurement personality firmware into the instrument memory. See “Loading an Optional Measurement Personality” on page 29.
2. Enter a license key number that activates the measurement personality. See “Installing a License Key” on page 30.

Adding additional measurement personalities requires purchasing a retrofit kit for the desired option. The retrofit kit contains the measurement personality firmware and a license key certificate. It documents the license key number that is for your specific option and instrument serial number.

Available Measurement Personality Options

Available Personality Options[a]	**Option**
Digital Demod Hardware (with Basic Mode)	**B7J**
GSM (with EDGE) measurement personality	**202**
cdmaOne measurement personality	**BAC**
NADC, PDC measurement personalities	**BAE**
W-CDMA measurement personality	**BAF**
cdma2000 measurement personality	**B78**
Phase noise measurement personality	**226**

a. Available as of the print date of this guide.

You need two pieces of information about your instrument to order a retrofit kit adding an option. You need the Host ID, and the instrument serial number.

Required Information:	**Key Path:**
Host ID: _____	**System**, **Show System**
Instrument Serial Number: _____	**System**, **Show System**

NOTE The instrument must have Option B7J in order to add most of the measurement personality options. (Basic, cdmaOne, cdma2000, W-CDMA, GSM, NADC, PDC.)

Loading an Optional Measurement Personality

You must load the desired option into your instrument memory. Loading can be done from a CD-ROM or a www location. The automated loading program runs from your PC and comes with the firmware.

NOTE When you add a new option, or update an existing option, you will get the updated version of all your current options since they are reloaded simultaneously. This process may also require you to update the instrument core firmware so that it is compatible with the new option.

You may not be able to fit all of the available measurement personalities in instrument memory at the same time. The approximate memory requirements for the options are listed below. These numbers are worst case examples. Many options share components/libraries so the total memory usage of multiple options may not be exactly equal to the combined total.

Available Personality Options	**File Size (PSA - A.02.06)**
GSM (with EDGE) measurement personality	3.3 MB
cdmaOne measurement personality	2.0 MB
NADC measurement personalities	1.3 MB
PDC measurement personalities	1.4 MB
W-CDMA measurement personality	4.2 MB[a]
cdma2000 measurement personality	3.8 MB[a]
Phase noise measurement personality	2.6 MB
**Shared measurement library	1.5 MB

a. This application uses the shared library, so you have to add its memory requirements to this value.

You can install an updated version of firmware and your licensed options using a LAN connection and your PC. Instructions for loading future firmware updates are available at the following URL: **www.agilent.com/find/psa/**

Installing a License Key

To install a license key number for the selected option, use the following procedure.

NOTE You can also use this to reinstall a license key number that has been deleted during an uninstall process, or lost due to a memory failure.

1. Press **System**, **More**, **More**, **Licensing**, **Option**. The **Option** key accesses the alpha editor menu. Use the alpha editor to enter letters (upper-case) and the front-panel numeric keys to enter numbers for the option designation. Then press the **Enter** key. As you enter the option, you will see your entry in the active function area of the display.
2. Press **License Key**. Enter the letters/digits of your license key. You will see your entry in the active function area of the display. When you have completed entering the license key number, press the **Enter** key.
3. Press the **Activate License** key.

Viewing a License Key

Measurement personalities purchased with your instrument have been installed and activated at the factory. You will receive a unique **License Key** number with every measurement personality purchased. The license key number is a hexadecimal number that is for your specific measurement personality, instrument serial number and host ID. It enables you to install, or reactivate that particular personality.

Follow these steps to display the unique license key for a measurement personality that is already installed in your instrument:

1. Press **System**, **More**, **More**, **Licensing**, **Show License.** The **System**, **Personalities** key shows you if the option has been activated.

You will want to keep a copy of your license key number in a secure location. Please enter your license key numbers below for future reference. If you should lose your license key number, call your nearest Agilent Technologies service or sales office for assistance.

License Key Numbers for Instrument with Serial # _____
For Option_____ the license key number is _____
For Option_____ the license key number is _____
For Option_____ the license key number is _____
For Option_____ the license key number is _____
For Option_____ the license key number is _____

License Key Numbers for Instrument with Serial # _____
For Option_____ the license key number is _____

Using the Delete License Key

The following procedure removes the license key number for the selected option. This will make the option unavailable for use. Please write down the 12-digit license key number for the option before proceeding. If you want to use that measurement personality at a later date you will need the license key number to reactivate the personality firmware.

NOTE

Using the **Delete License** key does not remove the personality from the instrument memory, and does not free memory to be available to install another option. If you need to free memory to install another option, refer to the instructions for loading firmware updates located at the URL: **www.agilent.com/find/psa/**

1. Press **System**, **More**, **More**, **Licensing**, **Option**. Pressing the **Option** key will activate the alpha editor menu. Use the alpha editor to enter the letters (upper-case) and the front-panel numeric keyboard to enter the digits (if required) for the option, then press the **Enter** key. As you enter the option, you will see your entry in the active function area of the display.
2. Press **Delete License** to remove the license key from memory.

2 Making Measurements

Basic Measurements

Once in the Basic mode, the following measurements are available by pressing the **Measure** key:

- ❏ Spectrum (Frequency Domain) on page 38.
- ❏ Waveform (Time Domain) on page 47.

When you press the key to select the measurement it will become the active measurement, using settings and a display unique to that measurement. Data acquisitions will automatically begin provided trigger requirements, if any, are met.

These measurements are similar to using the spectrum analyzer in the Signal Analysis mode. The difference is that the user settings/functions are optimized for measuring signals with digital modulation. It provides more flexible FFT analysis capabilities and gives you access to the I/Q data from your measured signals.

There is also some added functionality in the remote command capability allowing preprocessing of your time waveform measurement data. This can capability can be used to reduce the amount of data that you must return to the controller for processing. See the CALCulate:DATA:COMPress? command description.

Preparing for Measurements

If you want to set the Basic mode to a known, factory default state, press **Preset**. This will preset the mode setup and all of the measurements to the factory default parameters. Note that **Preset** does not switch modes if it is set to Mode Preset. (Mode preset is the default. Set the preset type from the System front panel keys.)

To preset only the settings that are specific to the selected measurement, press **Meas Setup**, **More**, **Restore Meas Defaults**. This will set the measurement setup parameters, for only the currently selected measurement, to the factory defaults.

Initial Setup

Before making a measurement, make sure the mode setup and frequency channel parameters are set to the desired settings. Refer to the sections "Changing the Mode Setup" and "Changing the Frequency/Channel" in the previous chapter.

How to Make a Measurement

Follow the three-step process shown in the table below:

Step	Primary Key	Setup Keys	Related Keys
1. Select & setup a mode	**Mode**	**Mode Setup**, **Input**, **Frequency Channel**	**System**
2. Select & setup a measurement	**Measure**	**Meas Setup**	**Meas Control**, **Restart**
3. Select & setup view	**Trace/View**	**Span X Scale**, **Amplitude Y Scale**, **Display**, **Next Window**, **Zoom**	**File**, **Save**, **Print**, **Print Setup**, **Marker**, **Search**

Measure Control

The **Meas Control** front panel menu key controls processes that affect the running of the current measurement.

- **Measure** key. Press **Meas Control**, **Measure Single/Cont** to toggle between making single or continuous measurements. When set to Single, the measurement will continue until it has reached the specified number of averages set by the average counter. The default setting is continuous.

- **Pause** key. Press **Meas Control**, **Pause** to pause the current measurement. Once toggled, the label of the **Pause** key changes to read **Resume**; the **Resume** key, once pressed, continues the active measurement from the point at which it was paused.
- **Restart** key. Press **Restart** front panel key to repeat the current measurement from the beginning, while retaining the current measurement settings.

Measurement Setup

The **Meas Setup** key accesses features that enable you to adjust parameters of the current measurement, such as resolution bandwidth. You will also use the **Meas Setup** menu to access **Average, Trig Source**, and **Advanced** measure setup feature menus.

The following measure setup features can be used with many or all measurements:

- **Res BW** key. Press **Meas Setup**, **Res BW** to change the resolution of a given measurement. Selection of a narrower bandwidth will result in a longer data acquisition time.
- **Restore Meas Defaults** key. Press **Meas Setup**, **More**, **Restore Meas Defaults** to preset only the settings that are specific to the selected measurement. This will set the measure setup parameters, for the currently selected measurement only, to the factory defaults.

Averaging

Selecting one of the averaging keys in the **Meas Setup** menu will allow you to modify the number, average mode, and type of averaging you use for the currently selected measurement.

- **Avg Number** - will allow you to change the number of N averages to be made.
- **Avg Mode** - will allow you to choose either exponential or repeat averaging. This selection only effects the averaging after the number of N averages is reached (set using **Avg Number**).
  - **Normal averaging**: Normal (linear) averaging is always used until the specified number of N averages is reached. When **Measure** is set at **Single**, data acquisitions are stopped when the number of averages is reached - thus **Avg Mode** has no effect on single measurements.
  - **Exponential averaging**: When **Measure** is set at **Cont**, data acquisitions will continue indefinitely. After N averages, exponential averaging is used with a weighting factor of N (the displayed average count stops at N). Exponential averaging weights new data more than old data, which allows tracking of

slow-changing signals. The weighting factor N is set using **Avg Number**.

— **Repeat averaging**: When **Measure** is set at **Cont**, data acquisitions will continue indefinitely. After N averages is reached, all previous result data is cleared and the average count is set back to 1. This is equivalent to being in **Measure Single** and pressing the **Restart** key each time the single measurement finishes.

Trigger Source

Changing the **Trig Source** alters the trigger source for the selected measurement only. Not all of the selections are available for all measurements. Many CDMA measurements do not require a trigger. These do not have a Trig Source key. Note that the **RF Burst**, **Video (IF Envlp)**, **Ext Front**, and **Ext Rear** menu keys found in the **Trigger** menu enable you to change settings to modify the delay, level, and slope for each of these trigger sources. Choose one of the following trigger sources:

- **Free Run (Immediate)** - the trigger occurs at the time the data is requested, completely asynchronous to the RF or IF signal.
- **Video (IF Envlp)** - an internal IF envelope trigger. It triggers on an absolute threshold level of the signal passed by the IF.
- **RF Burst (Wideband)** - an internal wideband RF burst trigger that has an automatic level control for burst signals. It triggers on a level that is relative to the peak of the signal passed by the RF (12 MHz bandwidth).
- **Ext Front** - activates the front panel **EXT TRIGGER INPUT**. The external trigger must be a signal between –5 and +5 volts.
- **Ext Rear** - activates the rear panel **TRIGGER IN**. The external trigger must be a signal between –5 and +5 volts.
- **Trig Holdoff** - sets the minimum time after a trigger, before a re-trigger can occur.
- **Frame** - uses the internal frame clock to generate a trigger signal. The clock parameters are controlled under the **Mode Setup** key or the measurement firmware, not both. See the specific measurement for details.
- **Line** - activates an internal line trigger. Sweep triggers occur at intervals synchronized to the line frequency.

Rear panel **TRIGGER 1 OUT** and **TRIGGER 2 OUT** connectors are coupled to the selected trigger source. These trigger outputs are always on the rising edge with a pulse width of at least 1 µs.

Making the Spectrum (Frequency Domain) Measurement

Purpose

The spectrum measurement provides spectrum analysis capability for the instrument. The control of the measurement was designed to be familiar to those who are accustomed to using swept spectrum analyzers.

This measurement is FFT (Fast Fourier Transform) based. The FFT-specific parameters are located in the **Advanced** menu. Also available under basic mode spectrum measurements is an I/Q window, which shows the I and Q signal waveforms in parameters of voltage versus time. The advantage of having an I/Q view available while in the spectrum measurement is that it allows you to view complex components of the same signal without changing settings or measurements.

Measurement Method

The measurement uses digital signal processing to sample the input signal and convert it to the frequency domain. With the instrument tuned to a fixed center frequency, samples are digitized at a high rate, converted to I and Q components with DSP hardware, and then converted to the frequency domain with FFT software.

Making the Measurement

NOTE The factory default parameters provide a good starting point.You will likely want to change some of the settings. Press **Meas Setup**, **More (1 of 2)**, **Restore Meas Defaults** at any time to return all parameters for the current measurement to their default settings.

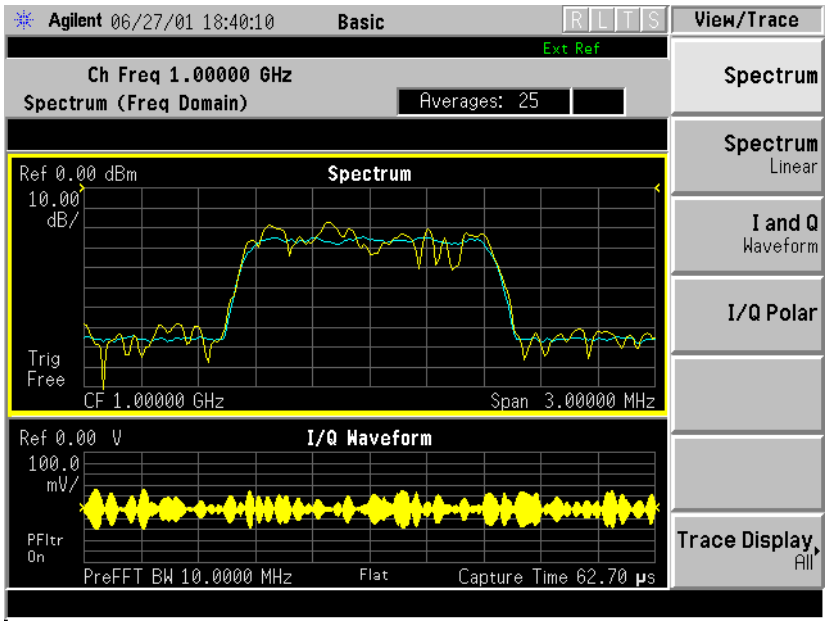
Press **Measure**, **Spectrum (Freq Domain)** to immediately make a spectrum measurement.

To change any of the measurement parameters from the factory default values, refer to the “Changing the Measurement Setup” section for this measurement.

Results

A display with both a `Spectrum` window and an `I/Q Waveform` window will appear when you activate a spectrum measurement. Use the **Next Window** key to select a window, and the **Zoom** key to enlarge a window.

Figure 2-1 Spectrum Measurement - Spectrum and I/Q Waveform View



Changing the Measurement Setup

The following table shows the factory default settings for spectrum (frequency domain) measurements.

Table 2-1 Spectrum (Frequency Domain) Measurement Defaults

Measurement Parameter	Factory Default Condition
View/Trace	Spectrum
Trace Display	All
Res BW	20.0000 kHz; Auto
Averaging: Avg Number Avg Mode Avg Type	 25; On Exp Log-Pwr Avg (Video)
Trig Source	Free Run (Immediate)
Spectrum View: SPAN AMPLITUDE Y Scale - Scale/Div	 1.00000 MHz 10.00 dB
I and Q Waveform View: Capture Time AMPLITUDE Y Scale - Scale/Div	 188.00 µs 100.0 mV
I/Q Polar View: I/Q Scale/Div I or Q Origin	 100.0 mV 0.00 V
Advanced	
Pre-ADC BPF	On
Pre-FFT Filter	Flat
Pre-FFT BW	1.55000 MHz; Auto
FFT Window	Flat Top (High Amptd Acc)
FFT Size: Length Control Min Points/RBW Window Length FFT Length	 Auto 3.100000 706 1024
ADC Range	Auto Peak
Data Packing	Auto
ADC Dither	Auto
Decimation	0; Auto
IF Flatness	On

NOTE Parameters under the **Advanced** key seldom need to be changed. Any changes from the default advanced values may result in invalid measurement data.

Make sure the **Spectrum (Freq Domain)** measurement is selected under the **Measure** menu. Press the **Meas Setup** key to access a menu which allows you to modify the averaging and trigger source for this measurement (as described in the "Measurement Setup" section). In addition, the following parameters can be modified:

- **Span** - Allows you to modify the frequency span. The range is 10.000 Hz to 10.000 MHz with 1 Hz resolution, depending on the **Res BW** setting. Changing the span causes the resolution bandwidth to change automatically, and will affect data acquisition time.
- **Res BW** - Allows you to set the resolution bandwidth for the FFT, and to toggle its mode between **Auto** and **Man** (manual). If set to **Auto**, the resolution bandwidth is set to **Span**/50 (2% of the span). If set to **Man**, you can enter a value ranging from 100.0 mHz to 3.00000 MHz. A narrower bandwidth will result in a longer data acquisition time.
- **Advanced** - Allows you to access the menu to change the following parameters. The FFT advanced features should be used only if you are familiar with their operation. Changes from the default values may result in invalid data.
  - **Pre-ADC BPF** - Allows you to toggle the pre-ADC bandpass filter function between **On** and **Off**. The pre-ADC bandpass filter is useful for rejecting nearby signals, so that sensitivity within the span range can be improved by increasing the ADC range gain.
  - **Pre-FFT Fltr** - Allows you to toggle the pre-FFT filter between **Flat** (flat top) and **Gaussian**. The pre-FFT filter defaults to a flat top filter which has better amplitude accuracy. The Gaussian filter has better pulse response.
  - **Pre-FFT BW** - Allows you to toggle the pre-FFT bandwidth function between **Auto** and **Man** (manual). The pre-FFT bandwidth filter can be set between 1 Hz and 10 MHz. If set to **Auto**, this pre-FFT bandwidth is nominally 50% wider than the span. This bandwidth determines the ADC sampling rate.
  - **FFT Window** - Allows you to access the following selection menu. Unless you are familiar with FFT windows, use the flat top filter (the default filter).
    - **Flat Top** - Selects this filter for best amplitude accuracy by reducing scalloping error.
    - **Uniform** - Select this filter to have no window active by using the uniform setting.
    - **Hanning** - Press this key to activate the Hanning filter.

- ❏ **Hamming** - Press this key to activate the Hamming filter.
- ❏ **Gaussian** - Press this key to activate the Gaussian filter with the roll-off factor (alpha) of 3.5.
- ❏ **Blackman** - Press this key to activate the Hamming filter.
- ❏ **Blackman Harris** - Press this key to activate the Hamming filter.
- ❏ **K-B 70dB/90dB/110dB (Kaiser-Bessel)** - Select one of the Kaiser-Bessel filters with sidelobes at –70, –90, or –110 dBc.

— **FFT Size** - Allows you to access the menu to change the following parameters:

- ❏ **Length Ctrl** - Allows you to toggle the FFT and window length setting function between **Auto** and **Man** (manual).
- ❏ **Min Pts in RBW** - Allows you to set the minimum number of data points that will be used inside the resolution bandwidth. The range is 0.10 to 100.00 points with 0.01 resolution. This key is grayed out if **Length Ctrl** is set to **Man**.
- ❏ **Window Length** - Allows you to enter the FFT window length in the number of capture samples, ranging from 8 to 1048576. This length represents the actual quantity of I/Q samples that are captured for processing by the FFT ("`Capture Time`" is the associated parameter shown on the screen). This key is grayed out if **Length Control** is set to **Auto**.
- ❏ **FFT Length** - Allows you to enter the FFT length in the number of captured samples, ranging from 8 to 1048576. The FFT length setting is automatically limited so that it is equal to or greater than the FFT window length setting. Any amount greater than the window length is implemented by zero-padding. This key is grayed out if **Length Control** is set to **Auto**.

— **ADC Range** - Allows you to access the menu to define one of the following ADC ranging functions:

- ❏ **Auto** - Select this to set the ADC range automatically. For most FFT spectrum measurements, the auto feature should not be selected. An exception is when measuring a signal which is "bursty", in which case auto can maximize the time domain dynamic range, if FFT results are less important to you than time domain results.
- ❏ **Auto Peak** - Select this to set the ADC range automatically to the peak signal level. Auto peak is a compromise that works well for both CW and burst signals.
- ❏ **Auto Peak Lock** - Select this to hold the ADC range automatically at the peak signal level. Auto peak lock is more stable than auto peak for CW signals, but should not be used

for “bursty” signals.

- ❏ **Manual** - Allows you to access the selection menu of values to set the ADC range level. Also note that manual ranging is best for CW signals.

— **Data Packing** - Allows you to select **Auto** (the default) or the **Short (16 bit)**, **Medium (24 bit**) and **Long (32 bit)** methods of data packing. The short, medium, and long methods are not compatible with all settings and should not be used unless you are familiar with data packing methods. **Auto** is the preferred choice.

- ❏ **Auto** - The data packing value most appropriate for current instrument settings is selected automatically.
- ❏ **Short (16 bit)** - Select this to pack data every 16 bits.
- ❏ **Medium (24 bit)** - Select this to pack data every 24 bits.
- ❏ **Long (32 bit)** - Select this to pack data every 32 bits.

— **ADC Dither** - Allows you to toggle the ADC dither function between **Auto**, **On**, and **Off**. When set to **Auto** (the default), the ADC dither function will be activated when a narrow bandwidth is being measured, and deactivated when a wide bandwidth is being measured. “ADC dither” refers to the introduction of noise to the digitized steps of the analog-to-digital converter; the result is an improvement in amplitude accuracy. Use of the ADC dither, however, reduces dynamic range by approximately 3 dB.

— **Decimation** - Allows you to toggle the decimation function between **Auto** and **Man**, and to set the decimation value. **Auto** is the preferred setting, and the only setting that guarantees alias-free FFT spectrum measurements. If you are familiar with the decimation feature, you can change the decimation value by setting to **Man**, but be aware that aliasing can result in higher values. Decimation numbers 1 to 1000 describe the factor by which the number of points are reduced. The default setting is 0, which results in no data point reduction. Decimation by 3 keeps every 3rd sample, throwing away the 2 in between.

— **IF Flatness** - Allows you to toggle the IF flatness function between **On** and **Off**. If set to **On** (the default), the IF flatness feature causes background amplitude corrections to be performed on the FFT spectrum. The **Off** setting is used for adjustment and troubleshooting of the test instrument.

Changing the View

The View/Trace key allows you to select the desired view of the measurement from the following. You can use the Next Window key to move between the multiple windows (if any) and make it full size by Zoom.

- **Spectrum** - Provides a combination view of the spectrum graph in parameters of power versus frequency with the semi-log graticules, and the I/Q waveform graph in the parameters of voltage and time. Changes to frequency span or power will sometimes affect data acquisition.
- **I/Q Waveform** - Provides a view of the I/Q waveform graph in parameters of voltage versus time in the linear graticules. Changes to sweep time or resolution bandwidth will sometimes affect data acquisition.

Changing the Display

The **Span** key under the **Meas Setup** menu controls the horizontal span of the spectrum window. If the **SPAN X Scale** key is pressed, this **Span** key is activated, while the **AMPLITUDE Y Scale** key allows you to access the menus to modify the vertical parameters depending on the selected windows.

Changing the Spectrum Display

If the window is active in the **Spectrum** view, the **SPAN X Scale** and **AMPLITUDE Y Scale** keys access the menus to modify the following parameters:

- With the **SPAN X Scale** key:
  - **Span** - Allows you to modify the frequency span. The range is 10.000 Hz to 10.000 MHz with 1 Hz resolution, depending on the **Res BW** setting. Changing the span causes the resolution bandwidth to change automatically, and will affect data acquisition time.
- With the **AMPLITUDE Y Scale** key:
  - **Scale/Div** - Allows you to set the vertical scale by changing an amplitude value per division. The range is 1.00 nV to 20.00 V per division. The default setting is 100.0 mV. However, since the **Scale Coupling** default is **On**, this value is automatically determined by the measurement results. To manually set this value **Scale Coupling** must be **Off**.
  - **Ref Value** - Allows you to set the reference value ranging from –250.00 to 250.00 V. The default setting is 0.00 V. However, since the **Scale Coupling** default is **On**, this value is automatically determined by the measurement results. To manually set this value **Scale Coupling** must be **Off**.
  - **Ref Position** - Allows you to set the reference position to either **Top**, **Ctr** (center) or **Bot** (bottom). The default setting is **Ctr**.
  - **Scale Coupling** - Allows you to toggle the scale coupling function between **On** and **Off**. The default setting is **On**. Upon pressing the **Restart** front-panel key or **Restart** softkey under the **Meas Control**

menu, this function automatically determines the scale per division and reference values based on the measurement results. To manually set either **Scale/Div** or **Ref Value** values, **Scale Coupling** must be **Off**.

Selecting Displayed Traces Within Windows

The **View/Trace** key allows you to access the **Trace Display** key to reveal the trace selection menu. The currently selected trace type is shown on the **Trace Display** key.

- **All** - Allows you to view both the current trace and the average trace.
- **Average** - Allows you to view only the average trace (in blue color).
- **Current** - Allows you to view only the trace (in yellow color) for the latest data acquisition.

Using the Markers

The **Marker** front-panel key accesses the menu to configure the markers. If you want to use the marker function in the I waveform window, press **View/Trace**, **I and Q Waveform**, **Marker**, **Trace**, **Spectrum**.

- **Select 1 2 3 4** - Allows you to activate up to four markers with the corresponding numbers, respectively. The selected number is underlined and its function is defined by pressing the **Function** key. The default is 1.
- **Normal** - Allows you to activate the selected marker to read the frequency and amplitude of the marker position on the spectrum trace. Marker position is controlled by the **RPG** knob.
- **Delta** - Allows you to read the differences in frequencies and amplitudes between the selected marker and the next.
- **Function Off** - Allows you to define the selected marker function to be **Band Power**, **Noise**, or **Off**. The default is **Off**. If set to **Band Power**, you need to select **Delta**.
- **Trace Spectrum** - Allows you to place the selected marker on the **Spectrum** trace. The default is **Spectrum**.
- **Off** - Allows you to turn off the selected marker.
- **Shape Diamond** - Allows you to access the menu to define the selected marker shape to be **Diamond**, **Line**, **Square**, or **Cross**. The default shape is **Diamond**.
- **Marker All Off** - Allows you to turn off all of the markers.

The front panel **Search** key performs a peak search when pressed. A marker will automatically be activated at the highest peak.

Measuring Band Power

A band power measurement using the markers calculates the average power between two adjustable markers. To make a band power measurement:

1. Press the **Marker** key.
2. Press **Trace**, **Spectrum** to activate a marker on the instantaneous spectrum signal.
3. Press the **Spectrum Avg** key to activate a marker on the average spectrum trace.
4. Press **Function, Band Power**.
5. Two marker lines are activated at the extreme left side of the horizontal scale. Press **Normal** and move marker 1 to the desired place by rotating the **RPG** knob.
6. Press **Delta** to bring marker 2 to the same place as marker 1.
7. Move marker 1 to the other desired position by rotating the **RPG** knob. Band power measures the average power between the two markers.
8. When the band power markers are active, the results are shown in the results window as `Mean Pwr (Between Mks)`. When the band power function is off the results window reads `Mean Pwr (Entire Trace)`.

Troubleshooting Hints

Changes made by the user to advanced spectrum settings, particularly to ADC range settings, can inadvertently result in spectrum measurements that are invalid and cause error messages to appear. Care needs to be taken when using advanced features.

Making the Waveform (Time Domain) Measurement

Purpose

The waveform measurement is a generic measurement for viewing the input signal waveforms in the time domain. This measurement is how the instrument performs the zero span functionality found in traditional spectrum analyzers. Also available under basic mode waveform measurements is an I/Q window, which shows the I and Q signal waveforms in parameters of voltage versus time. The advantage of having an I/Q view available while in the waveform measurement is that it allows you to view complex components of the same signal without changing settings or measurements.

The waveform measurement can be used to perform general purpose power measurements to a high degree of accuracy.

Measurement Method

The instrument makes repeated power measurements at a set frequency, similar to the way a swept-tuned spectrum analyzer makes zero span measurements. The input analog signal is converted to a digital signal, which then is processed into a representation of a waveform measurement. The measurement relies on a high rates of sampling to create an accurate representation of a time domain signal.

This measurement is available for use with both the RF input and baseband I/Q inputs. For details on Baseband I/Q operation see the section on “Using Option B7C Baseband I/Q Inputs”.

Making the Measurement

NOTE The factory default parameters provide a good starting point.You may want to change some of the settings. Press **Meas Setup**, **More (1 of 2)**, **Restore Meas Defaults** at any time to return all parameters for the current measurement to their default settings.

Press **MEASURE**, **Waveform (Time Domain)** to immediately make a waveform (time domain) measurement.

To change any of the measurement parameters from the factory default values, refer to the “Changing the Measurement Setup” section for this measurement.

Results

The next figure shows an example of a RF Envelope result for the waveform (time domain) measurements in the graph window. The measured values for the mean power and peak-to-mean power are shown in the text window.

Figure 2-2 Waveform Measurement - RF Envelope View

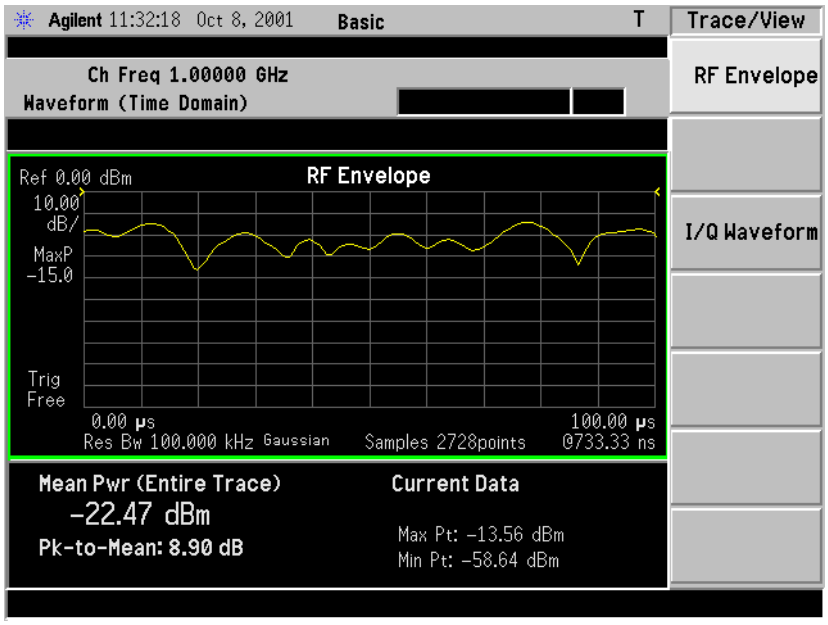


Figure 2-3 Waveform Measurement - I/Q Waveform View

Changing the Measurement Setup

This table shows the factory default settings for waveform (time domain) measurements.

Table 2-2 Waveform (Time Domain) Measurement Defaults

Measurement Parameter	Factory Default Condition
View/Trace	RF Envelope
Sweep Time	2.000 ms
Res BW	100.000 kHz
Averaging: Avg Number Avg Mode Avg Type	 10; Off Exp Pwr Avg (RMS)
Trig Source	Free Run (Immediate)
RF Envelope View: SPAN X Scale - Scale/Div AMPLITUDE Y Scale - Scale/Div	 200.0 µs 10.00 dB
I/Q Waveform View: SPAN X Scale -Scale/Div AMPLITUDE Y Scale - Scale/Div	 200.0 µs 100.0 mV

Table 2-2 Waveform (Time Domain) Measurement Defaults

Measurement Parameter	Factory Default Condition
Advanced	
Pre-ADC BPF	Off
RBW Filter	Gaussian
ADC Range	Auto
Data Packing	Auto
ADC Dither	Off
Decimation	Off

NOTE Parameters that are under the **Advanced** key seldom need to be changed. Any changes from the default values may result in invalid measurement data.

Make sure the **Waveform (Time Domain)** measurement is selected under the **MEASURE** menu. Press the **Meas Setup** key to access a menu which allows you to modify the averaging, and trigger source for this measurement (as described in the “Measurement Setup” section).

In addition, the following parameters can be modified:

- **Sweep Time** - Allows you to specify the measurement acquisition time which is used as the length of the time capture record. The range is 1.0 µs and 100.0 s, depending upon the resolution bandwidth setting and the available internal memory size for acquisition points.
- **Res BW** - Allows you to set the measurement bandwidth. The range is 10 Hz to 7.5 MHz. A larger bandwidth results in a larger number of acquisition points and reduces the maximum value allowed for the sweep time.
- **Advanced** - Allows you to access the menu to change the following parameters. Changes from the default values may result in invalid data.
  - **Pre-ADC BPF** - Allows you to toggle the pre-ADC bandpass filter function between **On** or **Off**. The default setting is **Off**. The pre-ADC bandpass filter is useful for rejecting nearby signals, so that sensitivity within the span range can be improved by increasing the ADC range gain.

RBW Filter - Allows you toggle the resolution bandwidth filter selection between **Flat** and **Gaussian**. If set to **Gaussian**, the filter provides more even time-domain response, particularly for "bursts". If set to **Flat**, the filter provides a flatter bandwidth but is less accurate for "pulse responses". A flat top filter also requires less memory and allows longer data acquisition times. For most waveform applications, the Gaussian filter is recommended.

— **ADC Range** - Allows you to access the menu to select one of the ADC ranging functions:

- ❏ **Auto** - Select this to cause the instrument to automatically adjust the signal range for optimal measurement results.
- ❏ **AutoPeak** - Select this to cause the instrument to continuously seek the highest peak signal.
- ❏ **AutoPeakLock** - Select this to cause the instrument to adjust the range for the highest peak signal it identifies, and retains the range settings determined by that peak signal, even when the peak signal is no longer present.
- ❏ **Manual** - Allows you to access the selection menu of values to set the ADC range level. Also note that manual ranging is best for CW signals.

— **Data Packing** - Allows you to select **Auto** (the default) or the **Short (16 bit)**, **Medium (24 bit**) and **Long (32 bit)** methods of data packing. The short, medium, and long methods are not compatible with all settings and should not be used unless you are familiar with data packing methods. **Auto** is the preferred choice.

- ❏ **Auto** - The data packing value most appropriate for current instrument settings is selected automatically.
- ❏ **Short (16 bit)** - Select this to pack data every 16 bits.
- ❏ **Medium (24 bit)** - Select this to pack data every 24 bits.
- ❏ **Long (32 bit)** - Select this to pack data every 32 bits.

— **ADC Dither** - Allows you to toggle the ADC dither function between **On** and **Off**. The default setting is **Off**. If set to **On**, the ADC dither refers to the introduction of noise to the digitized steps of the analog-to-digital converter, and results in better amplitude linearity and resolution in low level signals. However, it also results in reduced dynamic range by approximately 3 dB.

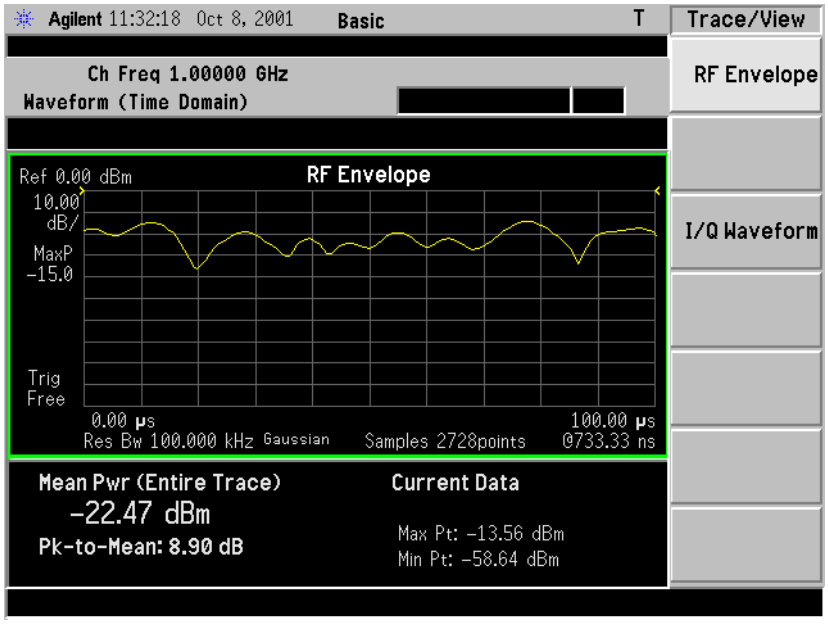
— **Decimation** - Allows you to toggle the decimation function between **On** and **Off**, and to set the decimation value. Decimation allows longer acquisition times for a given bandwidth by eliminating data points. Long time captures can be limited by the instrument data acquisition memory. Decimation numbers 1 to 4 describe the factor by which the number of points are reduced. The default setting is 1, which results in no data point reduction.

Changing the View

The **View/Trace** key allows you to access the selection menu for the desired measurement view. You can use the **Next Window** key to move between the multiple windows (if any) and make it full size by **Zoom**.

- **RF Envelope** - Provides a combination view of the waveform graph in parameters of power versus time with the semi-log graticules, and the measurement results for `Mean Pwr (Entire Trace)`, `Pk-to-Mean`, `Current Data` for `Max Pt` and `Min Pt` are shown in the text window. Changes to sweep time or resolution bandwidth will sometimes affect data acquisition.

Figure 2-4 Waveform Measurement - RF Envelope View



- **I/Q Waveform** - Provides a view of the I/Q waveform graph in parameters of voltage versus time in the linear graticules. Changes to sweep time or resolution bandwidth will sometimes affect data acquisition.

Figure 2-5 Waveform Measurement - I/Q Waveform View

*Meas Setup: View/Trace = I/Q Waveform View
Others = Factory default settings

*Input signal: cdma2000 Rev 8, SR1, 9 Channel

NOTE For the widest spans the I/Q Waveform window becomes just “ADC time domain samples”, because the I/Q down-conversion is no longer in effect.

Changing the Display

The **Sweep Time** key under the **Meas Setup** menu controls the horizontal time span for this measurement, while the **SPAN X Scale** key allows you to access the menu to modify the horizontal parameters common to the rectangular windows for this measurement:

- **Scale/Div** - Allows you to set the horizontal scale by changing a time value per division. The range is 1.0 ns to 1.000 s per division with 0.01 ns resolution. The default setting is 200.0 µs per division. When the **Scale Coupling** default setting **On** is in effect, displayed plots use a Scale/Div value determined by the analyzer, based on the measurement result.

- **Ref Value** - Allows you to set the reference value ranging from –1.0 to 10.0 s. The default setting is 0.00 s.When the **Scale Coupling** default setting **On** is in effect, displayed plots use a Scale/Div value determined by the analyzer, based on the measurement result.
- **Ref Position** - Allows you to set the reference position to either **Left**, **Ctr** (center) or **Right**. The default setting is **Left**.
- **Scale Coupling** - Allows you to toggle the scale coupling function between **On** and **Off**. The default setting is **On**. Upon pressing the **Restart** front-panel key or **Restart** softkey under the **Meas Control** menu, this function automatically determines the scale per division and reference values based on the measurement results.

If the Signal Envelope window is active in the **Signal Envelope** view, the **AMPLITUDE Y Scale** key accesses the menu to modify the following parameters (In the PSA Series it is the RF Envelope window):

- **Scale/Div** - Allows you to set the vertical scale by changing an amplitude value per division. The range is 0.10 to 20.00 dB per division with 0.01 dB resolution. The default setting is 10.00 dB per division. When the **Scale Coupling** default setting **On** is in effect, displayed plots use a Scale/Div value determined by the analyzer, based on the measurement result.
- **Ref Value** - Allows you to set the reference value ranging from –250.00 to 250.00 dBm. The default setting is 0.00 dBm. When the **Scale Coupling** default setting **On** is in effect, displayed plots use a Scale/Div value determined by the analyzer, based on the measurement result.
- **Ref Position** - Allows you to set the reference position to either **Top**, **Ctr** (center) or **Bot** (bottom). The default setting is **Top**.
- **Scale Coupling** - Allows you to toggle the scale coupling function between **On** and **Off**. The default setting is **On**. Upon pressing the **Restart** front-panel key or **Restart** softkey under the **Meas Control** menu, this function automatically determines the scale per division and reference values based on the measurement results.

If the I/Q Waveform window is active in the **I/Q Waveform** view, the **AMPLITUDE Y Scale** key accesses the menu to modify the following parameters:

- **Scale/Div** - Allows you to set the vertical scale by changing an amplitude value per division. The range is 1.00 nV to 20.00 V per division. The default setting is 100.0 mV. When the **Scale Coupling** default setting **On** is in effect, displayed plots use a Scale/Div value determined by the analyzer, based on the measurement result.

- **Ref Value** - Allows you to set the reference value ranging from –250.00 to 250.00 V. The default setting is 0.00 V. When the **Scale Coupling** default setting **On** is in effect, displayed plots use a Scale/Div value determined by the analyzer, based on the measurement result.
- **Ref Position** - Allows you to set the reference position to either **Top**, **Ctr** (center) or **Bot** (bottom). The default setting is **Ctr**.
- **Scale Coupling** - Allows you to toggle the scale coupling function between **On** and **Off**. The default setting is **On**. Upon pressing the **Restart** front-panel key or **Restart** softkey under the **Meas Control** menu, this function automatically determines the scale per division and reference values based on the measurement results.

If the `I/Q Polar` window is active in the **I/Q Polar** view, the **SPAN X Scale** or **AMPLITUDE Y Scale** key accesses the menu to modify the following parameters:

- **I/Q Scale/Div** - Allows you to set the vertical and horizontal scales by changing a value per division. The range is 1.00 nV to 20.00 V per division. The default setting is 100.0 mV.
- **I** or **Q Origin** - Allows you to set the reference value ranging from –250.00 to 250.00 V. The default setting is 0.00 V.

The **Display** key is not available for this measurement.

Using the Markers

The **Marker** front-panel key accesses the menu to configure the markers.

- **Select 1 2 3 4** - Allows you to activate up to four markers with the corresponding numbers, respectively. The selected number is underlined and its function is defined by pressing the **Function** key. The default is 1.
- **Normal** - Allows you to activate the selected marker to read the time position and amplitude of the marker on the RF envelope trace. Marker position is controlled by the **RPG** knob.
- **Delta** - Allows you to read the differences in time positions and amplitudes between the selected marker and the next.
- **Function Off** - Allows you to define the selected marker function to be **Band Power**, **Noise**, or **Off**. The default is **Off**. If set to **Band Power**, you need to select **Delta**.
- **Trace** - Allows you to place the selected marker on **Signal Envelope** (**RF Envelope** for PSA Series), **I/Q Waveform**.
- **Off** - Allows you to turn off the selected marker.

- **Shape Diamond** - Allows you to access the menu to define the selected marker shape to be **Diamond**, **Line**, **Square**, or **Cross**. The default shape is **Diamond**.
- **Marker All Off** - Allows you to turn off all of the markers.

The front panel **Search** key performs a peak search when pressed. A marker will automatically be activated at the highest peak.

NOTE In the Waveform measurement, the `Mean Pwr (Entire Trace)` value plus the `Pk-to-Mean` value will sum to equal the current `Max Pt.` value as shown in the data window below the RF Envelope display. If you do a marker peak search (**Search**) with averaging turned off, the marker will find the same maximum point. However, if you turn averaging on, the `Pk-to-Mean` value will use the highest peak found for any acquisition during averaging, while the marker peak will look for the peak of the display, which is the result of n-averages. This will usually result in differing values for the maximum point.

Troubleshooting Hints

Changes made to advanced waveform settings can inadvertently result in measurements that are invalid and cause error messages to appear. Care needs to be taken when using advanced features, as some settings may incorrectly appear to provide a valid result. Use the Meas Setup, More, Restore Meas Defaults function to return the measurement settings to a known state, and then vary settings only as necessary.

3 Programming Commands

These commands are only available when the Basic mode has been selected using **INSTrument:SELect BASIC**. If Basic mode is selected, commands that are unique to another mode are not available.

SCPI Command Subsystems

"CALCulate Subsystem" on page 64.

"CONFigure Subsystem" on page 83.

"DISPlay Subsystem" on page 84.

"FETCh Subsystem" on page 92.

"FORMat Subsystem" on page 93.

"INITiate Subsystem" on page 95.

"INSTrument Subsystem" on page 97.

"MEASure Group of Commands" on page 100.

"READ Subsystem" on page 107.

"SENSe Subsystem" on page 108.

"TRIGger Subsystem" on page 131.

Programming Command Compatibility Across Model Numbers and Across Modes

Across PSA Modes: Command Subsystem Similarities

When you select different modes you get different sets of available programming commands. That is, *only* the commands that are appropriate for the current mode are available. Also, some commands have the same syntax in different modes but have different ranges or settings that are only appropriate to the current mode.

The following table shows which command subsystems are the same across different modes. If there is no "X" by a particular subsystem, then the set of available commands is different in those modes. Command ranges or defaults may also be different. Refer to the programming command descriptions in the documentation for each mode for details.

Command Subsystem	**Same command set is available:** **SA mode compared with the application modes: W-CDMA, cdmaOne, cdma2000, Basic, GSM, EDGE, NADC, or PDC**	**Same command set is available** **SA mode compared with the application mode: Phase Noise**
IEEE common commands	X	X
ABORt	X	X
CALCulate		
CALibration	X	X
CONFigure		
COUPle	not available in these application modes	not available in this application modes
DISPlay		
FETCh		
FORMat		X
HCOPy	X	X
INITiate		
INPut	not available in these application modes	X

Command Subsystem	Same command set is available: SA mode compared with the application modes: W-CDMA, cdmaOne, cdma2000, Basic, GSM, EDGE, NADC, or PDC	Same command set is available SA mode compared with the application mode: Phase Noise
MEASure		
MEMory	X	X
MMEMory	X	X
MMEMory:STORe:TRACe	not available in application modes	X
READ		
[SENSe] [SENSe:]CHANnel [SENSe:]CORRection [SENSe:]FEED [SENSe:]FREQuency:CENTer [SENSe:]FREQuency: <other subsystems> [SENSe:]<measurement> [SENSe:]POWer [SENSe:]RADio [SENSe:]SYNC	X not available in application modes	not available in application modes
STATus	X	X
SYSTem	X	X
TRACe	not available in application modes	X
TRIGger		
UNIT	X	X

Across PSA Modes: Specific Command Differences

Some programming commands operate differently depending on which Mode the analyzer is set to.

Command	Spectrum Analysis and Phase Noise Mode	Basic, cdmaOne, cdma2000, W-CDMA, GSM, EDGE, NADC, PDC Modes
*RST	Resets instrument, putting it in continuous measurement mode and turning off the current measurement.	Resets instrument, putting it in continuous measurement mode, but leaving the current measurement active.
CONFigure:<measurement>	Accesses the measurement and sets the instrument settings to the defaults. Averaging is turned on and set to 10. The instrument is put in single measurement mode. It does not initiate a measurement. Use INIT:IMM to make one measurement.	Accesses the measurement and sets the instrument settings to the defaults. If you were already in single measurement mode, it takes one measurement and then waits. If you were in continuous measurement mode it continues to measure.
*ESE default	Default is 255 which means that every error/status bit change that has occurred will be returned with a *ESR? query. You must set the value of *ESE to choose only the bits/status that you want returned.	Default is 0 which means that none of the error/status bit changes that have occurred will be returned with a *ESR? query. You must set the value of *ESE to choose the bits/status that you want returned.
TRIGger commands	For these modes, only one trigger source can be selected and it will be common across the modes. Also, only one value can be set for the trigger delay, level, or polarity.	For these modes, a unique trigger source can be selected for each mode. Also, each trigger source can have unique settings for the its delay, level, and polarity.
Saving and recalling traces	Traces can only be saved when in the Spectrum Analysis mode (MMEM:STOR:TRAC). This is because the instrument state must be saved along with the trace data and the state data varies depending on the number of modes currently available in the instrument.	

Using Applications in PSA Series vs. VSA E4406A

NOTE This information *only* applies to the application modes: Basic, cdmaOne, cdma2000, W-CDMA, GSM, EDGE, NADC, and PDC.

Command	PSA Series	VSA E4406A: A.04.00	VSA E4406A: A.05.00
*RST	Resets instrument, putting it in continuous measurement mode. Use INIT:CONT OFF to select single measurement mode and INIT:IMM to start one measurement.	Resets instrument, putting it in single measurement mode. One measurement is initiated when the command is sent.	Resets instrument, putting it in single measurement mode. No measurement is initiated when the command is sent. Use INIT:IMM to start one measurement.
CONFigure:<measurement>	Accesses the measurement and sets the instrument settings to the defaults. If you were already in single measurement mode, it takes one measurement and then waits.	Same as PSA. Accesses the measurement and sets the instrument settings to the defaults. If you were already in single measurement mode, it takes one measurement and then waits.	Accesses the measurement and sets the instrument settings to the defaults. If you were already in single measurement mode, it does not initiate a measurement. Use INIT:IMM to make one measurement.
*ESE default	Default is 255 which means that every error/status bit change that has occurred will be returned with a *ESR? query. You must set the value of *ESE to choose only the bits/status that you want returned.	Default is 0 which means that none of the error/status bit changes that have occurred will be returned with a *ESR? query. You must set the value of *ESE to choose the bits/status that you want returned.	Same as VSA A.04.00. Default is 0 which means that none of the error/status bit changes that have occurred will be returned with a *ESR? query. You must set the value of *ESE to choose the bits/status that you want returned.
TRIGger commands	In Spectrum Analysis mode only one value can be set for the trigger's source, delay, level, or polarity. Basic, GSM, EDGE, cdmaOne, cdma2000, W-CDMA, NADC, PDC modes function the same as VSA	You can select a unique trigger source for each mode. Each trigger source can have unique settings for the its delay, level, and polarity.	Same as VSA A.04.00. You can select a unique trigger source for each mode. Each trigger source can have unique settings for the its delay, level, and polarity.

Command	PSA Series	VSA E4406A: A.04.00	VSA E4406A: A.05.00
AUTO ON | OFF control and setting manual values	We recommend that you set a function's automatic state to OFF, before you send it your manual value. Some functions will turn off the automatic mode when you send a specific manual value, but others will not. This also varies with the instrument model.	We recommend that you set a function's automatic state to OFF, before you send it your manual value. Some functions will turn off the automatic mode when you send a specific manual value, but others will not. This also varies with the instrument model.	We recommend that you set a function's automatic state to OFF, before you send it your manual value. Some functions will turn off the automatic mode when you send a specific manual value, but others will not. This also varies with the instrument model.

CALCulate Subsystem

This subsystem is used to perform post-acquisition data processing. In effect, the collection of new data triggers the CALCulate subsystem. In this instrument, the primary functions in this subsystem are markers and limits.

The SCPI default for data output format is ASCII. The format can be changed to binary with FORMat:DATA which transports faster over the bus.

Test Current Results Against all Limits

:CALCulate:CLIMits:FAIL?

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.

Data Query

:CALCulate:DATA[n]?

Returns the designated measurement data for the currently selected measurement and sub-opcode.

n = any valid sub-opcode for the current measurement. See the "MEASure Group of Commands" on page 100 for information on the data that can be returned for each measurement.

For sub-opcodes that return trace data use the :CALCulate:DATA[n]:COMPress? command below.

Calculate/Compress Trace Data Query

:CALCulate:DATA<n>:COMPress?
BLOCk|CFIT|MAXimum|MEAN|MINimum|RMS|SAMPle|SDEViation
[,<soffset>[,<length>[,<roffset>[,<rlimit>]]]]

Returns compressed data for the specified trace data. The data is returned in the same units as the original trace and only works with the currently selected measurement. The command is used with a sub-opcode <*n*> since measurements usually return several types of trace data. See the following table for the sub-opcodes for the trace data names that are available in each measurement. For sub-opcodes that return scalar data use the :CALCulate:DATA[n]? command above.

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.

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.

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).

MAX, MEAN, MIN, RMS, SAMP, and SDEV 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 reagions you specify (using <rlimit>) ignoring any data beyond that.

MAXimum - returns the maximum data point 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 the arithmetic mean of the data point values 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. 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.

MINimum - returns the minimum data point for the specified region(s) of trace data For I/Q trace data, the minimum magnitude of the I/Q pairs is returned.

RMS - returns the arithmetic rms of the data point values for the specified region(s) of trace data. For I/Q trace data, the rms of the magnitudes of the I/Q pairs is returned. 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.

Once you have the rms value for a region of I/Q trace data, you may want to calculate the mean power. You must convert this rms I/Q value (peak volts) to power in dB.

$$10 \times \log[10 \times (\text{rms value})^2]$$

SAMPle - returns the first data value for the specified region(s) of trace data. For I/Q trace data, the first I/Q pair is returned.

SDEViation - returns the arithmetic standard deviation for the data point values for the specified region(s) of trace data. For I/Q trace data, the standard deviation of the magnitudes of the I/Q pairs is returned.

Figure 3-1 Sample Trace Data - Constant Envelope

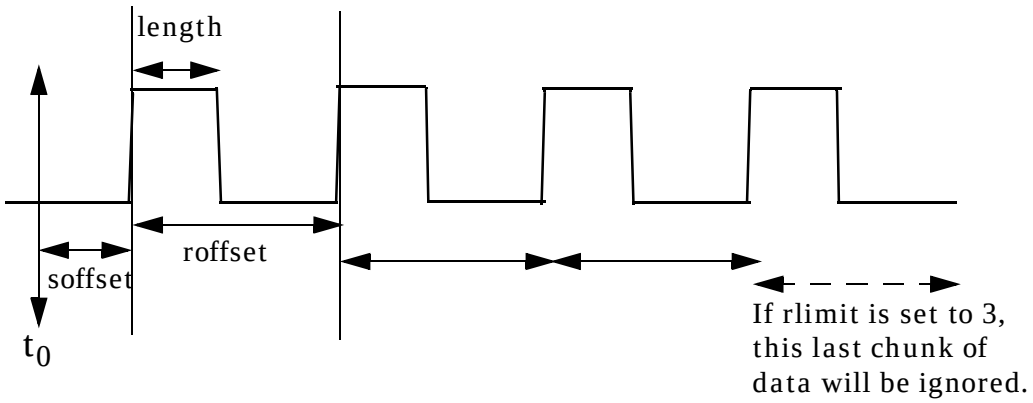
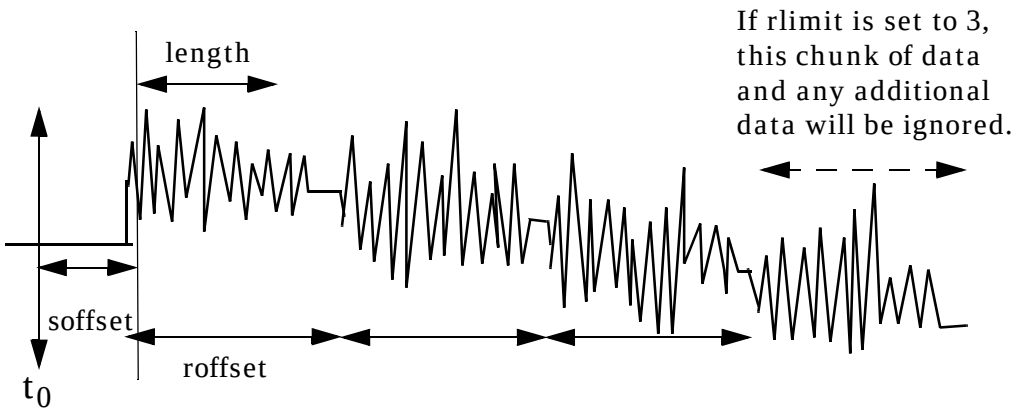


Figure 3-2 Sample Trace Data - Not Constant Envelope



<soffset> - start offset is an optional real number (in seconds). It specifies the amount of data at the beginning of the trace that will be ignored before the decimation process starts. It is the time from the start of the trace to the point where you want to start using the data. The default value is zero.

<length> - is an optional real number (in seconds). It defines how much data will be compressed into one value. This parameter has a default value equal to the current trace length.

<roffset> - repeat offset is an optional real number (in seconds). It defines the beginning of the next field of trace elements to be compressed. This is relative to the beginning of the previous field. This parameter has a default value equal to the <length> variable.

<rlimit> - repeat limit is an optional integer. It specifies the number of data items that you want returned. It will ignore any additional items beyond that number. You can use the Start offset and the Repeat limit to pick out exactly what part of the data you want to use. The default value is all the data.

Example: To query the mean power of a set of GSM bursts:

1. Set the waveform measurement sweep time to acquire at least one burst.
2. Set the triggers such that acquisition happens at a known position relative to a burst.
3. Then query the mean burst levels using, **`CALC:DATA2:COMP? MEAN,24e-6,526e-6`** (These parameter values correspond to GSM signals, where 526e-6 is the length of the burst in the slot and you just want 1 burst.)

NOTE There is a more detailed example in the "Improving the Speed of Your Measurements" section in the PSA Series *User's and Programmer's Reference*. There is also a sample program in the Programming Fundamentals chapter of that book, and a copy of it is on the documentation CD-ROM.

Remarks: The optional parameters must be entered in the specified order. For example, if you want to specify <length>, you must also specify <soffset>.

This command uses the data in the format specified by FORMat:DATA, returning either binary or ASCII data.

History: Added in revision A.03.00

Measurement	Available Traces	Markers Available?
ACP - adjacent channel power (Basic, cdmaOne, cdma2000, W-CDMA, NADC, PDC modes)	no traces (*n*=0)[a] for I/Q points	no markers
CDPower - code domain power (cdmaOne mode)	POWer (*n*=2)[a] TIMing (*n*=3)[a] PHASe (*n*=4)[a] (*n*=0)[a] for I/Q points	yes

Measurement	Available Traces	Markers Available?
CDPower - code domain power (cdma2000, W-CDMA modes)	CDPower (*n*=2)[a] EVM (*n*=5)[a] MERRor (*n*=6)[a] PERRor (*n*=7)[a] SPOWer (*n*=9)[a] CPOWer (*n*=10)[a] (*n*=0)[a] for I/Q points	yes
CHPower - channel power (Basic, cdmaOne, cdma2000, W-CDMA modes)	SPECtrum (*n*=2)[a] (*n*=0)[a] for I/Q points	no markers
CSPur - spurs close (cdmaOne mode)	SPECtrum (*n*=2)[a] ULIMit (*n*=3)[a] (*n*=0)[a] for I/Q points	yes
EEVM - EDGE error vector magnitude (EDGE mode)	EVMerror (*n*=2)[a] MERRor (*n*=3)[a] PERRor (*n*=4)[a] (*n*=0)[a] for I/Q points	yes
EORFspectr - EDGE output RF spectrum (EDGE mode)	RFEMod (*n*=2)[a] RFESwitching (*n*=3)[a] SPEMod (*n*=4)[a] LIMMod (*n*=5)[a] (*n*=0)[a] for I/Q points	yes, only for a single offset yes, only for multiple offsets
EPVTime - EDGE power versus time (EDGE mode)	RFENvelope (*n*=2)[a] UMASk (*n*=3)[a] LMASk (*n*=4)[a] (*n*=0)[a] for I/Q points	yes
ETSPur - EDGE transmit band spurs (EDGE mode)	SPECtrum (*n*=2)[a] ULIMit (*n*=3)[a] (*n*=0)[a] for I/Q points	yes

Measurement	Available Traces	Markers Available?
EVM - error vector magnitude (NADC, PDC modes)	EVM (*n*=2)[a] MERRor (*n*=3)[a] PERRor (*n*=4)[a] (*n*=0)[a] for I/Q points	yes
EVMQpsk - QPSK error vector magnitude (cdma2000, W-CDMA modes)	EVM (*n*=2)[a] MERRor (*n*=3)[a] PERRor (*n*=4)[a] (*n*=0)[a] for I/Q points	yes
IM - intermodulation (cdma2000, W-CDMA modes)	SPECtrum (*n*=2)[a] (*n*=0)[a] for I/Q points	yes
MCPower - multi-carrier power (W-CDMA mode)	no traces (*n*=0)[a] for I/Q points	no markers
OBW - occupied bandwidth (cdmaOne, cdma2000, PDC, W-CDMA modes)	no traces (*n*=0)[a] for I/Q points	no markers
ORFSpectrum - output RF spectrum (GSM, EDGE mode)	RFEMod (*n*=2)[a] RFESwitching (*n*=3)[a] SPEMod (*n*=4)[a] LIMMod (*n*=5)[a] (*n*=0)[a] for I/Q points	yes, only for a single offset yes, only for multiple offsets
PFERror - phase and frequency error (GSM, EDGE mode)	PERRor (*n*=2)[a] PFERror (*n*=3)[a] RFENvelope (*n*=4)[a] (*n*=0)[a] for I/Q points	yes
PSTatistic - power statistics CCDF (Basic, cdma2000, W-CDMA modes)	MEASured (*n*=2)[a] GAUSian (*n*=3)[a] REFerence (*n*=4)[a] (*n*=0)[a] for I/Q points	yes

Measurement	Available Traces	Markers Available?
PVTime - power versus time (GSM, EDGE modes)	RFENvelope (*n*=2)[a] UMASk (*n*=3)[a] LMASk (*n*=4)[a] (*n*=0)[a] for I/Q points	yes
RHO - modulation quality (cdmaOne, cdma2000, W-CDMA mode)	(*n*=0)[a] for I/Q points EVM (*n*=2)[a] MERRor (*n*=3)[a] PERRor (*n*=4)[a] (*n*=0)[a] for I/Q points	yes
SEMask - spectrum emissions mask (cdma2000, W-CDMA mode)	SPECtrum (*n*=2)[a] (*n*=0)[a] for I/Q points	yes
TSPur - transmit band spurs (GSM, EDGE mode)	SPECtrum (*n*=2)[a] ULIMit (*n*=3)[a] (*n*=0)[a] for I/Q points	yes
TXPower - transmit power (GSM, EDGE mode)	RFENvelope (*n*=2)[a] IQ (*n*=8)[a] (*n*=0)[a] for I/Q points	yes
SPECtrum - (frequency domain) (all modes)	IQ (*n*=3)[a] SPECtrum (*n*=4)[a] ASPectrum (*n*=7)[a] (*n*=0)[a] for I/Q points	yes
WAVEform - (time domain) (all modes)	RFENvelope (*n*=2)[a] (also for Signal Envelope trace) IQ (*n*=5)[a] (*n*=0)[a] for I/Q points	yes

a. The *n* number indicates the sub-opcode that corresponds to this trace. Detailed descriptions of the trace data can be found in the MEASure subsystem documentation by looking up the sub-opcode for the appropriate measurement.

Calculate Peaks of Trace Data

:CALCulate:DATA<n>:PEAKs?
<threshold>,<excursion>[,AMPLitude|FREQuency|TIME]

Returns a list of peaks for the designated trace data *n* for the currently selected measurement. The peaks must meet the requirements of the peak threshold and excursion values.

The command can only be used with specific <*n*> (sub-opcode) values, for measurement results that are trace data. See the table above for the appropriate sub-opcodes. Both real and complex traces can be searched, but complex traces are converted to magnitude in dBm. Sub-opcode *n*=0, is the raw trace data which cannot be searched for peaks. Sub-opcode *n*=1, is the scaler data which also cannot be searched for peaks.

Threshold - is the level below which trace data peaks are ignored.

Excursion - To be defined as a peak, the signal must rise above the threshold by a minimum amplitude change. Excursion is measured from the lowest point above the threshold (of the rising edge of the peak), to the highest signal point that begins the falling edge.

Amplitude - lists the peaks in order of descending amplitude, so the highest peak is listed first. This is the default peak order listing if the optional parameter is not specified.

Frequency - lists the peaks in order of occurrence, left to right across the x-axis.

Time - lists the peaks in order of occurrence, left to right across the x-axis.

Example: Select the spectrum measurement.

Use **CALC:DATA4:PEAK? -40,10,FREQ** to identify the peaks above –40 dBm, with excursions of at least 10 dB, in order of increasing frequency.

Query Results: Returns a list of floating-point numbers. The first value in the list is the number of peak points that follow. A peak point consists of two values: a peak amplitude followed by the its corresponding frequency (or time).

If no peaks are found the peak list will consist of only the number of peaks, (0).

The peak list is limited to 100 peaks. Peaks in excess of 100 are ignored.

Remarks: This command uses the data setting specified by the FORMat:DATA command and can return real 32-bit, real 64-bit, or ASCII data. The default data format is ASCII.

CALCulate:MARKers Subsystem

Markers can be put on your displayed measurement data to supply information about specific points on the data. Some of the things that markers can be used to measure include: precise frequency at a point, minimum or maximum amplitude, and the difference in amplitude or frequency between two points.

When using the marker commands you must specify the measurement in the SCPI command. We recommend that you use the marker commands only on the current measurement. Many marker commands will return invalid results, when used on a measurement that is not current. (This is true for commands that do more than simply setting or querying an instrument parameter.) No error is reported for these invalid results.

You must make sure that the measurement is completed before trying to query the marker value. Using the MEASure or READ command, before the marker command, forces the measurement to complete before allowing the next command to be executed.

Each measurement has its own instrument state for marker parameters. Therefore, if you exit the measurement, the marker settings in each measurement are saved and are then recalled when you change back to that measurement.

Basic Mode - <measurement> key words

- SPECtrum - markers available
- WAVeform - markers available

cdmaOne Mode - <measurement> key words

- ACPr - no markers
- CHPower - no markers
- CDPower - markers available
- CSPur - markers available
- RHO - markers available
- SPECtrum - markers available
- WAVeform - markers available

cdma2000 Mode - <measurement> key words

- ACP - no markers
- CDPower - markers available
- CHPower - no markers
- EVMQpsk - markers available
- IM - markers available
- OBW - no markers
- PSTatistic - markers available
- RHO - markers available
- SEMask - markers available

- SPECtrum - markers available
- WAVeform - markers available

GSM (with EDGE) Mode - <measurement> key words

- EEVM - markers available
- EORFspectr - markers available
- EPVTime - no markers
- ETSPur - markers available
- ORFSpectrum - markers available
- PFERror - markers available
- PVTime - no markers
- SPECtrum - markers available
- TSPur - markers available
- TXPower - no markers
- WAVeform - markers available

NADC Mode - <measurement> key words

- ACP - no markers
- EVM - markers available
- SPECtrum - markers available
- WAVeform - markers available

PDC Mode - <measurement> key words

- ACP - no markers
- EVM - markers available
- OBW - no markers
- SPECtrum - markers available
- WAVeform - markers available

W-CDMA (3GPP) Mode - <measurement> key words

- ACP - no markers
- CDPower - markers available
- CHPower - no markers
- EVMQpsk - markers available
- IM - markers available
- MCPower - no markers
- OBW - no markers
- PSTatistic - markers available
- RHO - markers available
- SEMask - markers available
- SPECtrum - markers available
- WAVeform - markers available

Example:

Suppose you are using the Spectrum measurement in your measurement personality. To position marker 2 at the maximum peak value of the trace that marker 2 is currently on, the command is:

:CALCulate:SPECtrum:MARKer2:MAXimum

You must make sure that the measurement is completed before trying to query the marker value. Use the MEASure or READ command before using the marker command. This forces the measurement to complete before allowing the next command to be executed.

Markers All Off on All Traces

:CALCulate:<measurement>:MARKer:AOFF

Turns off all markers on all the traces in the specified measurement.

Example: **CALC:SPEC:MARK:AOFF**

Remarks: The keyword for the current measurement must be specified in the command. (Some examples include: SPECtrum, WAVeform)

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

Marker Function

:CALCulate:<measurement>:MARKer[1]|2|3|4:FUNCtion BPOWer|NOISe|OFF

:CALCulate:<measurement>:MARKer[1]|2|3|4:FUNCtion?

Selects the type of marker for the specified marker. A particular measurement may not have all the types of markers that are commonly available.

The marker must have already been assigned to a trace. Use **:CALCulate:<measurement>:MARKer[1]|2|3|4:TRACe** to assign a marker to a particular trace.

Band Power – is the integrated power between the two markers for traces in the frequency domain and is the mean power between the two markers for traces in the time domain.

Noise – is the noise power spectral density in a 1 Hz bandwidth. It is averaged over 32 horizontal trace points.

Off – turns off the marker functions

Example: **CALC:SPEC:MARK3:FUNC Noise**

Remarks: The keyword for the current measurement must be specified in the command. (Some examples include: SPECtrum, WAVeform)

Front Panel Access: **Marker, Marker Function**

Marker Function Result

:CALCulate:<measurement>:MARKer[1]|2|3|4:FUNCtion:RESult?

Queries the result of the currently active marker function. The measurement must be completed before querying the marker. A particular measurement may not have all the types of markers available.

The marker must have already been assigned to a trace. Use **:CALCulate:<measurement>:MARKer[1]|2|3|4:TRACe** to assign a marker to a particular trace.

Example: **CALC:SPEC:MARK:FUNC:RES?**

Remarks: The keyword for the current measurement must be specified in the command. (Some examples include: SPECtrum, WAVeform)

Front Panel Access: **Marker, Marker Function**

Marker Peak (Maximum) Search

:CALCulate:<measurement>:MARKer[1]|2|3|4:MAXimum

Places the selected marker on the highest point on the trace that is assigned to that particular marker number.

The marker must have already been assigned to a trace. Use **:CALCulate:<measurement>:MARKer[1]|2|3|4:TRACe** to assign a marker to a particular trace.

Example: **CALC:SPEC:MARK1:MAX**

Remarks: The keyword for the current measurement must be specified in the command. (Some examples include: SPECtrum, WAVeform)

Front Panel Access: **Search**

Marker Peak (Minimum) Search

:CALCulate:<measurement>:MARKer[1]|2|3|4:MINimum

Places the selected marker on the lowest point on the trace that is assigned to that particular marker number.

The marker must have already been assigned to a trace. Use **:CALCulate:<measurement>:MARKer[1]|2|3|4:TRACe** to assign a marker to a particular trace.

Example: **CALC:SPEC:MARK2 MIN**

Remarks: The keyword for the current measurement must be specified in the command. (Some examples include: SPECtrum, WAVeform)

Marker On/Off

:CALCulate:<measurement>:MARKer[1]|2|3|4[:STATe] OFF|ON|0|1

:CALCulate:<measurement>:MARKer[1]|2|3|4[:STATe]?

Turns the selected marker on or off.

The marker must have already been assigned to a trace. Use **:CALCulate:<measurement>:MARKer[1]|2|3|4:TRACe** to assign a marker to a particular trace.

Example: **CALC:SPEC:MARK2: on**

Remarks: The keyword for the current measurement must be specified in the command. (Some examples include: SPECtrum, AREFerence, WAVeform)

The WAVeform measurement only has two markers available.

Front Panel Access: **Marker, Select** then **Marker Normal** or **Marker On Off**

Marker to Trace

:CALCulate:<measurement>:MARKer[1]|2|3|4:TRACe <trace_name>

:CALCulate:<measurement>:MARKer[1]|2|3|4:TRACe?

Assigns the specified marker to the designated trace. Not all types of measurement data can have markers assigned to them.

Example: With the WAVeform measurement selected, a valid command is **CALC:SPEC:MARK2:TRACE rfenvelope**.

Range: The names of valid traces are dependent upon the selected measurement. See the following table for the available trace names. The trace name assignment is independent of the marker number.

Remarks: The keyword for the current measurement must be specified in the command. (Some examples include: SPECtrum, WAVeform)

Front Panel Access: **Marker, Marker Trace**

Measurement	Available Traces	Markers Available?
ACP - adjacent channel power (Basic, cdmaOne, cdma2000, W-CDMA, NADC, PDC modes)	no traces (*n*=0)[a] for I/Q points	no markers
CDPower - code domain power (cdmaOne mode)	POWer (*n*=2)[a] TIMing (*n*=3)[a] PHASe (*n*=4)[a] (*n*=0)[a] for I/Q points	yes
CDPower - code domain power (cdma2000, W-CDMA modes)	CDPower (*n*=2)[a] EVM (*n*=5)[a] MERRor (*n*=6)[a] PERRor (*n*=7)[a] SPOWer (*n*=9)[a] CPOWer (*n*=10)[a] (*n*=0)[a] for I/Q points	yes
CHPower - channel power (Basic, cdmaOne, cdma2000, W-CDMA modes)	SPECtrum (*n*=2)[a] (*n*=0)[a] for I/Q points	no markers
CSPur - spurs close (cdmaOne mode)	SPECtrum (*n*=2)[a] ULIMit (*n*=3)[a] (*n*=0)[a] for I/Q points	yes

Measurement	Available Traces	Markers Available?
EEVM - EDGE error vector magnitude (EDGE mode)	EVMerror (*n*=2)[a] MERRor (*n*=3)[a] PERRor (*n*=4)[a] (*n*=0)[a] for I/Q points	yes
EORFspectr - EDGE output RF spectrum (EDGE mode)	RFEMod (*n*=2)[a] RFESwitching (*n*=3)[a] SPEMod (*n*=4)[a] LIMMod (*n*=5)[a] (*n*=0)[a] for I/Q points	yes, only for a single offset yes, only for multiple offsets
EPVTime - EDGE power versus time (EDGE mode)	RFENvelope (*n*=2)[a] UMASk (*n*=3)[a] LMASk (*n*=4)[a] (*n*=0)[a] for I/Q points	yes
ETSPur - EDGE transmit band spurs (EDGE mode)	SPECtrum (*n*=2)[a] ULIMit (*n*=3)[a] (*n*=0)[a] for I/Q points	yes
EVM - error vector magnitude (NADC, PDC modes)	EVM (*n*=2)[a] MERRor (*n*=3)[a] PERRor (*n*=4)[a] (*n*=0)[a] for I/Q points	yes
EVMQpsk - QPSK error vector magnitude (cdma2000, W-CDMA modes)	EVM (*n*=2)[a] MERRor (*n*=3)[a] PERRor (*n*=4)[a] (*n*=0)[a] for I/Q points	yes
IM - intermodulation (cdma2000, W-CDMA modes)	SPECtrum (*n*=2)[a] (*n*=0)[a] for I/Q points	yes
MCPower - multi-carrier power (W-CDMA mode)	no traces (*n*=0)[a] for I/Q points	no markers

Measurement	Available Traces	Markers Available?
OBW - occupied bandwidth (cdmaOne, cdma2000, PDC, W-CDMA modes)	no traces (*n*=0)[a] for I/Q points	no markers
ORFSpectrum - output RF spectrum (GSM, EDGE mode)	RFEMod (*n*=2)[a] RFESwitching (*n*=3)[a] SPEMod (*n*=4)[a] LIMMod (*n*=5)[a] (*n*=0)[a] for I/Q points	yes, only for a single offset yes, only for multiple offsets
PFERror - phase and frequency error (GSM, EDGE mode)	PERRor (*n*=2)[a] PFERror (*n*=3)[a] RFENvelope (*n*=4)[a] (*n*=0)[a] for I/Q points	yes
PSTatistic - power statistics CCDF (Basic, cdma2000, W-CDMA modes)	MEASured (*n*=2)[a] GAUSian (*n*=3)[a] REFerence (*n*=4)[a] (*n*=0)[a] for I/Q points	yes
PVTime - power versus time (GSM, EDGE modes)	RFENvelope (*n*=2)[a] UMASk (*n*=3)[a] LMASk (*n*=4)[a] (*n*=0)[a] for I/Q points	yes
RHO - modulation quality (cdmaOne, cdma2000, W-CDMA mode)	(*n*=0)[a] for I/Q points EVM (*n*=2)[a] MERRor (*n*=3)[a] PERRor (*n*=4)[a] (*n*=0)[a] for I/Q points	yes
SEMask - spectrum emissions mask (cdma2000, W-CDMA mode)	SPECtrum (*n*=2)[a] (*n*=0)[a] for I/Q points	yes

Measurement	Available Traces	Markers Available?
TSPur - transmit band spurs (GSM, EDGE mode)	SPECtrum (n=2)[a] ULIMit (n=3)[a] (n=0)[a] for I/Q points	yes
TXPower - transmit power (GSM, EDGE mode)	RFENvelope (n=2)[a] IQ (n=8)[a] (n=0)[a] for I/Q points	yes
SPECtrum - (frequency domain) (all modes)	IQ (n=3)[a] SPECtrum (n=4)[a] ASPectrum (n=7)[a] (n=0)[a] for I/Q points	yes
WAVEform - (time domain) (all modes)	RFENvelope (n=2)[a] (also for Signal Envelope trace) IQ (n=5)[a] (n=0)[a] for I/Q points	yes

a. The *n* number indicates the sub-opcode that corresponds to this trace. Detailed descriptions of the trace data can be found in the MEASure subsystem documentation by looking up the sub-opcode for the appropriate measurement.

Marker X Value

:CALCulate:<measurement>:MARKer[1]|2|3|4:X <param>

:CALCulate:<measurement>:MARKer[1]|2|3|4:X?

Position the designated marker on its assigned trace at the specified X value. The parameter value is in X-axis units (which is often frequency or time).

The marker must have already been assigned to a trace. Use **:CALCulate:<measurement>:MARKer[1]|2|3|4:TRACe** to assign a marker to a particular trace.

The query returns the current X value of the designated marker. The measurement must be completed before querying the marker.

Example: **CALC:SPEC:MARK2:X 1.2e6 Hz**

Default Unit: Matches the units of the trace on which the marker is positioned.

Remarks: The keyword for the current measurement must be specified in the command. (Some examples include: SPECtrum, WAVeform)

Front Panel Access: **Marker, <active marker>, RPG**

Marker X Position

:CALCulate:<measurement>:MARKer[1]|2|3|4:X:POSition <integer>

:CALCulate:<measurement>:MARKer[1]|2|3|4:X:POSition?

Position the designated marker on its assigned trace at the specified X position. A trace is composed of a variable number of measurement points. This number changes depending on the current measurement conditions. The current number of points must be identified before using this command to place the marker at a specific location.

The marker must have already been assigned to a trace. Use **:CALCulate:<measurement>:MARKer[1]|2|3|4:TRACe** to assign a marker to a particular trace.

The query returns the current X position for the designated marker. The measurement must be completed before querying the marker.

Example: **CALC:SPEC:MARK:X:POS 500**

Range: 0 to a maximum of (3 to 920,000)

Remarks: The keyword for the current measurement must be specified in the command. (Some examples include: SPECtrum, WAVeform)

Front Panel Access: **Marker, <active marker>, RPG**

Marker Readout Y Value

:CALCulate:<measurement>:MARKer[1]|2|3|4:Y?

Readout the current Y value for the designated marker on its assigned trace. The value is in the Y-axis units for the trace (which is often dBm).

The marker must have already been assigned to a trace. Use **:CALCulate:<measurement>:MARKer[1]|2|3|4:TRACe** to assign a marker to a particular trace.

The measurement must be completed before querying the marker.

Example: **CALC:SPEC:MARK1:Y?**

Default Unit: Matches the units of the trace on which the marker is positioned

Remarks: The keyword for the current measurement must be specified in the command. (Some examples include: SPECtrum, WAVeform)

CONFigure Subsystem

The CONFigure commands are used with several other commands to control the measurement process. The full set of commands are described in the section "MEASure Group of Commands" on page 100.

Selecting measurements with the CONFigure/FETCh/MEASure/READ commands sets the instrument state to the defaults for that measurement and to make a single measurement. Other commands are available for each measurement to allow you to change: settings, view, limits, etc. Refer to:

SENSe:<measurement>, SENSe:CHANnel, SENSe:CORRection,
SENSe:DEFaults, SENSe:DEViation, SENSe:FREQuency,
SENSe:PACKet, SENSe:POWer, SENSe:RADio, SENSe:SYNC
CALCulate:<measurement>, CALCulate:CLIMits
DISPlay:<measurement>
TRIGger

The INITiate[:IMMediate] or INITiate:RESTart commands will initiate the taking of measurement data without resetting any of the measurement settings that you have changed from their defaults.

Configure the Selected Measurement

:CONFigure:<measurement>

A CONFigure command must specify the desired measurement. It will set the instrument settings for that measurements standard defaults, but should not initiate the taking of data. The available measurements are described in the MEASure subsystem.

NOTE

If CONFigure initiates the the taking of data, the data should be ignored. Other SCPI commands can be processed immediately after sending CONFigure. You do not need to wait for the CONF command to complete this 'false' data acquisition.

Configure Query

:CONFigure?

The CONFigure query returns the name of the current measurement.

DISPlay Subsystem

The DISPlay controls the selection and presentation of textual, graphical, and TRACe information. Within a DISPlay, information may be separated into individual WINDows.

Turn the Display On/Off

:DISPlay:ENABle OFF|ON|0|1

:DISPlay:ENABle?

Controls the display. If enable is set to off, the display is turned off. Measurements may run faster since the instrument doesn't have to update the display after every data acquisition. There is often no need to update the display information when using remote operation. Turning the display off will also extend its life and reduce EMI. An instrument preset will turn the display back on.

Factory Preset: On

Remarks: The following key presses will turn display enable back on:

1. If in local, press any key
2. If in remote, press the local (system) key
3. If in local lockout (SYST:KLOCK), no key press will work

Select Display Format

:DISPlay:FORMat:TILE

Selects the viewing format that displays multiple windows of the current measurement data simultaneously. Use DISP:FORM:ZOOM to return the display to a single window.

Remarks: You msut be in the Basic, cdmaOne,cdma2000, W-CDMA, GSM (w/EDGE), NADC, or PDC mode to use this command. Use INSTrument:SELect to set the mode

Front Panel Access: **Zoom** (toggles between Tile and Zoom)

Select Display Format

:DISPlay:FORMat:ZOOM

Selects the viewing format that displays only one window of the current measurement data (the current active window). Use DISP:FORM:TILE to return the display to multiple windows.

Remarks: You msut be in the Basic, cdmaOne,cdma2000, W-CDMA, GSM (w/EDGE), NADC, or PDC mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: **Zoom** (toggles between Tile and Zoom)

Spectrum - Y-Axis Scale/Div

:DISPlay:SPECtrum[n]:WINDow[m]:TRACe:Y[:SCALe]:PDIVision <power>

:DISPlay:SPECtrum[n]:WINDow[m]:TRACe:Y[:SCALe]:PDIVision?

Sets the amplitude reference level for the y-axis.

n – selects the view, the default is Spectrum.

— n=1, m=1 Spectrum

— n=1, m=2 I/Q Waveform

— n=1, m=2 I and Q Waveform (Basic, W-CDMA, cdma2000)

— n=3, m=1 I/Q Polar (Basic, W-CDMA, cdma2000)

— n=4, m=1 Linear Spectrum (Basic, W-CDMA, cdma2000)

m – selects the window within the view. The default is 1.

Factory Preset: 10 dB per division, for Spectrum

Range: .1 dB to 20 dB per division, for Spectrum

Default Unit: 10 dB per division, for Spectrum

Remarks: May affect input attenuator setting.

You must be in Basic, cdmaOne, cdma2000, W-CDMA GSM w/EDGE, NADC, or PDC mode. Set the mode with INSTrument:SELect.

Front Panel Access: When in Spectrum measurement: **Amplitude Y Scale, Scale/Div.**

History: Added revision A.02.00.

Spectrum - Y-Axis Reference Level

:DISPlay:SPECtrum[n]:WINDow[m]:TRACe:Y[:SCALe]:RLEVel <power>

:DISPlay:SPECtrum[n]:WINDow[m]:TRACe:Y[:SCALe]:RLEVel?

Sets the amplitude reference level for the y-axis.

n, selects the view, the default is RF envelope.

— n=1, m=1 Spectrum

— n=1, m=2 I/Q Waveform

— n=1, m=2 I and Q Waveform (Basic, W-CDMA, cdma2000)

— n=3, m=1 I/Q Polar (Basic, W-CDMA, cdma2000)

— n=4, m=1 Linear Spectrum (Basic, W-CDMA, cdma2000)

m – selects the window within the view. The default is 1.

Factory Preset: 0 dBm, for Spectrum

Range: –250 to 250 dBm, for Spectrum

Default Unit: dBm, for Spectrum

Remarks: May affect input attenuator setting.

You must be in Basic, cdmaOne, cdma2000, W-CDMA GSM w/EDGE, NADC, or PDC mode. Set the mode with INSTrument:SELect.

Front Panel Access: When in Spectrum measurement: **Amplitude Y Scale, Ref Level**

History: Added revision A.02.00

Turn a Trace Display On/Off

:DISPlay:TRACe[n][:STATe] OFF|ON|0|1

:DISPlay:TRACe[n][:STATe]?

Controls whether the specified trace is visible or not.

n is a sub-opcode that is valid for the current measurement. See the "MEASure Group of Commands" on page 100 for more information about sub-opcodes.

Factory Preset: On

Range: The valid traces and their sub-opcodes are dependent upon the selected measurement. See the following table.

The trace name assignment is independent of the window number.

Remarks: You msut be in the Basic, cdmaOne,cdma2000, W-CDMA, GSM (w/EDGE), NADC, or PDC mode to use this command. Use INSTrument:SELect to set the mode

Front Panel Access: **Display, Display Traces**

Measurement	Available Traces	Markers Available?
ACP - adjacent channel power (Basic, cdmaOne, cdma2000, W-CDMA, NADC, PDC modes)	no traces (*n*=0)[a] for I/Q points	no markers
CDPower - code domain power (cdmaOne mode)	POWer (*n*=2)[a] TIMing (*n*=3)[a] PHASe (*n*=4)[a] (*n*=0)[a] for I/Q points	yes
CDPower - code domain power (cdma2000, W-CDMA modes)	CDPower (*n*=2)[a] EVM (*n*=5)[a] MERRor (*n*=6)[a] PERRor (*n*=7)[a] SPOWer (*n*=9)[a] CPOWer (*n*=10)[a] (*n*=0)[a] for I/Q points	yes
CHPower - channel power (Basic, cdmaOne, cdma2000, W-CDMA modes)	SPECtrum (*n*=2)[a] (*n*=0)[a] for I/Q points	no markers
CSPur - spurs close (cdmaOne mode)	SPECtrum (*n*=2)[a] ULIMit (*n*=3)[a] (*n*=0)[a] for I/Q points	yes

Measurement	Available Traces	Markers Available?
EEVM - EDGE error vector magnitude (EDGE mode)	EVMerror (*n*=2)[a] MERRor (*n*=3)[a] PERRor (*n*=4)[a] (*n*=0)[a] for I/Q points	yes
EORFspectr - EDGE output RF spectrum (EDGE mode)	RFEMod (*n*=2)[a] RFESwitching (*n*=3)[a] SPEMod (*n*=4)[a] LIMMod (*n*=5)[a] (*n*=0)[a] for I/Q points	yes, only for a single offset yes, only for multiple offsets
EPVTime - EDGE power versus time (EDGE mode)	RFENvelope (*n*=2)[a] UMASk (*n*=3)[a] LMASk (*n*=4)[a] (*n*=0)[a] for I/Q points	yes
ETSPur - EDGE transmit band spurs (EDGE mode)	SPECtrum (*n*=2)[a] ULIMit (*n*=3)[a] (*n*=0)[a] for I/Q points	yes
EVM - error vector magnitude (NADC, PDC modes)	EVM (*n*=2)[a] MERRor (*n*=3)[a] PERRor (*n*=4)[a] (*n*=0)[a] for I/Q points	yes
EVMQpsk - QPSK error vector magnitude (cdma2000, W-CDMA modes)	EVM (*n*=2)[a] MERRor (*n*=3)[a] PERRor (*n*=4)[a] (*n*=0)[a] for I/Q points	yes
IM - intermodulation (cdma2000, W-CDMA modes)	SPECtrum (*n*=2)[a] (*n*=0)[a] for I/Q points	yes
MCPower - multi-carrier power (W-CDMA mode)	no traces (*n*=0)[a] for I/Q points	no markers

Measurement	Available Traces	Markers Available?
OBW - occupied bandwidth (cdmaOne, cdma2000, PDC, W-CDMA modes)	no traces (*n*=0)[a] for I/Q points	no markers
ORFSpectrum - output RF spectrum (GSM, EDGE mode)	RFEMod (*n*=2)[a] RFESwitching (*n*=3)[a] SPEMod (*n*=4)[a] LIMMod (*n*=5)[a] (*n*=0)[a] for I/Q points	yes, only for a single offset yes, only for multiple offsets
PFERror - phase and frequency error (GSM, EDGE mode)	PERRor (*n*=2)[a] PFERror (*n*=3)[a] RFENvelope (*n*=4)[a] (*n*=0)[a] for I/Q points	yes
PSTatistic - power statistics CCDF (Basic, cdma2000, W-CDMA modes)	MEASured (*n*=2)[a] GAUSian (*n*=3)[a] REFerence (*n*=4)[a] (*n*=0)[a] for I/Q points	yes
PVTime - power versus time (GSM, EDGE modes)	RFENvelope (*n*=2)[a] UMASk (*n*=3)[a] LMASk (*n*=4)[a] (*n*=0)[a] for I/Q points	yes
RHO - modulation quality (cdmaOne, cdma2000, W-CDMA mode)	(*n*=0)[a] for I/Q points EVM (*n*=2)[a] MERRor (*n*=3)[a] PERRor (*n*=4)[a] (*n*=0)[a] for I/Q points	yes
SEMask - spectrum emissions mask (cdma2000, W-CDMA mode)	SPECtrum (*n*=2)[a] (*n*=0)[a] for I/Q points	yes

Measurement	Available Traces	Markers Available?
TSPur - transmit band spurs (GSM, EDGE mode)	SPECtrum (n=2)[a] ULIMit (n=3)[a] (n=0)[a] for I/Q points	yes
TXPower - transmit power (GSM, EDGE mode)	RFENvelope (n=2)[a] IQ (n=8)[a] (n=0)[a] for I/Q points	yes
SPECtrum - (frequency domain) (all modes)	IQ (n=3)[a] SPECtrum (n=4)[a] ASPectrum (n=7)[a] (n=0)[a] for I/Q points	yes
WAVEform - (time domain) (all modes)	RFENvelope (n=2)[a] (also for Signal Envelope trace) IQ (n=5)[a] (n=0)[a] for I/Q points	yes

a. The *n* number indicates the sub-opcode that corresponds to this trace. Detailed descriptions of the trace data can be found in the MEASure subsystem documentation by looking up the sub-opcode for the appropriate measurement.

Waveform - Y-Axis Scale/Div

:DISPlay:WAVeform[n]:WINDow[m]:TRACe:Y[:SCALe]:PDIVision <power>

:DISPlay:WAVeform[n]:WINDow[m]:TRACe:Y[:SCALe]:PDIVision?

Sets the scale per division for the y-axis.

n, selects the view, the default is RF envelope.

n=1, m=1 RF envelope

n=2, m=1 I/Q Waveform

n=4, m=1 I/Q Polar (Basic, W-CDMA, cdma2000)

m, selects the window within the view. The default is 1.

Factory Preset: 10 dBm, for RF envelope

Range: .1 dB to 20 dB, for RF envelope

Default Unit: dBm, for RF envelope

Remarks: May affect input attenuator setting.

You must be in Basic, cdmaOne, cdma2000, W-CDMA GSM w/EDGE, NADC, or PDC mode. Set the mode with INSTrument:SELect.

Front Panel Access: When in Waveform measurement: **Amplitude Y Scale, Scale/Div.**

History: Added revision A.02.00.

Waveform - Y-Axis Reference Level

:DISPlay:WAVeform[n]:WINDow[m]:TRACe:Y[:SCALe]:RLEVel <power>

:DISPlay:WAVeform[n]:WINDow[m]:TRACe:Y[:SCALe]:RLEVel?

Sets the amplitude reference level for the y-axis.

n, selects the view, the default is RF envelope.

n=1, m=1 RF envelope

n=2, m=1 I/Q Waveform

n=4, m=1 I/Q Polar (Basic, W-CDMA, cdma2000)

m, selects the window within the view. The default is 1.

Factory Preset: 0 dBm, for RF envelope

Range: –250 to 250 dBm, for RF envelope

Default Unit: dBm, for RF envelope

Remarks: May affect input attenuator setting.

You must be in Basic, cdmaOne, cdma2000, W-CDMA GSM w/EDGE, NADC, or PDC mode. Set the mode with INSTrument:SELect.

Front Panel Access: When in Waveform measurement: **Amplitude Y Scale, Ref Level**

History: Added revision A.02.00.

FETCh Subsystem

The FETCh? queries are used with several other commands to control the measurement process. These commands are described in the section on the "MEASure Group of Commands" on page 100. These commands apply only to measurements found in the MEASURE menu.

Fetch the Current Measurement Results

:FETCh:<measurement>[n]?

A FETCh? command must specify the desired measurement. It will return the valid results that are currently available, but will not initiate the taking of any new data. You can only fetch results from the measurement that is currently selected. The code number n selects the kind of results that will be returned. The available measurements and data results are described in the "MEASure Group of Commands" on page 100.

FORMat Subsystem

The FORMat subsystem sets a data format for transferring numeric and array information. The TRACe[:DATA] command is affected by FORMat subsystem commands.

Byte Order

:FORMat:BORDer NORMal|SWAPped

:FORMat:BORDer?

Selects the binary data byte order for numeric data transfer. In normal mode the most significant byte is sent first. In swapped mode the least significant byte is first. (PCs use the swapped order.) Binary data byte order functionality does not apply to ASCII.

Remarks: You msut be in the Basic, cdmaOne,cdma2000, W-CDMA, GSM (w/EDGE), NADC, or PDC mode to use this command. Use INSTrument:SELect to set the mode

Factory Preset: Normal

Numeric Data format

:FORMat[:DATA] ASCii|REAL,32|REAL,64

:FORMat[:DATA]?

For Spectrum Analysis mode only:

:FORMat[:TRACe][:DATA]
ASCii|INTeger,16|INTeger,32|REAL,32|REAL,64|UINTeger,16

:FORMat[:TRACe][:DATA]?

This command controls the format of data output, that is, data transfer across any remote port. The REAL and ASCII formats will format trace data in the current amplitude units.

The format of state data cannot be changed. It is always in a machine readable format only.

ASCII - Amplitude values are in ASCII, in amplitude units, separated by commas. ASCII format requires more memory than the binary formats. Therefore, handling large amounts of this type of data, will take more time and storage space.

Integer,16 - Binary 16-bit integer values in internal units (dBm), in a definite length block. **PSA, SA mode only.

Integer,32 - Binary 32-bit integer values in internal units (dBm), in a definite length block.

Real,32 (or 64) - Binary 32-bit (or 64-bit) real values in amplitude unit, in a definite length block. Transfers of real data are done in a binary block format.

UINTeger,16 - Binary 16-bit unsigned integer that is uncorrected ADC values, in a definite length block. This format is almost never applicable with current data.

A definite length block of data starts with an ASCII header that begins with # and indicates how many additional data points are following in the block. Suppose the header is #512320.

- The first digit in the header (5) tells you how many additional digits/bytes there are in the header.
- The 12320 means 12 thousand, 3 hundred, 20 data bytes follow the header.
- Divide this number of bytes by your selected data format bytes/point, either 8 (for real 64), or 4 (for real 32). In this example, if you are using real 64 then there are 1540 points in the block.

Example: FORM REAL,64

Factory Preset: Real,32 for Spectrum Analysis mode

ASCII for Basic, cdmaOne, cdma2000, W-CDMA, GSM with EDGE, NADC, PDC modes

Remarks: The acceptable settings for this command changes for different modes.

INITiate Subsystem

The INITiate subsystem is used to initiate a trigger for a measurement. They only initiate measurements from the MEASURE front panel key or the "MEASure Group of Commands" on page 100. Refer to the TRIGger and ABORt subsystems for related commands.

Continuous or Single Measurements

:INITiate:CONTinuous OFF|ON|0|1

:INITiate:CONTinuous?

Selects whether a trigger is continuously initiated or not. Each trigger initiates a single, complete, measurement operation.

When set to ON another trigger cycle is initiated at the completion of each measurement.

When set to OFF, the trigger system remains in the "idle" state until an INITiate[:IMMediate] command is received. On receiving the INITiate[:IMMediate] command, it will go through a single trigger/measurement cycle, and then return to the "idle" state.

Example: INIT:CONT ON

Factory Preset: On

*RST: Off (recommended for remote operation)

Front Panel Access: **Meas Control, Measure Cont Single**

Take New Data Acquisitions

:INITiate[:IMMediate]

The instrument must be in the single measurement mode. If INIT:CONT is ON, then the command is ignored. The desired measurement must be selected and waiting. The command causes the system to exit the "waiting" state and go to the "initiated" state.

The trigger system is initiated and completes one full trigger cycle. It returns to the "waiting" state on completion of the trigger cycle. Depending upon the measurement and the number of averages, there may be multiple data acquisitions, with multiple trigger events, for one full trigger cycle.

This command triggers the instrument, if external triggering is the type of trigger event selected. Otherwise, the command is ignored. Use the TRIGer[:SEQuence]:SOURce EXT command to select the external trigger.

Example: INIT:IMM

Remarks: See also the *TRG command and the TRIGger subsystem.

Front Panel Access: **Meas Control, Measure Cont Single**

Restart the Measurement

`:INITiate:RESTart`

This command applies to measurements found in the MEASURE menu. It restarts the current measurement from the “idle” state regardless of its current operating state. It is equivalent to:

INITiate[:IMMediate]

ABORt (for continuous measurement mode)

Example: INIT:REST

Front Panel Access: **Restart**

or

Meas Control, Restart

INSTrument Subsystem

This subsystem includes commands for querying and selecting instrument measurement (personality option) modes.

Catalog Query

:INSTrument:CATalog?

Returns a comma separated list of strings which contains the names of all the installed applications. These names can only be used with the **INST:SELECT** command.

Example: INST:CAT?

Query response: ”CDMA”4,”PNOISE”14

Select Application by Number

:INSTrument:NSELect <integer>

:INSTrument:NSELect?

Select the measurement mode by its instrument number. The actual available choices depends upon which applications are installed in the instrument.

1 = SA
4 = CDMA (cdmaOne)
5 = NADC
6 = PDC
8 = BASIC
9 = WCDMA (3GPP)
10 = CDMA2K (cdma2000)
13 = EDGEGSM
14 = PNOISE (phase noise)

NOTE

If you are using the SCPI status registers and the analyzer mode is changed, the status bits should be read, and any errors resolved, prior to switching modes. Error conditions that exist prior to switching modes cannot be detected using the condition registers after the mode change. This is true unless they recur after the mode change, although transitions of these conditions can be detected using the event registers.

Changing modes resets all SCPI status registers and mask registers to their power-on defaults. Hence, any event or condition register masks must be re-established after a mode change. Also note that the power up status bit is set by any mode change, since that is the default state after power up.

Example: INST:NSEL 4

Factory Preset: Persistent state with factory default of 1

Range: 1 to x, where x depends upon which applications are installed.

Front Panel Access: **Mode**

Select Application

:INSTrument[:SELect]
SA|PNOISE|BASIC|CDMA|CDMA2K|EDGEGSM|NADC|PDC|WCDMA

:INSTrument[:SELect]?

Select the measurement mode. The actual available choices depend upon which modes (measurement applications) are installed in the instrument. A list of the valid choices is returned with the INST:CAT? query.

Once an instrument mode is selected, only the commands that are valid for that mode can be executed.

1 = SA
4 = CDMA (cdmaOne)
5 = NADC
6 = PDC
8 = BASIC
9 = WCDMA (3GPP)
10 = CDMA2K (cdma2000)
13 = EDGEGSM
14 = PNOISE (phase noise)

NOTE

If you are using the status bits and the analyzer mode is changed, the status bits should be read, and any errors resolved, prior to switching modes. Error conditions that exist prior to switching modes cannot be detected using the condition registers after the mode change. This is true unless they recur after the mode change, although transitions of these conditions can be detected using the event registers.

Changing modes resets all SCPI status registers and mask registers to their power-on defaults. Hence, any event or condition register masks must be re-established after a mode change. Also note that the power up status bit is set by any mode change, since that is the default state after power up.

Example: INST:SEL CDMA

Factory Preset: Persistent state with factory default of Basic mode.

Front Panel Access: **Mode**

MEASure Group of Commands

This group includes the CONFigure, FETCh, MEASure, and READ commands that are used to make measurements and return results. The different commands can be used to provide fine control of the overall measurement process, like changing measurement parameters from their default settings. Most measurements should be done in single measurement mode, rather than measuring continuously.

The SCPI default for the format of any data output is ASCII. The format can be changed to binary with FORMat:DATA which transports faster over the bus.

CONFigure, FETCh, MEASure, READ Interactions

Measure Commands

`:MEASure:<measurement>[n]?`

This is a fast single-command way to make a measurement using the factory default instrument settings. These are the settings and units that conform to the Mode Setup settings (e.g. radio standard) that you have currently selected.

- Stops the current measurement (if any) and sets up the instrument for the specified measurement using the factory defaults.
- Initiates the data acquisition for the measurement.
- Blocks other SCPI communication, waiting until the measurement is complete before returning results.
- After the data is valid it returns the scalar results, or the trace data, for the specified measurement. The type of data returned may be defined by an [n] value that is sent with the command.

  The scalar measurement results will be returned if the optional [n] value is not included, or is set to 1. If the [n] value is set to a value other than 1, the selected trace data results will be returned. See each command for details of what types of scalar results or trace data results are available.

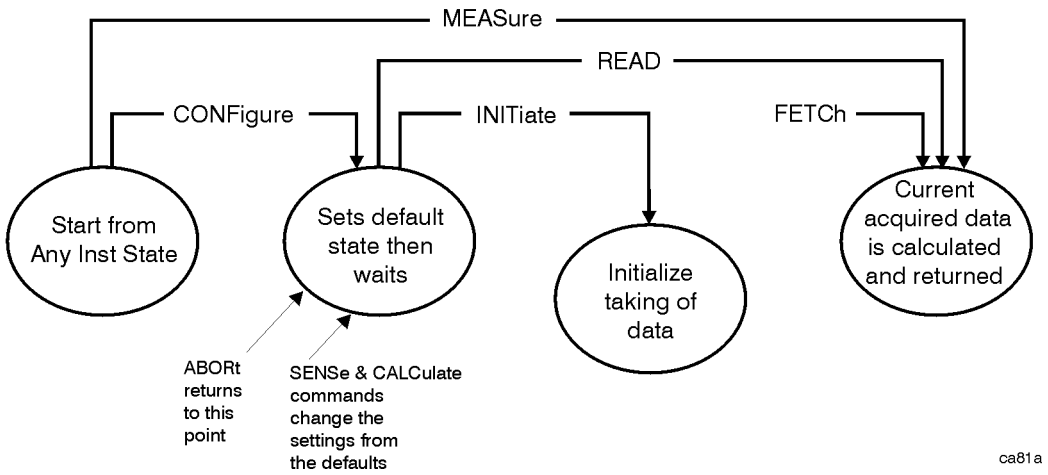
  ASCII is the default format for the data output. The binary data formats should be used for handling large blocks of data since they are smaller and faster then the ASCII format. Refer to the FORMat:DATA command for more information.

If you need to change some of the measurement parameters from the factory default settings you can set up the measurement with the CONFigure command. Use the commands in the SENSe:<measurement> and CALCulate:<measurement> subsystems to change the settings. Then you can use the READ? command to initiate the measurement and query the results. See Figure 3-3.

If you need to repeatedly make a given measurement with settings other than the factory defaults, you can use the commands in the SENSe:<measurement> and CALCulate:<measurement> subsystems to set up the measurement. Then use the READ? command to initiate the measurement and query results.

Measurement settings persist if you initiate a different measurement and then return to a previous one. Use READ:<measurement>? if you want to use those persistent settings. If you want to go back to the default settings, use MEASure:<measurement>?.

Figure 3-3 Measurement Group of Commands



Configure Commands

`:CONFigure:<measurement>`

This command stops the current measurement (if any) and sets up the instrument for the specified measurement using the factory default instrument settings. It sets the instrument to single measurement mode but should not initiate the taking of measurement data unless INIT:CONTinuous is ON. After you change any measurement settings, the READ command can be used to initiate a measurement without changing the settings back to their defaults.

The CONFigure? query returns the current measurement name.

Fetch Commands

:FETCh:<measurement>[n]?

This command puts selected data from the most recent measurement into the output buffer. Use FETCh if you have already made a good measurement and you want to return several types of data (different [n] values, e.g. both scalars and trace data) from a single measurement. FETCh saves you the time of re-making the measurement. You can only FETCh results from the measurement that is currently active, it will not change to a different measurement.

If you need to get new measurement data, use the READ command, which is equivalent to an INITiate followed by a FETCh.

The scalar measurement results will be returned if the optional [n] value is not included, or is set to 1. If the [n] value is set to a value other than 1, the selected trace data results will be returned. See each command for details of what types of scalar results or trace data results are available. The binary data formats should be used for handling large blocks of data since they are smaller and transfer faster then the ASCII format. (FORMat:DATA)

FETCh may be used to return results other than those specified with the original READ or MEASure command that you sent.

Read Commands

:READ:<measurement>[n]?

- Does not preset the measurement to the factory default settings. For example, if you have previously initiated the ACP measurement and you send READ:ACP? it will initiate a new measurement using the same instrument settings.
- Initiates the measurement and puts valid data into the output buffer. If a measurement other than the current one is specified, the instrument will switch to that measurement before it initiates the measurement and returns results.

  For example, suppose you have previously initiated the ACP measurement, but now you are running the channel power measurement. Then you send READ:ACP? It will change from channel power back to ACP and, using the previous ACP settings, will initiate the measurement and return results.
- Blocks other SCPI communication, waiting until the measurement is complete before returning the results.

  If the optional [n] value is not included, or is set to 1, the scalar measurement results will be returned. If the [n] value is set to a value other than 1, the selected trace data results will be returned. See each command for details of what types of scalar results or trace data results are available. The binary data formats should be used

when handling large blocks of data since they are smaller and faster then the ASCII format. (FORMat:DATA)

Spectrum (Frequency Domain) Measurement

This measures the amplitude of your input signal with respect to the frequency. It provides spectrum analysis capability using FFT (fast Fourier transform) measurement techniques. You must be in the Basic, cdmaOne, cdma2000, W-CDMA (3GPP), GSM (w/EDGE), NADC, or PDC mode to use these commands. Use INSTrument:SELect, to select the mode.

The general functionality of CONFigure, FETCh, MEASure, and READ are described at the beginning of this section. See the SENSe:SPECtrum commands for more measurement related commands.

:CONFigure:SPECtrum

:FETCh:SPECtrum[n]?

:READ:SPECtrum[n]?

:MEASure:SPECtrum[n]?

Front Panel Access: **Measure, Spectrum (Freq Domain)**

After the measurement is selected, press **Restore Meas Defaults** to restore factory defaults.

Measurement Results Available

n	Results Returned
0	Returns unprocessed I/Q trace data, as a series of comma-separated trace points, in volts. The I values are listed first in each pair, using the 0 through even-indexed values. The Q values are the odd-indexed values.

n	Results Returned
not specified or n=1	Returns the following comma-separated scalar results: 1. **FFT peak** is the FFT peak amplitude. 2. **FFT frequency** is the FFT frequency of the peak amplitude. 3. **FFT points** is the Number of points in the FFT spectrum. 4. **First FFT frequency** is the frequency of the first FFT point of the spectrum. 5. **FFT spacing** is the frequency spacing between the FFT points of the spectrum. 6. **Time domain points** is the number of points in the time domain trace used for the FFT. The number of points doubles if the data is complex instead of real. See the time domain scaler description below. 7. **First time point** is the time of the first time domain point, where time zero is the trigger event. 8. **Time spacing** is the time spacing between the time domain points. The time spacing value doubles if the data is complex instead of real. See the time domain scaler description below. 9. **Time domain** returns a 1 if time domain is complex (I/Q) and complex data will be returned. It returns a 0 if the data is real. (raw ADC samples) When this value is 1 rather than 0 (complex vs. real data), the time domain points and the time spacing scalers both increase by a factor of two. 10. **Scan time** is the total scan time of the time domain trace used for the FFT. The total scan time = (time spacing) X (time domain points – 1) 11. **Current average count** is the current number of data measurements that have already been combined, in the averaging calculation.
3	Returns the I and Q trace data. It is represented by I and Q pairs (in volts) versus time.
4	Returns spectrum trace data. That is, the trace of log-magnitude versus frequency. (The trace is computed using a FFT.)
6	Not used.
7	Returns the averaged spectrum trace data. That is, the trace of the averaged log-magnitude versus frequency.
8	Not used.
11, cdma2000, W-CDMA, Basic modes only	Returns comma-separated linear spectrum trace data in Volts RMS.
12, cdma2000, W-CDMA, Basic modes only	Returns comma-separated averaged linear spectrum trace data in Volts RMS.

Waveform (Time Domain) Measurement

This measures the amplitude of your input signal with respect to the frequency. It provides spectrum analysis capability using FFT (fast Fourier transform) measurement techniques. You must be in the Basic, cdmaOne, cdma2000, W-CDMA (3GPP), GSM (w/EDGE), NADC, or PDC mode to use these commands. Use INSTrument:SELect, to select the mode.

The general functionality of CONFigure, FETCh, MEASure, and READ are described at the beginning of this section. See the SENSe:WAVeform commands for more measurement related commands.

:CONFigure:WAVeform

:FETCh:WAVeform[n]?

:READ:WAVeform[n]?

:MEASure:WAVeform[n]?

Front Panel Access: **Measure, Waveform (Time Domain)**

After the measurement is selected, press **Restore Meas Defaults** to restore factory defaults.

Measurement Results Available

n	Results Returned
0	Returns unprocessed I/Q trace data, as a series of comma-separated trace points, in volts. The I values are listed first in each pair, using the 0 through even-indexed values. The Q values are the odd-indexed values.

n	Results Returned
not specified or n=1	Returns the following comma-separated scalar results: 1. **Sample time** is a floating point number representing the time between samples when using the trace queries (n=0,2,etc). 2. **Mean power** is the mean power (in dBm). This is either the power across the entire trace, or the power between markers if the markers are enabled. If averaging is on, the power is for the latest acquisition. 3. **Mean power averaged** is the power (in dBm) for N averages, if averaging is on. This is either the power across the entire trace, or the power between markers if the markers are enabled. If averaging is on, the power is for the latest acquisition. If averaging is off, the value of the mean power averaged is the same as the value of the mean power. 4. **Number of samples** is the number of data points in the captured signal. This number is useful when performing a query on the signal (i.e. when n=0,2,etc.). 5. **Peak-to-mean ratio** has units of dB. This is the ratio of the maximum signal level to the mean power. Valid values are only obtained with averaging turned off. If averaging is on, the peak-to-mean ratio is calculated using the highest peak value, rather than the displayed average peak value. 6. **Maximum value** is the maximum of the most recently acquired data (in dBm). 7. **Minimum value** is the minimum of the most recently acquired data (in dBm).
2	Returns comma-separated trace points of the entire captured trace data. These data points are floating point numbers representing the power of the signal (in dBm). There are N data points, where N is the **number of samples**. The period between the samples is defined by the **sample time**.
5, cdma2000, W-CDMA, Basic modes only	In input modes other than Ionly and Qonly returns comma-separated values of I and Q trace data in Volts. The values are in pairs with the I value first. In Ionly and Qonly the data retured is comma-separated values of the I data or the Q data.

READ Subsystem

The READ? commands are used with several other commands and are documented in the section on the “MEASure Group of Commands” on page 100.

Initiate and Read Measurement Data

:READ:<measurement>[n]?

A READ? query must specify the desired measurement. It will cause a measurement to occur without changing any of the current settings and will return any valid results. The code number n selects the kind of results that will be returned. The available measurements and data results are described in the “MEASure Group of Commands” on page 100.

SENSe Subsystem

These commands are used to set the instrument state parameters so that you can measure a particular input signal. Some SENSe commands are only for use with specific measurements found under the MEASURE key menu or the "MEASure Group of Commands" on page 100. The measurement must be active before you can use these commands.

The SCPI default for the format of any data output is ASCII. The format can be changed to binary with FORMat:DATA which transports faster over the bus.

Correction for RF Port External Attenuation

[:SENSe]:CORRection[:RF]:LOSS <rel_power>

[:SENSe]:CORRection[:RF]:LOSS?

Set the correction equal to the external attenuation used when measuring the device under test.

Factory Preset: 0 dB

Range: -50 to +50 dB

Default Unit: dB

Remarks: You must be in the Basic mode to use this command. Use INSTrument:SELect to set the mode.

Value is global to Basic mode.

Front Panel Access: **Input**, **Ext Atten**

Select the Input Signal

[:SENSe]:FEED RF|AREFerence|IFAlign

[:SENSe]:FEED?

Selects the input signal. The default input signal is taken from the front panel RF input port. For calibration and testing purposes the input signal can be taken from an internal 321.4 MHz IF alignment signal or an internal 50 MHz amplitude reference source.

RF selects the signal from the front panel RF INPUT port.

AREFerence selects the internal 50 MHz amplitude reference signal.

IFALign selects the internal, 321.4 MHz, IF alignment signal.

Factory Preset: RF

Front Panel Access: **Input, Input Port**

Center Frequency

[:SENSe]:FREQuency:CENTer <freq>

[:SENSe]:FREQuency:CENTer?

Set the center frequency.

Factory Preset: 13.255: GHz

Default Unit: Hz

Front Panel Access:

Frequency Span

[:SENSe]:FREQuency:SPAN <freq>

[:SENSe]:FREQuency:SPAN?

Set the frequency span. Setting the span to 0 Hz puts the analyzer into zero span.

NOTE In ESA instruments only, the maximum span is limited to 5MHz whenever the resolution bandwidth is set to a value of less than 1 1kHz. This limitation does not apply to PSA instruments.

Factory Preset: ESA E4401B, E4411B: 1.5 GHz
ESA E4402B, E4403B: 3.0 GHz
ESA E4404B: 6.7 GHz
ESA E4405B: 13.2 GHz
ESA E4407B, E4408B: 26.5 GHz
PSA E4443A: 6.78 GHz
PSA E4445A: 13.3 GHz
PSA E4440A: 27.0 GHz

Range: ESA E4401B, E4411B: 100 Hz to 1.58 GHz
ESA E4402B, E4403B: 100 Hz to 3.10 GHz
ESA E4404B: 100 Hz to 6.78 GHz

ESA E4405B: 100 Hz to 13.3 GHz

ESA E4407B, E4408B: 100 Hz to 27.0 GHz

PSA E4443A: 3 Hz to 6.78 GHz

PSA E4445A: 3 Hz to 13.3 GHz

PSA E4440A: 3 Hz to 27.0 GHz

Default Unit: Hz

Front Panel Access: **SPAN/X Scale, Span**

or **SPAN/X Scale, Zero Span**

RF Port Input Attenuation

[:SENSe]:POWer[:RF]:ATTenuation <rel_power>

[:SENSe]:POWer[:RF]:ATTenuation?

Set the RF input attenuator. This value is set at its auto value if input is set to auto.

Factory Preset: 0 dB

Range: 0 to 40 dB

Default Unit: dB

Front Panel Access: **Input, Input Atten**

RF Port Power Range Auto

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

[:SENSe]:POWer[:RF]:RANGe:AUTO?

Select the RF port power range to be set either automatically or manually.

ON - power range is automatically set as determined by the actual measured power level at the start of a measurement.

OFF - power range is manually set

Factory Preset: ON

Remarks: You must be in the cdmaOne, GSM, EDGE, NADC, PDC, cdma2000, W-CDMA, mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: **Input, Max Total Pwr (at UUT)**

RF Port Power Range Maximum Total Power

[:SENSe]:POWer[:RF]:RANGe[:UPPer] <power>

[:SENSe]:POWer[:RF]:RANGe[:UPPer]?

Set the maximum expected total power level at the radio unit under test. This value is ignored if RF port power range is set to auto. External attenuation required above 30 dBm.

Factory Preset: –15.0 dBm

Range: –100.0 to 80.0 dBm for EDGE, GSM

–100.0 to 27.7 dBm for cdmaOne

–200.0 to 50.0 dBm for NADC, PDC

–200.0 to 100.0 dBm for cdma2000, W-CDMA

Default Unit: dBm

Remarks: Global to the current mode. This is coupled to the RF input attenuation

You must be in the cdmaOne, GSM, EDGE, NADC, PDC, cdma2000, W-CDMA mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: **Input, Max Total Pwr (at UUT)**

Spectrum (Frequency-Domain) Measurement

Commands for querying the spectrum measurement results and for setting to the default values are found in the "MEASure Group of Commands" on page 100. The equivalent front panel keys for the parameters described in the following commands, are found under the **Meas Setup** key, after the **Spectrum (Freq Domain)** measurement has been selected from the **MEASURE** key menu.

Spectrum—Data Acquisition Packing

[:SENSe]:SPECtrum:ACQuisition:PACKing AUTO|LONG|MEDium|SHORt

[:SENSe]:SPECtrum:ACQuisition:PACKing?

Select the amount of data acquisition packing. This is an advanced control that normally does not need to be changed.

Factory Preset: AUTO

Remarks: You must be in the Basic, cdmaOne, cdma2000, W-CDMA, GSM, EDGE, NADC, or PDC mode to use this command. Use INSTrument:SELect to set the mode.

Spectrum—ADC Dither

[:SENSe]:SPECtrum:ADC:DITHer[:STATe] AUTO|ON|OFF|2|1|0

[:SENSe]:SPECtrum:ADC:DITHer[:STATe]?

Turn the ADC dither on or off. This is an advanced control that normally does not need to be changed.

Factory Preset: AUTO

Remarks: You must be in the Basic, cdmaOne, cdma2000, W-CDMA, GSM, EDGE, NADC, or PDC mode to use this command. Use INSTrument:SELect to set the mode.

Spectrum—ADC Range

[:SENSe]:SPECtrum:ADC:RANGe
AUTO|APEak|APLock|NONE|P0|P6|P12|P18

[:SENSe]:SPECtrum:ADC:RANGe?

Select the range for the gain-ranging that is done in front of the ADC. This is an advanced control that normally does not need to be changed. Auto peak ranging is the default for this measurement. If you are measuring a CW signal please see the description below.

- AUTO - automatic range

  For FFT spectrums - auto ranging should not be not be used. An exception to this would be if you know that your signal is “bursty”. Then you might use auto to maximize the time domain dynamic range as long as you are not very interested in the FFT data.

- Auto Peak (APEak) - automatically peak the range

  For CW signals, the default of auto-peak ranging can be used, but a better FFT measurement of the signal can be made by selecting one of the manual ranges that are available: P0 - P18.
  Auto peaking can cause the ADC range gain to move monotonically down during the data capture. This movement should have negligible effect on the FFT spectrum, but selecting a manual range removes this possibility. Note that if the CW signal being measured is close to the auto-ranging threshold, the noise floor may shift as much as 6 dB from sweep to sweep.

- Auto Peak Lock (APLock) - automatically peak lock the range

  For CW signals, auto-peak lock ranging may be used. It will find the best ADC measurement range for this particular signal and will not move the range as auto-peak can. Note that if the CW signal being measured is close to the auto-ranging threshold, the noise floor may shift as much as 6 dB from sweep to sweep.
  For “bursty” signals, auto-peak lock ranging should not be used. The measurement will fail to operate, since the wrong (locked) ADC range will be chosen often and overloads will occur in the ADC.

- P0 to 18 - manually selects ADC ranges that add 0 to 18dB of fixed gain across the range. Manual ranging is best for CW signals.

Factory Preset: APEak

Remarks: You must be in the Basic, cdmaOne, cdma2000, W-CDMA, GSM, EDGE, NADC, or PDC mode to use this command. Use INSTrument:SELect to set the mode.

Spectrum—Average Clear

[:SENSe]:SPECtrum:AVERage:CLEar

The average data is cleared and the average counter is reset.

Remarks: You must be in the Basic, cdmaOne, cdma2000, W-CDMA, GSM, EDGE, NADC, or PDC mode to use this command. Use INSTrument:SELect to set the mode.

Spectrum—Number of Averages

[:SENSe]:SPECtrum:AVERage:COUNt <integer>

[:SENSe]:SPECtrum:AVERage:COUNt?

Set the number of 'sweeps' that will be averaged. After the specified number of 'sweeps' (average counts), the averaging mode (terminal control) setting determines the averaging action.

Factory Preset: 25

Range: 1 to 10,000

Remarks: You must be in the Basic, cdmaOne, cdma2000, W-CDMA, GSM, EDGE, NADC, or PDC mode to use this command. Use INSTrument:SELect to set the mode.

Spectrum—Averaging State

[:SENSe]:SPECtrum:AVERage[:STATe] OFF|ON|0|1

[:SENSe]:SPECtrum:AVERage[:STATe]?

Turn averaging on or off.

Factory Preset: ON

Remarks: You must be in the Basic, cdmaOne, cdma2000, W-CDMA, GSM, EDGE, NADC, or PDC mode to use this command. Use INSTrument:SELect to set the mode.

Spectrum—Averaging Mode

[:SENSe]:SPECtrum:AVERage:TCONtrol EXPonential|REPeat

[:SENSe]:SPECtrum:AVERage:TCONtrol?

Select the type of termination control used for the averaging function. This determines the averaging action after the specified number of 'sweeps' (average count) is reached.

EXPonential - Each successive data acquisition after the average count is reached, is exponentially weighted and combined with the existing average.

REPeat - After reaching the average count, the averaging is reset and a new average is started.

Factory Preset: EXPonential

Remarks: You must be in the Basic, cdmaOne, cdma2000, W-CDMA, GSM, EDGE, NADC, or PDC mode to use this command. Use INSTrument:SELect to set the mode.

Spectrum—Averaging Type

[:SENSe]:SPECtrum:AVERage:TYPE LOG|MAXimum|MINimum|RMS|SCALar

[:SENSe]:SPECtrum:AVERage:TYPE?

Select the type of averaging.

LOG – The log of the power is averaged. (This is also known as video averaging.)

MAXimum – The maximum values are retained.

MINimum – The minimum values are retained.

RMS – The power is averaged, providing the rms of the voltage.

SCALar – The voltage is averaged.

Factory Preset: LOG

Remarks: You must be in the Basic, cdmaOne, cdma2000, W-CDMA, GSM, EDGE, NADC, or PDC mode to use this command. Use INSTrument:SELect to set the mode.

Spectrum— Select Pre-FFT Bandwidth

[:SENSe]:SPECtrum:BANDwidth|BWIDth:IF:AUTO OFF|ON|0|1

[:SENSe]:SPECtrum:BANDwidth|BWIDth:IF:AUTO?

Select auto or manual control of the pre-FFT BW.

Factory Preset: AUTO, 1.55 MHz

Remarks: You must be in the Basic, cdmaOne, cdma2000, W-CDMA, GSM, EDGE, NADC, or PDC mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: **Measure**, **Spectrum**, **Meas Setup**, **More**, **Advanced**, **Pre-FFT BW**.

Spectrum — IF Flatness Corrections

[:SENSe]:SPECtrum:BANDwidth|BWIDth:IF:FLATness OFF|ON|0|1

[:SENSe]:SPECtrum:BANDwidth|BWIDth:IF:FLATness?

Turns IF flatness corrections on and off.

Factory Preset: ON

Remarks: You must be in the Basic, cdmaOne, cdma2000, W-CDMA, GSM, EDGE, NADC, or PDC mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: **Measure**, **Spectrum**, **Meas Setup**, **More**, **Advanced**, **Pre-FFT BW**

Spectrum—Pre-ADC Bandpass Filter

[:SENSe]:SPECtrum:BANDwidth|BWIDth:PADC OFF|ON|0|1

[:SENSe]:SPECtrum:BANDwidth|BWIDth:PADC?

Turn the pre-ADC bandpass filter on or off. This is an advanced control that normally does not need to be changed.

Remarks: You must be in the Basic, cdmaOne, cdma2000, W-CDMA, GSM, EDGE, NADC, or PDC mode to use this command. Use INSTrument:SELect to set the mode.

Spectrum—Pre-FFT BW

[:SENSe]:SPECtrum:BANDwidth|BWIDth:PFFT[:SIZE] <freq>

[:SENSe]:SPECtrum:BANDwidth|BWIDth:PFFT[:SIZE]?

Set the pre-FFT bandwidth. This is an advanced control that normally does not need to be changed.

Frequency span, resolution bandwidth, and the pre-FFT bandwidth settings are normally coupled. If you are not auto-coupled, there can be combinations of these settings that are not valid.

Factory Preset: 1.55 MHz

1.25 MHz for cdmaOne

Range: 1 Hz to 10.0 MHz

Remarks: You must be in the Basic, cdmaOne, cdma2000, W-CDMA, GSM, EDGE, NADC, or PDC mode to use this command. Use INSTrument:SELect to set the mode.

Spectrum—Pre-FFT BW Filter Type

[:SENSe]:SPECtrum:BANDwidth|BWIDth:PFFT:TYPE FLAT|GAUSsian

[:SENSe]:SPECtrum:BANDwidth|BWIDth:PFFT:TYPE?

Select the type of pre-FFT filter that is used. This is an advanced control that normally does not need to be changed.

Flat top (FLAT)- a filter with a flat amplitude response, which provides the best amplitude accuracy.

GAUSsian - a filter with Gaussian characteristics, which provides the best pulse response.

Factory Preset: FLAT

Remarks: You must be in the Basic, cdmaOne, cdma2000, W-CDMA, GSM, EDGE, NADC, or PDC mode to use this command. Use INSTrument:SELect to set the mode.

Spectrum—Resolution BW

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

[:SENSe]:SPECtrum:BANDwidth|BWIDth[:RESolution]?

Set the resolution bandwidth for the FFT. This is the bandwidth used for resolving the FFT measurement. It is not the pre-FFT bandwidth. This value is ignored if the function is auto-coupled.

Frequency span, resolution bandwidth, and the pre-FFT bandwidth settings are normally coupled. If you are not auto-coupled, there can be combinations of these settings that are not valid.

Factory Preset: 20.0 kHz

Range: 0.10 Hz to 3.0 MHz

Remarks: You must be in the Basic, cdmaOne, cdma2000, W-CDMA, GSM, EDGE, NADC, or PDC mode to use this command. Use INSTrument:SELect to set the mode.

Spectrum—Resolution BW Auto

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

[:SENSe]:SPECtrum:BANDwidth|BWIDth[:RESolution]:AUTO?

Select auto or manual control of the resolution BW. The automatic mode couples the resolution bandwidth setting to the frequency span.

Factory Preset: ON

Remarks: You must be in the Basic, cdmaOne, cdma2000, W-CDMA, GSM, EDGE, NADC, or PDC mode to use this command. Use INSTrument:SELect to set the mode.

Decimation of Spectrum Display

[:SENSe]:SPECtrum:DECimate[:FACTor] <integer>

[:SENSe]:SPECtrum:DECimate[:FACTor]?

Sets the amount of data decimation done by the hardware and/or the software. Decimation by n keeps every nth sample, throwing away each of the remaining samples in the group of n. For example, decimation by 3 keeps every third sample, throwing away the two in between. Similarly, decimation by 5 keeps every fifth sample, throwing away the four in between.

Using zero (0) decimation selects the automatic mode. The measurement will then automatically choose decimation by “1” or “2” as is appropriate for the bandwidth being used.

This is an advanced control that normally does not need to be changed.

Factory Preset: 0

Range: 0 to 1,000, where 0 sets the function to automatic

Remarks: You must be in the Basic, cdmaOne, cdma2000, W-CDMA, GSM, EDGE, NADC, or PDC mode to use this command. Use INSTrument:SELect to set the mode.

Spectrum—FFT Length

[:SENSe]:SPECtrum:FFT:LENGth <integer>

[:SENSe]:SPECtrum:FFT:LENGth?

Set the FFT length. This value is only used if length control is set to manual. The value must be greater than or equal to the window length value. Any amount greater than the window length is implemented by zero-padding. This is an advanced control that normally does not need to be changed.

Factory Preset: 706

Range: min, depends on the current setting of the spectrum window length

max, 1,048,576

Remarks: You must be in the Basic, cdmaOne, cdma2000, W-CDMA, GSM, EDGE, NADC, or PDC mode to use this command. Use INSTrument:SELect to set the mode.

Spectrum—FFT Length Auto

[:SENSe]:SPECtrum:FFT:LENGth:AUTO OFF|ON|0|1

[:SENSe]:SPECtrum:FFT:LENGth:AUTO?

Select auto or manual control of the FFT and window lengths.

This is an advanced control that normally does not need to be changed.

On - the window lengths are coupled to resolution bandwidth, window type (FFT), pre-FFT bandwidth (sample rate) and SENSe:SPECtrum:FFT:RBWPoints.

Off - lets you set SENSe:SPECtrum:FFT:LENGth and SENSe:SPECtrum:FFT:WINDow:LENGth.

Factory Preset: ON

Remarks: You must be in the Basic, cdmaOne, cdma2000, W-CDMA, GSM, EDGE, NADC, or PDC mode to use this command. Use INSTrument:SELect to set the mode.

Spectrum—FFT Minimum Points in Resolution BW

[:SENSe]:SPECtrum:FFT:RBWPoints <real>

[:SENSe]:SPECtrum:FFT:RBWPoints?

Set the minimum number of data points that will be used inside the resolution bandwidth. The value is ignored if length control is set to manual. This is an advanced control that normally does not need to be changed.

Factory Preset: 1.30

Range: 0.1 to 100

Remarks: You must be in the Basic, cdmaOne, cdma2000, W-CDMA, GSM, EDGE, NADC, or PDC mode to use this command. Use INSTrument:SELect to set the mode.

Spectrum—Window Delay

[:SENSe]:SPECtrum:FFT:WINDow:DELay <real>

[:SENSe]:SPECtrum:FFT:WINDow:DELay?

Set the FFT window delay to move the FFT window from its nominal position of being centered within the time capture. This function is not available from the front panel. It is an advanced control that normally does not need to be changed.

Factory Preset: 0

Range: –10.0 to +10.0s

Default Unit: seconds

Remarks: You must be in the Basic, cdmaOne, cdma2000, W-CDMA, GSM, EDGE, NADC, or PDC mode to use this command. Use INSTrument:SELect to set the mode.

Spectrum—Window Length

[:SENSe]:SPECtrum:FFT:WINDow:LENGth <integer>

[:SENSe]:SPECtrum:FFT:WINDow:LENGth?

Set the FFT window length. This value is only used if length control is set to manual. This is an advanced control that normally does not need to be changed.

Factory Preset: 706

Range: 8 to 1,048,576

Remarks: You must be in the Basic, cdmaOne, cdma2000, W-CDMA, GSM, EDGE, NADC, or PDC mode to use this command. Use INSTrument:SELect to set the mode.

Spectrum—FFT Window

[:SENSe]:SPECtrum:FFT:WINDow[:TYPE] BH4Tap|BLACkman|FLATtop|GAUSsian|HAMMing|HANNing|KB70|KB90|KB110|UNIForm

[:SENSe]:SPECtrum:FFT:WINDow[:TYPE]?

Select the FFT window type.

BH4Tap - Blackman Harris with 4 taps

BLACkman - Blackman

FLATtop - flat top, the default (for high amplitude accuracy)

GAUSsian - Gaussian with alpha of 3.5

HAMMing - Hamming

HANNing - Hanning

KB70, 90, and 110 - Kaiser Bessel with sidelobes at –70, –90, or –110 dBc

UNIForm - no window is used. (This is the unity response.)

Factory Preset: FLATtop

Remarks: This selection affects the acquisition point quantity and the FFT size, based on the resolution bandwidth selected.

You must be in the Basic, cdmaOne, cdma2000, W-CDMA, GSM, EDGE, NADC, or PDC mode to use this command. Use INSTrument:SELect to set the mode.

Spectrum—Frequency Span

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

[:SENSe]:SPECtrum:FREQuency:SPAN?

Set the frequency span to be measured.

Factory Preset: 1.0 MHz

Range: 10 Hz to 10.0 MHz (15 MHz when Service mode is selected)

Default Unit: Hz

Remarks: The actual measured span will generally be slightly wider due to the finite resolution of the FFT.

You must be in the Basic, cdmaOne, cdma2000, W-CDMA, GSM, EDGE, NADC, or PDC mode to use this command. Use INSTrument:SELect to set the mode.

Spectrum—Sweep (Acquisition) Time

[:SENSe]:SPECtrum:SWEep:TIME[:VALue] <time>

[:SENSe]:SPECtrum:SWEep:TIME?

Set the sweep (measurement acquisition) time. It is used to specify the length of the time capture record. If the value you specifiy is less than the capture time required for the specified span and resolution bandwidth, the value is ignored. The value is set at its auto value when auto is selected. This is an advanced control that normally does not need to be changed.

Factory Preset: 188.0 µs

Range: 100 ns to 10 s

Default Unit: seconds

Remarks: You must be in the Basic, cdmaOne, cdma2000, W-CDMA, GSM, EDGE, NADC, or PDC mode to use this command. Use INSTrument:SELect to set the mode.

Spectrum—Sweep (Acquisition) Time Auto

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

[:SENSe]:SPECtrum:SWEep:TIME:AUTO

Select auto or manual control of the sweep (acquisition) time. This is an advanced control that normally does not need to be changed.

AUTO - couples the Sweep Time to the Frequency Span and Resolution BW

Manual - the Sweep Time is uncoupled from the Frequency Span and Resolution BW.

Factory Preset: AUTO

Remarks: You must be in the Basic, cdmaOne, cdma2000, W-CDMA, GSM, EDGE, NADC, or PDC mode to use this command. Use INSTrument:SELect to set the mode.

Spectrum—Trigger Source

[:SENSe]:SPECtrum:TRIGger:SOURce EXTernal[1]|EXTernal2|FRAMe|IF|LINE|IMMediate|RFBurst

[:SENSe]:SPECtrum:TRIGger:SOURce?

Select the trigger source used to control the data acquisitions.

EXTernal1 - front panel external trigger input

EXTernal2 - rear panel external trigger input

FRAMe - internal frame timer from front panel input

IF - internal IF envelope (video) trigger

LINE - internal line trigger

IMMediate - the next data acquisition is immediately taken (also called free run)

RFBurst - wideband RF burst envelope trigger that has automatic level control for periodic burst signals

Factory Preset: IMMediate (free run)

RFBurst, for GSM mode

Remarks: You must be in the Basic, cdmaOne, cdma2000, W-CDMA, GSM, EDGE, NADC, or PDC mode to use this command. Use INSTrument:SELect to set the mode.

Waveform (Time-Domain) Measurement

Commands for querying the waveform measurement results and for setting to the default values are found in the "MEASure Group of Commands" on page 100. The equivalent front panel keys for the parameters described in the following commands, are found under the **Meas Setup** key, after the **Waveform (Time Domain)** measurement has been selected from the **MEASURE** key menu.

Waveform—Data Acquisition Packing

[:SENSe]:WAVeform:ACQuistion:PACKing AUTO|LONG|MEDium|SHORt

[:SENSe]:WAVeform:ACQuistion:PACKing?

This is an advanced control that normally does not need to be changed.

Factory Preset: AUTO

Remarks: You must be in the Basic, cdmaOne, cdma2000, W-CDMA, GSM, EDGE, NADC, or PDC mode to use this command. Use INSTrument:SELect to set the mode.

Waveform—ADC Dither State]

[:SENSe]:WAVeform:ADC:DITHer[:STATe] |OFF|ON|0|1

[:SENSe]:WAVeform:ADC:DITHer[:STATe]?

This is an Advanced control that normally does not need to be changed.

Factory Preset: OFF

Remarks: You must be in the Basic, cdmaOne, cdma2000, W-CDMA, GSM, EDGE, NADC, or PDC mode to use this command. Use INSTrument:SELect to set the mode.

Waveform—Pre-ADC Bandpass Filter

[:SENSe]:WAVeform:ADC:FILTer[:STATe] OFF|ON|0|1

[:SENSe]:WAVeform:ADC:FILTer[:STATe]?

Turn the pre-ADC bandpass filter on or off. This is an Advanced control that normally does not need to be changed.

Preset: OFF

Remarks: You must be in the Basic, cdmaOne, cdma2000, W-CDMA, GSM, EDGE, NADC, or PDC mode to use this command. Use INSTrument:SELect to set the mode.

Waveform—ADC Range

[:SENSe]:WAVeform:ADC:RANGe AUTO|APEak|APLock|GROund|NONE|P0|P6|P12|P18

[:SENSe]:WAVeform:ADC:RANGe?

Select the range for the gain-ranging that is done in front of the ADC. This is an Advanced control that normally does not need to be changed.

AUTO - automatic range

Auto Peak (APEak) - automatically peak the range

Auto Peak Lock (APLock)- automatically peak lock the range

GROund - ground

P0 to 18 - adds 0 to 18 dB of fixed gain across the range

Factory Preset: AUTO

Remarks: You must be in the Basic, cdmaOne, cdma2000, W-CDMA, GSM, EDGE, NADC, or PDC mode to use this command. Use INSTrument:SELect to set the mode.

Waveform - Query Aperture Setting

[:SENSe]:WAVeform:APERture?

Returns the waveform sample period (aperture) based on current resolution bandwidth, filter type, and decimation factor. Sample rate is the reciprocal of period.

Remarks: You must be in the Basic, cdmaOne, cdma2000, W-CDMA, GSM, EDGE, NADC, or PDC mode to use this command. Use INSTrument:SELect to set the mode.

Waveform—Number of Averages

[:SENSe]:WAVeform:AVERage:COUNt <integer>

[:SENSe]:WAVeform:AVERage:COUNt?

Set the number of sweeps that will be averaged. After the specified number of sweeps (average counts), the averaging mode (terminal control) setting determines the averaging action.

Factory Preset: 10

Range: 1 to 10,000

Remarks: You must be in the Basic, cdmaOne, cdma2000,

W-CDMA, GSM, EDGE, NADC, or PDC mode to use this command. Use INSTrument:SELect to set the mode.

Waveform—Averaging State

[:SENSe]:WAVeform:AVERage[:STATe] OFF|ON|0|1

[:SENSe]:WAVeform:AVERage[:STATe]?

Turn averaging on or off.

Factory Preset: OFF

Remarks: You must be in the Basic, cdmaOne, cdma2000, W-CDMA, GSM, EDGE, NADC, or PDC mode to use this command. Use INSTrument:SELect to set the mode.

Waveform—Averaging Mode

[:SENSe]:WAVeform:AVERage:TCONtrol EXPonential|REPeat

[:SENSe]:WAVeform:AVERage:TCONtrol?

Select the type of termination control used for the averaging function. This determines the averaging action after the specified number of 'sweeps' (average count) is reached.

EXPonential - Each successive data acquisition after the average count is reached, is exponentially weighted and combined with the existing average.

REPeat - After reaching the average count, the averaging is reset and a new average is started.

Factory Preset: EXPonential

Remarks: You must be in the Basic, cdmaOne, cdma2000, W-CDMA, GSM, EDGE, NADC, or PDC mode to use this command. Use INSTrument:SELect to set the mode.

Waveform—Averaging Type

[:SENSe]:WAVeform:AVERage:TYPE LOG|MAXimum|MINimum|RMS|SCALar

[:SENSe]:WAVeform:AVERage:TYPE?

Select the type of averaging.

LOG - The log of the power is averaged. (This is also known as video averaging.)

MAXimum - The maximum values are retained.

MINimum - The minimum values are retained.

RMS - The power is averaged, providing the rms of the voltage.

Factory Preset: RMS

Remarks: You must be in the Basic, cdmaOne, cdma2000, W-CDMA, GSM, EDGE, NADC, or PDC mode to use this command. Use INSTrument:SELect to set the mode.

Waveform—Resolution BW

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

[:SENSe]:WAVeform:BANDwidth|BWIDth[:RESolution]?

Set the resolution bandwidth. This value is ignored if the function is auto-coupled.

Factory Preset: 100.0 kHz for NADC, PDC, cdma2000, W-CDMA, Basic
500.0 kHz for GSM
2.0 MHz for cdmaOne

Range: 1.0 kHz to 5.0 MHz

Remarks: You must be in the Basic, cdmaOne, cdma2000, W-CDMA, GSM, EDGE, NADC, or PDC mode to use this command. Use INSTrument:SELect to set the mode.

Waveform - Query Actual Resolution Bandwidth

[:SENSe]:WAVeform:BANDwidth:RESolution]:ACTual?

Due to memory constraints the actual resolution bandwidth value may vary from the value entered by the user. For most applications the resulting difference in value is inconsequential but for some it is necessary to know the actual value; this query retrieves the actual resolution bandwidth value.

Remarks: You must be in the Basic, cdmaOne, cdma2000, W-CDMA, GSM, EDGE, NADC, or PDC mode to use this command. Use INSTrument:SELect to set the mode.

Waveform—Resolution BW Filter Type

[:SENSe]:WAVeform:BANDwidth|BWIDth[:RESolution]:TYPE FLATtop|GAUSsian

[:SENSe]:WAVeform:BANDwidth|BWIDth[:RESolution]:TYPE?

Select the type of Resolution BW filter that is used. This is an Advanced control that normally does not need to be changed.

FLATtop - a filter with a flat amplitude response, which provides the best amplitude accuracy.

GAUSsian - a filter with Gaussian characteristics, which provides the best pulse response.

Factory Preset: GAUSsian

Remarks: You must be in the Basic, cdmaOne, cdma2000, W-CDMA, GSM, EDGE, NADC, or PDC mode to use this command. Use INSTrument:SELect to set the mode.

Waveform—Decimation of Waveform Display

[:SENSe]:WAVeform:DECimate[:FACTor] <integer>

[:SENSe]:WAVeform:DECimate[:FACTor]?

Set the amount of data decimation done on the IQ data stream. For example, if 4 is selected, three out of every four data points will be thrown away. So every 4th data point will be kept.

Factory Preset: 1

Range: 1 to 4

Remarks: You must be in the Basic, cdmaOne, cdma2000, W-CDMA, GSM, EDGE, NADC, or PDC mode to use this command. Use INSTrument:SELect to set the mode.

Waveform—Control Decimation of Waveform Display

[:SENSe]:WAVeform:DECimate:STATe OFF|ON|0|1

[:SENSe]:WAVeform:DECimate:STATe?

Set the amount of data decimation done by the hardware in order to decrease the number of acquired points in a long capture time. This is the amount of data that the measurement ignores.

Factory Preset: OFF

Remarks: You must be in the Basic, cdmaOne, cdma2000, W-CDMA, GSM, EDGE, NADC, or PDC mode to use this command. Use INSTrument:SELect to set the mode.

Waveform—Sweep (Acquisition) Time

[:SENSe]:WAVeform:SWEep:TIME <time>

[:SENSe]:WAVeform:SWEep:TIME?

Set the measurement acquisition time. It is used to specify the length of the time capture record.

Factory Preset: 2.0 ms

10.0 ms, for NADC, PDC

Range: 1 µs to 100 s

Default Unit: seconds

Remarks: You must be in the Basic, cdmaOne, cdma2000, W-CDMA, GSM, EDGE, NADC, or PDC mode to use this command. Use INSTrument:SELect to set the mode.

Waveform—Trigger Source

[:SENSe]:WAVeform:TRIGger:SOURce EXTernal[1]|EXTernal2|FRAMe|IF|IMMediate|LINE|RFBurst

[:SENSe]:WAVeform:TRIGger:SOURce?

Select the trigger source used to control the data acquisitions.

EXTernal 1 - front panel external trigger input

EXTernal 2 - rear panel external trigger input

FRAMe - internal frame timer from front panel input

IF - internal IF envelope (video) trigger

IMMediate - the next data acquisition is immediately taken (also called free run)

LINE - internal line trigger

RFBurst - wideband RF burst envelope trigger that has automatic level control for periodic burst signals

Factory Preset: IMMediate (free run), for Basic, cdmaOne, NADC, PDC mode

RFBurst, for GSM mode

Remarks: You must be in the Basic, cdmaOne, cdma2000, W-CDMA, GSM, EDGE, NADC, or PDC mode to use this command. Use INSTrument:SELect to set the mode.

TRIGger Subsystem

The Trigger Subsystem is used to set the controls and parameters associated with triggering the data acquisitions. Other trigger-related commands are found in the INITiate and ABORt subsystems.

The trigger parameters are global within a selected Mode. The commands in the TRIGger subsystem set up the way the triggers function, but selection of the trigger source is made from each measurement. There is a separate trigger source command in the SENSe:<meas> subsystem for each measurement. The equivalent front panel keys for the parameters described in the following commands, can be found under the **Mode Setup, Trigger** key.

Automatic Trigger Control

:TRIGger[:SEQuence]:AUTO:STATe OFF|ON|0|1

:TRIGger[:SEQuence]:AUTO:STATe?

Turns the automatic trigger function on and off. This function causes a trigger to occur if the designated time has elapsed and no trigger occurred. It can be used with unpredictable trigger sources, like external or burst, to make sure a measurement is initiated even if a trigger doesn't occur. Use TRIGger[:SEQuence]:AUTO[:TIME] to set the time limit.

Factory Preset and *RST — Off for cdma2000, W-CDMA, NADC, and PDC

Front Panel Access — **Mode Setup, Trigger, Auto Trig**

Automatic Trigger Time

:TRIGger[:SEQuence]:AUTO[:TIME] <time>

:TRIGger[:SEQuence]:AUTO[:TIME]?

After the measurement is activated the instrument will take a data acquisition immediately upon receiving a signal from the selected trigger source. If no trigger signal is received by the end of the time specified in this command, a data acquisition is taken anyway. TRIGger[:SEQuence]:AUTO:STATE must be on.

Factory Preset: 100.0 ms

Range: 1.0 ms to 1000.0 s

0.0 to 1000.0 s for cdma2000, W-CDMA

Default Unit: seconds

External Trigger Delay

:TRIGger[:SEQuence]:EXTernal[1]|2:DELay <time>

:TRIGger[:SEQuence]:EXTernal[1]|2:DELay?

Set the trigger delay when using an external trigger. Set the trigger value to zero (0) seconds to turn off the delay.

EXT or EXT1is the front panel trigger input

EXT2 is the rear panel trigger input

Factory Preset: 0.0 s

Range: –100.0 ms to 100.0 ms

Default Unit: seconds

Front Panel Access: **Mode Setup, Trigger, Ext Rear (or Ext Front), Delay**

External Trigger Level

:TRIGger[:SEQuence]:EXTernal[1]|2:LEVel <voltage>

:TRIGger[:SEQuence]:EXTernal[1]|2:LEVel?

Set the trigger level when using an external trigger input.

EXT or EXT1is the front panel trigger input

EXT2 is the rear panel trigger input

Factory Preset: 2.0 V

Range: –5.0 to +5.0 V

Default Unit: volts

Front Panel Access: **Mode Setup, Trigger, Ext Rear, Level**

Mode Setup, Trigger, Ext Front, Level

External Trigger Slope

:TRIGger[:SEQuence]:EXTernal[1]|2:SLOPe NEGative|POSitive

:TRIGger[:SEQuence]:EXTernal[1]|2:SLOPe?

Sets the trigger slope when using an external trigger input.

EXT or EXT1is the front panel trigger input

EXT2 is the rear panel trigger input

Factory Preset: Positive

Front Panel Access: **Mode Setup, Trigger, Ext Rear (or Ext Front), Slope**

Frame Trigger Adjust

:TRIGger[:SEQuence]:FRAMe:ADJust <time>

Lets you advance the phase of the frame trigger by the specified amount. It does not change the period of the trigger waveform. If the command is sent multiple times, it advances the phase of the frame trigger more each time it is sent.

Factory Preset: 0.0 s

Range: 0.0 to 10.0 s

Default Unit: seconds

Front Panel Access: None

Frame Trigger Period

:TRIGger[:SEQuence]:FRAMe:PERiod <time>

:TRIGger[:SEQuence]:FRAMe:PERiod?

Set the frame period that you want when using the external frame timer trigger. If the traffic rate is changed, the value of the frame period is initialized to the preset value.

Factory Preset: 250.0 µs for Basic, cdmaOne

4.615383 ms, for GSM

26.666667 ms for cdma2000

10.0 ms (1 radio frame) for W-CDMA

20.0 ms with rate=full for NADC, PDC

40.0 ms with rate=half for NADC, PDC

Range: 0.0 ms to 559.0 ms for Basic, cdmaOne, GSM, cdma2000, W-CDMA

1.0 ms to 559.0 ms for NADC, PDC

Default Unit: seconds

Front Panel Access: **Mode Setup, Trigger, Frame Timer, Period**

Frame Trigger Sync Source

:TRIGger[:SEQuence]:FRAMe:SYNC EXTFront|EXTRear|OFF

:TRIGger[:SEQuence]:FRAMe:SYNC?

Selects the input port location for the external frame trigger that you are using.

Factory Preset: Off

Remarks: You must be in the Basic, cdmaOne, EDGE (w/GSM), GSM, NADC, PDC, Service mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: **Mode Setup, Trigger, Frame Timer, Sync Source**

History: Changed firmware revision A.05.00.

Frame Trigger Synchronization Offset

:TRIGger[:SEQuence]:FRAMe:SYNC:OFFSet <time>

:TRIGger[:SEQuence]:FRAMe:SYNC:OFFSet?

Lets you adjust the frame triggering with respect to the external trigger input that you are using.

Factory Preset: 0.0 s

Range: 0.0 to 10.0 s

Default Unit: seconds

Remarks: You must be in the Basic, cdmaOne, GSM, EDGE, NADC, PDC, Service mode to use this command. Use INSTrument:SELect to set the mode.

History: Revision A.03.27 or later.

Front Panel Access: **Mode Setup, Trigger, Frame Timer, Offset**

Trigger Holdoff

:TRIGger[:SEQuence]:HOLDoff <time>

:TRIGger[:SEQuence]:HOLDoff?

Set the holdoff time between triggers. After a trigger, another trigger will not be allowed until the holdoff time expires. This parameter affects all trigger sources.

Factory Preset: 0.0 s

10.0 ms for NADC or PDC

Range: 0.0 to 500.0 ms

Default Unit: seconds

Front Panel Access: **Mode Setup, Trigger, Trig Holdoff**

Video (IF) Trigger Delay

:TRIGger[:SEQuence]:IF:DELay <time>

:TRIGger[:SEQuence]:IF:DELay?

Set the trigger delay when using the IF (video) trigger (after the Resolution BW filter).

Factory Preset: 0.0 s

Range: –500.0 ms to 500.0 ms

–100.0 ms to 100.0 ms for cdma2000, W-CDMA

Default Unit: seconds

Front Panel Access: **Mode Setup, Trigger, Video (IF Envlp), Delay**

Video (IF) Trigger Level

:TRIGger[:SEQuence]:IF:LEVel <power>

:TRIGger[:SEQuence]:IF:LEVel?

Set the trigger level when using the IF (video) trigger.

Factory Preset: –6.0 dBm for cdmaOne, GSM, EDGE, Basic, cdma2000, W-CDMA

–30.0 dBm for NADC, PDC

Range: –200.0 to 50.0 dBm

Default Unit: dBm

Front Panel Access: **Mode Setup, Trigger, Video (IF Envlp), Level**

Video (IF) Trigger Slope

:TRIGger[:SEQuence]:IF:SLOPe NEGative|POSitive

:TRIGger[:SEQuence]:IF:SLOPe?

Sets the trigger slope when using the IF (video) trigger.

Factory Preset: Positive

Front Panel Access: **Mode Setup, Trigger, Video (IF Envlp), Slope**

RF Burst Trigger Delay

:TRIGger[:SEQuence]:RFBurst:DELay <time>

:TRIGger[:SEQuence]:RFBurst:DELay?

Set the trigger delay when using the RF burst (wideband) trigger.

Factory Preset: 0.0 s

Range: –500.0 ms to 500.0 ms

–100.0 ms to 500.0 ms for cdma2000, W-CDMA

Default Unit: seconds

Front Panel Access: **Mode Setup, Trigger, RF Burst, Delay**

RF Burst Trigger Level

:TRIGger[:SEQuence]:RFBurst:LEVel <rel_power>

:TRIGger[:SEQuence]:RFBurst:LEVel?

Set the trigger level when using the RF Burst (wideband) Trigger. The value is relative to the peak of the signal. RF Burst is also known as RF Envelope.

Factory Preset: –6.0 dB

Range: –25.0 to 0.0 dB

–200.0 to 0.0 dB for NADC, PDC

Default Unit: dB

Front Panel Access: **Mode Setup, Trigger, RF Burst, Peak Level**

RF Burst Trigger Slope

:TRIGger[:SEQuence]:RFBurst:SLOPe NEGative|POSitive

:TRIGger[:SEQuence]:RFBurst:SLOPe?

Set the trigger slope when using the RF Burst (wideband) Trigger.

Factory Preset: Positive

Remarks: You must be in the cdmaOne, cdma2000, W-CDMA mode to use this command. Use :INSTrument:SELect to set the mode.

Front Panel Access: **Mode Setup, Trigger, RF Burst, Slope**

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