cdmaOne Guide

Agilent Technologies PSA Series
and VSA E4406A

Option BAC

This manual provides documentation for the following instruments:

Transmitter Tester:
E4406A

Spectrum Analyzers:
E4440A (3 Hz – 26.5 GHz)
E4443A (3 Hz – 6.7 GHz)
E4445A (3 Hz – 13.2 GHz)
E4446A (3 Hz – 44.0 GHz)
E4448A (3 Hz – 50.0 GHz)

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1 Understanding cdmaOne

What Is the cdmaOne (IS-95) Communication System?

Code Division Multiple Access (CDMA) is a direct sequence spread-spectrum digital communications technique that was originally designed for military applications. The main advantages of CDMA over other types of communications schemes are:

- greater capacity than with other techniques
- immunity to signal loss and degradation in the presence of high broadband interference
- immunity to signal loss and degradation due to multipath, scatter, and fading
- power consumption of mobile stations is strictly minimized (by base station control)
- supports full 9600 baud capability for voice and data communications
- provides increased security

CDMA uses correlative codes to distinguish one user from another. Frequency division is still used, as is done with Frequency Division Multiple Access (FDMA) and Time Division Multiple Access (TDMA), but in a much larger bandwidth (1.25 MHz). CDMA uses a direct sequence spread spectrum technique that realizes increased capacity from 1:1 frequency reuse and sectored cells. The capacity limit is soft. That is, capacity can be increased with some degradation of the error rate or voice quality.

In cdmaOne, a single user's channel consists of a specific frequency combined with a unique code. Correlative codes allow each user to operate in the presence of substantial interference. The interference is the sum of all other users on the same cdmaOne frequency, both from within and without the home cell, and from delayed versions of these signals. It also includes the usual thermal noise and atmospheric disturbances. Delayed signals caused by multipath are separately received and combined in cdmaOne. One of the major differences in access, compared to a non-cdma system, is that any cdmaOne frequency can be used in all sectors of all cells. This is possible because cdmaOne is designed to decode the proper signal in the presence of high interference.

The cdmaOne communication system is defined in the following Electronics Industry Association (EIA) and Telecommunications Industry Association (TIA) documents:

TIA/EIA/ IS-95-A	Mobile Station - Base Station Compatibility Standard for Dual-Mode Wideband Spread Spectrum Cellular System

TIA/EIA-97-B	Recommended Minimum Performance Standards for Base Stations Supporting Dual-Mode Wideband Spread Spectrum Cellular Mobile Stations
TIA/EIA-98-B	Recommended Minimum Performance Standards for dual-Mode Wideband Spread Spectrum Cellular Mobile Stations

And the following American National Standards Institute (ANSI) documents:

J-STD-008	Personal Station-Base Station Compatibility Requirements for 1.8 to 2.0 GHz Code Division Multiple Access (CDMA) Personal Communications Systems
J-STD-018	Recommended Minimum Performance Requirements for 1.8 to 2.0 GHz Code Division Multiple Access (CDMA) Personal Stations
J-STD-019	Recommended Minimum Performance Requirements for Base Stations Supporting 1.8 to 2.0 GHz Code Division Multiple Access (CDMA) Personal Stations

What Does the Agilent PSA Series or VSA E4406A Do?

This instrument can help determine if a cdmaOne transmitter is working correctly. When configured for cdmaOne, the instrument can be used for the testing of a cdmaOne transmitter, according to the Electronics Industry Association and Telecommunications Industry Association TIA/EIA-95B, TIA/EIA-97C, and TIA/EIA-98C documents. These documents define complex, multi-part measurements used to maintain an interference-free environment. For example, the documents include measuring the power of a carrier. This instrument automatically makes measurements using the measurement methods and limits defined in the standards. The detailed results displayed by the measurements allow you to analyze cdmaOne system performance. You may alter the measurement parameters for specialized analysis.

For infrastructure test, the instrument will test base station transmitters in a non-interfering manner by means of a coupler or power splitter.

This instrument makes the following measurements:

- ☐ Channel Power
- ☐ Modulation Accuracy (Rho)
- ☐ Spurious Close
- ☐ Code Domain - power, timing, and phase
- ☐ Spectrum (Frequency Domain)
- ☐ Waveform (Time Domain)
- ☐ ACPR (Adjacent Channel Power Ratio)

Other Sources of Measurement Information

Additional measurement application information is available through your local Agilent sales and service office. The following application notes treat digital communications measurements in much greater detail than discussed in this measurement guide.

- Digital Modulation in Communications Systems - An Introduction
  Application Note 1298
  Part number 5965-7160E
- Understanding CDMA Measurements for Base Stations and Their Components
  Application Note 1311
  Part number 5968-0953E
- HPSK Spreading for 3GPP
  Application Note 1335
  Part number 5968-8438E
- 3GPP W-CDMA - User Equipment
  Application Note
  Part number 5980-1238E
- 3GPP W-CDMA - Base Stations
  Application Note
  Part number 5980-1239E
- Designing and Testing cdma2000 Base Stations
  Application Note 1357
  Part number 5980-1303E
- Characterizing Digitally Modulated Signals with CCDF Curves
  Application Note
  Part number 5968-6875E
- E4406A Self-Guided Demo
  Product Note
  Part number 5968-7617E

Instrument Updates at http://www.agilent.com

These web locations can be used to access the latest information about the instrument, including the latest firmware version.

http://www.agilent.com/find/vsa

http://www.agilent.com/find/psa

2 Setting Up the Mode

Accessing the Mode

To access the cdmaOne measurement personality, press the **MODE** key and select the **cdmaOne** key. As there are some differences between the Agilent PSA series spectrum analyzer and the E4406A VSA transmitter tester from the general design philosophies, make sure which instrument you are using to make tests.

- **For PSA** - At initial power up, the spectrum analyzer will come up in the Spectrum Analysis mode with default measurement conditions.

  To access the measurement personality that includes EDGE and GSM, press the **MODE** key and select the **GSM w/EDGE** key.

NOTE Pressing the **Preset** key does not switch instrument modes, if the **Mode** type of preset is selected under **System**, **Power On/Preset**. Pressing the **Preset** key does not return the instrument to factory default parameters if the **User** type of preset has been selected under **System**.

- **For E4406A** - At initial power up, the transmitter tester will come up in the Basic mode, with the Spectrum (Frequency Domain) measurement selected and the Measure menu displayed.

  To access the GSM measurement personality, press the **MODE** key and select the **GSM** key.

  To access the measurement personality that includes EDGE and GSM, press the **MODE** key and select the **EDGE w/GSM** key.

- **For Both Instruments** - 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 measurements to the factory default parameters.

  You may want to install a new personality, reinstall a personality that you have previously uninstalled, 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 `Basic Mode` (for

E4406A), or the `Spectrum Analysis Mode` (for PSA) measurement capabilities. It also has optional measurement personalities that make measurements based on established industry standards.

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

1. Press **MODE** to select a 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 selecting the mode, make any required adjustments to the mode settings by pressing **Mode Setup**.
2. Press **MEASURE** to select a specific measurement to be performed, like ACP, Channel Power, or EVM, and so forth. After selection of your measurement, make any required adjustments to the measurement settings by pressing **Meas Setup**.

   Depending on the current settings of **Meas Control**, the instrument will begin making the selected measurements. The resulting data will be shown on the display or available for export.
3. Press **Trace/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” section 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** (E4406A), **Input/Output** (PSA), **FREQUENCY Channel**	**System**
2. Select & setup a measurement	**MEASURE**	**Meas Setup**	**Meas Control**, **Restart**
3. Select & setup a view	**View/Trace** (E4406A), **Trace/View** (PSA)	**SPAN X Scale**, **AMPLITUDE Y Scale**, **Display**, **Next Window**, **Zoom**	**File**, **Save**, **Print**, **Print Setup**, **Marker**, **Search** (E4406A), **PeakSearch** (PSA)

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.

Configuring the Radio Setting

The **Radio** key accesses the following menu to select a radio system, band class, and device to be tested:

- **Radio Std** - Select one of the radio standards to be tested:
  - **IS-95A** - Sets to the standard of IS-95A system.
  - **J-STD-008** - Sets to the standard of J-STD-008 system.
  - **IS-97D IS-98D** - Sets to the standards of IS-97D and IS-98D systems.
- **Band Class** - Select one of the band classes to be tested, when **Radio Std** is set to **IS-97D IS-98D**.
  - **0 (800MHz)** - Sets the band class to 0 for testing the North American and Korean cellular systems.
  - **1 (1900 MHz)** - Sets the band class to 1 for testing the North American PCS system.
  - **3 (JTACS)** - Sets the band class to 3 for testing the Japan TACS system.
  - **4 (Korean PCS)** - Sets the band class to 4 for testing the Korean PCS system.
- **Device** - Select either **Base** or **Mobile** to be tested.

The following table lists the factory default settings for **Radio**.

Radio Default Settings	
Radio STD	IS-95A
Band Class (grayed out)	0 (800 MHz)
Device	Base

Configuring the Input Condition

The **Input** key accesses the menu as follows: (You can also access this menu from the **Input/Output** front-panel key.)

- **Input Port** - Allows you to access the menu to select one of the signal input ports as follows:
  - **RF** - Allows you to measure an RF signal supplied to the front panel RF input port.
  - **50 MHz Ref** - (For E4406A) Allows you to measure the **50 MHz Reference** signal to calibrate the instrument.
  - **Amptd Ref (f=50 MHz)** - (For PSA) Allows you to measure the 50 MHz reference signal to calibrate the instrument.

- **IF Align** - Allows you to configure the IF alignment signal. The RF path is switched to bring in the same alignment signal that is automatically switched to perform many alignments.

- **RF Input Range** - Allows you to toggle the RF input range control between **Auto** and **Man** (manual). If **Auto** is chosen, the instrument automatically sets the attenuation based on the carrier power level, where it is tuned. Once you change the **Max Total Pwr** or **RF Input Atten** value with the RPG knob, for example, the **RF Input Range** key is automatically set to **Man**. If there are multiple carriers present, the total power might overdrive the front end. In this case you need to set the **RF Input Range** to **Man** and enter the expected maximum total power by activating the **Max Total Pwr** key. **Man** is also useful to hold the input attenuation constant for the best relative power accuracy. For single carriers it is generally recommended to set this to **Auto**.

- **Max Total Pwr** - Allows you to set the maximum total power level from the UUT (Unit Under Test). The range is –200.00 to 100.00 dBm with 0.01 dB resolution. This is the expected maximum value of the mean carrier power referenced to the output of the UUT; it may include multiple carriers. The **Max Total Pwr** setting is coupled together with the **Input Atten** and **Ext Atten** settings. Once you change the **Max Total Pwr** value with the RPG knob, for example, the **Input Range** key is automatically set to **Man**.

- **Input Atten** - Allows you to control the internal input attenuator setting. The range is 0 to 40 dB with 1 dB resolution. The **Input Atten** key reads out the actual hardware value that is used for the current measurement. If more than one input attenuation value is used in a single measurement, the value used at the carrier frequency will be displayed. The **Input Atten** setting is coupled to the **Max Total Pwr** setting. Once you change the **Input Atten** setting with the RPG knob, for example, the **Input Range** key is automatically set to **Man**.

- **Ext RF Atten** - Allows you to access the following menu to enter the external attenuation values. Either of the **Ext RF Atten** settings is coupled together with the **RF Input Range** setting. However, pressing **Ext RF Atten** does not switch the **RF Input Range** key to **Man**. This will allow the instrument to display the measurement results referenced to the output of the UUT.

  - **MS** - Allows you to set an external attenuation value for MS tests. The range is –50.00 to +50.00 dB with 0.01 dB resolution.

  - **BTS** - Allows you to set an external attenuation value for BTS tests. The range is –50.00 to +50.00 dB with 0.01 dB resolution.

- **IF Align Signal** - Allows you to access the following menu to select one of the signals to be used for IF alignment.

  - **Signal Rate** - Allows you to set a value to be used for dividing the fundamental frequency of 468.75 kHz. The value ranges from 0 to

12 as the power of 2.

- **Signal Amptd** - Allows you to set an amplitude value to be applied to the digital analog converter, for the IF alignment signal. The value ranges from 0 to 4095.
- **Signal Type** - Allows you to access the following menu to select one of the signal types.
  - ☐ **CW** - Sets the IF alignment signal to CW.
  - ☐ **Comb** - Sets the IF alignment signal to comb wave.
  - ☐ **Pulse** - Sets the IF alignment signal to pulse wave.

The following table lists the factory default setting for Input.

Input Default Settings	
Input Port	RF
RF Input Range	Auto[a]
Max Total Power	–15.00 dBm[b]
Input Atten	0.00 dB[b]
Ext Atten Mobile Base	 0.00 dB 0.00 dB
IF Align Signal Signal Rate Signal Amptd Signal Type	 0 (= 468.75 kHz) DAC 500 CW

[a] Auto is not used for Spectrum (frequency domain) measurements.

[b] This may differ if the maximum input power is more than –15.00 dBm, or depending on the previous measurements.

Configuring the Trigger

The **Trigger** key allows you:

(1) to access the trigger selection menu to specify each triggering condition,

(2) to modify the default trigger holdoff time using the **Trig Holdoff** key,

(3) to modify the auto trigger time and to activate or deactivate the auto trigger feature using the **Auto Trig** key, and

(4) to modify the period of the frame timer using the **Frame Timer** key.

NOTE The actual trigger source is selected individually for each measurement under the **Meas Setup** key.

- **RF Burst**, **Video (Envlp)**, **Ext Front**, **Ext Rear**- Pressing one of these trigger keys will access each triggering condition setup menu. This menu is used to specify the **Delay**, **Level** and **Slope** settings for each trigger source as follows:
  - **Delay** - Allows you to enter a numerical value to modify the trigger delay time. The range is –100.0 to +500.0 ms with 1 µs resolution. For trigger delay use a positive value, and for pre-trigger use a negative value.
  - **Level** - Allows you to enter a numerical value to adjust the trigger level depending on the trigger source selected.

    For **RF Burst**, the key label reads as **Peak Level**. The RF level range is –25.00 to 0.00 dB with 0.01 dB resolution, relative to the peak RF signal level. The realistic range can be down to –20 dB.

    For **Video (Envlp)**, the video level range is –200.00 to +50.00 dBm with 0.01 dB resolution at the RF input. The realistic range can be down to around –50 dBm depending on the noise floor level of the input signal.

    For **Ext Front** or **Ext Rear**, the level range is –5.00 to +5.00 V with 1 or 10 mV resolution.
  - **Slope** - Allows you to toggle the trigger slope between **Pos** at the positive-going edge and **Neg** at the negative-going edge of the burst signal.

There are other keys under the **Trigger** key as follows:

- **Trig Holdoff** - Allows you to set the period of time before the next trigger can occur. The range is 0.000 µs to 500.0 ms with 1 µs resolution.
- **Auto Trig** - Allows you to specify a time for a trigger timeout and toggle the auto trigger function between **On** and **Off**. The range is 1.000 ms to 1.000 ks with 1 µs resolution. If no trigger occurs by the specified time, a trigger is automatically generated.
- **Frame Timer** - Allows you to access the menu to manually control the frame timer:
  - **Period** - Allows you to set the period of the frame clock. The range is 0.000 ns to 559.0000 ms with 1 ps resolution.
  - **Offset** - Allows you to set the offset of the frame clock. The range is 0.000 to 10.00 s with 100 ns resolution over 1.000 µs range.
  - **Reset Offset Display** - Allows you to display without any offset of

the frame clock.

— **Sync Source** - Allows you to access the menu to select one of the sources to be synchronized with.

  - ☐ **Off** - Allows you to turn the synchronizing source off for asynchronous tests.
  - ☐ **RF Burst (Wideband)** - Allows you to select the RF burst signal as the synchronizing source.
  - ☐ **Ext Front** - Allows you to select the external input signal from the front-panel input port as the synchronizing source.
  - ☐ **Ext Rear** - Allows you to select the external input signal from the rear panel input port as the synchronizing source.

The trigger default settings are listed in the following table:

Trigger Default Settings	
RF Burst Delay Peak Level Slope	 0.000 s –6.00 dB Pos
Video (Envlp) Delay Level Slope	 0.000 s –6.00 dBm Pos
Ext Front Delay Level Slope	 0.000 s 2.00 V Pos
Ext Rear Delay Level Slope	 0.000 s 2.00 V Pos
Trig Holdoff	0.000 s
Auto Trig	100.0 ms; Off
Frame Timer Period Offset Reset Offset Display Sync Source	 250.0 µs 0.000 s (no parameter) Off

Configuring the Demodulation

The **Demod** key allows you to configure the synchronization signal selection and to make measurements on base stations with either the single carrier signal or the multiple carrier signal. This is effective for the code domain and modulation accuracy measurements.

- **Sync Type** - Allows you to select the type of synchronization used for the demodulation.
  - **Even Sec** - Sets to synchronize to the internal frame timer that has been synchronized to an even second clock input. The frame timer has a 26.6667 ms period. This input signal is connected to the rear-panel TRIGGER IN connector.
  - **Pilot Seq** - Sets to synchronize to the pilot sequence on the RF channel. As this does not provide an absolute time reference, the measured time offset value will not be valid.
  - **Ext Front** - Sets to directly synchronize to an external signal connected to the front-panel EXT TRIGGER INPUT connector.
  - **Ext Rear** - Sets to directly synchronize to an external signal connected to the rear-panel TRIGGER IN connector.
  - **None** - Sets to use no synchronization signal.
- **PN Offset** - Allows you to enter the PN offset of the base station being tested. This allows correct time offset values to be determined. This setting is not applicable when **Sync Type** is set to **Pilot Seq**.
- **RF Carrier** - Allows you to select **Single** if there is a single RF carrier present at the RF input signal, or **Multi** if there is more than one carrier present at the RF input signal which rejects the upper and lower adjacent channels for the modulation accuracy and code domain measurements.

The following table lists the factory default settings for the demodulation.

Demod Default Settings	
Sync Type	Even Sec (Rear Trig In)
PN Offset	0 × 64 [chips]
RF Carrier	Single

Changing the Frequency Channel

After selecting the desired mode setup, you will need to select the desired center frequency and PN offset. The selections made here will apply to all measurements in the mode. Press the **FREQUENCY Channel** key to access the following softkeys:

- **Channel Number >** - Allows you to enter a channel value. This channel number and **Center Freq** are coupled together, then the frequency value automatically changes to the corresponding value for that channel number. The ranges are from 1 to 799 and 991 to 1023.

- **Center Freq** - Allows you to enter a frequency value. This center frequency and **Channel Number >** are coupled together, then the channel number automatically changes to the corresponding value for the specific frequency value in the ranges of 870.030 MHz to 893.970 MHz and 824.040 MHz to 835.000 MHz. This is the current instrument center frequency value. The overall frequency range without coupling function is 1.000 kHz to 4.32140 GHz.

FREQUENCY Channel Default Settings	
Channel Number	>799
Center Frequency	1.00000 GHz
PN Offset	0 × 64[chips]

cdmaOne Measurement Key Flow

The key flow diagrams, shown in a hierarchical manner on the following pages, will help the user to 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:

“Mode Setup/FREQUENCY Channel Key Flow (1 of 2)” on page 38

“Channel Power Measurement Key Flow” on page 40

“Modulation Accuracy (Rho) Measurement Key Flow” on page 41

“Code Domain Measurement Key Flow (1 of 2)” on page 42

“Spur Close Measurement Key Flow” on page 44

“Spectrum (Freq Domain) Measurement Key Flow (1 of 3)” on page 45

“Waveform (Time Domain) Measurement Key Flow (1 of 2)” on page 48

“ACPR Measurement Key Flow (1 of 2)” on page 50

Use these flow diagrams as follows:

- There are some basic conventions:

Meas Setup	An oval represents one of the front-panel keys.
I/Q Error (Quad View)	This box represents one of the softkeys displayed.
<Bot for EVM>	This represents an explanatory description on its specific key.
Avg Number 20 On|Off	This box represents one of the default condition softkeys displayed. Default conditions are shown as much as possible with underlined parameters or values displayed on those softkey labels.

- Follow the measurement diagram from left to right and top to bottom.
- A single softkey may allow multiple choices. For example; the **Device** softkey reveals two choices, **Base** or **Mobile**. The underlined choice is the current state of the instrument. To change choices, press the softkey one time.
- When entering a numeric value of **FREQUENCY**, for example, use the numeric keypad and terminate the entry with the appropriate unit selection from the softkeys displayed.
- When entering a numeric value of **Slot (Std)**, for example, use the numeric keypad and terminate with the **Enter** front-panel key.
- Instead of using the numeric keypad to enter a value, it may be easier to use the RPG knob or **Up/Down** keys.

Figure 2-1 Mode Setup/FREQUENCY Channel Key Flow (1 of 2)

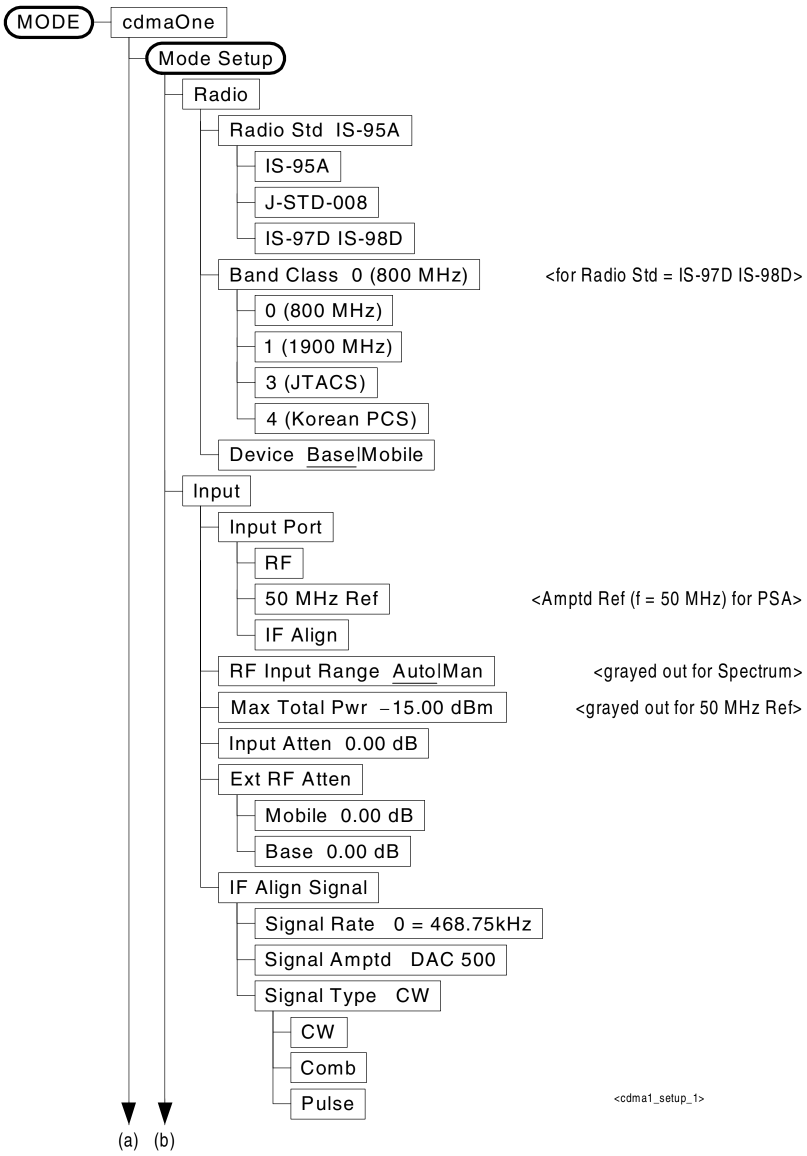


Figure 2-2 **Mode Setup/FREQUENCY Channel Key Flow (2 of 2)**

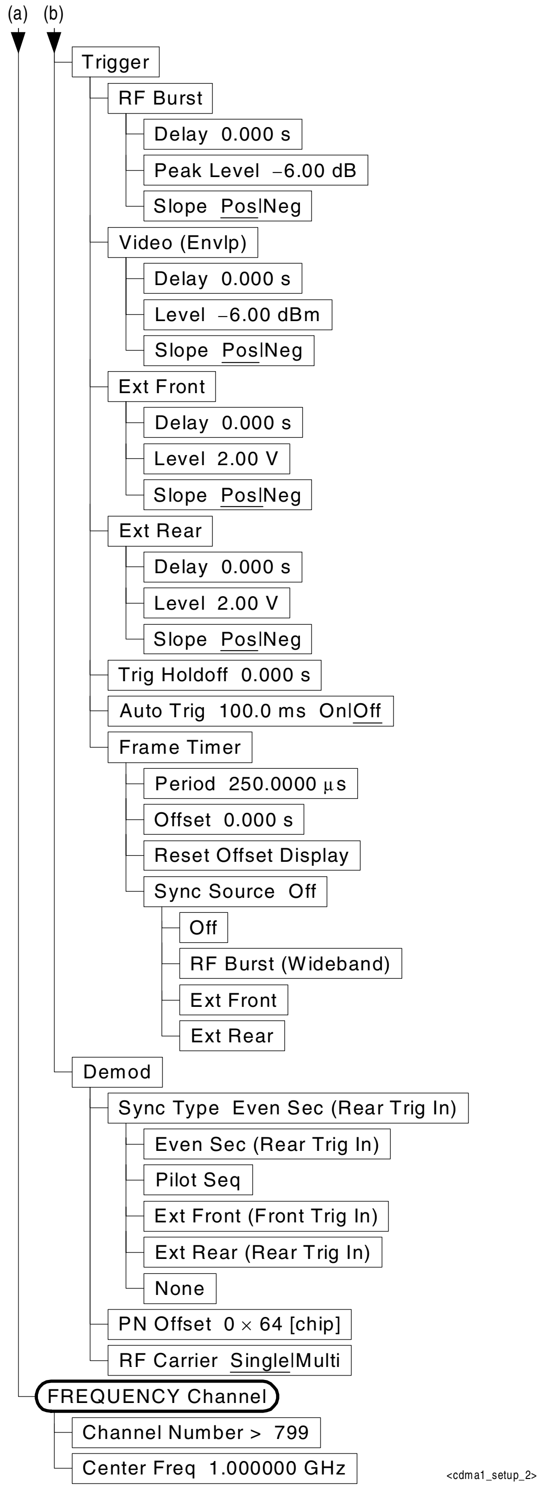


Figure 2-3 **Channel Power Measurement Key Flow**

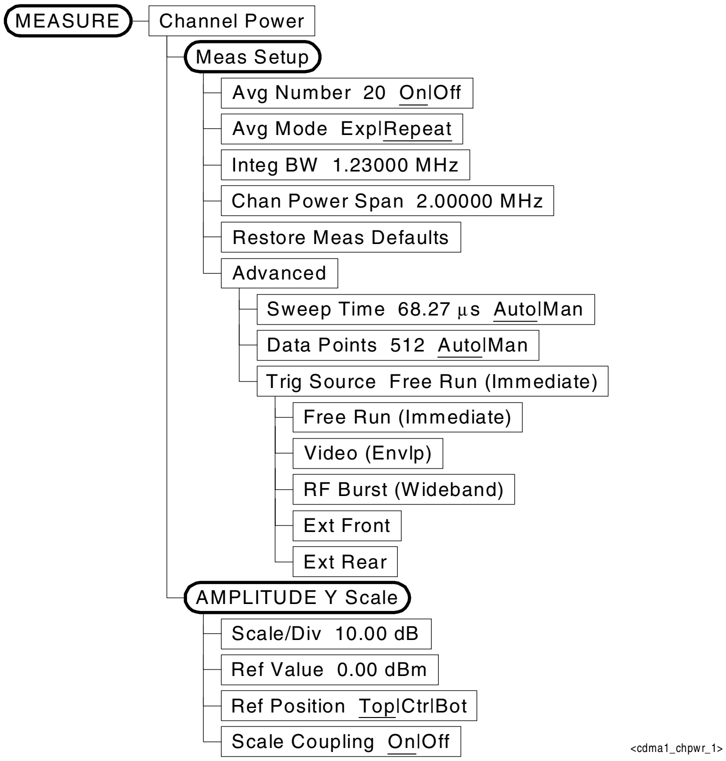


Figure 2-4 Modulation Accuracy (Rho) Measurement Key Flow

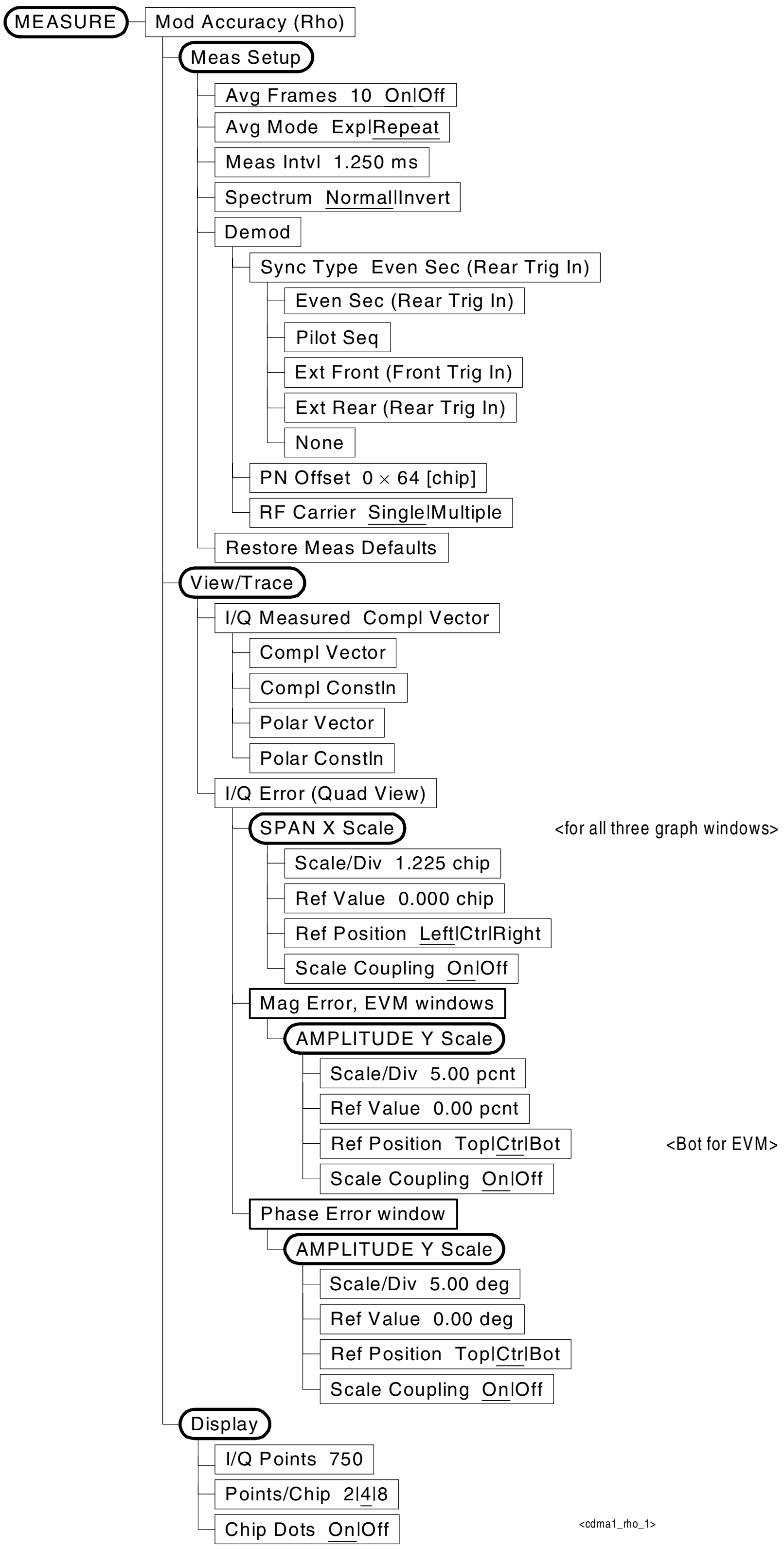


Figure 2-5 Code Domain Measurement Key Flow (1 of 2)

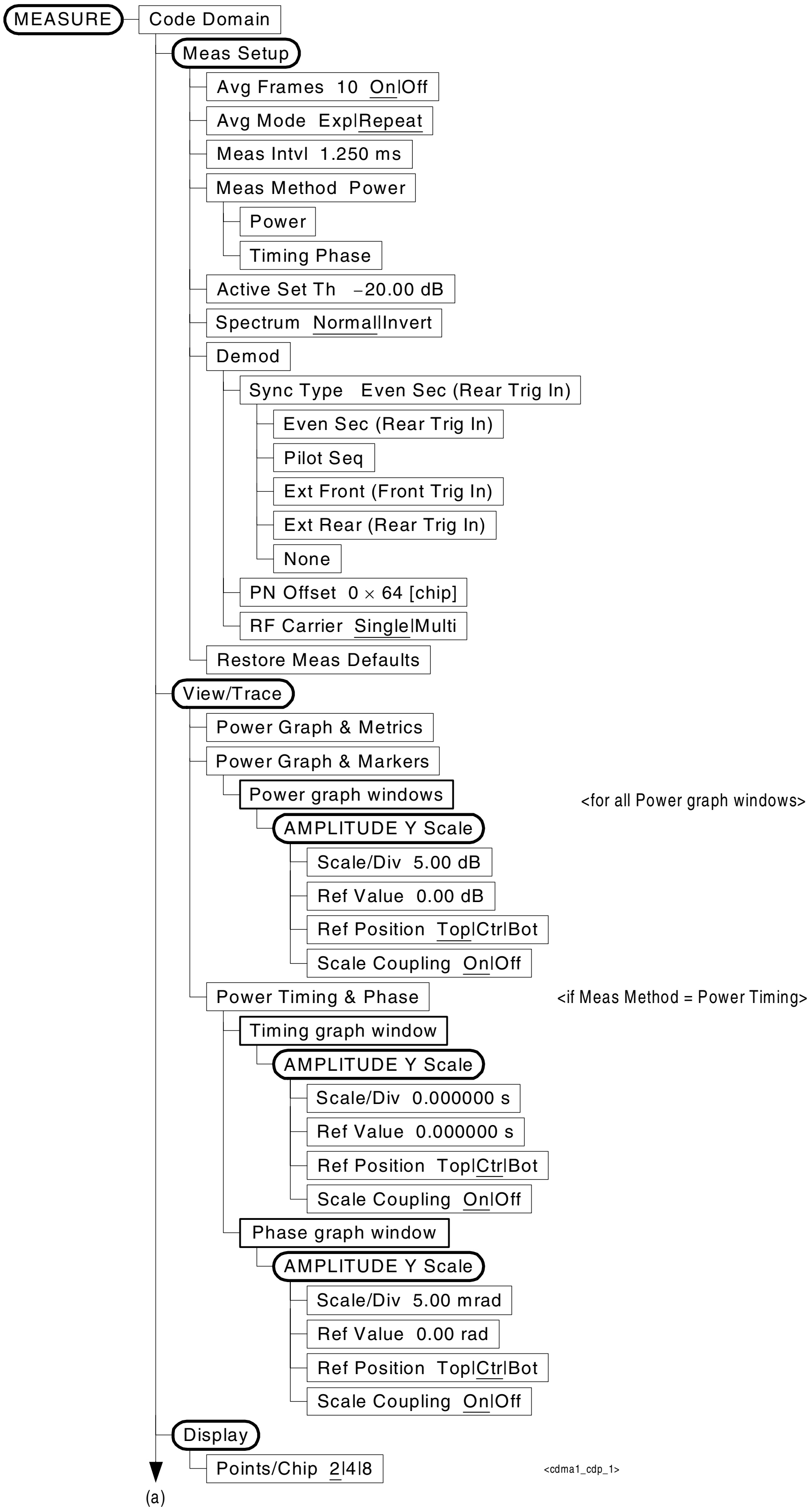


Figure 2-6 Code Domain Measurement Key Flow (2 of 2)

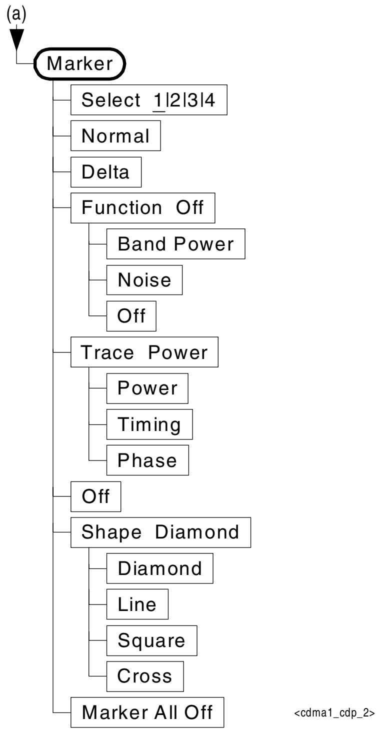


Figure 2-7 Spur Close Measurement Key Flow

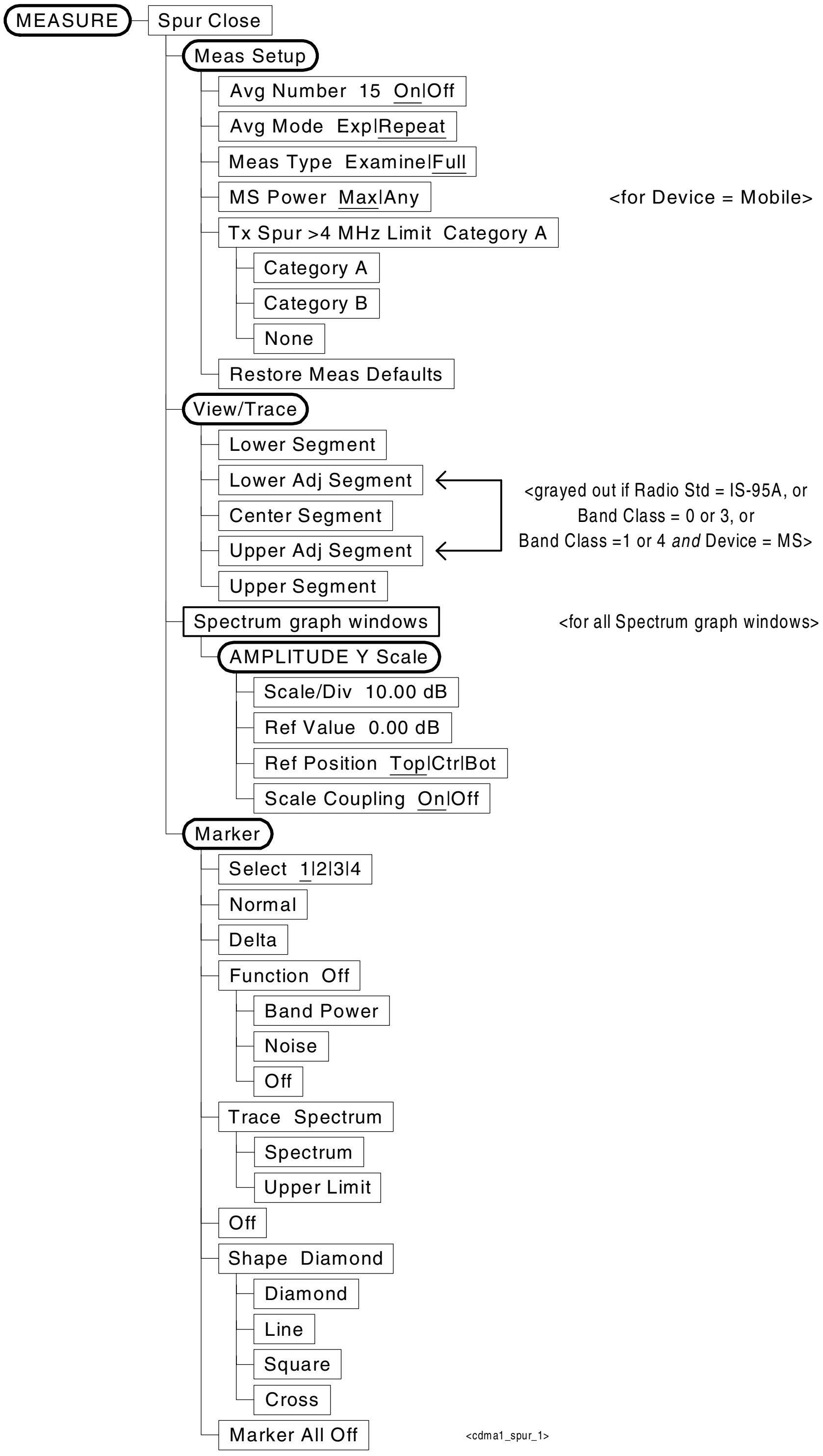


Figure 2-8 Spectrum (Freq Domain) Measurement Key Flow (1 of 3)

Figure 2-9 Spectrum (Freq Domain) Measurement Key Flow (2 of 3)

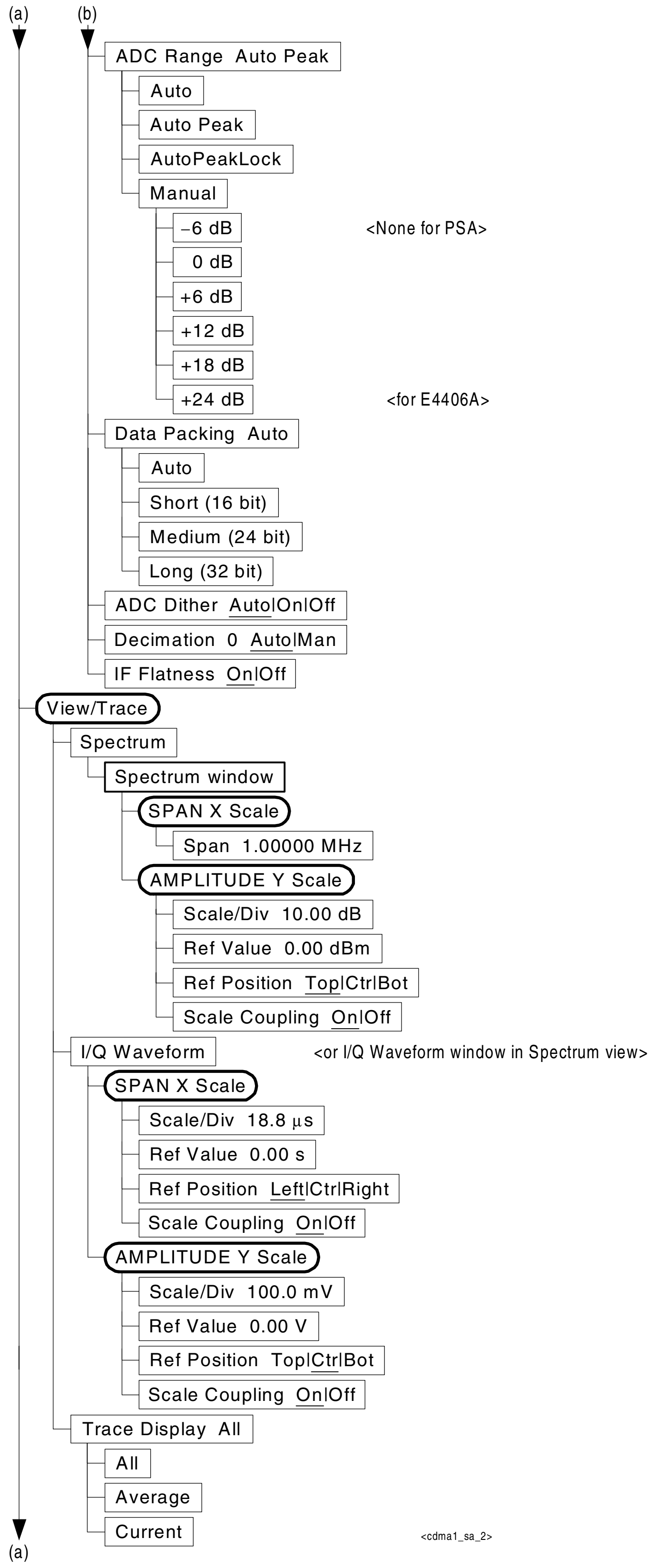


Figure 2-10 Spectrum (Freq Domain) Measurement Key Flow (3 of 3)

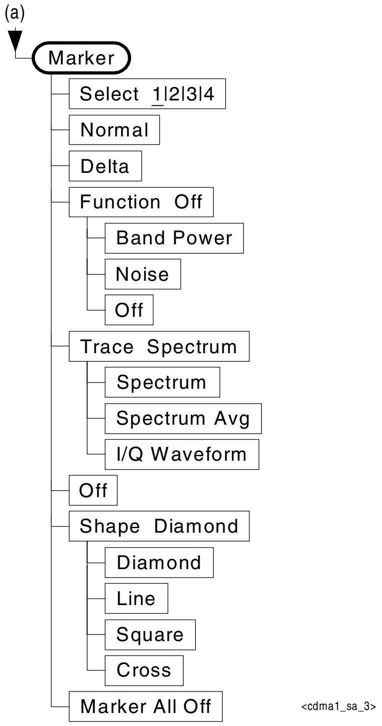


Figure 2-11 Waveform (Time Domain) Measurement Key Flow (1 of 2)

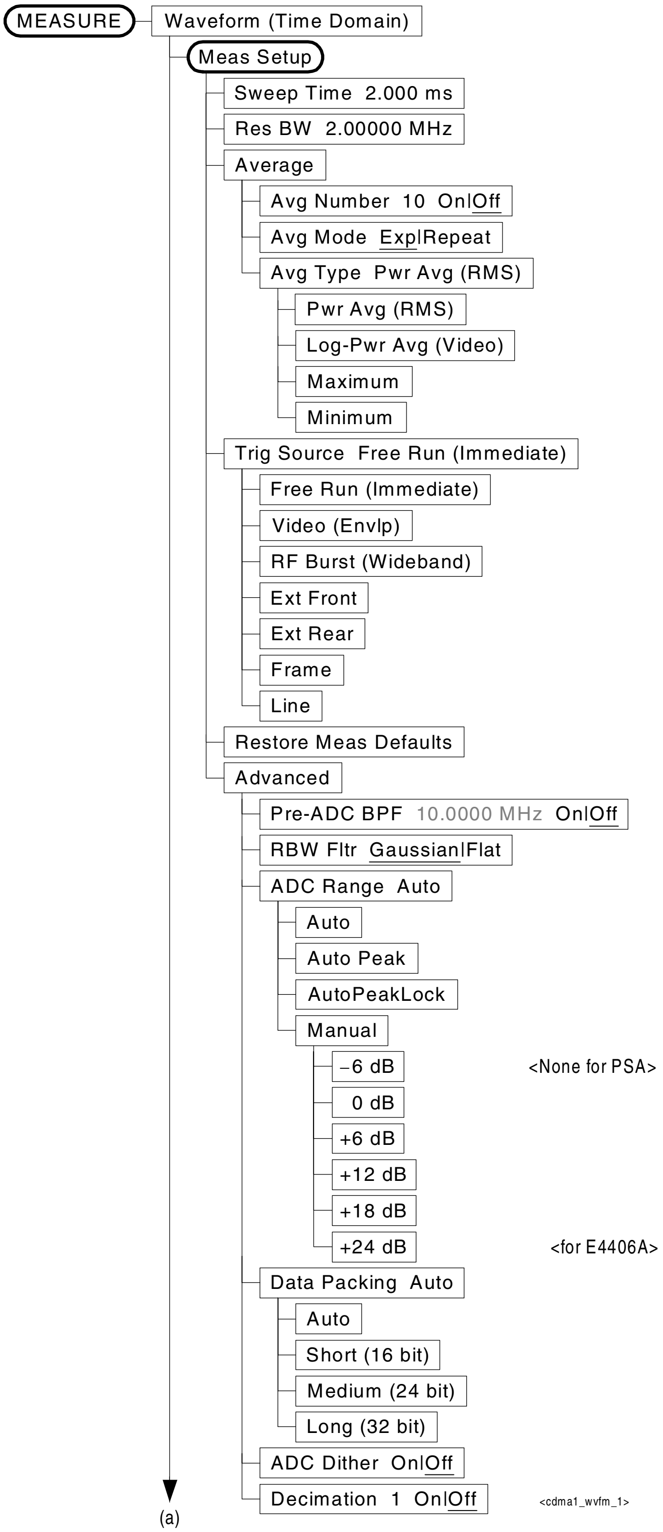


Figure 2-12 Waveform (Time Domain) Measurement Key Flow (2 of 2)

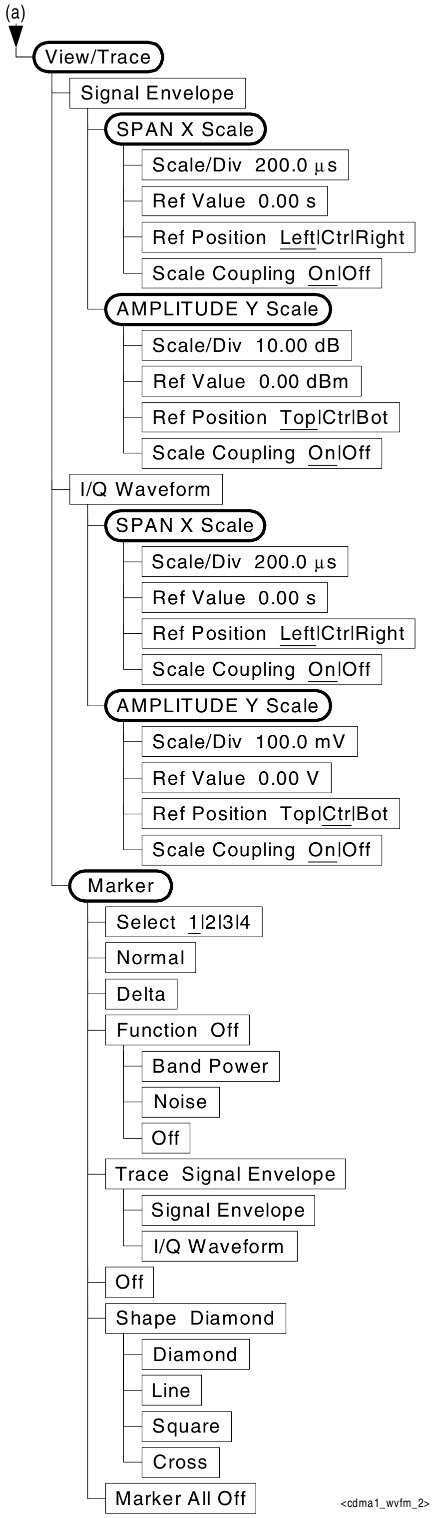


Figure 2-13 ACPR Measurement Key Flow (1 of 2)

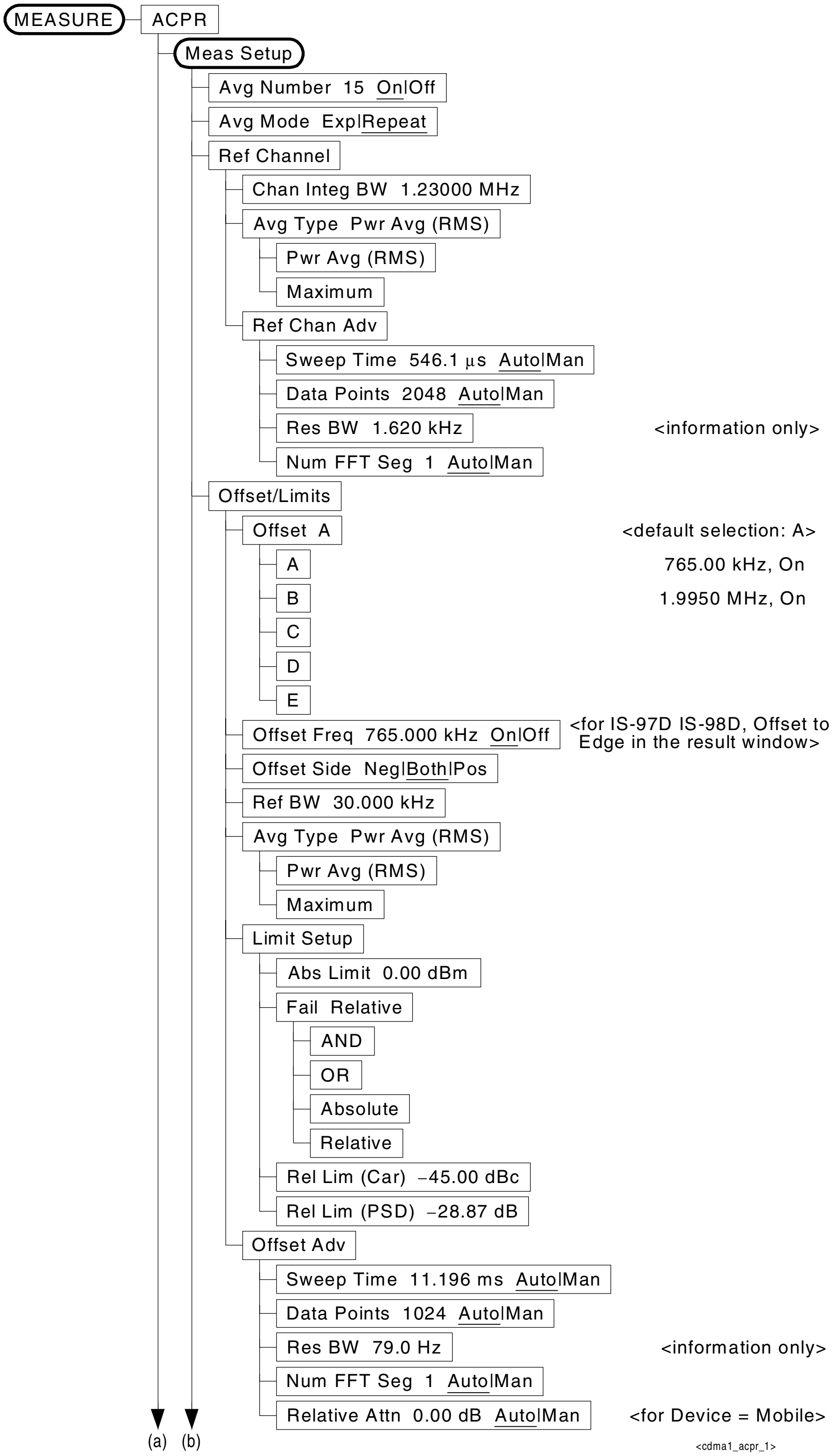
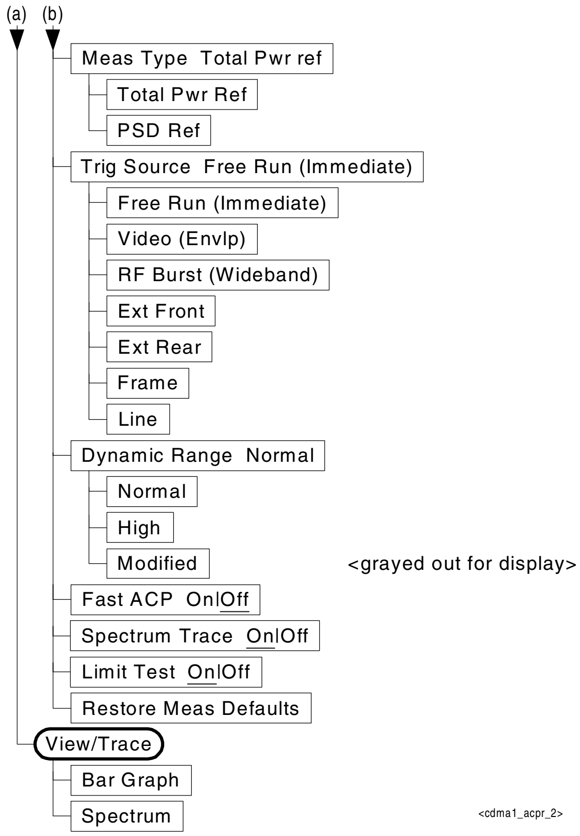


Figure 2-14 ACPR Measurement Key Flow (2 of 2)



Using Basic Mode on PSA Series

Basic mode is part of Option B7J for the PSA series. Basic mode is *not* related to a particular communications standard. That is, it does not default to measurement settings that are for any specific standard. You may want to use Basic Mode if you are making measurements on a signal that is not part of a specific digital communications standard.

There are two measurements available under the **MEASURE** key in Basic mode:

- Spectrum measurement (frequency domain).
- Waveform measurement (time domain)

These measurements provide a measurement mode that is similar to a standard spectrum analyzer. Unlike the standard analyzer, these measurements are optimized for measuring digitally modulated signals, so they can be used to output the measured I/Q data.

The Spectrum and Waveform measurements are also available in this mode, with the same functionality, so you can refer to this manual for information about using them.

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 55.
2. Enter a license key number that activates the measurement personality. See “Installing a License Key” on page 56.

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 specific for your option and instrument serial number.

Why Aren’t All the Personality Options Loaded in Memory?

There are many measurement personality options available for use with this instrument. Some versions of instrument hardware my not have enough memory to accommodate all the options that you have ordered. If this is the case you will need to swap the applications in/out of memory, as needed. It may be possible to upgrade your hardware to have more memory. Contact your local sales/service office.

Available Measurement Personality Options

To order a measurement personality option you need the instrument model number, the host ID and the serial number.

Required Information:	**Front Panel Key Path:**
Model #: (Ex. E4406A)	
Host ID: __________________	**System**, **Show System**
Instrument Serial Number: __________________	**System**, **Show System**

NOTE For PSA, the instrument must have Option B7J in order to use most of the measurement personality options. (cdmaOne, cdma2000, 1xEV-DO, W-CDMA, GSM, EDGE, NADC, PDC.)

Personality Options[a] **(for PSA series and E4406A)**	**Option**	**File Size** **(PSA Rev: A.04.00)** **(E4406A Rev: A.06.00)**
cdmaOne measurement personality	**BAC**	2,000,000 Bytes
NADC measurement personalities (sold with PDC)	**BAE**	1,300,000 Bytes
PDC measurement personalities (sold with NADC)	**BAE**	1,400,000 Bytes
W-CDMA measurement personality	**BAF**	4,700,000 Bytes [b]
cdma2000 measurement personality	**B78**	4,000,000 Bytes [b]
1xEV-DO measurement personality	**204**	4,800,000 Bytes [b]
Shared measurement library[c]	n/a	1,400,000 Bytes
PSA only Options:		
Phase noise measurement personality	**226**	2,800,000 Bytes
Noise Figure measurement personality	**219**	3,000,000 Bytes
Basic measurement personality with digital demod hardware	**B7J**	Cannot be deleted
GSM (with EDGE) measurement personality	**202**	3,400,000 Bytes[b]
HP8566B/HP8568B Programming Code Compatibility [d]	**266**	650,000 Bytes
E4406A only Options:		
GSM measurement personality	**BAH**	2,500,000 Bytes
EDGE (with GSM) measurement personality [e]	**202**	3,400,000 Bytes
iDEN measurement personality	**HN1**	1,800,000 Bytes
Baseband I/Q Inputs	**B7C**	n/a (hardware only)

a. Available as of the print date of this guide.
b. Some PSA Series personality options use a shared measurement library. You have to add the memory requirements of this library to the value needed for the option. If you are loading multiple personalities that use this library, you only need to add this memory requirement once.
c. The E4406A personality options use a shared measurement library. You have to add the memory requirements of this library to the value needed for any option.

d. This option is free and does not require a license key.
e. For instruments that already have Option BAH licensed, order E4406AU Option 252 to add EDGE (with GSM).

Loading an Optional Measurement Personality

You must load the desired personality option into the instrument memory. Loading can be done from a firmware CD-ROM or the internet location. An automatic loading program comes with the files and runs from your PC.

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. You may need to delete an existing option file from memory and load the one you want. Use the automatic update program that is provided with the files.

The approximate memory requirements for the options are listed above. These numbers are worst case examples. Some options share components and libraries, therefore the total memory usage of multiple options may not be exactly equal to the combined total.

For E4406A, you may want (or need) to add optional memory to load all the different measurement personalities that you want.

Required Information:	**Key Path:**
Instrument Memory: __________________	**System**, **File System** (This key is grayed out.) The total amount of memory in your instrument will be the sum of the `Used` memory and the `Free` memory.

For E4406A, you can install an update version of core firmware and your licensed options using a LAN connection and your PC. The **Exit Main Firmware** key halts the operation of the instrument firmware so you can install an updated version. Instructions for loading future firmware updates are available from the following internet location: **http://www.agilent.com/find/vsa/**

For PSA, 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 from the following internet location: **http://www.agilent.com/find/psa/**

Installing a License Key

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

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

For PSA:

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

For E4406A:

1. Press **System**, **More**, **More**, **Install**, **Choose Option** to accesses the alpha editor. Use this alpha editor to enter letters (upper-case), and the front-panel numeric keys to enter numbers for the option designation. You will validate your option entry in the active function area of the display. Then, press the **Done** key.

NOTE Before you enter the license key for the EDGE Retrofit Option 252, you must already have entered the license key for the GSM Option BAH.

2. Press **License Key** to enter the letters and digits of your license key. You will validate your license key entry in the active function area of the display. Then, press the **Done** key.
3. Press the **Install Now** key. The message “`New option keys become active after reboot.`” will appear, along with the **Yes/No** menu: press the **Yes** key and cycle the instrument power off and then on to complete your installation process, or press the **No** key to cancel the installation process.

Viewing a License Key

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

Use the following procedure to display the license key number unique to your personality option that is already installed in your instrument:

For PSA:

> Press **System**, **More**, **More**, **Licensing**, **Show License.** The **System**, **Personalities** keys show you the license key if the option has been activated.

For E4406A:

> Press **System**, **More**, **More**, **Install**, **Choose Option** to enter the letters/numbers for the option you want.You can see the key on the **License Key** softkey. Press the Done key.

NOTE You will want to keep a copy of your license key number in a secure location. Press System, More, then Personality (for PSA), or Show System (for E4406A), and print out a copy of the display that shows the license numbers. If you should lose your license key number, call your nearest Agilent Technologies service or sales office for assistance.

Using the Delete License Key on PSA

This key will make the option unavailable for use, but will not delete it from memory. Write down the 12-digit license key number for the option before you delete it. If you want to use that measurement personality later, 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: **http://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.

Using the Uninstall Key on E4406A

This key will make the option unavailable for use, but will not delete it from memory. The message “`Application Not Licensed`” will appear in the Status/Info bar at the bottom of the display. Record the 12-digit license key number for the option before you delete it. If you want to use that measurement personality later, you will need the license key number to reactivate the personality firmware.

NOTE Using the **Uninstall** key does not remove the personality firmware 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 available at the URL: **http://www.agilent.com/find/vsa/**

1. Press **System**, **More**, **More**, **Uninstall**, **Choose Option** to access the alpha editor. Use this alpha editor to enter the letters (upper-case), and the front-panel numeric keys to enter the numbers (if required) for the installed option. You will validate your option entry in the active function area of the display. Then, press the **Done** key.
2. Pressing the **Uninstall Now** key will activate the **Yes/No** menu: press the **Yes** key to continue your uninstall process, or press the **No** key to cancel the uninstall process.
3. Cycle the instrument power off and then on to complete the uninstall process.

3 Making Measurements

cdmaOne Measurements

Once in the cdmaOne mode, the following measurements are available by pressing the **MEASURE** key:

- ❏ "Making the Channel Power Measurement" on page 65
- ❏ "Making the Modulation Accuracy (Rho) Measurement" on page 70
- ❏ "Making the Code Domain Measurement (Base Station Only)" on page 77
- ❏ "Making the Spur Close Measurement" on page 85
- ❏ "Making the Spectrum (Frequency Domain) Measurement" on page 93
- ❏ "Making the Waveform (Time Domain) Measurement" on page 102
- ❏ "Making the Adjacent Channel Power Ratio (ACPR/ACLR) Measurement" on page 110

These are referred to as one-button measurements. 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.

Preparing for Measurements

If you want to set the cdmaOne 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.

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" on page 29 and "Changing the Frequency Channel" on page 35 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** (E4406A), **Input/Output** (PSA), **FREQUENCY Channel**	**System**
2. Select & setup a measurement	**MEASURE**	**Meas Setup**	**Meas Control**, **Restart**
3. Select & setup a view	**View/Trace** (E4406A), **Trace/View** (PSA)	**SPAN X Scale**, **AMPLITUDE Y Scale**, **Display**, **Next Window**, **Zoom**	**File**, **Save**, **Print**, **Print Setup**, **Marker**, **Search** (E4406A), **Peak Search** (PSA)

Measure Control

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

- **Measure** - Press **Meas Control**, **Measure** (not to be confused with the front panel **MEASURE** key which has a different function) to toggle between Single and Cont (for continuous) measurement states. When set to Single, the measurement will continue until it has reached the specified number of averages set by the average counter. When set to Cont, the measurement will run continuously, and perform averaging according to the current average type (repeat or exponential). The default setting is continuous.

- **Pause** - 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** - 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** - 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** - 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** - Allows you to change the number of N averages to be made.
- **Avg Mode** - Allows 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 to **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 **Single** for **Measure** and pressing the **Restart** key each time the single measurement finishes.

Selecting a Trigger Source

Changing the selection in the **Trig Source** menu 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 (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)** - A trigger occurs at the time the data is requested, completely asynchronous with the RF or IF signal.
- **Video (Envlp)** - An internal IF envelope trigger that occurs at the absolute threshold level of the IF signal level.
- **RF Burst (Wideband)** - An internal wideband RF burst trigger that has the automatic level control for burst signals. It triggers at the level that is set relative to the peak RF signal (12 MHz bandwidth) input level.
- **Ext Front** - Activates the front panel **EXT TRIGGER INPUT** port. The external trigger must be between –5.00 V and +5.00 V.
- **Ext Rear** - Activates the rear panel **TRIGGER IN** port. The external trigger must be between –5.00 V and +5.00 V.
- **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, but not both. See the specific measurement for details.
- **Line** - Sets the trigger to the internal line mode. Sweep triggers occur at intervals synchronized to the line frequency.

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

Making a Measurement

This instrument enables you to make a wide variety of measurements on digital communications equipment using the `Basic Mode` (for E4406A), or the `Spectrum Analysis Mode` (for PSA) measurement capabilities. It also has optional measurement personalities that make measurements based on established industry standards.

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

1. Press **MODE** to select a 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 selecting the mode, make any required adjustments to the mode settings by pressing **Mode Setup**.
2. Press **MEASURE** to select a specific measurement to be performed, like ACP, Channel Power, or EVM, and so forth. After selection of your measurement, make any required adjustments to the measurement settings by pressing **Meas Setup**.

   Depending on the current settings of **Meas Control**, the instrument will begin making the selected measurements. The resulting data will be shown on the display or available for export.
3. Press **Trace/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” section 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** (E4406A), **Input/Output** (PSA), **FREQUENCY Channel**	**System**
2. Select & setup a measurement	**MEASURE**	**Meas Setup**	**Meas Control**, **Restart**
3. Select & setup a view	**View/Trace** (E4406A), **Trace/View** (PSA)	**SPAN X Scale**, **AMPLITUDE Y Scale**, **Display**, **Next Window**, **Zoom**	**File**, **Save**, **Print**, **Print Setup**, **Marker**, **Search** (E4406A), **PeakSearch** (PSA)

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

Making the Channel Power Measurement

Purpose

The Channel Power measurement is a common test used in the wireless industry to measure the total transmitted power of a radio within a defined frequency channel. This procedure measures the total power within the defined channel for cdmaOne. This measurement is applied to design, characterize, evaluate, and verify transmitters and their components or devices for base stations and mobile stations.

Measurement Method

The Channel Power measurement reports the total transmitted power within the channel bandwidth, 1.23000 MHz for the cdmaOne mode. The measurement acquires a number of points representing the input signal in the time domain. It transforms this information into the frequency domain using FFT and then calculates the channel power. The effective resolution bandwidth of the frequency domain trace is proportional to the number of points acquired for FFT. The fastest FFT process is achieved using a number of acquired points that is a power of 2 (for example: 64, 128, 512).

Since the measurement is optimized for speed and accuracy, you are permitted to change only the number of acquired data points in powers of 2, not the actual resolution bandwidth which is shown in gray. However, if absolute sweep time is required, it can be changed to the user’s specific value at the expense of reduced speed. At no time will both sweep time and data points be set to manual because of conflicting parameter settings. This flexibility is available through the **Advanced** menu of the channel power measurement.

To improve repeatability, you can increase either the number of averages or the number of data points with longer time record length. The channel power graph is shown in the graph window, while the absolute channel power in dBm and the mean power spectral density in dBm/Hz are shown in the text window.

Making the Measurement

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

Select the desired center frequency as described in “Changing the Frequency Channel”.

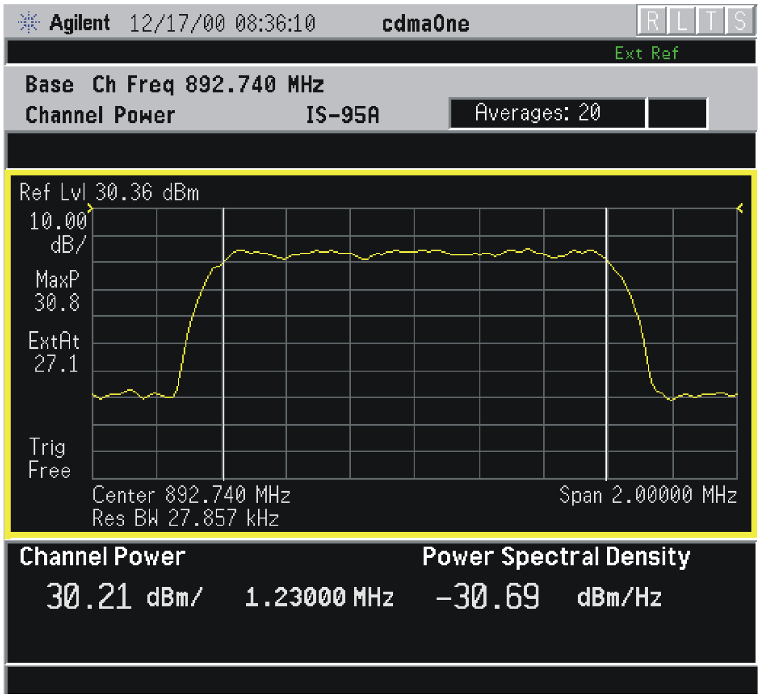
Press **MEASURE**, **Channel Power** to immediately make a channel power measurement.

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 following figure shows an example result of `Channel Power` measurement result. The channel power graph is shown in the graph window. The absolute channel power and its mean power spectral density are shown in the text window.

Figure 3-1 **Channel Power Measurement**



Agilent 12/17/00 08:36:10 cdmaOne

Ext Ref

Base Ch Freq 892.740 MHz
Channel Power IS-95A
Averages: 20

Channel Power
30.21 dBm/ 1.23000 MHz

Power Spectral Density
-30.69 dBm/Hz

Changing the Measurement Setup

The next table shows the factory default settings for channel power measurements.

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

Table 3-1 **Channel Power Measurement Defaults**

Measurement Parameter	Factory Default Condition
Meas Setup:	
Avg Number	20; On
Avg Mode	Repeat
Integ BW[a]	1.23000 MHz
Chan Power Span[a]	2.00000 MHz
Advanced	
Sweep Time	68.27 µs; Auto
Data Points	512; Auto
Res BW (grayed out)	27.857 kHz (grayed out)
Trig Source	Free Run (Immediate)

[a] The Integ BW setting proportionally changes the Chan Power Span setting up to 10 MHz.

Make sure the **Channel Power** measurement is selected under the **MEASURE** menu. The **Meas Setup** key accesses the menu which allows you to modify the average number and average mode for this measurement.

In addition, the following parameters can be changed according to your measurement requirements:

- **Integ BW** - Allows you to specify the integration bandwidth in which the power is measured. The range is 1.000 kHz to 10.0000 MHz with 1 Hz resolution. Since **Integ BW** is coupled to **Chan Power Span** in the factory default condition, if you change the integration bandwidth setting, the channel power span setting changes by a proportional amount, 1.626 times the integration bandwidth, until a limit value is reached.

- **Chan Power Span** - Allows you to set the frequency span for the channel power measurement. The range is 1.000 kHz to 10.0000 MHz with 1 Hz resolution. This span is used for the current integration bandwidth setting. Since **Chan Power Span** is coupled to **Integ BW** in the factory default condition, if you change the integration bandwidth setting, the channel power span setting changes by a proportional amount, 1.626 times the integration bandwidth, until a limit value is reached. However, the channel power span can be individually set.

- **Advanced** - Allows you to access the following menu to modify the channel power measurement parameters:

— **Sweep Time** - Allows you to manually change the sweep time and also to toggle the sweep time control between **Auto** and **Man** (manual). The range is 1.0 µs to 50.00 ms with 1 µs resolution. If set to **Auto**, the sweep time derived from the data point setting is shown on this key regardless of the manual entry range.

— **Data Points** - Allows you to select the number of data points and also to toggle the data point control between **Auto** and **Man** (manual). The range is 64 to 65536 with acceptable entries in powers of 2 (for example: 64, 128, 512). If set to **Auto**, the optimum number of points is determined for the fastest measurement time with acceptable repeatability. The minimum number of points that could be used is determined by the sweep time and the sampling rate. You can increase the length of the measured time record (capture more of the burst) by increasing the number of points, but the measurement will take longer.

— **Res BW** - Shows information on the resolution bandwidth derived from the sweep time. This key is always grayed out.

— **Trig Source** - Allows you to choose a trigger source from **Free Run (Immediate)**, **Video (Envlp)**, **RF Burst (Wideband)**, **Ext Front**, **Ext Rear**, **Frame**, or **Line**.

Changing the Display

The **AMPLITUDE Y Scale** key accesses the menu to set the desired vertical scale and associated settings:

- **Scale/Div** - Allows you to enter a numeric value to change the vertical display sensitivity. The range is 0.10 to 20.00 dB with 0.01 dB resolution. The default setting is 10.00 dB. However, since the **Scale Coupling** default is **On**, this value is automatically determined by the measurement result. When you set a value manually, **Scale Coupling** automatically changes to **Off**.

- **Ref Value** - Allows you to set the absolute power reference value ranging from –250.00 to 250.00 dBm with 0.01 dB resolution. The default setting is 10.00 dBm. However, since the **Scale Coupling** default is **On**, this value is automatically determined by the measurement result. When you set a value manually, **Scale Coupling** automatically changes to **Off**.

- **Ref Position** - Allows you to set the display 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, the scale coupling function automatically determines the scale per division and reference values based on the measurement results. When you set a value to either **Scale/Div** or **Ref Value** manually, **Scale Coupling** automatically changes to **Off**.

Using the Marker

The **Marker** key is not available for this measurement function.

Troubleshooting Hints

If an external attenuator is used, be sure to use the **Ext RF Atten** key to include the attenuation value in the displayed measurement result.

The channel power measurement, along with the adjacent channel power ratio measurement and spectrum measurements, can reveal the effects of degraded or defective parts in the transmitter section of the UUT. The following are areas of concern which can contribute to performance degradation:

- DC power supply control of the transmitter power amplifier, RF power control of the pre-power amplifier stage, and/or I/Q control of the baseband stage.
- Gain and output power levels of the power amplifier, caused by degraded gain control and/or increased distortion.
- Amplifier linearity.

Making the Modulation Accuracy (Rho) Measurement

Purpose

Rho is one of the key modulation quality metrics, along with EVM and code domain power. Rho is the ratio of the correlated power in a single coded channel to the total signal power. This is a simplified case of code domain power since this measurement is made on a single coded channel. This measurement takes into account all possible error mechanisms in the entire transmission chain including baseband filtering, I/Q modulation anomalies, filter amplitude and phase non-linearities, and power amplifier distortion. This provides an overall indication of the performance level of the transmitter of the UUT.

Measurement Method

This procedure measures the performance of the transmitter’s modulation circuitry.

The instrument can perform base station and mobile measurements. In both cases the transmitter’s modulated signal is compared to an ideal reference waveform. Rho values are in the range of 0 to 1. A value of 1 indicates perfect correlation to the reference (high modulation quality).

The cdmaOne base station standards require that transmitters have a Rho performance of 0.912 or greater.

When performing mobile testing with the Rho measurement, the phone must be placed in a test mode to modulate only the known short code sequences in the reverse link. The measurement will not work with a live phone call on which data is being modulated.

The following data are provided by the Rho measurement:

- Rho - modulation quality
- Time Offset - how well your transmitter’s signal is time-aligned to system time
- Frequency Error - the frequency difference between your transmitter’s actual center frequency and the frequency (or channel) that you entered
- Carrier Feedthrough - measures the performance of the I/Q modulator of your transmitter
- EVM - rms Error Vector Magnitude
- Mag Error - rms Magnitude Error

- Phase Error - rms Phase Error

Making the Measurement

NOTE The factory default settings provide a cdmaOne compliant measurement. For special requirements, you may need to change some of the settings. Press **Meas Setup**, **More**, **Restore Meas Defaults** at any time to return all parameters for the current measurement to their default settings.

Select the desired center frequency and PN offset as described under "Changing the Frequency Channel" on page 35.

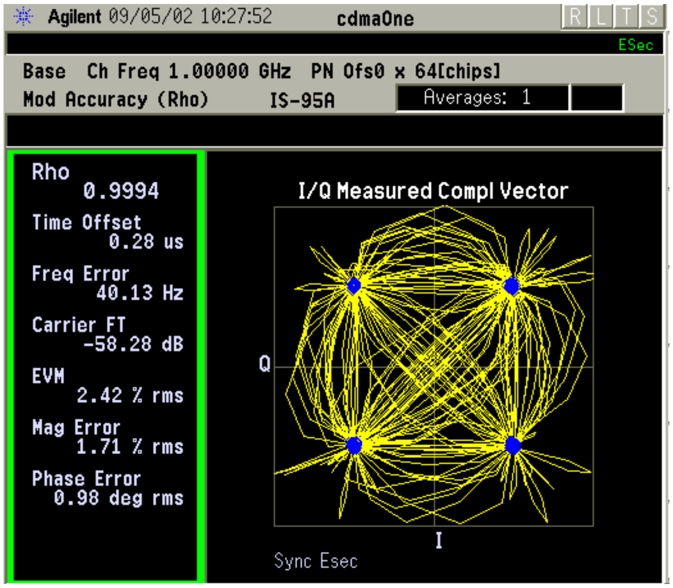
Press **MEASURE**, **Mod Accuracy (Rho)** to immediately make a modulation accuracy measurement.

To change any of the measurement parameters from the factory default values, refer to "Changing the Measurement Setup" on page 72.

Results

The following figure shows an example result of `I/Q Measured Compl Vector` graph for the modulation accuracy (rho) measurements in the graph window. The numeric results such as Rho, Time Offset, Freq Error, and so forth, are displayed in the text window.

Figure 3-2 **Modulation Accuracy Result - I/Q Measured Compl Vector View**



```
Agilent 09/05/02 10:27:52          cdmaOne
Base   Ch Freq 1.00000 GHz   PN Ofs0 x 64[chips]
Mod Accuracy (Rho)       IS-95A       Averages:  1

Rho
      0.9994
Time Offset
         0.28 us
Freq Error
        40.13 Hz
Carrier FT
      -58.28 dB
EVM
       2.42 % rms
Mag Error
       1.71 % rms
Phase Error
    0.98 deg rms

Sync Esec
```

Changing the Measurement Setup

This table shows the factory default settings for modulation accuracy (rho) measurements.

Table 3-2 Modulation Accuracy (Rho) Measurement Defaults

Measurement Parameter	Factory Default Condition
View/Trace	I/Q Measured Compl Vector
Display	
I/Q Points	750
Points/Chip	4
Chip Dots	On
Avg Frames	10; On
Avg Mode	Repeat
Meas Intvl	1.250 ms
Spectrum	Normal
Demod	
Sync Type	Even Sec (Rear Trig In)
PN Offset	0 × 64[chip]
RF Carrier	Single

Make sure the **Mod Accuracy (Rho)** measurement is selected under the **MEASURE** menu. Press the **Meas Setup** key to access a menu which allows you to modify the averaging as described in the "Measurement Setup" on page 62.

In addition, the following parameters can be modified according to your measurement requirements:

- **Meas Interval** - Sets the time interval over which the measurement is made.
- **Spectrum** - This key, when set to **Invert**, conjugates the spectrum, which equivalently negates the quadrature component in demodulation. The correct setting (**Normal** or **Invert**) depends on whether the signal being input to the instrument has a high or low side mix.
- **Demod** - Defines the demodulation method such as synchronization signal, PN offset, and RF carrier selection.
  - — **Sync Type** - Selects the type of synchronization used for the demodulation.
    - ☐ **Even Sec (Rear Trig In)** - Synchronizes to the internal frame timer that has been synchronized to an even second clock input. The frame timer has a 26.6667 ms period. This input signal is connected to the rear-panel TRIGGER IN connector.

- ☐ **Pilot Seq** - Synchronizes to the pilot sequence on the RF channel. As this does not provide an absolute time reference, the measured time offset value will not be valid.
- ☐ **Ext Front (Front Trig In)** - Directly synchronizes to an external signal connected to the front-panel EXT TRIGGER INPUT connector.
- ☐ **Ext Rear (Rear Trig In)** - Directly synchronizes to an external signal connected to the rear-panel TRIGGER IN connector.
- ☐ **None** - No synchronization is made.

— **PN Offset** - Used to enter the PN offset of the base station being tested. This allows correct time offset values to be determined. This setting is not applicable when **Sync Type** is set to **Pilot Seq**.

— **RF Carrier** - Select **Single** if there is a single RF carrier present at the RF input signal. Select **Multi** if there is more than one carrier present at the RF input signal, which rejects the upper and lower adjacent channels for the modulation accuracy and code domain measurements.

Changing the View

The **View/Trace** key will allow you to select the desired view of the measurement from the following:

- **I/Q Measured** - Provides a combination view of numeric results and a polar graph as shown in Figure 3-2 on page 71.

  Pressing the **I/Q Measured** key reveals the menu for you to select one of the four different graphic views as follows:

  — **Compl Vector** - Sets to view the I/Q complementary vector graph of the I/Q signals before the IS-95 complementary filter.

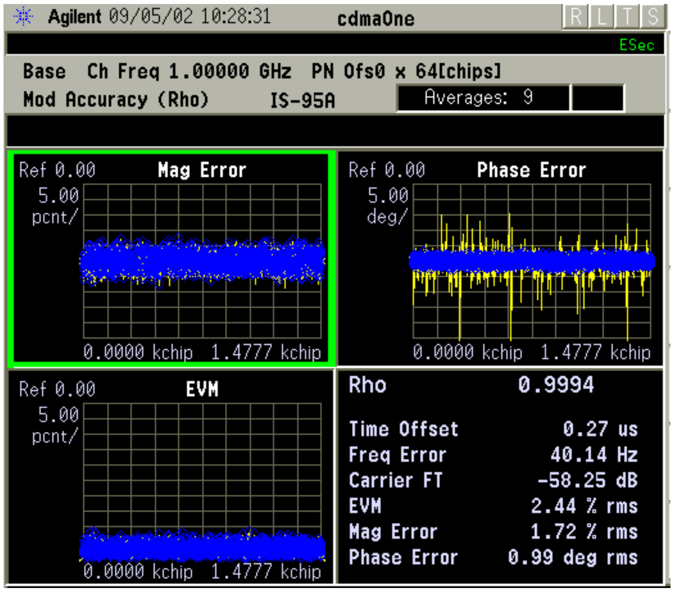
  — **Compl Constln** - Sets to view the I/Q complementary constellation graph of the I/Q signals before the IS-95 complementary filter.

  — **Polar Vector** - Sets to view the I/Q polar vector graph of the I/Q signals after the IS-95 complementary filter.

  — **Polar Constln** - Sets to view the I/Q polar constellation graph of the I/Q signals after the IS-95 complementary filter.

- **I/Q Error (Quad-View)** - Provides a combination view of the Mag Error, Phase Error, and EVM graphs versus chips in the graph window and the numeric measurement results for Rho, Time Offset, Freq Error and so forth in the text window.

Figure 3-3 **Modulation Accuracy Result - I/Q Error View (chip dots on)**



```
Agilent 09/05/02 10:28:31        cdmaOne           R L T S
                                                      ESec
Base  Ch Freq 1.00000 GHz  PN Ofs0 x 64[chips]
Mod Accuracy (Rho)      IS-95A     Averages: 9
```

```
Rho              0.9994

Time Offset       0.27 us
Freq Error       40.14 Hz
Carrier FT      -58.25 dB
EVM             2.44 % rms
Mag Error       1.72 % rms
Phase Error    0.99 deg rms
```

Any of these windows can be selected using the **Next Window** key and made full size using the **Zoom** key.

Changing the Display

The **Display** key access a menu to set the display control as follows:

- **I/Q Points** - Allows you to specify the number of displayed points for the I/Q waveforms. The range is 1 to 5000 points. The default setting is 750.
- **Points/Chip** - Allows you to set the number of sample points displayed per chip to either 2, 4, or 8. The default selection is 4.
- **Chip Dots** - Allows you to switch the chip dot display between **On** and **Off**. The default setting is **On**. Set to **Off** if you do not want the chip dots to be superimposed on the result traces.

If either `EVM`, `Phase Error`, or `Mag Error` window is active in the **I/Q Error (Quad-View)** view, the **SPAN X Scale** key accesses the menu to allow the following settings:

- **Scale/Div** - Allows you to set the horizontal scale by changing a chip value per division. The range is 1.000 to 500000.0 chips per division with 0.001 chip resolution. The default setting is 147.8 chips per division. However, since the **Scale Coupling** default **On**, this value is automatically determined by the measurement result. When you set a value manually, **Scale Coupling** automatically changes to **Off**.
- **Ref Value** - Allows you to set the chip reference value ranging from 0.000 to 5000000.0 chips. The default setting is 0.000 chip. However, since the **Scale Coupling** default is **On**, this value is automatically determined by the measurement results. When you set a value

manually, **Scale Coupling** automatically changes to **Off**.

- **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 the **Restart** softkey under the **Meas Control** menu, scale coupling automatically determines the scale per division and reference values based on the measurement results. When you set a value to either **Scale/Div** or **Ref Value** manually, **Scale Coupling** automatically changes to **Off**.

If either `EVM` or `Mag Error` window is active in the **I/Q Error (Quad-View)** view, the **AMPLITUDE Y Scale** key accesses the menu to allow the following settings:

- **Scale/Div** - Allows you to set the vertical scale by changing the value per division. The range is 0.100 to 50.0% per division. The default setting is 5.00%. However, since the **Scale Coupling** default is **On**, this value is automatically determined by the measurement result. When you set a value manually, **Scale Coupling** automatically changes to **Off**.
- **Ref Value** - Allows you to set the reference value ranging from 0.00 to 500.0%. The default setting is 0.00%. However, since the **Scale Coupling** default is **On**, this value is automatically determined by the measurement results. When you set a value manually, **Scale Coupling** automatically changes to **Off**.
- **Ref Position** - Allows you to set the reference position to either **Top**, **Ctr** (center) or **Bot** (bottom). For the `EVM` graph, the default setting is **Bot**. For the `Mag Error` graph, 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 the **Restart** softkey under the **Meas Control** menu, scale coupling automatically determines the scale per division and reference values based on the measurement results. When you set a value to either **Scale/Div** or **Ref Value** manually, **Scale Coupling** automatically changes to **Off**.

If the `Phase Error` window is active in the **I/Q Error (Quad-View)** view, the **AMPLITUDE Y Scale** key accesses the menu to allow the following settings:

- **Scale/Div** - Allows you to set the vertical scale by changing the value per division. The range is 0.01 to 3600.0 degrees. The default setting is 5.00 degrees per division. However, since the **Scale Coupling** default is **On**, this value is automatically determined by the measurement result. When you set a value manually, **Scale Coupling** automatically changes to **Off**.

- **Ref Value** - Allows you to set the reference value ranging from –36000 to 36000 degrees. The default setting is 0.00 degrees. However, since the **Scale Coupling** default is **On**, this value is automatically determined by the measurement results. When you set a value manually, **Scale Coupling** automatically changes to **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 the **Restart** softkey under the **Meas Control** menu, scale coupling automatically determines the scale per division and reference values based on the measurement results. When you set a value to either **Scale/Div** or **Ref Value** manually, **Scale Coupling** automatically changes to **Off**.

Using the Markers

The **Marker** front-panel key accesses the menu to configure the markers depending on the display selected.

- **Select** - 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 setting is 1.
- **Normal** - Allows you to activate the selected marker to read the magnitude or phase error and the number of chips of the marker position on the selected trace, for example. Marker position is controlled by the RPG knob.
- **Delta** - Allows you to read the differences in the magnitude or phase errors and the number of chips between the selected marker and the next.
- **Function** - Allows you to set the selected marker function to **Band Power**, **Noise**, or **Off**. The default setting is **Off**. The **Band Power** and **Noise** functions are not available for this measurement.
- **Trace** - Allows you to place the selected marker on the **EVM**, **Phase Error**, or **Mag Error** trace. The default setting is **EVM**.
- **Off** - Allows you to turn off the selected marker.
- **Shape** - Allows you to access the menu to set the selected marker shape to **Diamond**, **Line**, **Square**, or **Cross**. The default setting is **Diamond**.
- **Marker All Off** - Allows you to turn off all of the markers.

Making the Code Domain Measurement (Base Station Only)

Purpose

The code domain measurement displays the power for each of the 64 Walsh channels, relative to the total power inside a 1.23 MHz bandwidth centered at the Center Frequency. Each Walsh channel level is displayed as an individual vertical bar. Because this is a relative measurement, the unit of measure is dB (not dBm or watts). This allows a comparison of signal levels between the Pilot, Sync, Paging, and Traffic channels.

Measurement Method

This procedure measures the power, timing, and phase of the 64 Walsh channels in a single RF channel. The measurement method can be selected to either measure just code domain power, or to measure code domain power, timing, and phase. The measurement runs faster when measuring only code domain power.

Code Domain Phase

Code Domain Phase displays the phase error for each of the 64 Walsh channels relative to the Pilot channel. Displays above the zero reference in the center of the screen indicate that the Walsh channel leads the Pilot channel; displays below the zero reference in the center of the screen indicate that the Walsh channel lags the Pilot channel. Move the marker to read the phase for each individual channel.

Code Domain Timing

Code Domain Timing displays the time offset for each of the 64 Walsh channels relative to the Pilot channel which is Walsh code zero. Displays above the reference indicate that the Walsh channel leads the Pilot channel; displays below the zero reference indicate that the Walsh channel lags the Pilot channel. Move the marker to read the Timing for each individual channel

Time Offset

Time Offset indicates how well your transmitter's signal is time-aligned to system time. The displayed value takes into account the PN Sequence Offset Index of your transmitter that is entered using the **PN Offset** key

Frequency Error

Frequency Error is the frequency difference between your transmitter's actual center frequency and the frequency (or channel) that you entered.

Carrier Feedthrough

Carrier Feedthrough is used to measure the performance of the I/Q modulator of your transmitter. Extremely low values indicate a very good I/Q modulator. Higher values indicate potential problems with the I/Q modulator. If Carrier Feedthrough measures higher than approximately –20 dBc, there may be problems with the base station.

Avg AT	Average Active Traffic Power of all active Walsh channels. A Walsh channel is considered active if its power is above the value set by the **Active Set Th** key.
Max IT	Maximum Inactive Traffic power of all inactive Walsh channels.
Avg IT	Average Inactive Traffic power of any inactive Walsh channel.

Making the Measurement

NOTE The factory default settings provide a cdmaOne compliant measurement. For special requirements, you may need to change some of the settings. Press **Meas Setup**, **More**, **Restore Meas Defaults** at any time to return all parameters for the current measurement to their default settings.

Select the desired center frequency and PN offset as described under "Changing the Frequency Channel" on page 35.

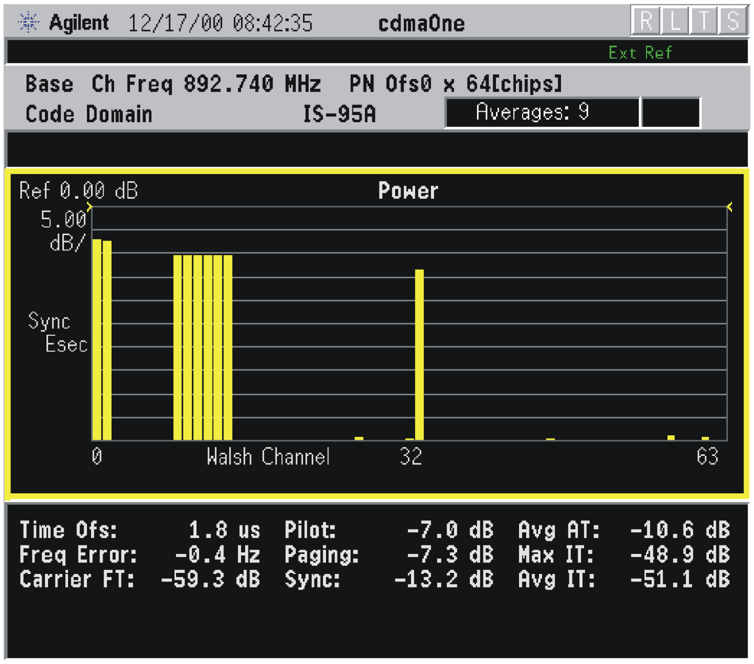
Press **MEASURE**, **Code Domain** to immediately make a code domain measurement.

To change any of the measurement parameters from the factory default values, refer to "Changing the Measurement Setup" on page 79.

Results

The next figure shows an example result of a `Code Domain Power` measurement. In the graph window, the active channel Walsh code and symbol rates are shown with those widths of the bars and the measured channel powers are shown with those heights. The time offset, frequency error, carrier feedthrough, pilot channel power, paging channel power, and so forth are shown in the text window.

Figure 3-4 Code Domain Measurement - Power Graph and Metrics View



```
12/17/00 08:42:35        cdmaOne
Base  Ch Freq 892.740 MHz   PN Ofs0 x 64[chips]
Code Domain              IS-95A      Averages: 9
```

```
Time Ofs:      1.8 us  Pilot:       -7.0 dB  Avg AT:   -10.6 dB
Freq Error:   -0.4 Hz  Paging:      -7.3 dB  Max IT:   -48.9 dB
Carrier FT:  -59.3 dB  Sync:       -13.2 dB  Avg IT:   -51.1 dB
```

Changing the Measurement Setup

This table shows the factory default settings for code domain measurements.

Table 3-3 Code Domain Measurement Defaults

Measurement Parameter	Factory Default Condition
View/Trace	Power Graph & Metrics
Display	
Points/Chip	2
Avg Frames	10; On
Avg Mode	Repeat
Meas Interval	1.250 ms
Meas Method	Power
Active Set Th	–20.00 dB
Spectrum	Normal
Demod	
Sync Type	Even Sec (Rear Trig In)
PN Offset	0 × 64[chip]
RF Carrier	Single

Make sure the **Code Domain** measurement is selected under the

MEASURE menu. Press the **Meas Setup** key to access a menu which allows you to modify the averaging frames and mode for this measurement as described in "Measurement Setup" on page 62.

In addition, the following parameters can be modified according to your measurement requirement:

- **Meas Intvl** - Allows you to set the time interval over which the measurement is made.
- **Meas Method** - Allows you to access the following menu:
  - **Power** - Sets to measure and display code domain power (fastest).
  - **Timing Phase** - Sets to measure and display code domain power, timing, and phase in the individual graph windows.
- **Active Set Th** -Allows you to set the relative power level used to separate active traffic channels from inactive traffic channels.
- **Spectrum** - This key, when set to **Invert**, conjugates the spectrum, which equivalently negates the quadrature component in demodulation. The correct setting (**Normal** or **Invert**) depends on whether the signal being input to the instrument has a high or low side mix.
- **Demod** - Defines the demodulation method such as synchronization signal, PN offset, and RF carrier selection.
  - **Sync Type** - Selects the type of synchronization used for the demodulation.
    - ☐ **Even Sec (Rear Trig In)** - Synchronizes to the internal frame timer that has been synchronized to an even second clock input. The frame timer has a 26.6667 ms period. This input signal is connected to the rear-panel TRIGGER IN connector.
    - ☐ **Pilot Seq** - Synchronizes to the pilot sequence on the RF channel. As this does not provide an absolute time reference, the measured time offset value will not be valid.
    - ☐ **Ext Front (Front Trig In)** - Directly synchronizes to an external signal connected to the front-panel EXT TRIGGER INPUT connector.
    - ☐ **Ext Rear (Rear Trig In)** - Directly synchronizes to an external signal connected to the rear-panel TRIGGER IN connector.
    - ☐ **None** - No synchronization is made.
  - **PN Offset** - Used to enter the PN offset of the base station being tested. This allows correct time offset values to be determined. This setting is not applicable when **Sync Type** is set to **Pilot Seq**.
  - **RF Carrier** - Select **Single** if there is a single RF carrier present at the RF input signal. Select **Multi** if there is more than one carrier

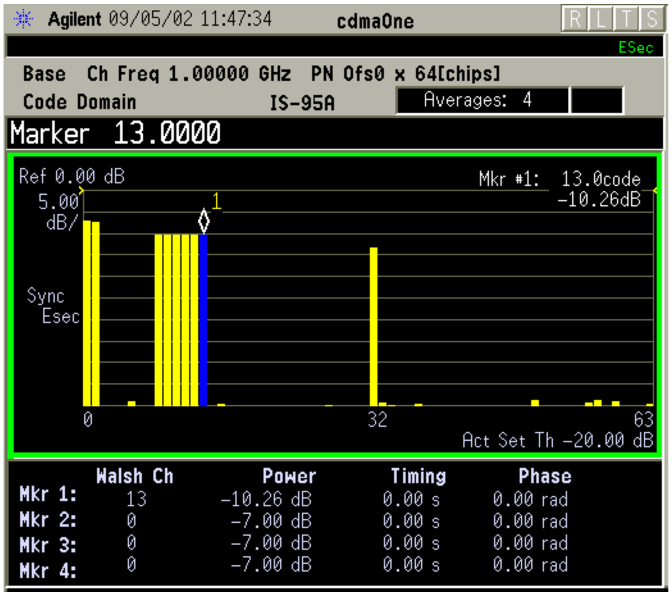
present at the RF input signal, which rejects the upper and lower adjacent channels for the modulation accuracy and code domain measurements.

Changing the View

The **View/Trace** key will allow you to select the desired view of the measurement from the following. Each of these views contains multiple windows that can be selected (using the **Next Window** key) and made full size (using the **Zoom** key).

- **Power Graph & Metrics** - Provides a combination view of the code domain power graph and the numeric result summary as shown in Figure 3-4 on page 79.
- **Power Graph & Markers** - Provides a combination view of the code domain power graph with the marker and the numeric results measured at those marker points up to four.

Figure 3-5 Code Domain Measurement - Power Graph and Markers View

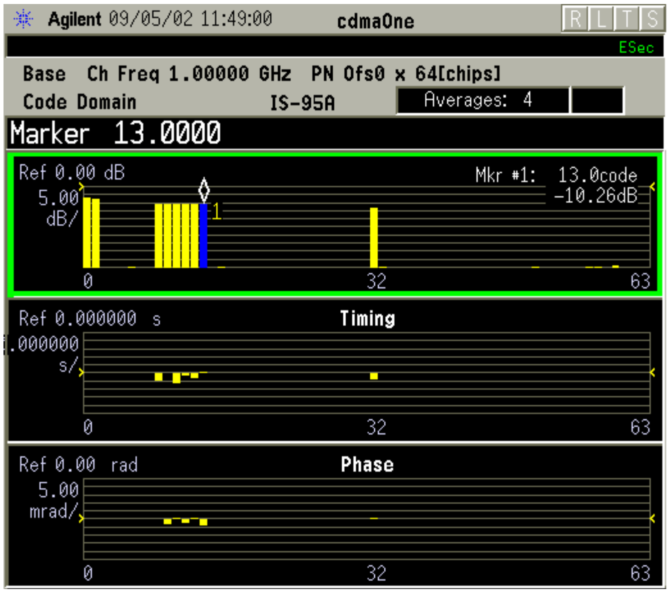


Base Ch Freq 1.00000 GHz PN Ofs0 x 64[chips]
Code Domain IS-95A
Averages: 4
Marker 13.0000
Mkr #1: 13.0code -10.26dB
Act Set Th -20.00 dB

	Walsh Ch	Power	Timing	Phase
Mkr 1:	13	-10.26 dB	0.00 s	0.00 rad
Mkr 2:	0	-7.00 dB	0.00 s	0.00 rad
Mkr 3:	0	-7.00 dB	0.00 s	0.00 rad
Mkr 4:	0	-7.00 dB	0.00 s	0.00 rad

- **Power Timing & Phase** - Provides a combination view of code domain power, timing, and phase graphs.

Figure 3-6 Code Domain Measurement - Power, Timing, and Phase View



Agilent 09/05/02 11:49:00 cdmaOne

Base Ch Freq 1.00000 GHz PN Ofs0 x 64[chips]

Code Domain IS-95A Averages: 4

Marker 13.0000

Mkr #1: 13.0code
-10.26dB

Changing the Display

To change the display parameters, the **Display** and **AMPLITUDE Y Scale** keys are available, depending on the window selected.

The **Display** key allows you to access the following parameter:

- **Points/Chip** - Allows you to set the number of sample points displayed per chip to either 2, 4, or 8. The default selection is 2.

If the `Power` window is active in the **Power Graph & Metrics**, **Power Graph & Markers**, or **Power Timing & Phase** view, the **AMPLITUDE Y Scale** key accesses the menus to allow the following settings:

- **Scale/Div** - Allows you to set the vertical scale by changing the value per division. The range is 0.10 to 20.00 dB. The default setting is 5.00 dB. However, since **Scale Coupling** default is **On**, this value is automatically determined by the measurement result. When you set a value manually, **Scale Coupling** automatically changes to **Off**.

- **Ref Value** - Allows you to set the reference value ranging from –250.00 to 250.00 dB. The default setting is 0.00 dB. However, since **Scale Coupling** default is **On**, this value is automatically determined by the measurement results. When you set a value manually, **Scale Coupling** automatically changes to **Off**.

- **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 the **Restart** softkey under the **Meas Control** menu, this function automatically determines the scale per division and reference values based on the measurement results. When you set a value to either **Scale/Div** or **Ref Value** manually, **Scale Coupling** automatically changes to **Off**.

If the `Timing` window is active in the **Power Timing & Phase** view, the **AMPLITUDE Y Scale** key accesses the menu to allow the following settings:

- **Scale/Div** - Allows you to set the vertical scale by changing the value per division. The range is 0.10 to 20.00 dB per division. The default setting is 5.00 dB. However, since **Scale Coupling** default is **On**, this value is automatically determined by the measurement result. When you set a value manually, **Scale Coupling** automatically changes to **Off**.
- **Ref Value** - Allows you to set the reference value ranging from –250.00 to 250.0 dB. The default setting is 0.00 dB. However, since **Scale Coupling** default is **On**, this value is automatically determined by the measurement results. When you set a value manually, **Scale Coupling** automatically changes to **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 the **Restart** softkey under the **Meas Control** menu, this function automatically determines the scale per division and reference values based on the measurement results. When you set a value to either **Scale/Div** or **Ref Value** manually, **Scale Coupling** automatically changes to **Off**.

If the `Phase` window is active in the **Power Timing & Phase** view, the **AMPLITUDE Y Scale** key accesses the menu to allow the following settings:

- **Scale/Div** - Allows you to set the vertical scale by changing the value per division. The range is 0.0100 to 3600.0 degrees. The default setting is 5.00 degrees. However, since **Scale Coupling** default is **On**, this value is automatically determined by the measurement result. When you set a value manually, **Scale Coupling** automatically changes to **Off**.
- **Ref Value** - Allows you to set the reference value ranging from –36000.0 to 36000.0 degrees. The default setting is 0.00 degrees. However, since **Scale Coupling** default is **On**, this value is automatically determined by the measurement results. When you set a value manually, **Scale Coupling** automatically changes to **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 the **Restart** softkey under the **Meas Control** menu, this function automatically determines the scale per division and reference values based on the measurement results. When you set a value to either **Scale/Div** or **Ref Value** manually, **Scale Coupling** automatically changes to **Off**.

Using the Markers

The **Marker** front-panel key accesses the menu to configure the markers depending on the display selected.

- **Select** - 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 setting is 1.
- **Normal** - Allows you to activate the selected marker to read the power level and symbol code with the code layer. The marker position is controlled either by manual adjustment of the RPG knob or by direct entry of the Walsh code number via the front panel keypad.
- **Delta** - Allows you to read the differences in the power levels and symbols codes between the selected marker and the next.
- **Function** - Allows you to set the selected marker function to **Band Power**, **Noise**, or **Off**. The default setting is **Off**. The **Band Power** and **Noise** functions are not available for this measurement.
- **Trace** - Allows you to place the selected marker on the **Power**, **Timing**, or **Phase** trace. The default setting is **Power**.
- **Off** - Allows you to turn off the selected marker.
- **Shape** - Allows you to access the menu to set the selected marker shape to **Diamond**, **Line**, **Square**, or **Cross**. The default setting 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.

Making the Spur Close Measurement

Purpose

This procedure measures the spurious emissions in the transmit band relative to channel power in the selected channel. The unit under test is typically set for maximum output power. The measurement can be used when the unit under test is set for output power less than maximum, however the limits used might not be correct.

Measurement Method

The transmit band spectrum is measured in several frequency segments using resolution bandwidths as specified by the standard. The channel power (integrated power in a 1.23 MHz bandwidth) is measured first, and then used as a reference for the measurement limit lines. The spectrum, centered around the carrier as well as above and below the carrier, is then measured. For each spectrum segment, the measurement looks for the spectrum peak closest to the limit and reports it as the `Worst Spur`. The amplitude difference from peak to the limit line (Δ from Limit), the frequency difference from the peak to the center of the channel (Offset Freq), and the amplitude difference from the peak to the channel power (Δ from Carrier) are displayed. If the peak goes above the limit line, the display will indicate `FAIL`. If **Marker** is on, the active marker is placed at the worst spur of the displayed segment.

Table 3-4 **Spurious Emission Limits When Transmitting**

Band	Device	Offset Frequency	Limit
IS-95A	**Base**	>750 kHz	–45 dBc/30 kHz
		>1.980 MHz	–60 dBc/30 kHz
		outside channel’s band but inside Tx band	–13 dBm/30 kHz or –60 dBc/30 kHz, whichever is smaller
		outside Tx band	–13 dBm/100 kHz
	Mobile	>885 kHz	–42 dBc/30 kHz
		>1.980 MHz	–54 dBc/30 kHz
		outside channel’s band but inside Tx band	–54 dBm/30 kHz
		outside Tx band	–13 dBm/100 kHz

Table 3-4 Spurious Emission Limits When Transmitting

Band	**Device**	**Offset Frequency**	**Limit**
J-STD-008	**Base**	>885 kHz	–45 dBc/30 kHz
		≤1 MHz outside & adjacent to the channel's band	–13 dBm/12.5 kHz or –80 dBc/12.5 kHz, whichever is greater
		>1 MHz outside channel's band but inside Tx band	–13 dBm/1 MHz or –80 dBc/1 MHz, whichever is greater
		outside Tx band	–13 dBm/1 MHz
	Mobile	>1.265 MHz	–42 dBc/30 kHz
		≤1 MHz outside & adjacent to the channel's band	–13 dBm/12.5 kHz
		>1 MHz outside channel's band but inside Tx band	–13 dBm/1 MHz
		outside Tx band	–13 dBm/1 MHz
IS-97D **IS-98D** **Band Class 0 or 3**	**Base**	765 kHz to 1.995 MHz	–45 dBc/30 kHz
		1.995 MHz to 4.015 MHz	–60 dBc/30 kHz at ≥33 dBm –27 dBm/30 kHz at 28 dBm –55 dBc/30 kHz at <28 dBm
		4.050 MHz to 14.000 MHz[a]	–13 dBm/100 kHz Category A –36 dBm/100 kHz Category B
	Mobile	900 kHz to 1.995 MHz	–42 dBc/30 kHz or –70.13 dBm/30 kHz whichever is greater
		1.995 MHz to 4.015 MHz	–54 dBc/30 kHz or –70.13 dBm/30 kHz, whichever is greater
		4.050 MHz to 14.000 MHz[a]	–13 dBm/100 kHz Category A –36 dBm/100 kHz Category B

Table 3-4 Spurious Emission Limits When Transmitting

Band	Device	Offset Frequency	Limit
IS-97D **IS-98D** **Band Class 1 or 4**	**Base**	900 kHz to 1.265 MHz	–45 dBc/30 kHz
		1.265 MHz to 1.995 MHz	–45 dBc/30 kHz or –9 dBm/30 kHz, whichever is smaller
		1.995 MHz to 2.265 MHz	–55 dBc/30 kHz at ≥33 dBm –22 dBm/30 kHz at 28 dBm –50 dBc/30 kHz at <28 dBm
		2.750 MHz to 4.500 MHz	–13 dBm/1 MHz
		4.500 MHz to 14.000 MHz[a]	–13 dBm/1 MHz Category A –30 dBm/1 MHz Category B
	Mobile	1.265 MHz to 1.995 MHz	–42 dBc/30 kHz or –70.13 dBm/30 kHz, whichever is greater
		1.995 MHz to 4.015 MHz	–50 dBc/30 kHz or –70.13 dBm/30 kHz, whichever is greater
		4.050 MHz to 14.000 MHz[a]	–13 dBm/1 MHz Category A –30 dBm/1 MHz Category B

[a] applicable if the measurement span is 10 MHz.

Making the Measurement

NOTE The factory default settings provide a cdmaOne compliant measurement. For special requirements, you may need to change some of the settings. Press **Meas Setup**, **More**, **Restore Meas Defaults** at any time to return all parameters for the current measurement to their default settings.

Select the desired center frequency as described under “Changing the Frequency Channel” on page 35.

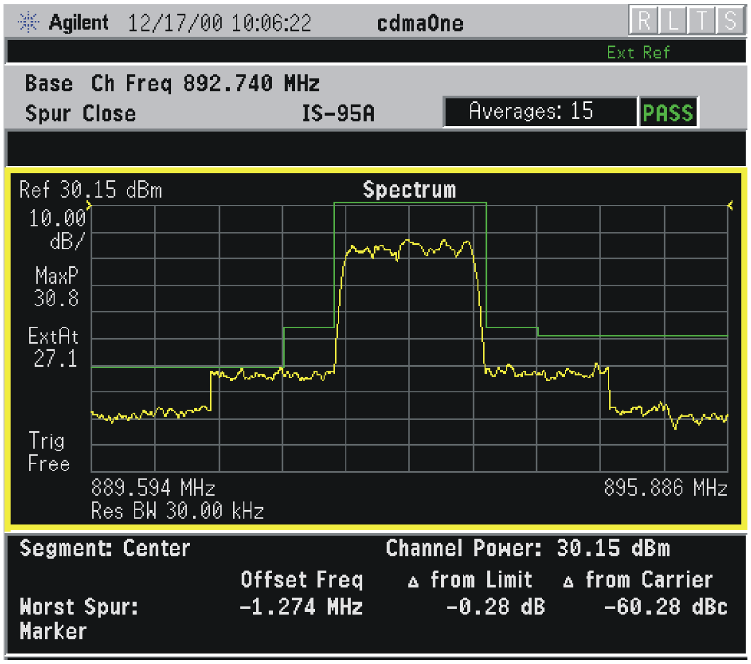
Press **MEASURE**, **Spur Close** to immediately make a spur close measurement.

To change any of the measurement parameters from the factory default values, refer to “Changing the Measurement Setup” on page 88.

Results

The following figure shows an example result of Spur Close Spectrum measurement. In the graph window, the center segment spectrum is shown with the limit mask. The total channel power, the worst spur levels from the carrier level and limit level are displayed in the text window.

Figure 3-7 **IS-95A Spur Close Measurement - Center Segment View**



```
Agilent  12/17/00 10:06:22        cdmaOne
Base  Ch Freq 892.740 MHz
Spur  Close             IS-95A    Averages: 15   PASS
```

```
Segment: Center                  Channel Power: 30.15 dBm
                     Offset Freq    Δ from Limit   Δ from Carrier
Worst Spur:          -1.274 MHz       -0.28 dB       -60.28 dBc
Marker
```

Changing the Measurement Setup

This table shows the factory default settings for spurious close measurements.

Table 3-5 **Spur Close Measurement Defaults**

Measurement Parameter	Factory Default Condition
View/Trace	Center Segment
Avg Number	15; On
Avg Mode	Repeat
Meas Type	Full
Tx Spur >4 MHz Limit	Category A

Make sure the **Spur Close** measurement is selected under the **MEASURE** menu. Press the **Meas Setup** key to access a menu which allows you to modify the averaging parameters as described in “Measurement Setup” on page 62.

In addition, the following parameters can be modified according to your measurement requirement:

- **Meas Type** - Allows you to toggle the measurement bandwidth between **Full** and **Examine**. If set to **Full**, all segments are measured and displayed. If set to **Examine** in the continuous measurement mode, each segment is repetitively measured and the segment where the worst spurious signal is found can be repetitively measured and displayed for further tests.
- **Tx Spur >4 MHz Limit** - Allows you to access the selection menu for the limit masks at the frequency offset more than 4 MHz.
  - **Category A** - Sets to use the limit level of power spectral density –13 dBm/100 kHz for Band Class 0 or 3, or –13 dBm/1 MHz for Band Class 1 or 4.
  - **Category B** - Sets to use the limit level of power spectral density –36 dBm/100 kHz for Band Class 0 or 3, or –30 dBm/1 MHz for Band Class 1 or 4.
  - **None** - Sets not to use the limit mask, and **Upper Segment** and **Lower Segment** are grayed out.

Changing the View

The **View/Trace** key will allow you to select the desired view of the measurement from the following. Each of these choices selects a different part of the frequency spectrum for viewing. The Center Segment shows the spectrum centered on the carrier channel frequency.

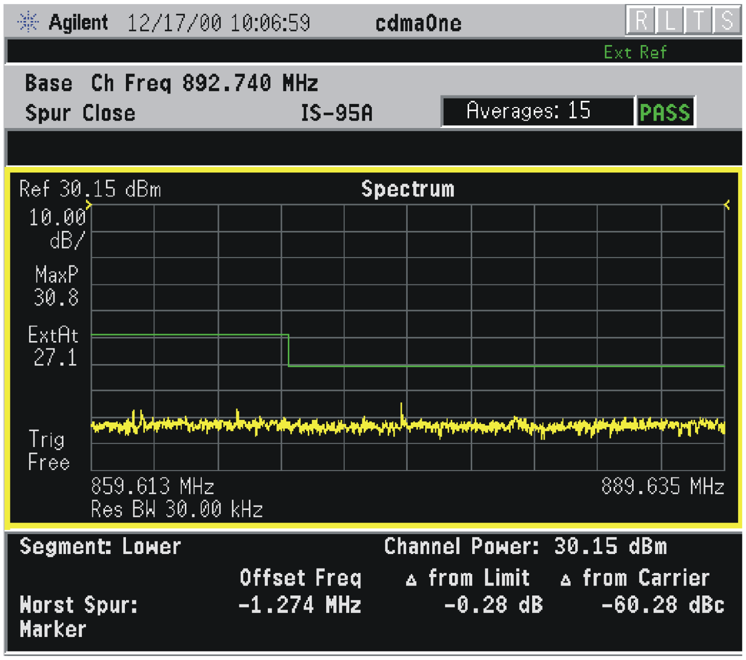
When **Radio Std** is set to **IS-95A**, or when **Radio Std** is set to **IS-97D IS-98D** and **Band Class** is set to **0 (800 MHz)** or **3 (JTACS)** for **Base** and **Mobile** tests, or when **Band Class** is set to **1 (1900 MHz)** or **4 (Korean PCS)** for **Mobile** tests, there are three measurement segments to be selected as follows:

- **Lower Segment**
- **Center Segment**
- **Upper Segment**

When **Radio Std** is set to **J-STD-008**, or when **Radio Std** is set to **IS-97D IS-98D** and **Band Class** is set to **1 (1900 MHz)** or **4 (Korean PCS)** for **Base** tests, all of the measurement segments are effective for your selection:

- **Lower Segment**
- **Lower Adj Segment**
- **Center Segment**
- **Upper Adj Segment**
- **Upper Segment**

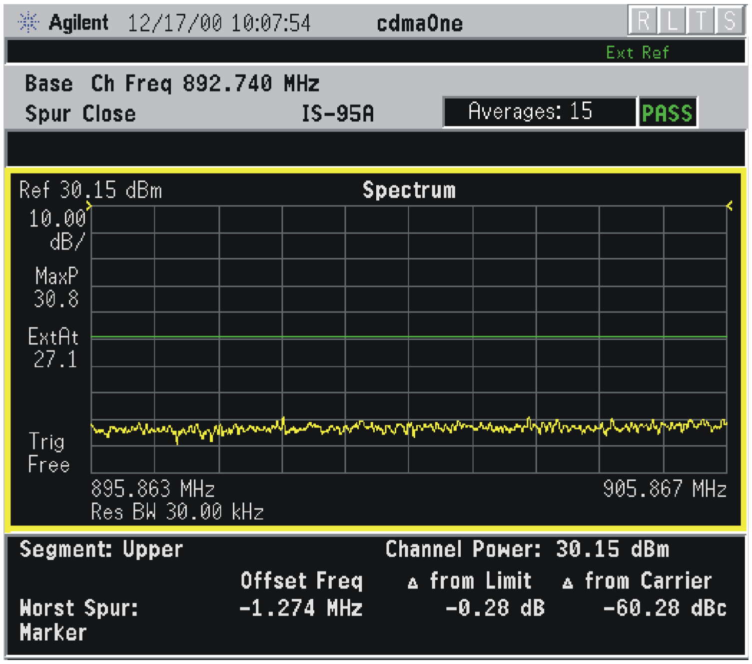
Figure 3-8 IS-95A Spur Close Measurement - Lower Segment View



```
Agilent  12/17/00 10:06:59       cdmaOne                    R L T S
                                                     Ext Ref
Base  Ch Freq 892.740 MHz
Spur Close                  IS-95A         Averages: 15   PASS

Segment: Lower                       Channel Power: 30.15 dBm
                           Offset Freq    Δ from Limit    Δ from Carrier
Worst Spur:                -1.274 MHz       -0.28 dB        -60.28 dBc
Marker
```

Figure 3-9 IS-95A Spur Close Measurement - Upper Segment View



```
Agilent  12/17/00 10:07:54       cdmaOne                    R L T S
                                                     Ext Ref
Base  Ch Freq 892.740 MHz
Spur Close                  IS-95A         Averages: 15   PASS

Segment: Upper                       Channel Power: 30.15 dBm
                           Offset Freq    Δ from Limit    Δ from Carrier
Worst Spur:                -1.274 MHz       -0.28 dB        -60.28 dBc
Marker
```

Changing the Display

The **AMPLITUDE Y Scale** key accesses the menu to set the desired measurement scale and associated parameters:

- **Scale/Div** - Allows you to enter a numeric value to change the vertical display sensitivity. The range is 0.10 to 20.00 dB with 0.01 dB resolution. The default setting is 10.00 dB. However, since the **Scale Coupling** default is **On**, this value is automatically determined by the measurement result. When you set a value manually, **Scale Coupling** automatically changes to **Off**.

- **Ref Value** - Allows you to set the absolute power reference value ranging from –250.00 to 250.00 dBm with 0.01 dB resolution. The default setting is 10.00 dBm. However, since the **Scale Coupling** default is **On**, this value is automatically determined by the measurement result. When you set a value manually, **Scale Coupling** automatically changes to **Off**.
- **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 the **Restart** softkey under the **Meas Control** menu, this function automatically determines the scale per division and reference values based on the measurement results. When you set a value to either **Scale/Div** or **Ref Value** manually, **Scale Coupling** automatically changes to **Off**.

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 Signal envelope trace, for example. 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** - Allows you to define the selected marker function to be **Band Power**, **Noise**, or **Off**. The default is **Off**. For measuring **Band Power**, you need to place the **Normal** marker and then place the **Delta** marker.
- **Trace** - Allows you to place the selected marker on the **Spectrum** trace.
- **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 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.

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**, **Restore Meas Defaults** at any time to return all parameters for the current measurement to their default settings.

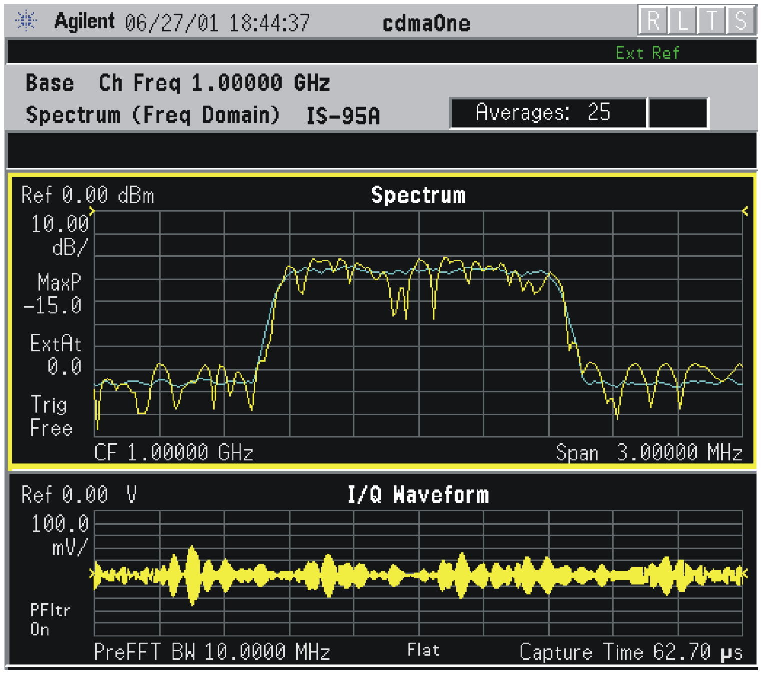
Press **MEASURE**, **Spectrum (Freq Domain)** to immediately make a spectrum measurement.

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 3-10 **Spectrum Measurement - Spectrum and I/Q Waveform View**



06/27/01 18:44:37 cdmaOne
Ext Ref
Base Ch Freq 1.00000 GHz
Spectrum (Freq Domain) IS-95A
Averages: 25
Ref 0.00 dBm
10.00 dB/
MaxP -15.0
ExtAt 0.0
Trig Free
CF 1.00000 GHz
Span 3.00000 MHz
Ref 0.00 V
100.0 mV/
PFltr On
PreFFT BW 10.0000 MHz
Flat
Capture Time 62.70 µs

Changing the Measurement Setup

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

Table 3-6 **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/Q Waveform View: Capture Time AMPLITUDE Y Scale - Scale/Div	 188.00 µs 100.0 mV

Table 3-6 Spectrum (Frequency Domain) Measurement Defaults

Measurement Parameter	**Factory Default Condition**
Spectrum Linear View: SPAN AMPLITUDE Y Scale - Scale/Div	**(for E4406A)** 1.00000 MHz 100.0 mV
I and Q Waveform View: Capture Time AMPLITUDE Y Scale - Scale/Div	**(for E4406A)** 188.00μs 100.0 mV
I/Q Polar View: I/Q Scale/Div I or Q Origin	**(for E4406A)** 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 a roll-off factor (alpha) of 3.5.
    - ❏ **Blackman** - Press this key to activate the Blackman filter.
    - ❏ **Blackman Harris** - Press this key to activate the Blackman Harris 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, –6 to +24 dB for E4406A or None to +18 dB for PSA, 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 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 window view of the I/Q waveform graph in parameters of voltage versus time with linear graticules. Changes to sweep time or resolution bandwidth will sometimes affect data acquisition. This is equivalent to change the selected window with the **Next** key.

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 `Spectrum` 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 0.10 dB to 20.00 dB per division. The default setting is 10.00 dB. However, since the **Scale Coupling** default is **On**, this value is automatically determined by the measurement results. When you set a value manually, **Scale Coupling** automatically changes to **Off**.
  - **Ref Value** - Allows you to set the reference value ranging from –250.00 to 250.00 dBm. The default setting is 0.00 dBm. However, since the **Scale Coupling** default is **On**, this value is automatically determined by the measurement results. When you set a value manually, **Scale Coupling** automatically changes to **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. When you set a value to either **Scale/Div** or **Ref Value** manually, **Scale Coupling** automatically changes to **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.

- **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**, **Spectrum Avg**, or **I/Q Waveform** 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.

Basic mode waveform measurement data may be displayed using either a Signal Envelope window, or 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 making a 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 in the time domain with excellent 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 rate of sampling to create an accurate representation of a time domain signal.

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**, **Restore Meas Defaults** at any time to return all parameters for the current measurement to their default settings.

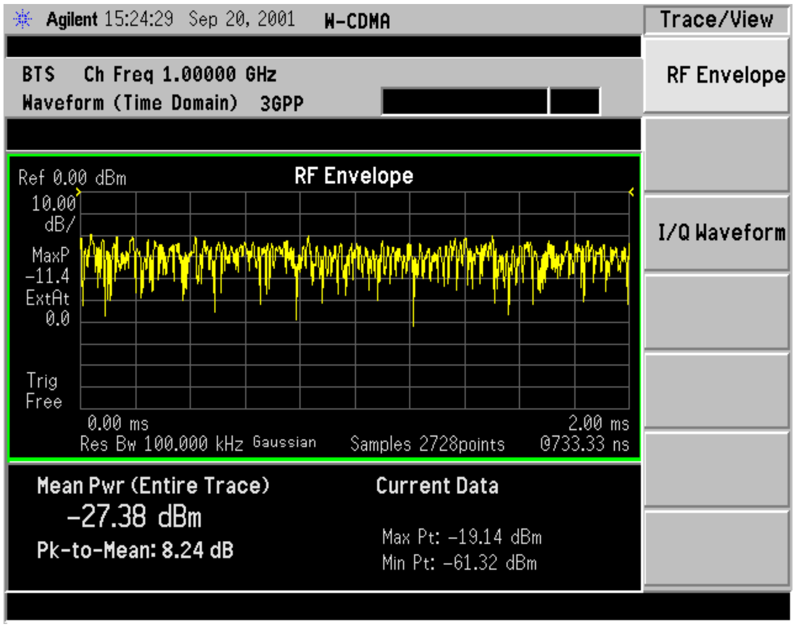
Press **MEASURE**, **Waveform (Time Domain)** to immediately make a waveform (time domain) measurement.

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 an `RF Envelope` (for E4406A) or `Signal Envelope` (for PSA) 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 3-11 **Waveform Measurement - RF Envelope Window**



Agilent 15:24:29 Sep 20, 2001 W-CDMA

BTS Ch Freq 1.00000 GHz
Waveform (Time Domain) 3GPP

Ref 0.00 dBm
10.00 dB/
MaxP -11.4
ExtAt 0.0
Trig Free
0.00 ms
2.00 ms
Res Bw 100.000 kHz Gaussian
Samples 2728points
@733.33 ns

Mean Pwr (Entire Trace)
-27.38 dBm
Pk-to-Mean: 8.24 dB

Current Data
Max Pt: -19.14 dBm
Min Pt: -61.32 dBm

Changing the Measurement Setup

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

Table 3-7 **Waveform (Time Domain) Measurement Defaults**

Measurement Parameter	**Factory Default Condition**
View/Trace	RF Envelope (for E4406A)
Sweep Time	2.000 ms
Res BW	100.000 kHz2.00000 MHz
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	**(for E4406A)** 200.0 µs 10.00 dB
Signal Envelope View SPAN X Scale - Scale/Div AMPLITUDE Y Scale - Scale/Div	**(for PSA)** 200.0 µs 10.00 dB

Table 3-7 **Waveform (Time Domain) Measurement Defaults**

Measurement Parameter	**Factory Default Condition**
I/Q Waveform View: SPAN X Scale -Scale/Div AMPLITUDE Y Scale - Scale/Div	 200.0 µs 100.0 mV
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 8 MHz using the **Gaussian** filter selected from **RBW Filter** under the **Advanced** menu, or 10 Hz to 10 MHz using the **Flat** top filter selected from **RBW Filter**. 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. The resolution bandwidth range is 10 Hz to 8 MHz using the Gaussian filter or 10 Hz to 10 MHz using the Flat top filter.

— **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, –6 to +24 dB for E4404A or None to +18 dB for PSA, 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

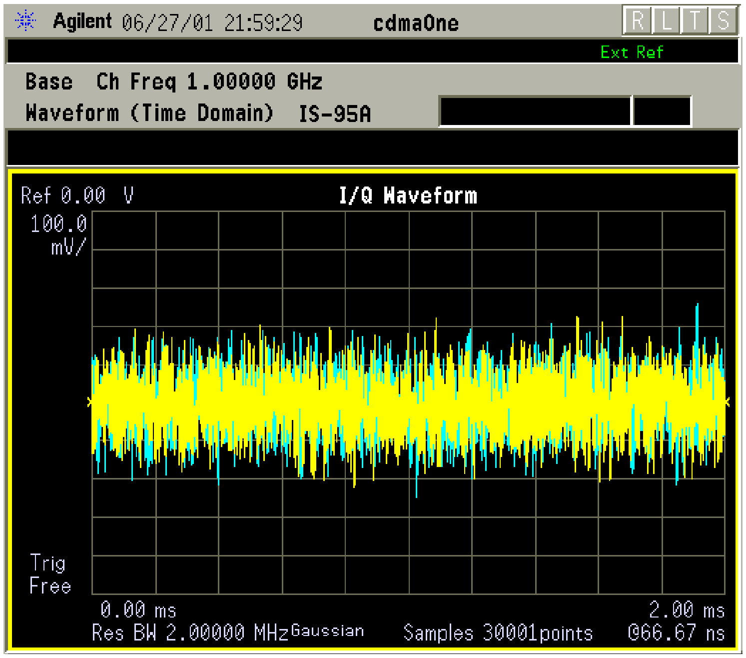
The **View/Trace** key allows you to access the selection menu for the desired measurement view. You can use the **Next Window** key to move between the multiple windows (if any) and make it full size by **Zoom**.

Windows Available for Waveform Measurements

The following views are available to display measurement data, and are accessed by pressing the **Trace/View** (for PSA) or **View/Trace** (for E4406A) key:

- **RF Envelope** (for E4406A) or **Signal Envelope** (for PSA) - Provides a combination view of the waveform graph in parameters of power versus time with semi-log graticules. 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 as shown in "Results" on page 102. Changes to sweep time or resolution bandwidth can affect data acquisition.
- **I/Q Waveform** - Provides a view of the I/Q waveform graph in parameters of voltage versus time in linear scale. Changes to sweep time or resolution bandwidth can affect data acquisition.

Figure 3-12 Waveform Measurement - I/Q Waveform View



Agilent 06/27/01 21:59:29 cdmaOne

Base Ch Freq 1.00000 GHz

Waveform (Time Domain) IS-95A

Res BW 2.00000 MHz Gaussian

Samples 30001points

@66.67 ns

*Meas Setup: View/Trace = I/Q Waveform View

Others = Factory defaults, except X and Y scales

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.

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. However, since the **Scale Coupling** default is **On**, this value is automatically determined by the measurement result. When you set a value manually, **Scale Coupling** automatically changes to **Off**.
- **Ref Value** - Allows you to set the reference value ranging from –1.0 to 10.0 s. The default setting is 0.00 s. However, since the **Scale Coupling** default is **On**, this value is automatically determined by the measurement result. When you set a value manually, **Scale Coupling** automatically changes to **Off**.
- **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. When you set a value to either **Scale/Div** or **Ref Value** manually, **Scale Coupling** automatically changes to **Off**.

If the `RF Envelope` (for E4406A) or `Signal Envelope` (for PSA) window is active in the **RF Envelope** (for E4406A) or **Signal Envelope** (for PSA) 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 0.10 to 20.00 dB per division with 0.01 dB resolution. The default setting is 10.00 dB per division. However, since the **Scale Coupling** default is **On**, this value is automatically determined by the measurement result. When you set a value manually, **Scale Coupling** automatically changes to **Off**.

- **Ref Value** - Allows you to set the reference value ranging from –250.00 to 250.00 dBm. The default setting is 0.00 dBm. However, since the **Scale Coupling** default is **On**, this value is automatically determined by the measurement result. When you set a value manually, **Scale Coupling** automatically changes to **Off**.
- **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. When you set a value to either **Scale/Div** or **Ref Value** manually, **Scale Coupling** automatically changes to **Off**.

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. However, since the **Scale Coupling** default is **On**, this value is automatically determined by the measurement result. When you set a value manually, **Scale Coupling** automatically changes to **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 result. When you set a value manually, **Scale Coupling** automatically changes to **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. When you set a value to either **Scale/Div** or **Ref Value** manually, **Scale Coupling** automatically changes to **Off**.

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 or Signal 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 **RF Envelope** (for E4406A), **Signal Envelope** (for PSA), or **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 or Signal 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.

Making the Adjacent Channel Power Ratio (ACPR/ACLR) Measurement

Purpose

Adjacent Channel Power Ratio (ACPR), as it applies to cdmaOneW-CDMA (3GPP), is the power contained in a specified frequency channel bandwidth relative to the total carrier power. It may also be expressed as a ratio of power spectral densities between the carrier and the specified offset frequency band. This is also called Adjacent Channel Leakage power Ratio (ACLR).

As a composite measurement of out-of-channel emissions, ACPR combines both in-band and out-of-band specifications to provide useful figures-of-merit for spectral regrowth and emissions produced by components and circuit blocks without the rigor of performing a full spectrum emissions mask measurement.

To maintain a quality call by avoiding channel interference, it is important to measure and reduce any adjacent channel leakage power transmitted from a mobile phone. The characteristics of adjacent channel leakage power are mainly determined by the transmitter design, particularly the low-pass filter.

Measurement Method

This ACPR measurement analyzes the total power levels within the defined carrier bandwidth and at given frequency offsets on both sides of the carrier frequency. This measurement requires the user to specify measurement bandwidths of the carrier channel and each of the offset frequency pairs up to 5. Each pair may be defined with unique measurement bandwidths.

It uses an integration bandwidth (IBW) method that performs a time domain data acquisition and applies FFT to get a frequency domain trace. In this process, the channel integration bandwidth is analyzed using the automatically defined resolution bandwidth (RBW), which is much narrower than the channel bandwidth. The measurement computes an average power of the channel over a specified number of data acquisitions, automatically compensating for resolution bandwidth and noise bandwidth.

If **Total Pwr Ref** is selected as the measurement type, the results are displayed as relative power in dBc and as absolute power in dBm. If **PSD Ref** (Power Spectral Density Reference) is selected, the results are displayed as relative power in dB, and as absolute power in dBm/Hz.

Recommended Offset Frequencies and Reference Bandwidths

While the user sets the specific offsets and reference bandwidths, the radio specifications recommend some common setups as shown in the following table. The offset frequency is titled as `Offset to Edge` in the measurement result window when **Radio** is set to **IS-97D IS-98D**.

Table 3-8 ACPR Setup Recommendation

Band	Test Device	Offset Frequency	Integration Bandwidth	Result Reference
cdmaOne IS-95A	Base	±750.0 kHz	30 kHz	PSD Ref
		±1.980 MHz	30 kHz	
	Mobile	±885.0 kHz	30 kHz	Total Power in 1.23 MHz
		±1.980 MHz	30 kHz	
cdmaOne J-STD-008	Base	±885.0 kHz	30 kHz	Total Power in 1.23 MHz
		±1.25625 MHz	12.5 kHz	
		±2.750 MHz	1 MHz	
	Mobile	±1.265 MHz	30 kHz	
		±1.750 MHz	1.00 MHz	
cdmaOne IS97D IS98D Band Class 0 or 3	Base	±765.0 kHz	30 kHz	PSD Ref
		±1.995 MHz	30 kHz	
	Mobile	±900.0 kHz	30 kHz	Total Power in 1.23 MHz
		±1.995 MHz	30 kHz	
cdmaOne IS97D IS98D Band Class 1 or 4	Base	±900.0 kHz	30 kHz	Total Power in 1.23 MHz
		±1.265 MHz	30 kHz	
		±1.995 MHz	30 kHz	
		±2.750 MHz	1.00 MHz	
	Mobile	±1.265 MHz	30 kHz	
		±1.995 MHz	30 kHz	

Making the Measurement

The factory default settings provide a good starting point. For special requirements, you many want to change some of the settings. Press **Meas Setup**, **More**, **Restore Meas Defaults** at any time to return all parameters for the current measurement to their default settings.

Select the desired center frequency as described in the “Changing the Frequency Channel” section.

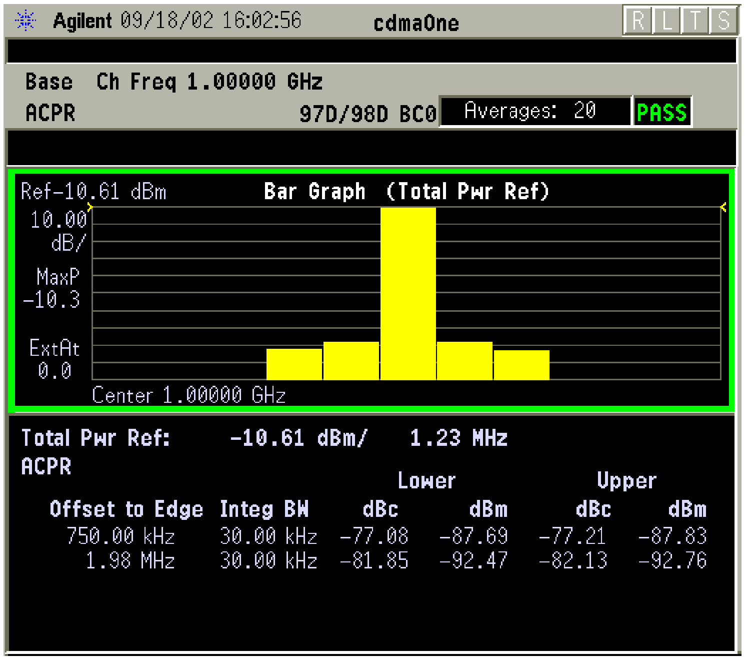
Press **MEASURE**, **ACPR (ACLR)** to immediately make an adjacent channel power ratio measurement.

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

Results

The following figure shows an example result of `ACPR (Total Pwr Ref)` measurements in the bar graph window. The absolute and relative power levels on both sides of the carrier frequency are displayed in the graphic window and text window.

Figure 3-13 cdmaOne ACPR Measurement - Bar Graph View



```
Agilent 09/18/02 16:02:56        cdmaOne
Base   Ch Freq 1.00000 GHz
ACPR                   97D/98D BC0  Averages: 20  PASS

Total Pwr Ref:     -10.61 dBm/    1.23 MHz
ACPR
                                    Lower            Upper
   Offset to Edge  Integ BW     dBc      dBm      dBc      dBm
     750.00 kHz    30.00 kHz  -77.08   -87.69   -77.21   -87.83
       1.98 MHz    30.00 kHz  -81.85   -92.47   -82.13   -92.76
```

Changing the Measurement Setup

The next table shows the factory default settings for adjacent channel power ratio measurements.

Table 3-9 Adjacent Channel Power Ratio Measurement Defaults

Measurement Parameter	Factory Default Condition
View/Trace	Bar Graph (Total Pwr Ref)
Spectrum Trace	On
Avg Number	15; On
Avg Mode	Repeat

Table 3-9 Adjacent Channel Power Ratio Measurement Defaults

Measurement Parameter	Factory Default Condition
Ref Channel:	
Chan Integ BW	1.23000 MHz
Avg Type	Pwr Avg (RMS)
Ref Chan Adv.:	
Sweep Time	546.1 µs; Auto
Data Points	2048; Auto
Res BW	1.620 kHz (grayed out)
Num FFT Seg	1; Auto
Offset/Limits:	
Offset	A
Offset Freq	A: 765.000 kHz; On B: 1.99500 MHz; On
Offset Side	Both
Ref BW	30.000 kHz
Avg Type	Pwr Avg (RMS)
Limit Setup:	
Abs Limit	0.00 dBm
Fail	Relative
Rel Lim (Car)	A: –45.00 dBc B: –60.00 dBc
Rel Lim (PSD)	A: –28.87 dB B: –43.87 dB
Offset Adv.:	
Sweep Time	11.20 ms; Auto
Data Points	1024; Auto
Res BW	79.0 Hz (grayed out)
Num FFT Seg	1; Auto
Relative Atten	0.00 dB
Meas Type	Total Pwr Ref
Trig Source	Free Run (Immediate)
Fast ACPR	Off
Limit Test	On
Dynamic Range	Normal

Make sure the **ACPR** measurement is selected under the **MEASURE** menu. The **Meas Setup** key accesses the menu which allows you to modify the average number and average mode for this measurement.

In addition, the following parameters for adjacent channel power ratio measurements can be modified:

- **Ref Channel** - Allows you to access the following parameters for the reference channel settings:

  — **Chan Integ BW** - Allows you to specify the channel integration bandwidth in which the carrier power is measured. The range is 1.000 kHz to 20.0000 MHz with the best resolution of 1 Hz.

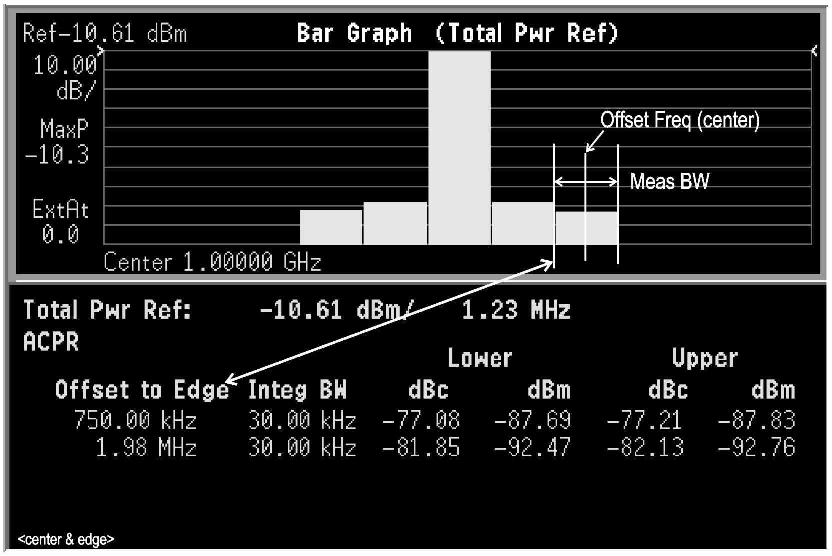
- — **Avg Type** - Allows you to set to power averaging type to either **Pwr Avg (RMS)** or **Maximum**.
- — **Ref Chan Adv** - Allows you to access the menu to change the following advanced parameters for the reference channel:
  - ❑ **Sweep Time** - Allows you to toggle the sweep time function between **Auto** and **Man** (manual), and to set a value for the sweep time ranging from 1.0 ms to 50.000 ms if set to **Man**. If set to **Auto**, the reference channel measurement sweep time is derived from the data points and the number of FFT segments.
  - ❑ **Data Points** - Allows you to toggle the control function of the number of data points between **Auto** and **Man** (manual), and to set the number of data points ranging from 64 to 65536. The automatic mode chooses the optimum number of points (= 2^{n+6} where n = 0 to 11) for the fastest measurement time with acceptable repeatability. The minimum number of points that could be used is determined by the sweep time and the sampling rate. You can increase the length of the measured time record (capture more of the burst) by increasing the number of points, but the measurement will take longer.
  - ❑ **Res BW** - This key is always grayed out. However, it allows you to see the resolution bandwidth that is derived from the combination of sweep time, data points, and FFT segments.
  - ❑ **Num FFT Seg** - Allows you to select the number of FFT segments used in making the measurement of the reference channel (carrier). In the automatic mode the measurement optimizes the number of FFT segments required for the shortest measurement time. The minimum number of segments required to make a measurement is set by your desired measurement bandwidth. Selecting more than the minimum number of segments will give you more dynamic range for making the measurement, but the measurement will take longer to execute.

- **Offset/Limits** - Allows you to access the menu to change the following parameters for offset frequency settings and pass/fail tests:
  - — **Offset** - Allows you to select one of five offsets (**A** through **E**). Only one selection at a time (A, B, C, D, or E) is shown on this key label. The remaining softkeys on the **Offset/Limits** menu then apply to the selected offset.
  - — **Offset Freq** - Allows you to enter an offset frequency value and toggle the offset function between **On** and **Off**. The range is 0.0 Hz to 45.000 MHz. While this key is activated, enter an offset value from the numeric keypad by terminating with one of the

frequency unit keys shown. Offsets A and B are defaulted as follows for BS tests, while others are defaulted to 0.0 Hz and Off:

Offset A: 765.00 kHz, On
Offset B: 1.9950 MHz, On

One offset frequency center value corresponding to the **Offset** menu selection is shown on this key label. When **Radio** is set to **IS-97D IS-98D**, `Offset to Edge` considering the measurement bandwidth is shown in the mesurement result window instead of `Offset Freq` for other radios as illustrated below.



```
Total Pwr Ref:     -10.61 dBm/    1.23 MHz
ACPR
                                  Lower                Upper
  Offset to Edge  Integ BW     dBc       dBm       dBc       dBm
     750.00 kHz    30.00 kHz  -77.08    -87.69    -77.21    -87.83
       1.98 MHz    30.00 kHz  -81.85    -92.47    -82.13    -92.76
```

<center & edge>

— **Offset Side** - Choose **Neg** (negative) or **Pos** (positive) to have single-sided offsets relative to the carrier, or **Both** (the default) to have offset frequency pairs.

— **Ref BW** - Allows you to enter a reference bandwidth ranging from 300 Hz to 20.0000 MHz with the best resolution of 1 Hz. When this parameter is changed, the integration bandwidth `Integ BW` in the summary data window changes to that value.

— **Avg Type** - Choose the type of averaging between **Pwr Avg (RMS)** or **Maximum**.

— **Limit Setup** - Allows you to access the menu to setup the limit values and conditions.

- ❑ **Abs Limit** - Allows you to enter an absolute limit value ranging from –200.00 to +50.00 dBm with 0.01 dB resolution.
- ❑ **Fail** - Allows you to access the following menu to select one of the logic keys for fail conditions between the measurement results and the test limits:

  AND - Fail is shown if one of the relative ACPR measurement results is larger than **Rel Lim (Car)** or **Rel Lim (PSD)** AND one of the absolute ACPR measurement results is larger than **Abs Limit**.

OR - Fail is shown if one of the relative ACPR measurement results is larger than **Rel Lim (Car)** or **Rel Lim (PSD)** OR one of the absolute ACPR measurement results is larger than **Abs Limit**.

Absolute - Fail is shown if one of the absolute ACPR measurement results is larger than **Abs Limit**.

Relative - Fail is shown if one of the relative ACPR measurement results is larger than **Rel Lim (Car)** or **Rel (PSD)**.

- ❑ **Rel Lim (Car)**- Allows you to enter a relative limit value of the carrier level ranging from –150.00 to +50.00 dBc with 0.01 dB resolution. The default is –45.00 dBc for **Offset A** and –60.00 dBc for **Offset B**.
- ❑ **Rel Lim (PSD)**- Allows you to enter a relative limit value of the power spectral density level ranging from –150.00 to +50.00 dB with 0.01 dB resolution. The default is –28.87 dB for **Offset A** and –43.87 dB for **Offset B**.

— **Offset Adv** - Allows you to access the menu to change the following advanced offset parameters:

- ❑ **Sweep Time** - Allows you to toggle the sweep time function between **Auto** and **Man** (manual), and to set a value for the sweep time ranging from 1.0 ms to 50.000 ms if set to **Man**. If set to **Auto**, the offset channel measurement sweep time is derived from the data points and the number of FFT segments.
- ❑ **Data Points** - Allows you to toggle the control function of the number of data points between **Auto** and **Man** (manual), and to set the number of data points ranging from 64 to 65536. If set to **Auto**, the optimum number of points (= 2^{n+6} where n = 0 to 11) for the fastest measurement time with acceptable repeatability is automatically determined. The minimum number of points that could be used is determined by the sweep time and the sampling rate. You can increase the length of the measured time record (capture more of the burst) by increasing the number of points, but the measurement will take longer.
- ❑ **Res BW** - This key is always grayed out. However, it allows you to see the resolution bandwidth that is derived from the combination of sweep time, data points, and FFT segments.
- ❑ **Num FFT Seg** - The automatic mode selects the optimum number of FFT segments to measure the offset, while making the fastest possible measurement.
- ❑ **Relative Atten** - Allows you to set a relative amount of

attenuation for the measurements made at your offsets. The amount of attenuation is always specified relative to the attenuation that is required to measure the carrier channel. Since the offset channel power is lower than the carrier channel power, less attenuation is required to measure the offset channel and you get wider dynamic range for the measurement.

- **Meas Type** - Allows you to access the menu to select one of the measurement reference types.
  - **Total Pwr Ref** - Select this to set the total carrier power to the measurement reference level and the measured data is shown in dBc and dBm.
  - **PSD Ref** - Select this to set the mean power spectral density of the carrier to the measurement reference level and the measured data is shown in dB and dBm/Hz.
- **Dynamic Range** - Allows you to optimize the dynamic range of the measurement in the following ways.
  - **Normal** - Select this to let the measurement automatically choose settings that trade off dynamic range for faster measurement speed. This is a good choice for making CDMA measurements on a signal with only one carrier turned on at a time.
  - **High** - Select this to choose settings that provide better dynamic range (better signal to noise ratio) at the expense of longer measurement time. This is a better choice for CDMA signals with multiple carriers turned on at the same time.
  - **Modified** - This is not a customer settable option. This choice is automatically selected depending on your selection of other related settings in the advanced measurement setup, like the number of FFT segments.
- **Fast ACPR** - Allows you to increase the speed of the measurement. A time domain computation method is used rather than an FFT transformation. When this faster measurement method is selected, repeatability is slightly reduced.
- **Spectrum Trace** - Turns off the spectrum trace data calculations. This is only applicable when using the Spectrum View. It speeds up the display of the other measured data values by not calculating the spectrum trace.
- **Limit Test** - Turns on or off the limit test function.

Changing the View

The **View/Trace** key accesses the menu to select either **Bar Graph** or **Spectrum** for the measurement result, depending on the **Sweep Type** setting.

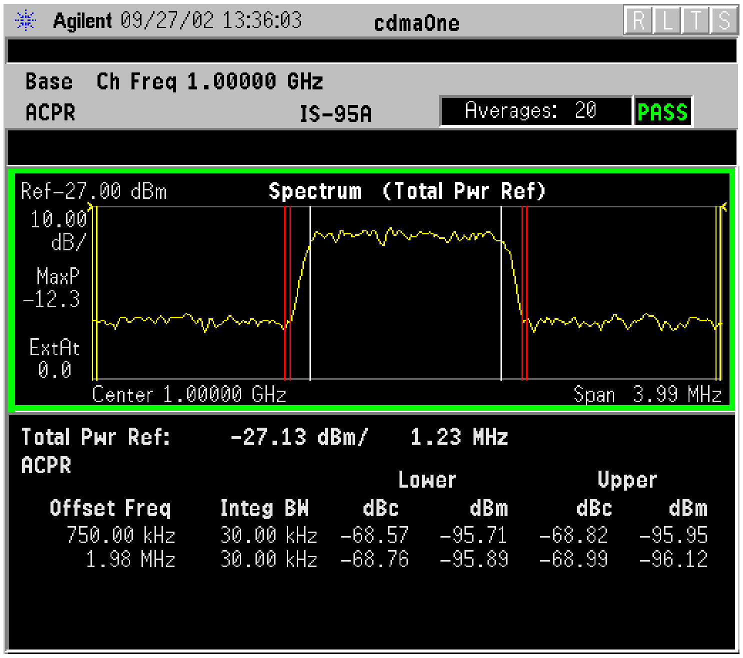
- **Bar Graph** - In the factory default condition 5 of the total integration power levels, centered at the carrier frequency and ±765.0 kHz and ±1.995 MHz offset frequencies, are shown in the figure for the "Results" section. The corresponding measured data is shown in the text window. When **Radio** is set to **IS-97D IS-98D**, `Offset to Edge` considering the measurement bandwidth is shown in the measurement result window instead of `Offset Freq` for other radios. Depending on the **Meas Type** selection, one of the two following displays is obtained:

  `Bar Graph (Total Pwr Ref)` - A histogram of powers referenced to the total power

  `Bar Graph (PSD Ref)` - A histogram of powers referenced to the mean power spectral density of the carrier in dBm/Hz

- **Spectrum** - In the factory default condition, the frequency spectrum with the FFT sweep type is displayed with the bandwidth marker lines in the graph window. The corresponding measured data in the text window is the total integration power levels, in dBc and dBm, within the defined bandwidth as shown in the figure below.

Figure 3-14 **ACPR Measurement - Spectrum View**



```
Base   Ch Freq 1.00000 GHz
ACPR                  IS-95A     Averages: 20  PASS

Total Pwr Ref:     -27.13 dBm/    1.23 MHz
ACPR
                                  Lower             Upper
  Offset Freq    Integ BW     dBc       dBm      dBc       dBm
   750.00 kHz    30.00 kHz  -68.57    -95.71   -68.82    -95.95
     1.98 MHz    30.00 kHz  -68.76    -95.89   -68.99    -96.12
```

Depending on the **Meas Type** setting, one of the two following displays is obtained:

`Spectrum (Total Pwr Ref)` - A spectrum display referenced to the total power

`Spectrum (PSD Ref)` - A spectrum display referenced to the mean power spectral density of the carrier in dBm/Hz

You can improve the update speed of the displayed data values by turning off the spectrum trace in **Meas Setup**.

Using the Marker

The **Marker** key is not available for this measurement function.

Troubleshooting Hints

This adjacent channel power ratio measurement can reveal degraded or defective parts in the transmitter section of the UUT. The following examples are those areas to be checked further.

- Some faults in the DC power supply control of the transmitter power amplifier, RF power controller of the pre-power amplifier stage, or I/Q control of the baseband stage

- Some degradation in the gain and output power level of the amplifier due to the degraded gain control and/or increased distortion
- Some degradation of the amplifier linearity and other performance characteristics

Power amplifiers are one of the final stage elements of a base or mobile transmitter and are a critical part of meeting the important power and spectral efficiency specifications. Since ACPR measures the spectral response of the amplifier to a complex wideband signal, it is a key measurement linking amplifier linearity and other performance characteristics to the stringent system specifications.

4 Programming Commands

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

SCPI Command Subsystems

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, 1xEV-DO, 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, 1xEV-DO, 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	X	
[SENSe:]FREQuency: <other subsystems>	not available in application modes	not available in application modes
[SENSe:]<measurement>		
[SENSe:]POWer		
[SENSe:]RADio		
[SENSe:]SYNC		
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, Phase Noise and Noise Figure Mode	Basic, cdmaOne, cdma2000, 1xEV-DO, W-CDMA, GSM, EDGE, NADC, PDC Modes
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, 1xEV-DO, 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.
*LRN	The command is *not* available.	The command is available.	The command is available.
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.

ACP - Limits

Adjacent Channel Power—Limit Test

:CALCulate:ACP:LIMit:STATe OFF|ON|0|1

:CALCulate:ACP:LIMit:STATe?

Turn limit test on or off.

Factory Preset: On

Remarks: For E4406A you must be in Basic, cdmaOne, iDEN mode to use this command. Use INSTrument:SELect to set the mode.

For PSA you must be in cdmaOne mode to use this command. Use INSTrument:SELect to set the mode.

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 169 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 4-1 **Sample Trace Data - Constant Envelope**

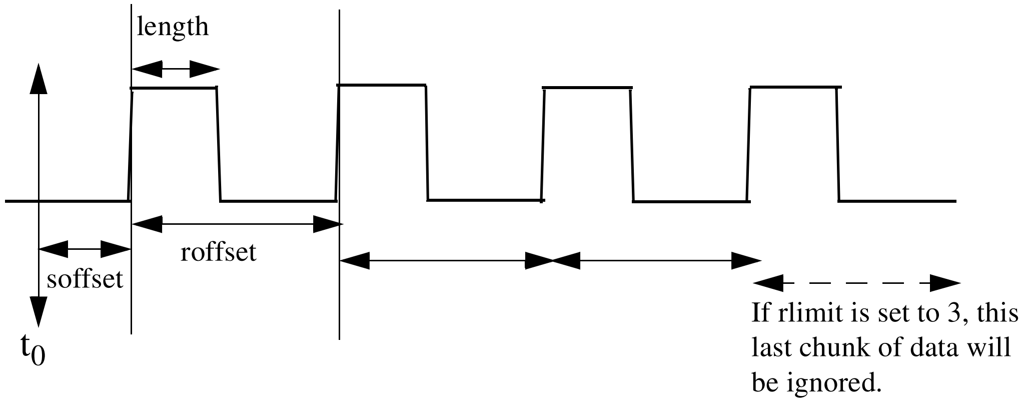
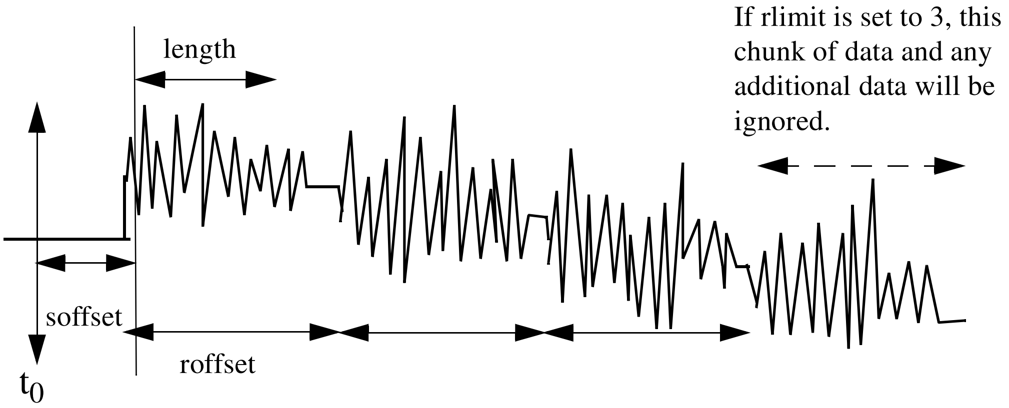


Figure 4-2 **Sample Trace Data - Not Constant Envelope**



<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 For PSA 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.

NOTE For E4406A there is a more detailed example in the “Improving the Speed of Your Measurements” section in the E4406A *Programmer’s Guide*. 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: For PSA:
Added in revision A.02.00

For E4406A:
Added in revision A.03.00
Changed in revision A.05.00

Measurement	Available Traces	Markers Available?
ACP - adjacent channel power (Basic, cdmaOne, cdma2000, W-CDMA, iDEN (E4406A only), NADC, PDC modes)	no traces (n=0)[a] for I/Q points	no markers
BER - bit error rate (iDEN mode, E4406A only)	no traces (n=0)[a] for I/Q data	no markers

Measurement	Available Traces	Markers Available?
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, 1xEV-DO 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, 1xEV-DO 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

Measurement	Available Traces	Markers Available?
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, 1xEV-DO 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, 1xEV-DO 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, iDEN (E4406A only), PDC, W-CDMA, 1xEV-DO 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

Measurement	**Available Traces**	**Markers Available?**
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, 1xEV-DO modes)	MEASured (n=2)[a] GAUSsian (n=3)[a] REFerence (n=4)[a] (n=0)[a] for I/Q points	yes
PVTime - power versus time (GSM, EDGE, 1xEV-DO, Service (E4406A only) 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, 1xEV-DO 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, 1xEV-DO 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

Measurement	**Available Traces**	**Markers Available?**
SPECtrum - (frequency domain) (all modes)	RFENvelope (n=2)[a] for Service mode (E4406A only) 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, or scalar, 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). 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. If a signal valley is higher then the threshold, then the excursion is referenced to that valley, and a peak is only defined if the signal following that valley exceeds the excursion.

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.

History: For E4406A:
Added in revision A.03.00 and later

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

- ACPr - no markers (E4406A only)
- CHPower - no markers (E4406A only)
- PSTatistic - markers available (E4406A only)
- SPECtrum - markers available
- WAVeform - markers available

Service Mode - <measurement> key words

- PVTime - no markers
- SPECtrum - markers available
- WAVeform - markers available

1xEV-DO Mode - <measurement> key words

- CDPower - markers available
- CHPower - no markers
- EVMQpsk - markers available
- IM - markers available
- OBW - no markers
- PSTatistic - markers available
- PVTime - markers available
- RHO - markers available

- SEMask - markers available
- 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

GSM Mode - <measurement> key words

- ORFSpectrum - markers available
- PFERror - markers available
- PVTime - no markers
- SPECtrum - markers available
- TSPur - markers available
- TXPower - no markers
- WAVeform - markers available

iDEN Mode - <measurement> key words

- ACP - no markers
- BER - no markers
- OBW - no markers
- SPECtrum - markers available
- 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 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 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 Mode

E4406A (all modes):

PSA Series (Basic, cdmaOne, cdma2000, W-CDMA, GSM/EDGE, NADC, PDC modes):

:CALCulate:<measurement>:MARKer[1]|2|3|4:MODE POSition|DELTa

ESA/PSA Series (Phase Noise mode only):

:CALCulate:<measurement>:MARKer[1]|2|3|4:MODE POSition|DELTa|RMSDegree|RMSRadian|RFM|RMSJitter|OFF

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

E4406A/PSA: Selects the type of marker to be a normal position-type marker or a delta marker. A specific measurement may not have both types of markers. For example, several measurements only have position markers

ESA/PSA Phase Noise Mode: Selects the type of marker to be a normal position-type marker, a delta marker or an RMS measurement marker.

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:MODE DELTA`

Remarks: For the delta mode only markers 1 and 2 are valid.

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

Front Panel Access: **Marker, Marker [Delta]**

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, iDEN (E4406A only), NADC, PDC modes)	no traces (n=0)[a] for I/Q points	no markers
BER - bit error rate (iDEN mode, E4406A only)	no traces (n=0)[a] for I/Q data	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, 1xEV-DO 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, 1xEV-DO 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

Measurement	Available Traces	Markers Available?
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, 1xEV-DO 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, 1xEV-DO 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, iDEN (E4406A only), PDC, W-CDMA, 1xEV-DO modes)	no traces (n=0)[a] for I/Q points	no markers

Measurement	Available Traces	Markers Available?
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, 1xEV-DO modes)	MEASured (n=2)[a] GAUSsian (n=3)[a] REFerence (n=4)[a] (n=0)[a] for I/Q points	yes
PVTime - power versus time (GSM, EDGE, 1xEV-DO, Service (E4406A only) 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, 1xEV-DO 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, 1xEV-DO 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

Measurement	Available Traces	Markers Available?
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)	RFENvelope (n=2)[a] for Service mode (E4406A only) 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`

Range: For Phase Noise mode: Graph Start Offset and Stop

	Offset frequencies.
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: LPLot, ACP, 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: LPLot, ACP, 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 169.

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 measurement’s standard defaults, but should not initiate the taking of data. The available measurements are described in the MEASure subsystem.

NOTE If CONFigure initiates 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.

Adjacent Channel Power - View Selection

:DISPlay:ACP:VIEW BGRaph|SPECtrum

:DISPlay:ACP:VIEW?

Select the adjacent channel power measurement display of bar graph or spectrum.

You may want to disable the spectrum trace data part of the measurement so you can increase the speed of the rest of the measurement display. Use SENSe:ACP:SPECtrum:ENABle to turn on or off the spectrum trace. (Basic and cdmaOne modes only)

Factory Preset:	Bar Graph (BGRaph)
Remarks:	For E4406A you must be in the Basic, cdmaOne, cdma2000, W-CDMA, NADC or PDC mode to use this command. Use INSTrument:SELect to set the mode. For PSA you must be in the cdmaOne, cdma2000, W-CDMA, NADC or PDC mode to use this command. Use INSTrument:SELect to set the mode.
Front Panel Access:	**ACP, View/Trace**

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:	For PSA you must be in the Basic, cdmaOne,cdma2000, 1xEV-DO, 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:	For PSA you must be in the Basic, cdmaOne,cdma2000, 1xEV-DO, 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.

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

— 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=1, m=3 numeric data (Service mode, E4406A only)

— n=1, m=4 RF envelope (Service mode, E4406A only)

— n=2, m=1 I Waveform (Option B7C, E4406A only)

— n=2, m=2 Q Waveform (Option B7C, E4406A only)

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

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

Factory Preset:	10 dB per division, for Spectrum
	100 mV per division, for I/Q Waveform
Range:	0.1 dB to 20 dB per division, for Spectrum
	1 nV to 20 V per division, for I/Q Waveform

Default Unit:	10 dB per division, for Spectrum
Remarks:	May affect input attenuator setting. For E4406A to use this command, the appropriate mode should be selected with INSTrument:SELect. For PSA you must be in Basic, cdmaOne, cdma2000, 1xEV-DO, 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:	For PSA: Added revision A.02.00 For E4406A: Modified revision A.05.00

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=1, m=3 numeric data (Service mode, E4406A only)

— n=1, m=4 RF envelope (Service mode, E4406A only)

— n=2, m=1 I Waveform (Option B7C, E4406A only)

— n=2, m=2 Q Waveform (Option B7C, E4406A only)

— 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. For E4406A to use this command, the appropriate mode should be selected with INSTrument:SELect. For PSA you must be in Basic, cdmaOne, cdma2000, 1xEV-DO, 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:	For PSA: Added revision A.02.00 For E4406A: Modified revision A.05.00

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 169 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:	For E4406A to use this command, the appropriate mode should be selected with INSTrument:SELect.
Remarks:	For PSA you must be in the Basic, cdmaOne,cdma2000, 1xEV-DO, 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, iDEN (E4406A only), NADC, PDC modes)	no traces (n=0)[a] for I/Q points	no markers
BER - bit error rate (iDEN mode, E4406A only)	no traces (n=0)[a] for I/Q data	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, 1xEV-DO, W-CDMA modes)	(n=0)[a] for I/Q raw data CDPower (n=2)[a] EVM (n=5)[a] MERRor (n=6)[a] PERRor (n=7)[a] SPOWer (n=9)[a] CPOWer (n=10)[a]	yes
CHPower - channel power (Basic, cdmaOne, cdma2000, 1xEV-DO, W-CDMA modes)	SPECtrum (n=2)[a] (n=0)[a] for I/Q raw data	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

Measurement	Available Traces	Markers Available?
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, 1xEV-DO, W-CDMA modes)	EVM (n=2)[a] MERRor (n=3)[a] PERRor (n=4)[a] (n=0)[a] for I/Q raw data	yes
IM - intermodulation (cdma2000, 1xEV-DO, W-CDMA modes)	SPECtrum (n=2)[a] (n=0)[a] for I/Q raw data	yes
MCPower - multi-carrier power (W-CDMA mode)	no traces (n=0)[a] for I/Q points	no markers
OBW - occupied bandwidth (cdmaOne, cdma2000, 1xEV-DO, iDEN (E4406A only), PDC, W-CDMA modes)	no traces (n=0)[a] for I/Q raw data	no markers

Measurement	Available Traces	Markers Available?
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, 1xEV-DO, 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, 1xEV-DO, Service (E4406A only) modes)	(n=0)[a] for I/Q raw data RFENvelope (n=2)[a] UMASk (n=3)[a] LMASk (n=4)[a]	yes
RHO - modulation quality (cdmaOne, cdma2000, W-CDMA mode)	(n=0)[a] for I/Q raw data EVM (n=2)[a] MERRor (n=3)[a] PERRor (n=4)[a] (n=5)[a] for I/Q corrected trace data	yes

Measurement	Available Traces	Markers Available?
RHO - modulation quality (1xEV-DO mode)	(*n*=0)[a] for I/Q raw data (*n*=1)[a] for various summary results EVM (*n*=2)[a] MERRor (*n*=3)[a] PERRor (*n*=4)[a] (*n*=5)[a] for I/Q corrected trace data	yes
SEMask - spectrum emissions mask (cdma2000, 1xEV-DO, W-CDMA mode)	SPECtrum (*n*=2)[a] (*n*=0)[a] for I/Q raw data	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)	RFENvelope (*n*=2)[a] for Service mode (E4406A only) IQ (*n*=3)[a] SPECtrum (*n*=4)[a] ASPectrum (*n*=7)[a] (*n*=0)[a] for I/Q raw data	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 raw data	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=2, m=1 I and Q Waveform (Option B7C, E4406A only)

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

n=5, m=1 Linear Envelope (Option B7C, E4406A only)

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. For E4406A to use this command, the appropriate mode should be selected with INSTrument:SELect. For PSA you must be in Basic, cdmaOne, cdma2000, 1xEV-DO, 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:	For PSA: Added revision A.02.00 For E4406A: Modified revision A.05.00

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=2, m=1 I and Q Waveform (Option B7C, E4406A only)

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

n=5, m=1 Linear Envelope (Option B7C, E4406A only)

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. For E4406A to use this command, the appropriate mode should be selected with INSTrument:SELect. For PSA you must be in Basic, cdmaOne, cdma2000, 1xEV-DO, 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:	For PSA: Added revision A.02.00 For E4406A: Modified revision A.05.00

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 169. These commands apply only to measurements found in the MEASURE menu.

This command puts selected data from the most recent measurement into the output buffer (new data is initiated/measured). Use FETCh if you have already made a good measurement and you want to look at several types of data (different [n] values) from the single measurement. FETCh saves you the time of re-making the measurement. You can only fetch results from the measurement that is currently active.

If you need to make a new measurement, use the READ command, which is equivalent to an INITiate[:IMMediate] followed by a FETCh.

:FETCh <meas>? will return valid data only when the measurement is in one of the following states:

idle
initiated
paused

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 169.

FORMat Subsystem

The FORMat subsystem sets a data format for transferring numeric and array information. For PSA 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.

Factory Preset:	Normal
Remarks:	You must be in the Basic, cdma2000, 1xEV-DO, W-CDMA, GSM (w/EDGE), NADC, or PDC mode to use this command. Use INSTrument:SELect to set the mode.

Numeric Data Format

PSA/VSA Basic, cdmaOne, cdma2000, 1xEV-DO, W-CDMA, GSM, EDGE, NADC, PDC modes:

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

:FORMat[:DATA]?

PSA Spectrum Analysis mode only:

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

:FORMat[:TRACe][:DATA]?

PSA Noise Figure mode only:

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

:FORMat[:TRACe][:DATA]?

VSA/PSA application modes: This command controls the format of data input/output, that is any data transfer across any remote port. The REAL and ASCII formats will format data in the current display 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 Real,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 measurement 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:	ASCII
	Real,32 for Spectrum Analysis mode
	ASCII for Basic, cdmaOne, cdma2000, 1xEV-DO, W-CDMA, GSM with EDGE, NADC, PDC modes
Remarks:	The acceptable settings for this command change for the different modes as described above.

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 169. Refer to the TRIGger and ABORt subsystems for related commands.

Take New Data Acquisition for Selected Measurement

`:INITiate:<measurement>`

For PSA this command is not available for measurements in the instrument modes: Spectrum Analysis, or Phase Noise.

This command initiates a trigger cycle for the measurement specified, but does not return data. The available measurement names are described in the MEASure subsystem..

If your selected measurement is not currently active it will change to the measurement in your INIT:<meas> command and initiate a trigger cycle.

Example: INIT:ACP

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

For E4406A, **`:INSTrument:CATalog[:FULL]?`**

For PSA, **`: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.

For E4406A if the optional keyword **`FULL`** is specified, each name is immediately followed by its associated instrument number. These instrument numbers can only be used with the **`INST:NSELect`** command.

Example:
(PSA) INST:CAT?

Query response: ”CDMA”4,”PNOISE”14

Example:
(E4406A) INST:CAT:FULL?

Query response:
”BASIC”8,“GSM”3,”CDMA”4,”SERVICE”1

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. For E4406A these instrument numbers can be obtained with **`INST:CATalog:FULL?`**

1 = SA (PSA)
1 = SERVICE (E4406A)
3 = GSM (E4406A)
4 = CDMA (cdmaOne)
5 = NADC
6 = PDC
8 = BASIC
9 = WCDMA (3GPP)

10 = CDMA2K (cdma2000)
11 = IDEN (E4406A)
13 = EDGEGSM
14 = PNOISE (phase noise, PSA)
15 = CMDA1XEV (1xEV-D0)
219 = NOISE FIGURE (PSA)

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 (PSA)

Persistent state with factory default of 8 (E4406A, BASIC)

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

Front Panel Access: **MODE**

Select Application

VSA E4406A:

:INSTrument[:SELect] BASIC|SERVICE|CDMA|CDMA2K|GSM|EDGEGSM|IDEN|NADC|PDC|WCDMA|CDMA1XEV

PSA Series:

:INSTrument[:SELect] SA|PNOISE|BASIC|CDMA|CDMA2K|EDGEGSM|NADC|PDC|WCDMA|CDMA1XEV|NFIGURE

: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 (PSA)
1 = SERVICE (E4406A)
3 = GSM (E4406A)
4 = CDMA (cdmaOne)
5 = NADC
6 = PDC
8 = BASIC
9 = WCDMA (3GPP)
10 = CDMA2K (cdma2000)
11 = IDEN (E4406A)
13 = EDGEGSM
14 = PNOISE (phase noise - PSA)
15 = CDMA1XEV (1xEV-DO)
219 = NOISE FIGURE (PSA)
229 = MAN (Modulation Analysis)
231 = LINK (89600 VSA Link software)

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:	ESA Series instruments: INST:SEL ‘CDMA’
Example:	PSA Series instruments: INST:SEL CDMA
Factory Preset: (PSA)	Persistent state with factory default of Spectrum Analyzer mode
Factory Preset: (E4406A)	Persistent state with factory default of Basic mode.
Front Panel Access:	**MODE**

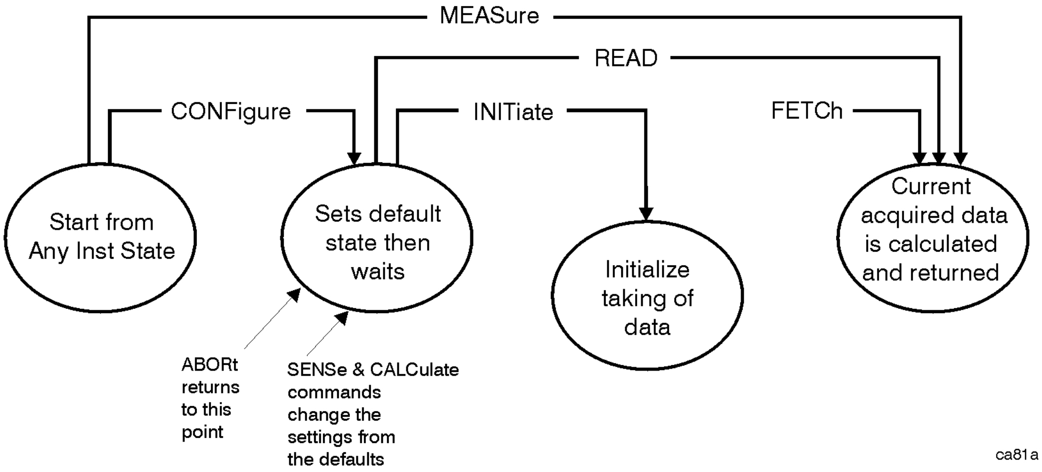
MEASure Group of Commands

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.

Command Interactions: MEASure, CONFigure, FETCh, INITiate and READ

Figure 4-3 **Measurement Group of Commands**



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. (Older versions of Spectrum Analysis and Phase Noise mode measurements only use ASCII.) The binary data formats should be used for handling large blocks of data since they are smaller and faster than 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 4-3.

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>?.

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.

NOTE In instruments with firmware older then A.05.00 CONFigure initiates 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.

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.

INITiate Commands:

`:INITiate:<measurement>`

This command is not available for measurements in all the instrument modes:

- Initiates a trigger cycle for the specified measurement, but does not output any data. You must then use the FETCh<meas> command to return data. If a measurement other than the current one is specified, the instrument will switch to that measurement and then initiate it.

  For example, suppose you have previously initiated the ACP measurement, but now you are running the channel power measurement. If you send INIT:ACP? it will change from channel power to ACP and will initiate an ACP measurement.
- Does not change any of the measurement settings. For example, if you have previously started the ACP measurement and you send INIT:ACP? it will initiate a new ACP measurement using the same instrument settings as the last time ACP was run.
- If your selected measurement is currently active (in the idle state) it triggers the measurement, assuming the trigger conditions are met. Then it completes one 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. It also holds off additional commands on GPIB until the acquisition is complete.

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)

Adjacent Channel Power Ratio (ACP) Measurement

For E4406A this measures the total rms power in the specified channel and in 5 offset channels. You must be in Basic, cdmaOne, cdma2000, W-CDMA, iDEN, NADC or PDC mode to use these commands. Use INSTrument:SELect to set the mode.

For PSA this measures the total rms power in the specified channel and in 5 offset channels. You must be in cdmaOne, cdma2000, W-CDMA, NADC or PDC mode to use these commands. Use INSTrument:SELect to set the mode.

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

```
:CONFigure:ACP

:INITiate:ACP

:FETCh:ACP[n]?

:READ:ACP[n]?

:MEASure:ACP[n]?
```

For Basic mode, a channel frequency and power level can be defined in the command statement to override the default standard setting. A comma must precede the power value as a place holder for the frequency, when no frequency is sent.

History:	E4406A: Added to Basic mode, version A.03.00 or later
Front Panel Access:	**Measure**, **ACP** or **ACPR** After the measurement is selected, press **Restore Meas Defaults** to restore factory defaults.

Measurement Results Available

Measurement Type	n	Results Returned
	0	Returns unprocessed I/Q trace data, as a series of trace point values, 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.

Measurement Type	**n**	**Results Returned**
	n=1 (or not specified) NADC and PDC mode	Returns 22 scalar results, in the following order: 1. Center frequency – absolute power (dBm) 2. Center frequency – absolute power (W) 3. Negative offset frequency (1) – relative power (dB) 4. Negative offset frequency (1) – absolute power (dBm) 5. Positive offset frequency (1) – relative power (dB) 6. Positive offset frequency (1) – absolute power (dBm) . . . 1. Positive offset frequency (5) – relative power (dB) 2. Positive offset frequency (5) – absolute power (dBm)
	n=1 (or not specified) iDEN mode E4406A	Returns 13 scalar results, in the following order: 1. Center frequency – relative power (dB) 2. Center frequency – absolute power (dBm) 3. Lower offset frequency – relative power (dB) 4. Lower offset freq– absolute power (dBm) 5. Upper offset frequency – relative power (dB) 6. Upper offset frequency – absolute power (dBm) 7. Total power (dBm) 8. Offset frequency (Hz) 9. Reference BW (Hz) 10. Offset BW (Hz) 11. Carrier/center frequency (Hz) 12. Frequency span (Hz) 13. Average count
Total power reference	n=1 (or not specified) Basic, cdmaOne, cdma2000, W-CDMA mode	Returns 24 scalar results, in the following order: 1. Center frequency - relative power (dB) 2. Center frequency - absolute power (dBm) 3. Center frequency - relative power (dB) (same as value 1) 4. Center frequency - absolute power (dBm) (same as value 2) 5. Negative offset frequency (1) - relative power (dB), 6. Negative offset frequency (1) - absolute power (dBm) 7. Positive offset frequency (1) - relative power (dB) 8. Positive offset frequency (1) - absolute power (dBm) . . . 1. Positive offset frequency (5) - relative power (dB) 2. Positive offset frequency (5) - absolute power (dBm) **NOTE** Center frequency relative power is relative to the center frequency absolute power and therefore, is always equal to 0.00 dB.

Measurement Type	n	Results Returned
Power spectral density reference	n=1 (or not specified) Basic, cdmaOne, cdma2000, W-CDMA mode	Returns 24 scalar results, in the following order: 1. Center frequency - relative power (dB) 2. Center frequency - absolute power (dBm/Hz) 3. Center frequency - relative power (dB) (same as value 1) 4. Center frequency - absolute power (dBm/Hz) (same as value 2) 5. Negative offset frequency (1) - relative power (dB) 6. Negative offset frequency (1) - absolute power (dBm/Hz) 7. Positive offset frequency (1) - relative power (dB) 8. Positive offset frequency (1) - absolute power (dBm/Hz) . . . 1. Positive offset frequency (5) - relative power (dB) 2. Positive offset frequency (5) - absolute power (dBm/Hz) **NOTE** Center frequency relative power is relative to the center frequency absolute power and therefore, is always equal to 0.00 dB.
	2 NADC and PDC mode	Returns 10 scalar values of the pass/fail (0=passed, or 1=failed) results determined by testing the absolute power of the offset frequencies: 1. Negative offset frequency (1) absolute power 2. Positive offset frequency (1) absolute power . . . 1. Negative offset frequency (5) absolute power 2. Positive offset frequency (5) absolute power
	2 iDEN mode	Returns 3 scalar values of the histogram absolute power trace: 1. Lower offset frequency – absolute power 2. Reference frequency – absolute power 3. Upper offset frequency – absolute power

Measurement Type	**n**	**Results Returned**
Total power reference	2 Basic, cdmaOne, cdma2000, W-CDMA mode	Returns 11 scalar values (in dBm) corresponding to the total power histogram display. The values are returned in ascending frequency order: 1. Negative offset frequency (5) 2. Negative offset frequency (4) 3. Negative offset frequency (3) . . . 1. Center frequency 2. Positive offset frequency (1) 3. Positive offset frequency (2) . . . 1. Positive offset frequency (5)
	3 NADC and PDC mode	Returns 10 scalar values of the pass/fail (0=passed, or 1=failed) results determined by testing the relative power of the offset frequencies: 1. Negative offset frequency (1) relative power 2. Positive offset frequency (1) relative power . . . 1. Negative offset frequency (5) relative power 2. Positive offset frequency (5) relative power
	3 iDEN mode E4406A	Returns 3 scalar values of the histogram relative power trace: 1. Lower offset frequency – relative power 2. Reference frequency – relative power 3. Upper offset frequency – relative power
Power spectral density reference	3 Basic, cdmaOne, cdma2000, W-CDMA mode	Returns 11 scalar values (in dBm/Hz) corresponding to the power spectral density histogram display. The values are returned in ascending frequency order: 1. Negative offset frequency (5) 2. Negative offset frequency (4) . . . 1. Center frequency 2. Positive offset frequency (1) . . . 1. Positive offset frequency (5)

Measurement Type	**n**	**Results Returned**
	4 NADC and PDC mode	Returns the frequency-domain spectrum trace (data array) for the entire frequency range being measured. In order to return spectrum data, the ACP display must be in the spectrum view and you must not turn off the spectrum trace.
	4 iDEN mode E4406A	Returns 4 absolute power values for the reference and offset channels. 1. Reference channel – absolute power 2. Reference channel – absolute power (duplicate of above) 3. Lower offset channel – absolute power 4. Upper offset channel – absolute power
(For cdma2000 and W-CDMA the data is only available with spectrum display selected)	4 Basic, cdmaOne, cdma2000, W-CDMA mode	Returns the frequency-domain spectrum trace data for the entire frequency range being measured. With the spectrum view selected (DISPlay:ACP:VIEW SPECtrum) and the spectrum trace on (SENSe:ACP:SPECtrum:ENABle): • In FFT mode (SENSe:ACP:SWEep:TYPE FFT) the number of trace points returned are 343 (cdma2000) or 1715 (W-CDMA). This is with the default span of 5 MHz (cdma2000) or 25 MHz (W-CDMA). The number of points also varies if another offset frequency is set. • In sweep mode (SENSe:ACP:SWEep:TYPE SWEep), the number of trace points returned is 601 (for cdma2000 or W-CDMA) for any span. With bar graph display selected, one point of –999.0 will be returned.
	5 iDEN mode E4406A	Returns 4 relative power values for the reference and offset channels: 1. Reference channel – relative power 2. Reference channel – relative power (duplicate of above) 3. Lower offset channel – relative power 4. Upper offset channel – relative power
Total power reference	5 Basic, cdmaOne, cdma2000, W-CDMA mode	Returns 12 scalar values (in dBm) of the absolute power of the center and the offset frequencies: 1. Upper adjacent chan center frequency 2. Lower adjacent chan center frequency 3. Negative offset frequency (1) 4. Positive offset frequency (1) . . . 1. Negative offset frequency (5) 2. Positive offset frequency (5)

Measurement Type	**n**	**Results Returned**
Power spectral density reference	5 Basic, cdmaOne, cdma2000, W-CDMA mode	Returns 12 scalar values (in dBm/Hz) of the absolute power of the center and the offset frequencies: 1. Upper adjacent chan center frequency 2. Lower adjacent chan center frequency 3. Negative offset frequency (1) 4. Positive offset frequency (1) . . . 1. Negative offset frequency (5) 2. Positive offset frequency (5)
	6 iDEN mode E4406A	Returns 4 pass/fail test results for the absolute power of the reference and offset channels: 1. Reference channel absolute power pass/fail 2. Reference channel absolute power pass/fail (duplicate of above) 3. Lower offset channel absolute power pass/fail 4. Upper offset channel absolute power pass/fail
Total power reference	6 Basic, cdmaOne, cdma2000, W-CDMA mode	Returns 12 scalar values (total power in dB) of the power relative to the carrier at the center and the offset frequencies: 1. Upper adjacent chan center frequency 2. Lower adjacent chan center frequency 3. Negative offset frequency (1) 4. Positive offset frequency (1) 5. Negative offset frequency (5) . . . 1. Negative offset frequency (5) 2. Positive offset frequency (5)
Power spectral density reference	6 Basic, cdmaOne, cdma2000, W-CDMA mode	Returns 12 scalar values (power spectral density in dB) of the power relative to the carrier at the center and offset frequencies: 1. Upper adjacent chan center frequency 2. Lower adjacent chan center frequency 3. Negative offset frequency (1) 4. Positive offset frequency (1) . . . 1. Negative offset frequency (5) 2. Positive offset frequency (5)

Measurement Type	**n**	**Results Returned**
	7 iDEN mode E4406A	Returns 4 pass/fail test results for the relative power of the reference and offset channels: 1. Reference channel relative power pass/fail 2. Reference channel relative power pass/fail (duplicate of above) 3. Lower offset channel relative power pass/fail 4. Upper offset channel relative power pass/fail
Total power reference	7 Basic, cdmaOne, cdma2000, W-CDMA mode	Returns 12 scalar values of the pass/fail (0=passed, or 1=failed) results determined by testing the absolute power limit of the center and offset frequencies (measured as total power in dB): 1. Upper adjacent chan center frequency 2. Lower adjacent chan center frequency 3. Negative offset frequency (1) 4. Positive offset frequency (1) . . . 1. Negative offset frequency (5) 2. Positive offset frequency (5)
Power spectral density reference	7 Basic, cdmaOne, cdma2000, W-CDMA mode	Returns 12 scalar values of the pass/fail (0=passed, or 1=failed) results determined by testing the absolute power limit of the center and offset frequencies (measured as power spectral density in dB): 1. Upper adjacent chan center frequency 2. Lower adjacent chan center frequency 3. Negative offset frequency (1) 4. Positive offset frequency (1) . . . 1. Negative offset frequency (5) 2. Positive offset frequency (5)
Total power reference	8 Basic, cdmaOne, cdma2000, W-CDMA mode	Returns 12 scalar values of the pass/fail (0=passed, or 1=failed) results determined by testing the power limit relative to the center frequency (measured as total power spectral in dB): 1. Upper adjacent chan center frequency 2. Lower adjacent chan center frequency 3. Negative offset frequency (1) 4. Positive offset frequency (1) . . . 1. Negative offset frequency (5) 2. Positive offset frequency (5)

Measurement Type	**n**	**Results Returned**
Power spectral density reference	8 Basic, cdmaOne, cdma2000, W-CDMA mode	Returns 12 scalar values of the pass/fail (0=passed, or 1=failed) results determined by testing the power limit relative to the center frequency (measured as power spectral density in dB): 1. Upper adjacent chan center frequency 2. Lower adjacent chan center frequency 3. Negative offset frequency (1) 4. Positive offset frequency (1) . . . 1. Negative offset frequency (5) 2. Positive offset frequency (5)

Code Domain Power Measurement

This measures the power levels of the spread channels in RF channel(s). You must be in the cdmaOne, cdma2000, W-CDMA, or 1xEV-DO mode to use these commands. Use INSTrument:SELect to set the mode.

For 1xEV-DO, this measurement is used only for base stations (Network Access). When measuring 1xEV-DO mobile stations (Access Terminals) use Terminal Code Domain Measurements (MEAS:TCDPower) and set SENSe:RADio:DEVice to MS.

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

```
:CONFigure:CDPower
```

```
:INITiate:CDPower
```

```
:FETCh:CDPower[n]?
```

```
:READ:CDPower[n]?
```

```
:MEASure:CDPower[n]?
```

Front Panel Access:	**Measure, Code 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 trace point values, 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
n=1 (or not specified) cdmaOne mode	Returns the following 25 scalar results: 1. **Time offset** is a floating point number with units of seconds. This is the time delay of the even second clock with respect to the start of the short code PN sequences, at offsets from the 15 zeros in the characteristic phase of the sequences. 2. **Frequency error** is a floating point number (in Hz) of the frequency error in the measured signal. This error is based on the linear best fit of the uncorrected measured phase. 3. **Carrier feedthrough** is a floating point number (in dB) of the dc offset, of I and Q, from the origin. 4. **Pilot power** is a floating point number with units of dB. It is the relative power of the pilot channel (Walsh code 0) with respect to the carrier power. 5. **Paging power** is a floating point number with units of dB. It is the relative power of the paging channel (Walsh code 1) with respect to the carrier power. 6. **Sync power** is a floating point number with units of dB. It is the relative power of the sync channel (Walsh code 32) with respect to the carrier power. 7. **Average traffic power** is a floating point number with units of dB. It is the average relative power of the active traffic channels with respect to the carrier power. Traffic channels are defined as all of the Walsh codes except Walsh 0,1,32. A traffic channel is active if its coding power is greater than the active threshold parameter which you have selected. 8. **Maximum inactive traffic power** is a floating point number with units of dB. It is the maximum relative power of an inactive traffic channel with respect to the carrier power. Traffic channels are defined as all of the Walsh codes except Walsh 0,1,32. A traffic channel is inactive if its coding power is less than the active threshold parameter which you have selected. 9. **Average inactive traffic power** is a floating point number with units of dB. It is the average relative power of the inactive traffic channels with respect to the carrier power. Traffic channels are defined as all of the Walsh codes except Walsh 0,1,32. A traffic channel is inactive if its coding power is less than the active threshold parameter which you have selected. 10. **Marker Values** The last 16 measurement results are the current values for all four available markers. The values are zero for any marker that is not active. 10. Marker 1 position (code number) 11, Marker 1 power level 12. Marker 1 time value 13. Marker 1 phase value . . . 25. Marker 4 phase value

n	Results Returned
n=1 (or not specified) cdma2000 mode	Returns the following 19 scalar results: 1. **RMS symbol EVM** is a floating point number (in percent) of the EVM over the entire measurement area. 2. **Peak symbol EVM** is a floating point number (in percent) of the peak EVM in the measurement area. 3. **Symbol magnitude error** is a floating point number (in percent) of the average magnitude error over the entire measurement area. 4. **Symbol phase error** is a floating point number (in degrees) of the average phase error over the entire measurement area. 5. **Total power** is a floating point number (in dBm) of the total RF power over the measurement interval. 6. **Average power** is a floating point number (in dBm) of the power in the entire slot, for the selected code, averaged over the measurement interval. 7. **Total active power** is a floating point number (in dB or dBm depending on the measurement type) of the sum of the active power. 8. **Pilot power** is a floating point number (in dB or dBm depending on the measurement type) of the average power of the Pilot code. 9. **Sync power** is a floating point number (in dB or dBm depending on the measurement type) of the average power of the Sync code. In the MS mode, the value returned is –999. 10. **Maximum active traffic power** is a floating point number (in dB or dBm depending on the measurement type) of the maximum average power of the active code. If no active code is detected the value returned is –999. In the MS mode, the value returned is –999. 11. **Average active traffic power** is a floating point number (in dB or dBm depending on the measurement type) of the average power of all the active traffic channels. If no active code is detected the value returned is –999. In the MS mode, the value returned is –999. 12. **Maximum inactive traffic power** is a floating point number (in dB or dBm depending on the measurement type) of the maximum average power of the inactive traffic channels. In the MS mode, the value returned is –999. 13. **Average inactive traffic power** is a floating point number (in dB or dBm depending on the measurement type) of the average power of the inactive traffic channels. In the MS mode, the value returned is –999. 14. **Number of active channel** In the MS mode, the value returned is –999.

n	Results Returned
n=1 (or not specified) cdma2000 mode (continued)	1. **I channel average active power** is a floating point number (in dB or dBm depending on the measurement type) of the average power of the active I channels. In the BS mode, the value returned is –999. 2. **I channel maximum inactive power** is a floating point number (in dB or dBm depending on the measurement type) of the maximum average power of the inactive I channels. In the BS mode, the value returned is –999. 3. **Q channel average active power** is a floating point number (in dB or dBm depending on the measurement type) of the average power of the active Q channels. In the BS mode, the value returned is –999. 4. **Q channel maximum inactive power** is a floating point number (in dB or dBm depending on the measurement type) of the maximum average power of the inactive Q channels. In the BS mode, the value returned is –999. 5. **Time between trigger to PN Offset** is a floating point number (in µs) of the time from the trigger point to the PN Offset. In the MS mode, the value returned is –999.

n	Results Returned
n=1 (or not specified) W-CDMA mode	Returns the following 31 scalar results: 1. **RMS symbol EVM** is a floating point number (in percent) of the EVM over the entire measurement area. 2. **Peak symbol EVM** is a floating point number (in percent) of the peak EVM in the measurement area. 3. **Symbol magnitude error** is a floating point number (in percent) of the average magnitude error over the entire measurement area. 4. **Symbol phase error** is a floating point number (in degrees) of the average phase error over the entire measurement area. 5. **Total power** is a floating point number (in dBm) of the total RF power over the measurement interval. 6. **Average power** is a floating point number (in dBm) of the power in the entire slot, for the selected code, averaged over the measurement interval. 7. **tDPCH** is a floating point number (in 256 chips) of dedicated physical channel (DPCH) delay time from the reference. (tDPCH equals T_n) 8. **Total power over a slot** is a floating point number (in dBm) of total RF power over the measurement interval. (SCH is excluded.) 9. **Total active power** is a floating point number (in dB or dBm depending on the measurement type) of the sum of the active power. (SCH is excluded.) 10. **Pilot power** is a floating point number (in dB or dBm depending on the measurement type) of the average power of the CPICH code relative to the total slot power. In the MS mode, the value returned is –999. (SCH is excluded.) 11. **Maximum active traffic power** is a floating point number (in dB or dBm depending on the measurement type) of the maximum average power of the active traffic channels. If no active code is detected the value returned is –999. In the MS mode, the value returned is –999. (SCH is excluded.) 12. **Average active traffic power** is a floating point number (in dB or dBm depending on the measurement type) of the average power of all the active traffic channels. If no active code is detected the value returned is –999. In the MS mode, the value returned is –999. (SCH is excluded.) 13. **Maximum inactive traffic power** is a floating point number (in dB or dBm depending on the measurement type) of the maximum average power of the inactive traffic channels. The slot timing is determined by Perch. In the MS mode, the value returned is –999. (SCH is excluded.) 14. **Average inactive traffic power** is a floating point number (in dB or dBm depending on the measurement type) of the average power of the inactive traffic channels. In the MS mode, the value returned is –999. (SCH is excluded.) 15. **Number of active channel** In the MS mode, the value returned is –999.

n	**Results Returned**
n=1 (or not specified) W-CDMA mode (continued)	16. **P-SCH** is a floating point number (in dBm) of the primary synchronization channel power. In the MS mode, the value returned is –999. 17. **S-SCH** is a floating point number (in dBm) of the secondary synchronization channel power. In the MS mode, the value returned is –999. 18. **DPCCH Power** is a floating point number (in dB or dBm depending on the measurement type) of the average power of dedicated physical control channel (DPCCH). In the BS mode, the value returned is –999. When PRACH is measured, this returns control part power. 19. **DPCCH Beta Nominal** is a floating point number of the nominal beta value of DPCCH Beta factor. In the BS mode, the value returned is –999. When PRACH is measured, this returns control part Beta nominal. 20. **DPCCH Beta Measured** is a floating point number of the measured value of the DPCCH Beta factor. In the BS mode, the value returned is –999. When PRACH is measured, this returns control part Beta measured. 21. **DPDCH Beta Nominal** is a floating point number of the nominal beta value of the dedicated physical data channel (DPDCH) Beta factor. In the BS mode, the value returned is –999. When PRACH is measured, this returns control part Beta nominal. 22. **DPDCH Beta 1 Measured** is a floating point number of the measured value of the DPDCH (C1) Beta factor. In the BS mode, the value returned is –999. When PRACH is measured, this returns control part Beta measured. 23. **DPDCH Beta 2 Measured** is a floating point number of the measured value of the DPDCH (C2) Beta factor. In the BS mode, the value returned is –999. When PRACH is measured, this returns –999. 24. **DPDCH Beta 3 Measured** is a floating point number of the measured value of the DPDCH (C3) Beta factor. In the BS mode, the value returned is –999. When PRACH is measured, this returns –999. 25. **DPDCH Beta 4 Measured** is a floating point number of the measured value of the DPDCH (C4) Beta factor. In the BS mode, the value returned is –999. When PRACH is measured, this returns –999. 26. **DPDCH Beta 5 Measured** is a floating point number of the measured value of the DPDCH (C5) Beta factor. In the BS mode, the value returned is –999. When PRACH is measured, this returns –999. 27. **DPDCH Beta 6 Measured** is a floating point number of the measured value of the DPDCH (C6) Beta factor. In the BS mode, the value returned is –999. When PRACH is measured, this returns –999.

n	Results Returned
n=1 (or not specified) W-CDMA mode (continued)	28. **I channel average active power** is a floating point number (in dB or dBm depending on the measurement type) of the average power of the active I channels. In the BS mode, the value returned is –999. 29. **I channel maximum inactive power** is a floating point number (in dB or dBm depending on the measurement type) of the maximum average power of the inactive I channels. In the BS mode, the value returned is –999. 30. **Q channel average active power** is a floating point number (in dB or dBm depending on the measurement type) of the average power of the active Q channels. In the BS mode, the value returned is –999. 31. **Q channel maximum inactive power** is a floating point number (in dB or dBm depending on the measurement type) of the maximum average power of the inactive Q channels. In the BS mode, the value returned is –999.

n	Results Returned
n=1 (or not specified) 1xEV-DO mode	Returns the following 18 comma-delimited scalar results, in the following order: 1. **Total power** is a floating point number (in dBm) of the total RF power over the measurement interval. NOTE: The following power results are computed by the CDP measurement. The unit used in the computation, either dB or dBm, is determined by the setting of the `CALCulate:CDPower:TYPE` command. When the selection is `ABSolute`, the unit used is dBm. When the selection is `RELative`, the unit used is dB relative to Total Power (above). 2. **Total active power** is a floating point number (in dB or dBm depending on the measurement type) of the sum of the active powers (–.999.0 when no active channel is detected). 3. **Maximum active power** is a floating point number (in dB or dBm depending on the measurement type) of the maximum average power of the active code (–.999.0 when no active channel is detected in I/Q Combined=On mode. Always –.999.0 in I/Q Combined=Off mode) 4. **Average active power** is a floating point number (in dB or dBm depending on the measurement type) of the average power of all the active traffic channels (–.999.0 when no active channel is detected in I/Q Combined=On mode. Always –.999.0 in I/Q Combined=Off mode). 5. **Maximum inactive power** is a floating point number (in dB or dBm depending on the measurement type) of the maximum average power of the inactive traffic channels. (–.999.0 in I/Q Combined=Off mode) 6. **Average inactive power** is a floating point number (in dB or dBm depending on the measurement type) of the average power of the inactive traffic channels. (–.999.0 in I/Q Combined=Off mode) 7. **Number of active channels** 8. **I channel average active power** is a floating point number (in dB or dBm depending on the measurement type) of the average power of the active I channels. (–.999.0 when I/Q Combined=On mode or when no active channel is detected in I/Q Combined=Off mode). 9. **I channel maximum inactive power** is a floating point number (in dB or dBm depending on the measurement type) of the maximum average power of the inactive I channels. (–.999.0 when I/Q Combined=On mode) 10. **Q channel average active power** is a floating point number (in dB or dBm depending on the measurement type) of the average power of the active Q channels. (–.999.0 when I/Q Combined=On mode or when no active channel is detected in I/Q Combined=Off mode). 11. **Q channel maximum inactive power** is a floating point number (in dB or dBm depending on the measurement type) of the maximum average power of the inactive Q channels. (–.999.0 when I/Q Combined=On mode)

n	**Results Returned**
n=1 (or not specified) 1xEV-DO mode (continued)	12. **Preamble Length** is a floating point number (in chips). 13. **Preamble MAC Index** is an integer number of MAC index. 14. **Minimum Active Power** is a floating point number (in dB or dBm depending on the measurement type) of the minimum average power of the active code (–.999.0 when no active channel is detected in I/Q Combined=On mode. Always –.999.0 in I/Q Combined=Off mode) 15. **I channel maximum inactive power** is a floating point number (in dB or dBm depending on the measurement type) of the maximum average power of the inactive I channels. (–.999.0 when I/Q Combined=On mode) 16. **I channel minimum inactive power** is a floating point number (in dB or dBm depending on the measurement type) of the minimum average power of the inactive I channels. (–.999.0 when I/Q Combined=On mode) 17. **Q channel maximum inactive power** is a floating point number (in dB or dBm depending on the measurement type) of the maximum average power of the inactive Q channels. (–.999.0 when I/Q Combined=On mode) 18. **Q channel minimum inactive power** is a floating point number (in dB or dBm depending on the measurement type) of the minimum average power of the inactive Q channels. (–.999.0 when I/Q Combined=On mode)
2 cdmaOne mode	Returns floating point numbers that are the trace data of the code domain *power* trace for all 64 Walsh codes. This series of 64 numbers represent the relative power levels (in dB) of all 64 walsh codes, with respect to the carrier power.

n	Results Returned
2 cdma2000 mode	Returns a series of floating point numbers (in dB or dBm depending on the measurement type) that represents all the code domain powers. With a device of BTS, there are 64 or 128 numbers depending on CALCulate:CDPower:WCODe:BASE. If the active channel occupies more than the max spreading factor (64 or 128 Walsh Code length depending on CALCulate:CDPower:WCODe:BASE) the power is duplicated (CALCulate:CDPower:WCODe:BASE / active Walsh code length) times. 1st number = 1st code power over the slot 2nd number = 2nd code power over the slot . . . Nth number = Nth code power over the slot With a device of MS, there are 256 I/Q pairs. If the active channel occupies more than the max spreading factor (C8) the power is duplicated (active Cx / C8) times. 1st number = 1st in-phase code power over the slot 2nd number = 1st quad-phase code power over the slot . . . (2×N-1)th number = Nth in-phase code power over the slot (2×N)th number = Nth quad-phase code power over a slot N = the number of codes detected. The total number of codes varies because of the different symbol rates of each code.
2 1xEV-DO mode	Returns a series of floating point numbers (in dB or dBm depending on the measurement type) that represents all the code domain powers. When I/Q Combined=On, total is 16 for Data, 32 for Pilot, and 64 for MAC. If the active channel occupies more than the max spreading factor (16 for Data, 32 for Pilot, and 64 for MAC) the power is duplicated. 1st number = 1st code power over the slot 2nd number = 2nd code power over the slot . . . Nth number = Nth code power over the slot When I/Q Combined=Off, results are returned alternatively. Total is 16 I/Q pairs for Data, 32 for Pilot, and 64 for MAC. If the active channel occupies more than the max spreading factor (16 for Data, 32 for Pilot, and 64 for MAC) the power is duplicated. 1st number = 1st in-phase code power over the slot 2nd number = 1st quad-phase code power over the slot . . . (2×N-1)th number = Nth in-phase code power over the slot (2×N)th number = Nth quad-phase code power over a slot N = the number of codes detected. The total number of codes varies because of the different symbol rates of each code.

n	Results Returned
2 W-CDMA.mode	Returns a series of floating point numbers (in dB or dBm depending on the measurement type) that represents all the code domain powers. With a device of BTS, there are 512 numbers. If the active channel occupies more than the max spreading factor (7.5 ksps) the power is duplicated (active symbol rate/7.5 ksps) times. 1st number = 1st code power over the slot 2nd number = 2nd code power over the slot . . . Nth number = Nth code power over the slot With a device of MS, there are 256 I/Q pairs. If the active channel occupies more than the max spreading factor (15 ksps) the power is duplicated (active symbol rate / 15 ksps) times. 1st number = 1st in-phase code power over the slot 2nd number = 1st quad-phase code power over the slot . . . (2×N-1)th number = Nth in-phase code power over the slot (2×N)th number = Nth quad-phase code power over a slot N = the number of codes detected. The total number of codes varies because of the different symbol rates of each code.
3 cdmaOne mode	Returns floating point numbers that are the trace data of the code domain *timing* trace for all 64 Walsh codes. This series of 64 numbers represent the relative timing estimations (in seconds) of the codes, relative to the pilot channel. Typical values are on the order of 1 ns.

n	Results Returned
3 cdma2000 mode	Returns a series of floating point numbers (in symbol rate) that represent all code domain symbol rates. With a device of BTS, there are 64 or 128 numbers depending on CALCulate:CDPower:WCODe:BASE. If the active channel occupies more than the max spreading factor (64 or 128 Walsh code length depending on CALCulate:CDPower:WCODe:BASE) the power is duplicated (CALCulate:CDPower:WCODe:BASE / active Walsh code length) times. 1st number = 1st code symbol rate over the slot 2nd number = 2nd code symbol rate over the slot . . . Nth number = Nth code symbol rate over the slot With a device of MS, there are 256 I/Q pairs. If the active channel occupies more than the max spreading factor (C8) the power is duplicated (active Cx / C8) times. 1st number = 1st in-phase code symbol rate over the slot 2nd number = 1st quad-phase code symbol rate over the slot . . . (2×N-1)th number = Nth in-phase code symbol rate over the slot (2×N)th number = Nth quad-phase code symbol rate over the slot N = the number of codes detected. The total number of codes varies because of the different symbol rates of each code.
3 1xEV-DO mode	Returns a series of floating point numbers (in dB or dBm depending on the measurement type) that represents all the code domain symbol rates. When I/Q Combined=On, total is 16 for Data, 32 for Pilot, and 64 for MAC. If the active channel occupies more than the max spreading factor (16 for Data, 32 for Pilot, and 64 for MAC) the power is duplicated. 1st number = 1st code symbol rate over the slot 2nd number = 2nd code symbol rate over the slot . . . Nth number = Nth code symbol rate over the slot When I/Q Combined=Off, results are returned alternatively. Total is 16 I/Q pairs for Data, 32 for Pilot, and 64 for MAC. If the active channel occupies more than the max spreading factor (16 for Data, 32 for Pilot, and 64 for MAC) the power is duplicated. 1st number = 1st in-phase code symbol rate over the slot 2nd number = 1st quad-phase code symbol rate over the slot . . . (2×N-1)th number = Nth in-phase code symbol rate over the slot (2×N)th number = Nth quad-phase code symbol rate over a slot N = the number of codes detected. The total number of codes varies because of the different symbol rates of each code.

n	Results Returned
3 W-CDMA mode	Returns a series of floating point numbers (in symbol rate) that represent all code domain symbol rates. With a device of BTS, there are 512 numbers. If the active channel occupies more than the max spreading factor (7.5 ksps) the power is duplicated (active symbol rate/7.5 ksps) times. 1st number = 1st code symbol rate over the slot 2nd number = 2nd code symbol rate over the slot . . . Nth number = Nth code symbol rate over the slot With a device of MS, there are 256 I/Q pairs. If the active channel occupies more than the max spreading factor (15 ksps) the power is duplicated (active symbol rate/15 ksps) times. 1st number = 1st in-phase code symbol rate over the slot 2nd number = 1st quad-phase code symbol rate over the slot . . . (2×N-1)th number = Nth in-phase code symbol rate over the slot (2×N)th number = Nth quad-phase code symbol rate over the slot N = the number of codes detected. The total number of codes varies because of the different symbol rates of each code.
4 cdmaOne mode	Returns floating point numbers that are the trace data of the code domain *phase* trace for all 64 Walsh codes. This series of 64 numbers represent the relative phase estimations (in radians) of the codes, relative to the pilot channel. Typical values are on the order of 1 mrad.
4 cdma2000 or W-CDMA mode	Returns a series of floating point numbers that show either active or inactive status for each of the code powers returned in n=2. (See above.) If a code is inactive, the value returned is 0.0, otherwise a value >0.0 is returned. 1st number = active or inactive flag of the 1st code . . . Nth number = active or inactive flag of the Nth code (where N= the number of codes identified)

n	Results Returned
4 1xEV-DO mode	Returns a series of floating point numbers that show either active or inactive status for each of the code powers returned in n=2 and 3. If a code is inactive, the value returned is 0.0, otherwise a value >0.0 is returned. When I/Q Combined=On, I/Q combined results are returned. 1st number = active or inactive flag of the 1st code . . . Nth number = active or inactive flag of the Nth code When channel type=Pilot or MAC, results are returned alternatively. 1st number = 1st in-phase code active flag 2nd number = 1st Quad Phase code active flag . . . (2×N-1)th number = Nth in-phase code active flag (2×N)th number = Nth Quad Phase code active flag N = the number of codes detected. The total number of codes varies because of the different symbol rates of each code. 2nd number = 1st quad-phase code symbol rate over the slot
5 cdma2000, or W-CDMA mode	Returns a series of floating point numbers (in percent) that represent each sample in the *EVM* trace. The first number is the symbol 0 decision point and there are X points per symbol. Therefore, the decision points are at 0, 1×X, 2×X, 3×X. . . (where X = the number of points per chip)
5 1xEV-DO mode	Returns series of floating point numbers that alternately represent I and Q pairs of the *corrected measured* trace. The magnitude of each I and Q pair is normalized to 1.0. The first number is the in-phase (I) sample of symbol 0 decision point and the second is the quadrature-phase (Q) sample of symbol 0 decision point. As in the EVM, there are X points per symbol, so that: 1st number is I of the symbol 0 decision point 2nd number is Q of the symbol 0 decision point . . . (2×X)+1 number is I of the symbol 1 decision point (2×X)+2 number is Q of the symbol 1 decision point . . . (2×X)×N+1th number is I of the symbol N decision point (2×X)×N+2th number is Q of the symbol N decision point where X = the number of points per symbol, and N = the number of symbols
6 cdma2000, or W-CDMA mode	Returns a series of floating point numbers (in percent) that represent each sample in the *magnitude error* trace. The first number is the symbol 0 decision point and there are X points per symbol. Therefore, the decision points are at 0, 1×X, 2×X, 3×X. . . (where X = the number of points per chip)

n	**Results Returned**
6 1xEV-DO mode	Returns series of floating point numbers (in dBm) that represent the trace data of the chip power vs. time.
7 cdma2000, or W-CDMA mode	Returns a series of floating point numbers (in degrees) that represent each sample in the *phase error* trace. The first number is the symbol 0 decision point and there are X points per symbol. Therefore, the decision points are at 0, 1×X, 2×X, 3×X. . . (where X = the number of points per chip)
8 cdma2000, or W-CDMA mode	Returns series of floating point numbers that alternately represent I and Q pairs of the *corrected measured* trace. The magnitude of each I and Q pair is normalized to 1.0. The first number is the in-phase (I) sample of symbol 0 decision point and the second is the quadrature-phase (Q) sample of symbol 0 decision point. As in the EVM, there are X points per symbol, so that: 1st number is I of the symbol 0 decision point 2nd number is Q of the symbol 0 decision point . . . (2×X)+1 number is I of the symbol 1 decision point (2×X)+2 number is Q of the symbol 1 decision point . . . (2×X)×N+1th number is I of the symbol N decision point (2×X)×N+2th number is Q of the symbol N decision point where X = the number of points per symbol, and N = the number of symbols
9 cdma2000, or W-CDMA mode	Returns series of floating point numbers (in dBm) that represent the trace data of the symbol power vs. time.
10 cdma2000, or W-CDMA mode	Returns series of floating point numbers (in dBm) that represent the trace data of the chip power vs. time.
11 cdma2000	Returns a series of floating point numbers (0.0 or 1.0) of the symbol values (demodulated bits) for the selected spread code. The results are returned as alternating values of I,Q,I,Q . . . for the entire measurement interval.
11 W-CDMA mode	Returns series of floating point numbers (0.0 or 1.0) of symbol values for the selected code with the entire capture length, when :CALCulate:CDPower:DBITs[:FORMat] is set to BINary. Returns series of floating point numbers (0.0, 1.0 or -1.0) of symbol values for the selected code with the entire capture length, when :CALCulate:CDPower:DBITs[:FORMat] is set to TRIState. "–1.0" represents DTX (Discontinuous Transmission) bit.

n	Results Returned
12 W-CDMA mode	Returns series of floating point numbers (0.0 or 1.0) of symbol values for the selected code with the period selected by Meas Interval, and Meas Offset and tDPCH, when :CALCulate:CDPower:DBITs[:FORMat] is set to BINary. Returns series of floating point numbers (0.0, 1.0 or -1.0) of symbol values for the selected code with the period selected by Meas Interval, and Meas Offset and tDPCH, when :CALCulate:CDPower:DBITs[:FORMat] is set to TRIState. “–1.0” represents DTX (Discontinuous Transmission) bit.

Channel Power Measurement

For E4406A this measures the total rms power in a specified integration bandwidth. You must be in the Basic, cdmaOne, cdma2000, W-CDMA, or 1xEV-DO mode to use these commands. Use INSTrument:SELect to set the mode.

For PSA this measures the total rms power in a specified integration bandwidth. You must be in the cdmaOne, cdma2000, or W-CDMA, or 1xEV-DO mode to use these commands. Use INSTrument:SELect to set the mode.

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

`:CONFigure:CHPower`

`:INITiate:CHPower`

`:FETCh:CHPower[n]?`

`:READ:CHPower[n]?`

`:MEASure:CHPower[n]?`

History:	For E4406A: Added to Basic mode, version A.03.00 or later
Front Panel Access:	**Measure, Channel Power** 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 trace point values, 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=1 (or not specified)	Returns 2 scalar results: 1. **Channel Power** is a floating point number representing the total channel power in the specified integration bandwidth. 2. **PSD** (**Power Spectral Density**) is the power (in dBm/Hz) in the specified integration bandwidth.
2	Returns floating point numbers that are the captured trace data of the power (in dBm/resolution BW) of the signal. The frequency span of the captured trace data is specified by the **Span** key.

Spur Close Measurement

This measures the spurious emissions in the transmit band relative to the channel power in the selected channel. You must be in the cdmaOne mode to use these commands. Use INSTrument:SELect to set the mode.

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

`:CONFigure:CSPur`

`:INITiate:CSPur`

`:FETCh:CSPur[n]?`

`:READ:CSPur[n]?`

`:MEASure:CSPur[n]?`

Front Panel Access:	**Measure, Spur Close** 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 trace point values, 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=1 (or not specified)	Returns 3 scalar results: 1. The worst spur’s frequency difference from channel center frequency (in MHz) 2. The worst spur’s amplitude difference from the limit (in dB) 3. The worst spur’s amplitude difference from channel power (in dB)
2	Returns trace of the segment containing the worst spur.

Modulation Accuracy (Rho) Measurement

This measures the modulation accuracy of the transmitter by checking the magnitude and phase error and the EVM (error vector magnitude). You must be in the cdmaOne, cdma2000, W-CDMA, or 1xEV-DO mode to use these commands. Use INSTrument:SELect to set the mode.

For 1xEV-DO: these commands will measure modulation accuracy on network access equipment (base transmitter stations). Use MEAS:TRHO to measure terminal transmitter modulation accuracy, after selecting mobile stations using SENSe:RADio:DEVice MS.

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

`:CONFigure:RHO`

`:INITiate:RHO`

`:FETCh:RHO[n]?`

`:READ:RHO[n]?`

`:MEASure:RHO[n]?`

Front Panel Access:	**Measure, Mod Accuracy (Rho)** for cdmaOne **Measure**, **Mod Accuracy (Composite Rho)** for cdma2000, 1xEV-DO, or W-CDMA (3GPP) After the measurement is selected, press **Restore Meas Defaults** to restore factory defaults.

Measurement Results Available

n	Results Returned
0 cdmaOne mode	Returns unprocessed I/Q trace data, as a series of trace point values. The I values are listed first in each pair, using the 0 through even-indexed values. The Q values are the odd-indexed values. The standard sample rate is 7.5 MHz and the trace length is determined by the current measurement interval.
0 cdma2000 or W-CDMA mode	Returns unprocessed I/Q trace data, as a series of trace point values. 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
n=1 (or not specified) cdmaOne mode	Returns 7 floating point numbers, in the following order: 1. **Rho** (no units) represents the correlation of the measured power compared to the ideal pilot channel. The calculation is performed after the complimentary filter, so it is IS95 compliant. It is performed at the decision points in the pilot waveform. If averaging is on, this is the average of the individual rms measurements. 2. **Time offset** (with units of seconds) is the time delay of the even second clock with respect to the start of the short code PN sequences, at offsets from the 15 zeros in the characteristic phase of the sequence. 3. **Frequency error** of the measured signal, with units of Hz. This is based on the linear best fit of the uncorrected measured phase. 4. **Carrier feedthrough** has units of dB and is the dc error offset of I and Q, from the origin. 5. **EVM** has units of percent. The calculation is based on the composite of the phase error and magnitude error, between the measured signal and the ideal pilot channel. It is performed after the complimentary filter which removes the inter-symbol interference in the modulated data. If averaging is on, this is the average of the individual rms measurements. 6. **Magnitude error** (with units of percent) is the rms error between the measured (compensated) magnitude and the ideal magnitude. This is performed after the complimentary filter which removes the inter-symbol interference in the modulated data. If averaging is on, this is the average of the individual rms measurements. 7. **Phase error** (with units in percent) is the rms phase error between the measured phase and the ideal phase. The calculation is performed after the complimentary filter which removes the inter-symbol interference in the modulated data. If averaging is on, this is the average of the individual rms measurements.

n	Results Returned
n=1 (or not specified) cdma2000	Returns 11 scalar results, in the following order. 1. **RMS EVM** is a floating point number (in percent) of EVM over the entire measurement area 2. **Peak EVM** is a floating point number (in percent) of peak EVM in the measurement area 3. **Magnitude error** is a floating point number (in percent) of average magnitude error over the entire measurement area 4. **Phase error** is a floating point number (in degree) of average phase error over the entire measurement area 5. **I/Q origin offset** is a floating point number (in dB) of the I and Q error (magnitude squared) offset from the origin 6. **Frequency error** is a floating point number (in Hz) of the frequency error in the measured signal 7. **Rho** is a floating point number of Rho 8. **Peak code domain error** is a floating point number (in dB) of the Peak Code Domain Error relative to the mean power 9. **Peak code domain error channel number** is the channel number in which the peak code domain error is detected at the max spreading factor. 10. **Number of active channels**. 11. **Time offset** is a floating point number (in second) PN offset from the trigger point.

n	**Results Returned**
n=1 (or not specified) W-CDMA mode	Returns following 13 scalar results, in the following order. 1. **RMS EVM** is a floating point number (in percent) of EVM over the entire measurement area 2. **Peak EVM error** is a floating point number (in percent) of peak EVM in the measurement area 3. **Magnitude error** is a floating point number (in percent) of average magnitude error over the entire measurement area 4. **Phase error** is a floating point number (in degree) of average phase error over the entire measurement area 5. **I/Q origin offset** is a floating point number (in dB) of the I and Q error (magnitude squared) offset from the origin 6. **Frequency error** is a floating point number (in Hz) of the frequency error in the measured signal 7. **Rho** is a floating point number of Rho 8. **Peak Code Domain Error** is a floating point number (in dB) of the Peak Code Domain Error relative to the mean power 9. **Peak Code Domain Error Channel Number** is the channel number in which the peak code domain error is detected at the max spreading factor. 10. **Number of active channels**. 11. **Time offset** is a floating point number (in chip) of the pilot phase timing from the acquisition trigger point. 12. **CPICH power over a slot** is a floating point number in dB of CPICH power over a measurement slot. In the MS mode the value returned is –999. 13. **Average total power over a slot** is a floating point number in dB of total RF power over a measurement slot. In the MS mode the value returned is –999.
n=1 (or not specified) 1xEV-DO mode For base stations: SENS:RAD:DEV BTS For meas type: CALC:RHO:TYPE DATA|MAC|PILot |PREamble	Returns following 9 comma-separated scalar results, in the following order, for base transmitter station measurements when the type is *NOT* set to ALL: 1. **RMS EVM** – a floating point number (in percent) of EVM over the entire measurement area. 2. **Peak EVM error** – a floating point number (in percent) of peak EVM in the measurement area. 3. **Magnitude error** – a floating point number (in percent) of average magnitude error over the entire measurement area. 4. **Phase error** – a floating point number (in degree) of average phase error over the entire measurement area. 5. **I/Q Origin Offset** – a floating point number (in dB) of the I and Q error (magnitude squared) offset from the origin. 6. **Frequency error** – a floating point number (in Hz) of the frequency error in the measured signal. 7. **Rho** – a floating point number of Rho. 8. **Number of active channels**. 9. **Time offset** is the time from the trigger to the PN offset – a floating point number (in micro seconds) of PN offset from the trigger point.

n	Results Returned
n=1 (or not specified) 1xEV-DO mode For base stations: SENS:RAD:DEV BTS For meas type ALL: CALC:RHO:TYPE ALL	Following 23 scalar results are available for base transmitter station measurements when the type is set to ALL. Rho Overall-1 and Rho Overall-2 specified in 3GPP2 TSG-C4.1 Recommended Minimum Performance Standard for cdma2000 High Rate Data Packet Access Network, 11.4.2 Waveform Quality Measurement section. 1. **Time offset** is the time from the trigger to the PN offset – a floating point number (in micro seconds) of PN offset from the trigger point. 2. **RMS EVM** (Overall-1) – a floating point number (in percent) of EVM over the entire measurement area. 3. **Peak EVM error** (Overall-1) – a floating point number (in percent) of peak EVM in the measurement area. 4. **Magnitude error** (Overall-1) – a floating point number (in percent) of average magnitude error over the entire measurement area. 5. **Phase error** (Overall-1) – a floating point number (in degree) of average phase error over the entire measurement area. 6. **I/Q Origin Offset** (Overall-1) – a floating point number (in dB) of the I and Q error (magnitude squared) offset from the origin. 7. **Frequency error** (Overall-1) – a floating point number (in Hz) of the frequency error in the measured signal. 8. **Rho** (Overall-1) – a floating point number of Rho. 9. **RMS EVM** (Overall-2) – a floating point number (in percent) of EVM over the entire measurement area. 10. **Peak EVM error** (Overall-2) – a floating point number (in percent) of peak EVM in the measurement area. 11. **Magnitude error** (Overall-2) – a floating point number (in percent) of average magnitude error over the entire measurement area. 12. **Phase error** (Overall-2) – a floating point number (in degree) of average phase error over the entire measurement area. 13. **I/Q Origin Offset** (Overall-2) – a floating point number (in dB) of the I and Q error (magnitude squared) offset from the origin. 14. **Frequency error** (Overall-2) – a floating point number (in Hz) of the frequency error in the measured signal. 15. **Rho** (Overall-2) – a floating point number of Rho. 16. **Number of active channels in Pilot** 17. **Number of active channels in Mac** 18. **Number of active channels in Data** 19. **Preamble Length** 20. **MAC index** 21. **Max MAC Inactive channel Power** – a floating point number (in dB) of Maximum MAC Inactive Channel Power 22. **Max Data Active Channel Power** – a floating point number (in dB) of Maximum Data Active Channel Power 23. **Min Data Active Channel Power** – a floating point number (in dB) of Minimum Data Active Channel Power

n	Results Returned
2 cdmaOne mode	EVM trace – returns error vector magnitude (EVM) data, as trace point values in percent. The first value is the chip 0 decision point. The trace is interpolated for the currently selected points/chips displayed on the front panel. The number of trace points depends on the current measurement interval setting.
2 cdma2000 or W-CDMA mode	EVM trace – returns series of floating point numbers (in percent) that represent each sample in the EVM trace. The first number is the symbol 0 decision point. There are X points per symbol (X = points/chip). Therefore, the decision points are at 0, $1 \times X$, $2 \times X$, $3 \times X$ . . .
2 1xEV-DO mode	Returns series of floating point numbers (in percent) that represent each sample in the EVM trace. The first number is the symbol 0 decision point and there are X points per symbol. Therefore, the decision points are at 0, 1xX, 2xX, 3xX... (X = the number of points per chip) This traces is available when the Measurement Channel Type Selection is Pilot, MAC or Data (CALCulate:RHO:TYPE = PILot|MAC|DATA) In all cases, returns one full slot data points, but only portion of EVM computation is performed are valid. All other portion is 0.0
3 cdmaOne mode	Magnitude error trace – returns magnitude error data, as trace point values, in percent. The first value is the chip 0 decision point. The trace is interpolated for the currently selected points/chips displayed on the front panel. The number of trace points depends on the current measurement interval setting.
3 cdma2000, W-CDMA, or 1xEV-DO mode	Magnitude error trace – returns series of floating point numbers (in percent) that represent each sample in the magnitude error trace. The first number is the symbol 0 decision point. There are X points per symbol (X = points/chip). Therefore, the decision points are at 0, $1 \times X$, $2 \times X$, $3 \times X$ . . . For 1xEV-DO: this traces is available when the Measurement Channel Type Selection is Pilot, MAC or Data (CALCulate:RHO:TYPE = PILot|MAC|DATA) In all cases, returns one full slot data points, but only portion of EVM computation is performed are valid. All other portion is 0.0
4 cdmaOne mode	Phase error trace – returns phase error data, as trace point values, in degrees. The first value is the symbol 0 decision point. The trace is interpolated for the currently selected chips/symbol displayed on the front panel. The number of trace points depends on the current measurement interval setting.

n	Results Returned
4 cdma2000, W-CDMA, or 1xEV-DO mode	Phase error trace – returns series of floating point numbers (in degrees) that represent each sample in the phase error trace. There are X points per symbol (X = points/ chip). Therefore, the decision points are at 0, $1 \times X$, $2 \times X$, $3 \times X$ . . . For 1xEV-DO: this traces is available when the Measurement Channel Type Selection is Pilot, MAC or Data (CALCulate:RHO:TYPE = PILot | MAC | DATA) In all cases, returns one full slot data points, but only portion of EVM computation is performed are valid. All other portion is 0.0
5 cdmaOne mode	Corrected measured data – returns a series of floating point numbers that alternately represent I and Q pairs of the corrected measured trace data. The magnitude of each I and Q pair are normalized to 1.0. The number of trace points depends on the current measurement interval setting. The numbers are sent in the following order: In-phase (I) sample, of symbol 0 decision point Quadrature-phase (Q) sample, of symbol 0 decision point . . . In-phase (I) sample, of symbol 1 decision point Quadrature-phase (Q) sample, of symbol 1 decision point . . . The trace can be interpolated to 2,4, 8 points/chip selected with the display Points/Chip softkey. This will change the number of points between decision points in the trace, changing the number of I/Q pairs sent for each decision point.
5 cdma2000, W-CDMA, 1xEV-DO mode	Corrected measured trace – returns series of floating point numbers that alternately represent I and Q pairs of the corrected measured trace. The magnitude of each I and Q pair are normalized to 1.0. The first number is the in-phase (I) sample of symbol 0 decision point and the second is the quadrature-phase (Q) sample of symbol 0 decision point. There are X points per symbol (X = points/chip), so the series of numbers is: 1st number = I of the symbol 0 decision point 2nd number = Q of the symbol 0 decision point . . . $(2 \times X) + 1$, number = I of the symbol 1 decision point $(2 \times X) + 2$, number = Q of the symbol 1 decision point . . . $(2 \times X) \times$ Nth + 1 number = I of the symbol N decision point $(2 \times X) \times$ Nth + 2 number = Q of the symbol N decision point For 1xEV-DO: this traces is available when the Measurement Channel Type Selection is Pilot, MAC or Data (CALCulate:RHO:TYPE = PILot | MAC | DATA) In all cases, returns one full slot data points, but only portion of EVM computation is performed are valid. All other portion is 0.0

n	Results Returned
6 cdmaOne mode	Reference IQ data – returns a series of floating point numbers that alternately represent I and Q pairs of the reference trace data. The number of trace points depends on the current measurement interval and points per chip settings. The numbers are sent in the following order: In-phase (I) sample, of symbol 0 decision point Quadrature-phase (Q) sample, of symbol 0 decision point . . . In-phase (I) sample, of symbol 1 decision point Quadrature-phase (Q) sample, of symbol 1 decision point . . . The trace can be interpolated to 2,4,8 points/chip selected with the display Points/Chip softkey.
6 cdma2000 mode	Returns 6 scalar values of the pass/fail (0=passed, or 1=failed) results determined by testing the EVM and peak EVM. 1. Test result of EVM 2. Test result of Peak EVM 3. Test result of Rho 4. Test result of Peak Code Domain Error 5. Test result of Time Offset 6. Test result of Phase Error
6 1xEV-DO mode	The same as n=2. (Overall–1) This trace is available when the Measurement Channel Type Selection is All (CALCulate:RHO:TYPE = ALL) (Rho Overall-1 and Rho Overall-2 as specified in 3GPP2 TSG-C4.1 Recommended Minimum Performance Standard for cdma2000 High Rate Data Packet Access Network, 11.4.2 Waveform Quality Measurement section.) n=6, 7, 8, 9 are for Overall-1 data trace n=10, 11, 12, 13 are for Overall-2 data trace In all cases, returns one full slot data points, but only portion of EVM computation is performed are valid. All other portion is 0.0
6 W-CDMA mode	Returns 6 comma-separated scalar values of the pass/fail (0.0 = passed, or 1.0 = failed) results determined by testing the EVM and peak EVM. 1. Test result of EVM 2. Test result of Peak EVM 3. Test result of Rho 4. Test result of Peak Code Domain Error 5. Test result of Frequency Error 6. Test result of CPICH power over a frame (If MS is selected, this always returns 0.0.)

n	Results Returned
7 cdmaOne mode	Complimentary filtered measured data – returns a series of floating point numbers that alternately represent I and Q pairs of the complimentary filtered measured data. This is inverse filtered data of the inter-symbol interference in CDMA signals due to the digital transmission filters defined in the standard as well as the base station phase equalization filter. The number of trace points depends on the current measurement interval setting. The numbers are sent in the following order: In-phase (I) sample, of symbol 0 decision point Quadrature-phase (Q) sample, of symbol 0 decision point . . . In-phase (I) sample, of symbol 1 decision point Quadrature-phase (Q) sample, of symbol 1 decision point . . . The trace can be interpolated to 2,4,8 points/chip selected with the display Points/Chip softkey. This will change the number of points between decision points in the trace, changing the number of I/Q pairs sent for each decision point.
7 cdma2000 mode	Returns series of floating point numbers of code level, code index, power (in dB), time offset (in ns), phase offset (in rad), and code domain error (in dB). The total number of results are six times of “number of active channels”. The number of active channels can be obtained by the 10th result of `FETCh:RHO0` command.
7 1xEV-DO mode	The same as n=3. (Overall–1) This trace is available when the Measurement Channel Type Selection is All (CALCulate:RHO:TYPE = ALL) (Rho Overall-1 and Rho Overall-2 as specified in 3GPP2 TSG-C4.1 Recommended Minimum Performance Standard for cdma2000 High Rate Data Packet Access Network, 11.4.2 Waveform Quality Measurement section.) n=6, 7, 8, 9 are for Overall-1 data trace n=10, 11, 12, 13 are for Overall-2 data trace In all cases, returns one full slot data points, but only portion of EVM computation is performed are valid. All other portion is 0.0

n	Results Returned
7 W-CDMA mode	With a device of BTS, it returns a series of floating point numbers: symbol rate (ex. 7.5 ksps), OVSF code number, a dummy value, power level and code domain error for the active channels. With a device of MS, it returns a series of floating point numbers: symbol rate (ex. 15 ksps), OVSF code number, 1.0 (I) or –1.0 (Q), power level and code domain error for the active channels. The results would look like the following: 1st number = Symbol Rate for 1st Active Channel 2nd number = OVSF Code number for 1st Active Channel 3rd number = (in BTS) –999, or (in MS) either –1 (I) or +1 (Q) for 1st Active Channel 4th number = Power Level (in dB) for 1st Active Channel 5th number = Code Domain Error for 1st Active Channel . . . (N-1)*5+1 number = Symbol Rate for Nth Active Channel (N-1)*5+2 number = OVSF Code number for Nth Active Channel (N-1)*5+3 number = –999 (in BTS), or either –1 (I) or +1 (Q) (in MS) for Nth Active Channel (N-1)*5+4 number = Power Level (in dB) for Nth Active Channel N*5 number = Code Domain Error for Nth Active Channel Number of active channel is given by 10th parameter of :MEASure:RHO[1].
8 cdmaOne mode	Complimentary filtered reference data – returns a series of floating point numbers that alternately represent I and Q pairs of the complimentary filtered reference data. This is inverse filtered data of the inter-symbol interference in CDMA signals due to the digital transmission filters defined in the standard as well as the base station phase equalization filter. The number of trace points depends on the current measurement interval setting. The numbers are sent in the following order: In-phase (I) sample, of symbol 0 decision point Quadrature-phase (Q) sample, of symbol 0 decision point . . . In-phase (I) sample, of symbol 1 decision point Quadrature-phase (Q) sample, of symbol 1 decision point . . . The trace can be interpolated to 2,4,8 points/chip selected with the display Points/Chip softkey. This will change the number of points between decision points in the trace, changing the number of I/Q pairs sent for each decision point.

n	Results Returned
8 W-CDMA mode	Returns a series of floating point numbers (in dB) that represents all the code domain powers. With a device of BTS, there are 512 numbers. If the active channel occupies more than the max spreading factor (7.5 ksps) the power is duplicated (active symbol rate/7.5 ksps) times. 1st number = 1st code power over the slot 2nd number = 2nd code power over the slot ... Nth number = Nth code power over the slot With a device of MS, there are 256 I/Q pairs. If the active channel occupies more than the max spreading factor (15 ksps) the power is duplicated (active symbol rate / 15 ksps) times. 1st number = 1st in-phase code power over the slot 2nd number = 1st quad-phase code power over the slot ... (2*N-1) number = Nth in-phase code power over the slot (2 *N) number = Nth quad-phase code power over a slot N = the number of codes detected. The total number of codes varies because of the different symbol rates of each code.
8 1xEV-DO mode	The same as n=4. (Overall–1) This trace is available when the Measurement Channel Type Selection is All (CALCulate:RHO:TYPE = ALL) (Rho Overall-1 and Rho Overall-2 as specified in 3GPP2 TSG-C4.1 Recommended Minimum Performance Standard for cdma2000 High Rate Data Packet Access Network, 11.4.2 Waveform Quality Measurement section.) n=6, 7, 8, 9 are for Overall-1 data trace n=10, 11, 12, 13 are for Overall-2 data trace In all cases, returns one full slot data points, but only portion of EVM computation is performed are valid. All other portion is 0.0

n	Results Returned
9 1xEV-DO mode	The same as n=5. (Overall–1) This trace is available when the Measurement Channel Type Selection is All (CALCulate:RHO:TYPE = ALL) (Rho Overall-1 and Rho Overall-2 as specified in 3GPP2 TSG-C4.1 Recommended Minimum Performance Standard for cdma2000 High Rate Data Packet Access Network, 11.4.2 Waveform Quality Measurement section.) n=6, 7, 8, 9 are for Overall-1 data trace n=10, 11, 12, 13 are for Overall-2 data trace In all cases, returns one full slot data points, but only portion of EVM computation is performed are valid. All other portion is 0.0
10 1xEV-DO mode	The same as n=2. (Overall–2) This trace is available when the Measurement Channel Type Selection is All (CALCulate:RHO:TYPE = ALL) (Rho Overall-1 and Rho Overall-2 as specified in 3GPP2 TSG-C4.1 Recommended Minimum Performance Standard for cdma2000 High Rate Data Packet Access Network, 11.4.2 Waveform Quality Measurement section.) n=6, 7, 8, 9 are for Overall-1 data trace n=10, 11, 12, 13 are for Overall-2 data trace In all cases, returns one full slot data points, but only portion of EVM computation is performed are valid. All other portion is 0.0
11 cdmaOne mode	Corrected measured data – returns a series of floating point numbers that alternately represent I and Q pairs of the corrected measured trace data. The magnitude of each I and Q pair are normalized to 1.0. The number of trace points depends on the current setting for the number of displayed I/Q points in the I/Q display. The numbers are sent in the following order: In-phase (I) sample, of symbol 0 decision point Quadrature-phase (Q) sample, of symbol 0 decision point . . . In-phase (I) sample, of symbol 1 decision point Quadrature-phase (Q) sample, of symbol 1 decision point . . . The trace can be interpolated to 2,4,8 points/chip selected with the display Points/Chip softkey. This will change the number of points between decision points in the trace, changing the number of I/Q pairs sent for each decision point.

n	**Results Returned**
11 1xEV-DO mode	The same as n=2. (Overall–2) This trace is available when the Measurement Channel Type Selection is All (CALCulate:RHO:TYPE = ALL) (Rho Overall-1 and Rho Overall-2 as specified in 3GPP2 TSG-C4.1 Recommended Minimum Performance Standard for cdma2000 High Rate Data Packet Access Network, 11.4.2 Waveform Quality Measurement section.) n=6, 7, 8, 9 are for Overall-1 data trace n=10, 11, 12, 13 are for Overall-2 data trace In all cases, returns one full slot data points, but only portion of EVM computation is performed are valid. All other portion is 0.0
12 1xEV-DO mode	The same as n=4. (Overall–2) This trace is available when the Measurement Channel Type Selection is All (CALCulate:RHO:TYPE = ALL) (Rho Overall-1 and Rho Overall-2 as specified in 3GPP2 TSG-C4.1 Recommended Minimum Performance Standard for cdma2000 High Rate Data Packet Access Network, 11.4.2 Waveform Quality Measurement section.) n=6, 7, 8, 9 are for Overall-1 data trace n=10, 11, 12, 13 are for Overall-2 data trace In all cases, returns one full slot data points, but only portion of EVM computation is performed are valid. All other portion is 0.0

n	Results Returned
13 cdmaOne mode	Complimentary filtered measured data – returns a series of floating point numbers that alternately represent I and Q pairs of the complimentary filtered measured data. This is inverse filtered data of the inter-symbol interference in CDMA signals due to the digital transmission filters defined in the standard as well as the base station phase equalization filter. The number of trace points depends on the current setting for the number of displayed I/Q points in the I/Q display. The numbers are sent in the following order: In-phase (I) sample, of symbol 0 decision point Quadrature-phase (Q) sample, of symbol 0 decision point . . . In-phase (I) sample, of symbol 1 decision point Quadrature-phase (Q) sample, of symbol 1 decision point . . . The trace can be interpolated to 2,4,8 points/chip selected with the display Points/Chip softkey. This will change the number of points between decision points in the trace, changing the number of I/Q pairs sent for each decision point.
13 1xEV-DO mode	The same as n=5. (Overall–2) This trace is available when the Measurement Channel Type Selection is All (CALCulate:RHO:TYPE = ALL) (Rho Overall-1 and Rho Overall-2 as specified in 3GPP2 TSG-C4.1 Recommended Minimum Performance Standard for cdma2000 High Rate Data Packet Access Network, 11.4.2 Waveform Quality Measurement section.) n=6, 7, 8, 9 are for Overall-1 data trace n=10, 11, 12, 13 are for Overall-2 data trace In all cases, returns one full slot data points, but only portion of EVM computation is performed are valid. All other portion is 0.0

n	Results Returned
14 1xEV-DO mode	The same as n=5. (Overall–2) I/Q trace data is descrambled. This trace is available when the Measurement Channel Type Selection is All (CALCulate:RHO:TYPE = ALL) (Rho Overall-1 and Rho Overall-2 as specified in 3GPP2 TSG-C4.1 Recommended Minimum Performance Standard for cdma2000 High Rate Data Packet Access Network, 11.4.2 Waveform Quality Measurement section.) n=6, 7, 8, 9 are for Overall-1 data trace n=10, 11, 12, 13 are for Overall-2 data trace In all cases, returns one full slot data points, but only portion of EVM computation is performed are valid. All other portion is 0.0
15 1xEV-DO mode	Returns 10 comma-separated scalar values of the pass/fail (0.0=passed, or 1.0=failed) results determined by testing the EVM, Peak EVM: 1. Test result of EVM 2. Test result of Peak EVM 3. Test result of Rho 4. Test result of Frequency Error Following Timing and Phase results are valid only Multichannel Estimater is On and existence of multiple codes. When the measurement is not valid, the results are 0.0 5. Test result of Timing 6. Test result of Phase Following Pilot Offset result is valid only external trigger is selected. When the measurement is not valid, the result is 0.0 7. Test result of Pilot Phase 8. Test result of Max MAC Inactive Channel Power 9. Test result of Max Data Active Channel Power 10. Test result of Min Data Active Channel Power This trace is available when the Measurement Channel Type Selection is All (CALCulate:RHO:TYPE = ALL) (Rho Overall-1 and Rho Overall-2 as specified in 3GPP2 TSG-C4.1 Recommended Minimum Performance Standard for cdma2000 High Rate Data Packet Access Network, 11.4.2 Waveform Quality Measurement section.) n=6, 7, 8, 9 are for Overall-1 data trace n=10, 11, 12, 13 are for Overall-2 data trace In all cases, returns one full slot data points, but only portion of EVM computation is performed are valid. All other portion is 0.0

Spectrum (Frequency Domain) Measurement

For E4406A 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 select the appropriate mode using INSTrument:SELect, to use these commands.

For PSA 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, 1xEV-DO, W-CDMA, 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`

`:INITiate: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 trace point values, 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**
n=1 (or not specified)	Returns the following 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.
2, **Service** mode only	Returns the trace data of the log-magnitude versus time. (That is, the RF envelope.)
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.)
5, **Service** mode only	Returns the averaged trace data of log-magnitude versus time. (That is, the RF envelope.)
6	Not used.
7	Returns the averaged spectrum trace data. That is, the trace of the averaged log-magnitude versus frequency.
8	Not used.
9, **Service** mode only	Returns a trace containing the shape of the FFT window.

n	Results Returned
10, **Service** mode only	Returns trace data of the phase of the FFT versus frequency.
11, cdma2000, 1xEV-DO, W-CDMA, Basic modes only	Returns linear spectrum trace data values in Volts RMS.
12, cdma2000, 1xEV-DO, W-CDMA, Basic modes only	Returns averaged linear spectrum trace data values in Volts RMS.

Waveform (Time Domain) Measurement

For E4406A 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 select the appropriate mode using INSTrument:SELect, to use these commands.

For PSA 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, 1xEV-DO, W-CDMA, 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
```

```
:INITiate: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 (see also 5)	Returns unprocessed I/Q trace data, as a series of trace point values, 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
n=1 (or not specified)	Returns the following 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 trace point values of the entire captured signal envelope 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**.
3, Option B7C with cdma2000, W-CDMA, Basic modes only (E4406A only)	Returns magnitude values of the time data in Volts peak.
4, Option B7C with cdma2000, W-CDMA, Basic modes only (E4406A only)	Returns values of phase data in degrees.

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 169.

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 169.

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 169. 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.

Adjacent Channel Power Measurement

Commands for querying the adjacent channel power measurement results and for setting to the default values are found in the "MEASure Group of Commands" on page 169. The equivalent front panel keys for the parameters described in the following commands, are found under the **Meas Setup** key, after the **ACP** or **ACPR** measurement has been selected from the **MEASURE** key menu.

Adjacent Channel Power—Average Count

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

[:SENSe]:ACP:AVERage:COUNt?

Set the number of data acquisitions that will be platform averaged. After the specified number of average counts, the average mode (termination control) setting determines the average action.

Factory Preset:	10 for cdma2000, W-CDMA
	20 for Basic, cdmaOne, iDEN (E4406A)
Range:	1 to 10,000
Remarks:	Use INSTrument:SELect to set the mode.
Front Panel Access:	**Meas Setup**

Adjacent Channel Power—Averaging State

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

[:SENSe]:ACP:AVERage[:STATe]?

Turn the averaging function On or Off.

Factory Preset: On

	Off for iDEN mode (E4406A)
Remarks:	Use INSTrument:SELect to set the mode.
Front Panel Access:	**Meas Setup**

Adjacent Channel Power—Averaging Termination Control

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

[:SENSe]:ACP:AVERage:TCONtrol?

Select the type of termination control used for averaging. This determines the averaging action after the specified number of data acquisitions (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:	REPeat for PSA cdmaOne, cdma2000, W-CDMA
	REPeat for E4406A Basic, cdmaOne, cdma2000, W-CDMA
	EXPonential for E4406A iDEN
	EXPonential for NADC, PDC
Remarks:	Use INSTrument:SELect to set the mode.

Adjacent Channel Power—Type of Carrier Averaging

[:SENSe]:ACP:AVERage:TYPE MAXimum|RMS

[:SENSe]:ACP:AVERage:TYPE?

Selects the type of averaging to be used for the measurement of the carrier.

Factory Preset:	RMS
Remarks:	You must be in Basic (E4406A), or cdmaOne mode to use this command. Use INSTrument:SELect to set the mode.
History:	E4406A: Revision A.03.00 or later, in cdmaOne revision A.04.00
Front Panel Access:	**Meas Setup, Avg Mode**

Adjacent Channel Power—Carrier Channel BW

Basic, iDEN mode (E4406A)

[:SENSe]:ACP:BANDwidth|BWIDth:INTegration <freq>

[:SENSe]:ACP:BANDwidth|BWIDth:INTegration?

cdma2000, W-CDMA mode

[:SENSe]:ACP:BANDwidth[n]|BWIDth[n]:INTegration <freq>

[:SENSe]:ACP:BANDwidth[n]|BWIDth[n]:INTegration?

cdmaOne mode

[:SENSe]:ACP:BANDwidth[n]|BWIDth[n]:INTegration[m] <freq>

[:SENSe]:ACP:BANDwidth[n]|BWIDth[n]:INTegration[m]?

Set the Integration bandwidth that will be used for the main (carrier) channel.

BANDwidth[n]|BWIDth[n]: m=1 is base station and 2 is mobiles. The default is base station (1).

INTegration[n]: m=1 is cellular bands and 2 is pcs bands. The default is cellular.

Factory Preset:

Mode	Format (Modulation Standard)		
Basic (E4406A)	1.23 MHz		
cdmaOne	1.23 MHz		
iDEN (E4406A)	18 kHz		
cdma2000	1.23 MHz		
W-CDMA	3.84 MHz		

Range: 300 Hz to 20 MHz for Basic (E4406A), cdmaOne, cdma2000, or W-CDMA mode

1 kHz to 5 MHz for iDEN (E4406A)

Default Unit: Hz

Remarks: With measurement type set at (TPR) total power reference, 1.40 MHz is sometimes used. Using 1.23 MHz will give a power that is very nearly identical to the 1.40 MHz value, and using 1.23 MHz will also yield the correct power spectral density with measurement type set at (PSD) reference. However, a setting of 1.40 MHz will not give the correct results with measurement type set at PSD reference.

For PSA you must be in cdmaOne, cdma2000, or W-CDMA mode to use this command. Use INSTrument:SELect to set the mode.

For E4406A you must be in Basic, cdmaOne, cdma2000, W-CDMA, or iDEN mode to use this command. Use INSTrument:SELect to set the mode.

Adjacent Channel Power—Dynamic Range

[:SENSe]:ACP:DYNamic[n]:RANGe[m] HIGH|NORMal|MODified

[:SENSe]:ACP:DYNamic[n]:RANGe[m]?

Select a dynamic range optimization.

High - chooses settings that provide better dynamic range (better signal to noise ratio) at the expense of longer measurement times. This is a better choice for CDMA signals with multiple carriers turned on at the same time.

Normal - lets the measurement automatically choose settings that trade off dynamic range for faster measurement speed. This is a good choice for making CDMA measurements on a signal with only one carrier turned on at a time.

Modified- is not a customer settable option. This choice is automatically selected depending on your selection of other related settings in the advanced measurement setup, like the number of FFT segments.

Dynamic [n]	n=1 is BTS (base station) and 2 is MS (mobile station). The default is base station (1).
Range [m]	m=1 is cellular bands (IS-95A) and 2 is pcs bands (J-STD-008) for cdmaOne. The default is cellular (1).
Factory Preset:	NORMal
Remarks:	You must be in the cdmaOne mode to use this command. Use INSTrument:SELect to set the mode.
History:	E4406A: Added A.04.00. Revised for A.05.00.

Adjacent Channel Power—Reference Channel FFT Segments

[:SENSe]:ACP:FFTSegment <integer>

[:SENSe]:ACP:FFTSegment?

Selects the number of FFT segments used in making the measurement of the reference channel (carrier). In automatic mode the measurement optimizes the number of FFT segments required for the shortest measurement time. The minimum number of segments required to make a measurement is set by your desired measurement bandwidth. Selecting more than the minimum number of segments will give you more dynamic range for making the measurement, but the measurement will take longer to execute.

To use this command you must first set SENSe:ACP:FFTS:AUTO to off.

Factory Preset:	1
Range:	1 to 12
Remarks:	You must be in Basic (E4406A), or cdmaOne mode to use this command. Use INSTrument:SELect to set the mode.
History:	E4406A: Revision A.03.00 or later, in cdmaOne revision A.04.00

Adjacent Channel Power—Reference Channel FFT Segments State

[:SENSe]:ACP:FFTSegment:AUTO OFF|ON|0|1

[:SENSe]:ACP:FFTSegment:AUTO?

The automatic mode selects the optimum number of FFT segments to measure the reference channel (carrier), while making the fastest possible measurement.

Factory Preset:	ON
Remarks:	You must be in Basic (E4406A), or cdmaOne mode to use this command. Use INSTrument:SELect to set the mode.
History:	E4406A: Revision A.03.00 or later, in cdmaOne revision A.04.00

Adjacent Channel Power—Frequency Span Query

] [:SENSe] :ACP:FREQuency:SPAN?

Returns the span of the spectrum view.

Remarks:	You must be in Basic (E4406A), or cdmaOne mode to use this command. Use INSTrument:SELect to set the mode.
History:	E4406A: Revision A.05.00 or later

Adjacent Channel Power—Absolute Amplitude Limits

iDEN mode (E4406A)

[:SENSe]:ACP:OFFSet:ABSolute <power>

[:SENSe]:ACP:OFFSet:ABSolute?

Basic (E4406A), cdmaOne mode

[:SENSe]:ACP:OFFSet:LIST:ABSolute <power>,<power>,<power>,<power>,<power>

[:SENSe]:ACP:OFFSet:LIST:ABSolute?

cdma2000, W-CDMA mode

[:SENSe]:ACP:OFFSet[n]:LIST:ABSolute <power>,<power>,<power>,<power>,<power>

[:SENSe]:ACP:OFFSet[n]:LIST:ABSolute?

Sets the absolute amplitude levels to test against for each of the custom offsets. The list must contain five (5) entries. If there is more than one offset, the offset closest to the carrier channel is the first one in the list. [:SENSe]:ACP:OFFSet[n]:LIST[m]:TEST selects the type of testing to be done at each offset.

You can turn off (not use) specific offsets with the [:SENSe]:ACP:OFFSet[n]:LIST:STATe command.

The query returns the five (5) sets of the real numbers that are the current absolute amplitude test limits.

Offset[n]	n=1 is base station and 2 is mobiles. The default is base station (1).
List[n]	m=1 is cellular bands and 2 is pcs bands. The default is cellular.

Factory Preset:

Mode	Variant	Offset A	Offset B	Offset C	Offset D	Offset E
Basic (E4406A)		0 dBm	0 dBm	0 dBm	0 dBm	0 dBm
cdmaOne	BS cellular	0 dBm	0 dBm	0 dBm	0 dBm	0 dBm
	BS pcs	0 dBm	–13 dBm	–13 dBm	0 dBm	0 dBm
	MS cellular	0 dBm	0 dBm	0 dBm	0 dBm	0 dBm
	MS pcs	0 dBm	–13 dBm	–13 dBm	0 dBm	0 dBm
cdma2000		50 dBm	50 dBm	50 dBm	50 dBm	50 dBm
W-CDMA		50 dBm	50 dBm	50 dBm	50 dBm	50 dBm
iDEN (E4406A)		0 dBm	n/a	n/a	n/a	n/a

Range:	–200.0 dBm to 50.0 dBm
Default Unit:	dBm
Remarks:	For PSA you must be in cdmaOne, cdma2000, or W-CDMA mode to use this command. Use INSTrument:SELect to set the mode. For E4406A you must be in Basic, cdmaOne, cdma2000, W-CDMA, or iDEN mode to use this command. Use INSTrument:SELect to set the mode.

Adjacent Channel Power—Type of Offset Averaging

[:SENSe]:ACP:OFFSet:LIST:AVERage:TYPE MAXimum|RMS

[:SENSe]:ACP:OFFSet:LIST:AVERage:TYPE?

Selects the type of averaging to be used for the measurement at each offset. You can turn off (not use) specific offsets with the SENS:ACP:OFFSet:LIST:STATe command.

Factory Preset:

Mode	Offset A	Offset B	Offset C	Offset D	Offset E
Basic (E4406A)	RMS	RMS	RMS	RMS	RMS
cdmaOne	RMS	RMS	RMS	RMS	RMS

Remarks: You must be in Basic (E4406A), or cdmaOne mode to use this command. Use INSTrument:SELect to set the mode.

History:	(E4406A): Revision A.03.00 or later, in cdmaOne revision A.04.00

Adjacent Channel Power—Define Resolution Bandwidth List

iDEN mode (E4406A)

[:SENSe]:ACP:OFFSet:BANDwidth|BWIDth <res_bw>

[:SENSe]:ACP:OFFSet:BANDwidth|BWIDth?

Basic mode (E4406A)

[:SENSe]:ACP:OFFSet:LIST:BANDwidth|BWIDth <res_bw>,<res_bw>,<res_bw>,<res_bw>,<res_bw>

[:SENSe]:ACP:OFFSet:LIST:BANDwidth|BWIDth?

cdma2000, W-CDMA mode

[:SENSe]:ACP:OFFSet[n]:LIST:BANDwidth|BWIDth <res_bw>,<res_bw>,<res_bw>,<res_bw>,<res_bw>

[:SENSe]:ACP:OFFSet[n]:LIST:BANDwidth|BWIDth?

cdmaOne mode

[:SENSe]:ACP:OFFSet[n]:LIST[n]:BANDwidth|BWIDth <res_bw>,<res_bw>,<res_bw>,<res_bw>,<res_bw>

[:SENSe]:ACP:OFFSet[n]:LIST[n]:BANDwidth|BWIDth?

Define the custom resolution bandwidth(s) for the adjacent channel power testing. If there is more than one bandwidth, the list must contain five (5) entries. Each resolution bandwidth in the list corresponds to an offset frequency in the list defined by [:SENSe]:ACP:OFFSet[n]:LIST[n][:FREQuency]. You can turn off (not use) specific offsets with the [:SENSe]:ACP:OFFSet[n]:LIST[n]:STATe command.

Offset[n]	n=1 is base station and 2 is mobiles. The default is base station (1).
List[n]	n=1 is cellular bands and 2 is pcs bands. The default is cellular.

Factory Preset:

Mode	**Variant**	**Offset A**	**Offset B**	**Offset C**	**Offset D**	**Offset E**
iDEN (E4406A)		10 kHz	n/a	n/a	n/a	n/a
Basic (E4406A)		30 kHz	30 kHz	30 kHz	30 kHz	30 kHz
cdmaOne	BS cellular	30 kHz	30 kHz	30 kHz	30 kHz	30 kHz
	BS pcs	30 kHz	12.5 kHz	1 MHz	30 kHz	30 kHz
	MS cellular	30 kHz	30 kHz	30 kHz	30 kHz	30 kHz
	MS pcs	30 kHz	12.5 kHz	1 MHz	30 kHz	30 kHz
cdma2000		30 kHz	30 kHz	30 kHz	30 kHz	30 kHz
W-CDMA		3.84 MHz	3.84 MHz	3.84 MHz	3.84 MHz	3.84 MHz

Range: 300 Hz to 20 MHz for cdmaOne, Basic, cdma2000, W-CDMA mode

1 kHz to 5 MHz for iDEN mode (E4406A)

Default Unit: Hz

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

For E4406A you must be in Basic, cdmaOne, cdma2000, W-CDMA, or iDEN mode to use this command. Use INSTrument:SELect to set the mode.

Adjacent Channel Power—FFT Segments

[:SENSe]:ACP:OFFSet:LIST:FFTSegment <integer>,<integer>,<integer>,<integer>,<integer>

[:SENSe]:ACP:OFFSet:LIST:FFTSegment?

Selects the number of FFT segments used in making the measurement. In automatic mode the measurement optimizes the number of FFT segments required for the shortest measurement time. The minimum number of segments required to make a measurement is set by your desired measurement bandwidth. Selecting more than the minimum number of segments will give you more dynamic range for making the measurement, but the measurement will take longer to execute.

Factory Preset:

Mode	Offset A	Offset B	Offset C	Offset D	Offset E
Basic (E4406A)	1	1	1	1	1
cdmaOne	1	1	1	1	1

Range:	1 to 12
Remarks:	You must be in Basic (E4406A), or cdmaOne mode to use this command. Use INSTrument:SELect to set the mode.
History:	E4406A: Revision A.03.00 or later, in cdmaOne revision A.04.00

Adjacent Channel Power—Automatic FFT Segments

[:SENSe]:ACP:OFFSet:LIST:FFTSegment:AUTO OFF|ON|0|1, OFF|ON|0|1, OFF|ON|0|1, OFF|ON|0|1, OFF|ON|0|1

[:SENSe]:ACP:OFFSet:LIST:FFTSegment:AUTO?

The automatic mode selects the optimum number of FFT segments to make the fastest possible measurement.

Factory Preset:

Mode	Offset A	Offset B	Offset C	Offset D	Offset E
Basic (E4406A)	ON	ON	ON	ON	ON
cdmaOne	ON	ON	ON	ON	ON

Remarks:	You must be in Basic (E4406A), or cdmaOne mode to use this command. Use INSTrument:SELect to set the mode.
History:	E4406A: Revision A.03.00 or later

Adjacent Channel Power—Define Offset Frequency List

iDEN mode (E4406A)

[:SENSe]:ACP:OFFSet[:FREQuency] <f_offset>

[:SENSe]:ACP:OFFSet[:FREQuency]?

Basic mode (E4406A)

[:SENSe]:ACP:OFFSet:LIST[:FREQuency] <f_offset>,<f_offset>,<f_offset>,<f_offset>,<f_offset>

[:SENSe]:ACP:OFFSet:LIST[:FREQuency]?

cdma2000, W-CDMA mode

[:SENSe]:ACP:OFFSet[n]:LIST[:FREQuency] <f_offset>,<f_offset>,<f_offset>,<f_offset>,<f_offset>

[:SENSe]:ACP:OFFSet[n]:LIST[:FREQuency]?

cdmaOne mode

[:SENSe]:ACP:OFFSet[n]:LIST[n][:FREQuency] <f_offset>,<f_offset>,<f_offset>,<f_offset>,<f_offset>

[:SENSe]:ACP:OFFSet[n]:LIST[n][:FREQuency]?

Define the custom set of offset frequencies at which the switching transient spectrum part of the ACP measurement will be made. The list contains five (5) entries for offset frequencies. Each offset frequency in the list corresponds to a reference bandwidth in the bandwidth list.

An offset frequency of zero turns the display of the measurement for that offset off, but the measurement is still made and reported. You can turn off (not use) specific offsets with the [:SENSe]:ACP:OFFSet:LIST:STATe command.

Offset[n]	n=1 is base station and 2 is mobiles. The default is base station (1).
List[n]	n=1 is cellular bands and 2 is pcs bands. The default is cellular.

Factory Preset:

Mode	Variant	Offset A	Offset B	Offset C	Offset D	Offset E
iDEN (E4406A)		25 kHz	n/a	n/a	n/a	n/a
Basic (E4406A)		750 kHz	1.98 MHz	0 Hz	0 Hz	0 Hz
cdmaOne	BS cellular	750 kHz	1.98 MHz	0 Hz	0 Hz	0 Hz
	BS pcs	885 kHz	1.25625 MHz	2.75 MHz	0 Hz	0 Hz
	MS cellular	885 kHz	1.98 MHz	0 Hz	0 Hz	0 Hz
	MS pcs	1.265 MHz	0 Hz	0 Hz	0 Hz	0 Hz
cdma2000	BTS	750 kHz	1.98 MHz	0 Hz	0 Hz	0 Hz
	MS	885 kHz	1.98 MHz	0 Hz	0 Hz	0 Hz
W-CDMA		5 MHz	10 MHz	15 MHz	20 MHz	25 MHz

Range: 0 Hz to 45 MHz for cdmaOne

0 Hz to 20 MHz for iDEN, Basic (E4406A)

0 Hz to 100 MHz for cdma2000, W-CDMA

Default Unit: Hz

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

For E4406A you must be in Basic, cdmaOne, cdma2000, W-CDMA, or iDEN mode to use this command. Use INSTrument:SELect to set the mode.

Adjacent Channel Power—Number of Measured Points

[:SENSe]:ACP:OFFSet:LIST:POINts <integer>,<integer>,<integer>,<integer>,<integer>

[:SENSe]:ACP:OFFSet:LIST:POINts?

Selects the number of data points. The automatic mode chooses the optimum number of points for the fastest measurement time with acceptable repeatability. The minimum number of points that could be used is determined by the sweep time and the sampling rate. You can increase the length of the measured time record (capture more of the burst) by increasing the number of points, but the measurement will take longer. Use `[:SENSe]:ACP:POINts` to set the number of points used for measuring the reference channel.

Factory Preset:

Mode	Offset A	Offset B	Offset C	Offset D	Offset E
Basic (E4406A)	1024	1024	1024	1024	1024
cdmaOne	1024	1024	1024	1024	1024

Range:	64 to 65536
Remarks:	The fastest measurement times are obtained when the number of points measured is 2^n. You must be in Basic (E4406A), or cdmaOne mode to use this command. Use INSTrument:SELect to set the mode.
History:	E4406A: Revision A.03.00 or later, in cdmaOne revision A.04.00

Adjacent Channel Power—Automatic Measurement Points

[:SENSe]:ACP:OFFSet:LIST:POINts:AUTO OFF|ON|0|1, OFF|ON|0|1, OFF|ON|0|1, OFF|ON|0|1, OFF|ON|0|1

[:SENSe]:ACP:OFFSet:LIST:POINts:AUTO?

Automatically selects the number of points for the optimum measurement speed.

Factory Preset:

Mode	Offset A	Offset B	Offset C	Offset D	Offset E
Basic (E4406A)	ON	ON	ON	ON	ON
cdmaOne	ON	ON	ON	ON	ON

Remarks:	You must be in Basic (E4406A), or cdmaOne mode to use this command. Use INSTrument:SELect to set the mode.
History:	E4406A: Revision A.03.00 or later, in cdmaOne revision A.04.00

Adjacent Channel Power—Relative Attenuation

[:SENSe]:ACP:OFFSet:LIST:RATTenuation <rel_powr>,<rel_powr>,<rel_powr>,<rel_powr>,<rel_powr>

[:SENSe]:ACP:OFFSet:LIST:RATTenuation?

Sets a relative amount of attenuation for the measurements made at your offsets. The amount of attenuation is always specified relative to the attenuation that is required to measure the carrier channel. Since the offset channel power is lower than the carrier channel power, less attenuation is required to measure the offset channel and you get wider dynamic range for the measurement.

You can turn off (not use) specific offsets with the SENS:ACP:OFFSet:LIST:STATe command.

Factory Preset:

Mode	Offset A	Offset B	Offset C	Offset D	Offset E
Basic (E4406A)	0 dB	0 dB	0 dB	0 dB	0 dB
cdmaOne	0 dB	0 dB	0 dB	0 dB	0 dB

Range:	–40 to 0 dB, but this relative attenuation cannot exceed the absolute attenuation range of 0 to 40 dB.
Default Unit:	dB
Remarks:	Remember that the attenuation that you specify is always relative to the amount of attenuation used for the carrier channel. Selecting negative attenuation means that you want less attenuation used. For example, if the measurement must use 20 dB of attenuation for the carrier measurement and you want to use 12 dB less attenuation for the first offset, you would send the value –12 dB. You must be in Basic (E4406A), or cdmaOne mode to use this command. Use INSTrument:SELect to set the mode.
History:	E4406A: Revision A.03.00 or later, in cdmaOne revision A.04.00

Adjacent Channel Power—Relative Attenuation Control

[:SENSe]:ACP:OFFSet:LIST:RATTenuation:AUTO OFF|ON|0|1

[:SENSe]:ACP:OFFSet:LIST:RATTenuation:AUTO?

Automatically sets a relative attenuation to make measurements with the optimum dynamic range at the current carrier channel power.

You can turn off (not use) specific offsets with the SENS:ACP:OFFSet:LIST:STATe command.

Factory Preset:	ON
Remarks:	You must be in Basic (E4406A), or cdmaOne mode to use this command. Use INSTrument:SELect to set the mode.
History:	E4406A: Revision A.03.00 or later, in cdmaOne revision A.04.00.

Adjacent Channel Power—Amplitude Limits Relative to the Carrier

iDEN mode (E4406A)

[:SENSe]:ACP:OFFSet:RCARrier <rel_power>

[:SENSe]:ACP:OFFSet:RCARrier?

Basic mode (E4406A)

[:SENSe]:ACP:OFFSet:LIST:RCARrier <rel_power>,<rel_power>,<rel_power>,<rel_power>,<rel_power>

[:SENSe]:ACP:OFFSet:LIST:RCARrier?

cdma2000, W-CDMA mode

[:SENSe]:ACP:OFFSet[n]:LIST:RCARrier <rel_power>,<rel_power>,<rel_power>,<rel_power>,<rel_power>

[:SENSe]:ACP:OFFSet[n]:LIST:RCARrier?

cdmaOne mode

[:SENSe]:ACP:OFFSet[n]:LIST[n]:RCARrier <rel_power>,<rel_power>,<rel_power>,<rel_power>,<rel_power>

[:SENSe]:ACP:OFFSet[n]:LIST[n]:RCARrier?

Sets the amplitude levels to test against for any custom offsets. This amplitude level is relative to the carrier amplitude. If multiple offsets are available, the list contains five (5) entries. The offset closest to the carrier channel is the first one in the list. [:SENSe]:ACP:OFFSet[n]:LIST[n]:TEST selects the type of testing to be done at each offset.

You can turn off (not use) specific offsets with the [:SENSe]:ACP:OFFSet[n]:LIST[n]:STATe command.

The query returns the five (5) sets of the real numbers that are the current amplitude test limits, relative to the carrier, for each offset.

Offset[n]	n=1 is base station and 2 is mobiles. The default is base

station (1).

List[n] n=1 is cellular bands and 2 is pcs bands. The default is cellular.

Factory Preset:

Mode	**Variant**	**Offset A**	**Offset B**	**Offset C**	**Offset D**	**Offset E**
iDEN (E4406A)		0 dBc	n/a	n/a	n/a	n/a
Basic (E4406A)		–45 dBc	–60 dBc	0 dBc	0 dBc	0 dBc
cdmaOne	BS cellular	–45 dBc	–60 dBc	0 dBc	0 dBc	0 dBc
	BS pcs	–45 dBc	0 dBc	0 dBc	0 dBc	0 dBc
	MS cellular	–42 dBc	–54 dBc	0 dBc	0 dBc	0 dBc
	MS pcs	–42 dBc	0 dBc	0 dBc	0 dBc	0 dBc
cdma2000		0 dBc	0 dBc	0 dBc	0 dBc	0 dBc
W-CDMA	BTS	–44.2 dBc	–49.2 dBc	–49.2 dBc	–49.2 dBc	–49.2 dBc
	MS	–32.2 dBc	–42.2 dBc	–42.2 dBc	–42.2 dBc	–42.2 dBc

Range: –150.0 dB to 50.0 dB for cdmaOne, cdma2000, W-CDMA, Basic (E4406A)

–200.0 dB to 50.0 dB for iDEN (E4406A)

Default Unit: dB

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

For E4406A you must be in Basic, cdmaOne, cdma2000, W-CDMA, or iDEN mode to use this command. Use INSTrument:SELect to set the mode.

Adjacent Channel Power—Amplitude Limits Relative to the Power Spectral Density

iDEN mode (E4406A)

[:SENSe]:ACP:OFFSet:RPSDensity <rel_power>

[:SENSe]:ACP:OFFSet:RPSDensity?

Basic mode (E4406A)

[:SENSe]:ACP:OFFSet:LIST:RPSDensity <rel_power>,<rel_power>,<rel_power>,<rel_power>,<rel_power>

[:SENSe]:ACP:OFFSet:LIST:RPSDensity?

cdma2000, W-CDMA mode

[:SENSe]:ACP:OFFSet[n]:LIST:RPSDensity <rel_power>,<rel_power>,<rel_power>,<rel_power>,<rel_power>

[:SENSe]:ACP:OFFSet[n]:LIST:RPSDensity?

cdmaOne mode

[:SENSe]:ACP:OFFSet[n]:LIST[n]:RPSDensity <rel_power>,<rel_power>,<rel_power>,<rel_power>,<rel_power>

[:SENSe]:ACP:OFFSet[n]:LIST[n]:RPSDensity?

Sets the amplitude levels to test against for any custom offsets. This amplitude level is relative to the power spectral density. If multiple offsets are available, the list contains five (5) entries. The offset closest to the carrier channel is the first one in the list. [:SENSe]:ACP:OFFSet[n]:LIST[n]:TEST selects the type of testing to be done at each offset.

You can turn off (not use) specific offsets with the [:SENSe]:ACP:OFFSet[n]:LIST:STATe command.

The query returns the five (5) sets of the real numbers that are the current amplitude test limits, relative to the power spectral density, for each offset.

Offset[n]	n=1 is base station and 2 is mobiles. The default is base station (1).
List[n]	n=1 is cellular bands and 2 is pcs bands. The default is cellular.

Factory Preset:

Mode	**Variant**	**Offset A**	**Offset B**	**Offset C**	**Offset D**	**Offset E**
iDEN (E4406A)		0 dB	n/a	n/a	n/a	n/a
Basic (E4406A)		–28.87 dB	–43.87 dB	0 dB	0 dB	0 dB
cdmaOne	BS cellular	–28.87 dB	–43.87 dB	0 dB	0 dB	0 dB
	BS pcs	–28.87 dB	0 dB	0 dB	0 dB	0 dB
	MS cellular	–25.87 dB	–37.87 dB	0 dB	0 dB	0 dB
	MS pcs	–25.87 dB	0 dB	0 dB	0 dB	0 dB
cdma2000		0 dB	0 dB	0 dB	0 dB	0 dB

Mode	Variant	Offset A	Offset B	Offset C	Offset D	Offset E
W-CDMA	BTS	–44.2 dBc	–49.2 dBc	–49.2 dBc	–49.2 dBc	–49.2 dBc
	MS	–32.2 dBc	–42.2 dBc	–42.2 dBc	–42.2 dBc	–42.2 dBc

Range:	–150.0 dB to 50.0 dB for cdmaOne, Basic, cdma2000, W-CDMA –200.0 dB to 50.0 dB for iDEN (E4406A)
Default Unit:	dB
Remarks:	For PSA you must be in cdmaOne, cdma2000, or W-CDMA mode to use this command. Use INSTrument:SELect to set the mode. For E4406A you must be in Basic, cdmaOne, cdma2000, W-CDMA, or iDEN mode to use this command. Use INSTrument:SELect to set the mode.

Adjacent Channel Power—Select Sideband

[:SENSe]:ACP:OFFSet:LIST:SIDE BOTH|NEGative|POSitive, BOTH|NEGative|POSitive, BOTH|NEGative|POSitive, BOTH|NEGative|POSitive, BOTH|NEGative|POSitive

[:SENSe]:ACP:OFFSet:LIST:SIDE?

Selects which sideband will be measured. You can turn off (not use) specific offsets with the SENS:ACP:OFFSet:LIST:STATe command.

Factory Preset:

Mode	Offset A	Offset B	Offset C	Offset D	Offset E
Basic (E4406A)	BOTH	BOTH	BOTH	BOTH	BOTH
cdmaOne	BOTH	BOTH	BOTH	BOTH	BOTH

Remarks:	You must be in Basic (E4406A), or cdmaOne mode to use this command. Use INSTrument:SELect to set the mode.
History:	E4406A: Revision A.03.00 or later, in cdmaOne revision A.04.00

Adjacent Channel Power—Control Offset Frequency List

Basic mode (E4406A)

[:SENSe]:ACP:OFFSet:LIST:STATe OFF|ON|0|1, OFF|ON|0|1, OFF|ON|0|1, OFF|ON|0|1, OFF|ON|0|1

[:SENSe]:ACP:OFFSet:LIST:STATe?

cdma2000, W-CDMA mode

**[:SENSe]:ACP:OFFSet[n]:LIST:STATe OFF|ON|0|1,
OFF|ON|0|1,
OFF|ON|0|1, OFF|ON|0|1, OFF|ON|0|1**

[:SENSe]:ACP:OFFSet[n]:LIST:STATe?

cdmaOne mode

[:SENSe]:ACP:OFFSet[n]:LIST[n]:STATe OFF|ON|0|1, OFF|ON|0|1, OFF|ON|0|1, OFF|ON|0|1, OFF|ON|0|1

[:SENSe]:ACP:OFFSet[n]:LIST[n]:STATe?

Selects whether testing is to be done at the custom offset frequencies. The measured powers are tested against the absolute values defined with [:SENSe]:ACP:OFFSet:LIST:ABSolute, or the relative values defined with [:SENSe]:ACP:OFFSet:LIST:RPSDensity and [:SENSe]:ACP:OFFSet:LIST:RCARier.

Offset[n]	n=1 is base station and 2 is mobiles. The default is base station (1).
List[n]	n=1 is cellular bands and 2 is pcs bands. The default is cellular.

Factory Preset:

Mode	**Variant**	**Offset A**	**Offset B**	**Offset C**	**Offset D**	**Offset E**
Basic (E4406A)		On	On	On	On	On
cdmaOne	BS cellular	On	On	On	On	On
	BS pcs	On	On	On	On	On
	MS cellular	On	On	On	On	On
	MS pcs	On	On	On	On	On
cdma2000		On	On	Off	Off	Off
W-CDMA		On	On	Off	Off	Off

Remarks: For PSA and E4406A you must be in Basic (E4406A), cdmaOne, cdma2000, or W-CDMA mode to use this command. Use INSTrument:SELect to set the mode.

Adjacent Channel Power—Sweep Time

[:SENSe]:ACP:OFFSet:LIST:SWEep:TIME <seconds>,<seconds>,<seconds>,<seconds>,<seconds>

[:SENSe]:ACP:OFFSet:LIST:SWEep:TIME?

Selects a specific sweep time. If you increase the sweep time, you increase the length of the time data captured and the number of points measured. You might need to specify a specific sweep speed to accommodate a specific condition in your transmitter. For example, you may have a burst signal and need to measure an exact portion of the burst.

Selecting a specific sweep time may result in a long measurement time since the resulting number of data points my not be the optimum 2^n. Use `[:SENSe]:ACP:SWEep:TIME` to set the number of points used for measuring the reference channel.

You can turn off (not use) specific offsets with the SENS:ACP:OFFSet:LIST:STATe command.

Factory Preset:

Mode	Offset A	Offset B	Offset C	Offset D	Offset E
Basic (E4406A)	11.20 ms	11.20 ms	11.20 ms	11.20 ms	11.20 ms
cdmaOne	11.20 ms	11.20 ms	11.20 ms	11.20 ms	11.20 ms

Range:	1 µs to 50 ms
Default Unit:	seconds
Remarks:	You must be in Basic (E4406A), or cdmaOne mode to use this command. Use INSTrument:SELect to set the mode.
History:	E4406A: Revision A.03.00 or later, in cdmaOne revision A.04.00

Adjacent Channel Power—Automatic Sweep Time

[:SENSe]:ACP:OFFSet:LIST:SWEep:TIME:AUTO OFF|ON|0|1, OFF|ON|0|1, OFF|ON|0|1, OFF|ON|0|1, OFF|ON|0|1

[:SENSe]:ACP:OFFSet:LIST:SWEep:TIME:AUTO?

Sets the sweep time to be automatically coupled for the fastest measurement time. You can turn off (not use) specific offsets with the SENS:ACP:OFFSet:LIST:STATe command.

Factory Preset:

Mode	**Offset A**	**Offset B**	**Offset C**	**Offset D**	**Offset E**
Basic (E4406A)	On	On	On	On	On
cdmaOne	On	On	On	On	On

Remarks:	You must be in Basic (E4406A), or cdmaOne mode to use this command. Use INSTrument:SELect to set the mode.
History:	E4406A: Revision A.03.00 or later, in cdmaOne revision A.04.00

Adjacent Channel Power—Define Type of Offset Frequency List

iDEN mode (E4406A)

[:SENSe]:ACP:OFFSet:TEST ABSolute|AND|OR|RELative

[:SENSe]:ACP:OFFSet:TEST?

Basic mode (E4406A)

[:SENSe]:ACP:OFFSet:LIST:TEST ABSolute|AND|OR|RELative, ABSolute|AND|OR|RELative, ABSolute|AND|OR|RELative, ABSolute|AND|OR|RELative, ABSolute|AND|OR|RELative

[:SENSe]:ACP:OFFSet:LIST:TEST?

cdma2000, W-CDMA mode

[:SENSe]:ACP:OFFSet[n]:LIST:TEST ABSolute|AND|OR|RELative, ABSolute|AND|OR|RELative, ABSolute|AND|OR|RELative, ABSolute|AND|OR|RELative, ABSolute|AND|OR|RELative

[:SENSe]:ACP:OFFSet[n]:LIST:TEST?

cdmaOne mode

[:SENSe]:ACP:OFFSet[n]:LIST[n]:TEST, ABSolute|AND|OR|RELative, ABSolute|AND|OR|RELative, ABSolute|AND|OR|RELative, ABSolute|AND|OR|RELative

[:SENSe]:ACP:OFFSet[n]:LIST[n]:TEST?

Defines the type of testing to be done at any custom offset frequencies. The measured powers are tested against the absolute values defined with [:SENSe]:ACP:OFFSet[n]:LIST:ABSolute, or the relative values defined with [:SENSe]:ACP:OFFSet:LIST:RPSDensity and

[:SENSe]:ACP:OFFSet:LIST:RCARrier.

You can turn off (not use) specific offsets with the [:SENS]:ACP:OFFSet:LIST:STATe command.

Offset[n]	n=1 is base station and 2 is mobiles. The default is base station (1).
List[n]	n=1 is cellular bands and 2 is pcs bands. The default is cellular.

The types of testing that can be done for each offset include:

- Absolute - Test the absolute power measurement. If it fails, then return a failure for the measurement at this offset.
- And - Test both the absolute power measurement and the power relative to the carrier. If they both fail, then return a failure for the measurement at this offset.
- Or - Test both the absolute power measurement and the power relative to the carrier. If either one fails, then return a failure for the measurement at this offset.
- Relative - Test the power relative to the carrier. If it fails, then return a failure for the measurement at this offset.
- OFF - Turns the power test off.

Factory Preset:

Mode	**Variant**	**Offset A**	**Offset B**	**Offset C**	**Offset D**	**Offset E**
iDEN (E4406A)		REL	n/a	n/a	n/a	n/a
Basic (E4406A)		REL	REL	REL	REL	REL
cdmaOne	BS cellular	REL	REL	REL	REL	REL
	BS pcs	REL	ABS	ABS	REL	REL
	MS cellular	REL	REL	REL	REL	REL
	MS pcs	REL	ABS	ABS	REL	REL
cdma2000		REL	REL	REL	REL	REL
W-CDMA		REL	REL	REL	REL	REL

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

For E4406A you must be in Basic, cdmaOne, cdma2000, W-CDMA, or iDEN mode to use this command. Use INSTrument:SELect to set the mode.

Adjacent Channel Power—Number of Measured Points

[:SENSe]:ACP:POINts <integer>

[:SENSe]:ACP:POINts?

Selects the number of data points used to measure the reference (carrier) channel. The automatic mode chooses the optimum number of points for the fastest measurement time with acceptable repeatability. The minimum number of points that could be used is determined by the sweep time and the sampling rate.

You can increase the length of the measured time record (capture more of the burst) by increasing the number of points, but the measurement will take longer. Use `[:SENSe]:ACP:OFFSet:LIST:POINts` to set the number of points used for measuring the offset channels.

Factory Preset: 1024

Remarks:	The fastest measurement times are obtained when the number of points measured is 2^n. You must be in Basic (E4406A), or cdmaOne mode to use this command. Use INSTrument:SELect to set the mode.
Range:	64 to 65536
History:	E4406A: Revision A.03.00 or later, in cdmaOne revision A.04.00

Adjacent Channel Power—Automatic Measurement Points

[:SENSe]:ACP:POINts:AUTO OFF|ON|0|1

[:SENSe]:ACP:POINts:AUTO?

Automatically selects the number of points for the optimum measurement speed.

Factory Preset: ON

Remarks:	You must be in Basic (E4406A), or cdmaOne mode to use this command. Use INSTrument:SELect to set the mode.
History:	E4406A: Revision A.03.00 or later, in cdmaOne revision A.04.00

Adjacent Channel Power—Spectrum Trace Control

[:SENSe]:ACP:SPECtrum:ENABle OFF|ON|0|1

[:SENSe]:ACP:SPECtrum:ENABle?

Turns on/off the measurement of the spectrum trace data when the spectrum view is selected. (Select the view with DISPlay:ACP:VIEW.) You may want to disable the spectrum trace data part of the measurement so you can increase the speed of the rest of the measurement data.

Factory Preset:	ON
Remarks:	You must be in Basic (E4406A), cdmaOne, or iDEN (E4406A) mode to use this command. Use INSTrument:SELect to set the mode.
History:	E4406A: Revision A.03.27 or later, in cdmaOne revision A.04.00

Adjacent Channel Power—Sweep Mode Resolution Bandwidth

[:SENSe]:ACP:SWEep:BANDwidth|BWIDth[:RESolution] <freq>

[:SENSe]:ACP:SWEep:BANDwidth|BWIDth[:RESolution]?

Sets the resolution bandwidth when using the spectrum analyzer type sweep mode. See `[:SENSe]:ACP:SWEep:TYPE`.

Factory Preset:	Auto coupled.
Range:	1.0 kHz to 1.0 MHz
Resolution:	1.0 kHz
Step Size:	1.0 kHz
Default Unit:	Hz
Remarks:	You must be in the cdmaOne cdma2000, or W-CDMA mode to use this command. Use INSTrument:SELect to set the mode.

Adjacent Channel Power—Sweep Mode Resolution BW Control

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

[:SENSe]:ACP:SWEep:BANDwidth|BWIDth[:RESolution]:AUTO ?

Sets the resolution bandwidth to automatic, when using the spectrum analyzer type sweep mode. See `[:SENSe]:ACP:SWEep:TYPE`.

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

Adjacent Channel Power—Sweep Time

[:SENSe]:ACP:SWEep:TIME <seconds>

[:SENSe]:ACP:SWEep:TIME?

Selects a specific sweep time used to measure the reference (carrier) channel. If you increase the sweep time, you increase the length of the time data captured and the number of points measured. You might need to specify a specific sweep speed to accommodate a specific condition in your transmitter. For example, you may have a burst signal and need to measure an exact portion of the burst.

Selecting a specific sweep time may result in a long measurement time since the resulting number of data points my not be the optimum 2^n. Use `[:SENSe]:ACP:OFFSet:LIST:SWEep:TIME` to set the number of points used for measuring the offset channels for Basic and cdmaOne.

For cdma2000 and W-CDMA, this command sets the sweep time when using the sweep mode. See `[:SENSe]:ACP:SWEep:TYPE`.

Factory Preset:	625 µs (1 slot) for W-CDMA
	1.25 ms for cdma2000
	11.20 ms for Basic, cdmaOne
Range:	500 µs to 10 ms for W-CDMA, cdma2000
	1 µs to 50 ms for Basic (E4406A), cdmaOne
Default Unit:	seconds
Remarks:	You must be in the Basic (E4406A), cdmaOne, cdma2000, or W-CDMA mode to use this command. Use INSTrument:SELect to set the mode.
History:	E4406A: Added to Basic revision A.03.00, to cdmaOne revision A.04.00

Adjacent Channel Power—Automatic Sweep Time

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

[:SENSe]:ACP:SWEep:TIME:AUTO?

Sets the sweep time to be automatically coupled for the fastest measurement time.

Factory Preset:	ON
Remarks:	You must be in Basic (E4406A), or cdmaOne mode to use this command. Use INSTrument:SELect to set the

mode.

History: E4406A:
Revision A.03.00 or later, in cdmaOne revision A.04.00

Adjacent Channel Power—Trigger Source

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

[:SENSe]:ACP: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 trigger from front panel input

IF – internal IF envelope (video) trigger

IMMediate – the next data acquisition is immediately taken, capturing the signal asynchronously (also called free run).

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

Factory Preset: IMMediate for BS

RFBurst for MS

Remarks: For PSA you must be in cdmaOne, NADC, or PDC mode to use this command. Use INSTrument:SELect to set the mode.

For E4406A you must be in Basic, cdmaOne, iDEN, NADC, or PDC mode to use this command. Use INSTrument:SELect to set the mode.

In Basic mode, for offset frequencies >12.5 MHz, the external triggers will be a more reliable trigger source than RF burst. Also, you can use the Waveform measurement to set up trigger delay.

History: E4406A:
Added revision A.04.00 or later

Adjacent Channel Power—Power Reference

[:SENSe]:ACP:TYPE PSDRef|TPRef

[:SENSe]:ACP:TYPE?

Selects the measurement type. This allows you to make absolute and relative power measurements of either total power or the power normalized to the measurement bandwidth.

Power Spectral Density Reference (PSDRef) - the power spectral density is used as the power reference

Total Power Reference (TPRef) - the total power is used as the power reference

Factory Preset: Total power reference (TPRef)

Remarks:

For E4406A you must be in the Basic, cdmaOne, cdma2000, W-CDMA, NADC, or PDC mode to use this command. Use INSTrument:SELect to set the mode.

For PSA you must be in the cdmaOne, cdma2000, W-CDMA, NADC, or PDC mode to use this command. Use INSTrument:SELect to set the mode.

Baseband I/Q Commands (E4406A only)

Baseband I/Q - Select I/Q Power Range

[:SENSe]:POWer:IQ:RANGe[:UPPer] <power> [DBM]|DBMV|W

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

Selects maximum total power expected from unit under test at test port when I or Q port is selected.

Range: For 50 Ohms:

13.0, 7.0. 1.0, or –5.1 dBm
60.0, 54.0, 48.0, or 41.9 dBmV
0.02, 0.005, 0.0013, or 0.00031 W

For 600 Ohms:

2.2, –3.8. –9.8, or –15.8 dBm
60.0, 54.0, 48.0, or 41.9 dBmV
0.0017, 0.00042, 0.0001, or 0.000026 W

For 1 M Ohm:

Values for 1 M Ohm vary according to selected reference impedance.

Default Units: DBM

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

History: Added revision A.05.00

Baseband I/Q - Select I/Q Voltage Range

[:SENSe]:VOLTage:IQ:RANGe[:UPPer] <level>

[:SENSe]:VOLTage:IQ:RANGe[:UPPer]?

Selects upper voltage range when I or Q port is selected. This setting helps set the gain which is generated in the variable gain block of the baseband IQ board to improve dynamic range.

Range: 1.0, 0.5, .025, or 0.125 volts

Default Units: V

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

History: Added revision A.05.00

Code Domain Measurement

Commands for querying the code domain power measurement results and for setting to the default values are found in the "MEASure Group of Commands" on page 169. The equivalent front panel keys for the parameters described in the following commands, are found under the **Meas Setup** key, after the **Code Domain** measurement has been selected from the **MEASURE** key menu.

Code Domain—Average Count

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

[:SENSe]:CDPower:AVERage:COUNt?

Set the number of frames that will be averaged. After the specified number of frames (average counts) have been averaged, the averaging mode (termination control) setting determines the averaging action.

Factory Preset:	10
Range:	1 to 10,000
Remarks:	You must be in the cdmaOne mode to use this command. Use INSTrument:SELect to set the mode.

Code Domain—Averaging State

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

[:SENSe]:CDPower:AVERage[:STATe]?

Turn code domain power averaging on or off.

Factory Preset:	ON
Remarks:	You must be in the cdmaOne mode to use this command. Use INSTrument:SELect to set the mode.

Code Domain—Averaging Termination Control

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

[:SENSe]:CDPower:AVERage:TCONtrol?

Select the type of termination control used for averaging. This determines the averaging action after the specified number of frames (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:	REPeat
Remarks:	You must be in the cdmaOne mode to use this command. Use INSTrument:SELect to set the mode.

Code Domain—Active Set Threshold

[:SENSe]:CDPower:ASET:THReshold <rel_power>

[:SENSe]:CDPower:ASET:THReshold?

Set the active set threshold value. Walsh channels with power less than this value, will be treated as non-active (noise) channels.

Factory Preset:	–20 dB
Range:	–30 dB to 0 dB
Default Unit:	dB
Remarks:	You must be in the cdmaOne mode to use this command. Use INSTrument:SELect to set the mode.

Code Domain—Method

[:SENSe]:CDPower:METHod FPOWer|POWer|TPHase

[:SENSe]:CDPower:METHod?

Select the measurement method.

- Fast Power (FPOWer)- Provides the fastest code domain power measurement. Only measures the power of those Walsh channels with powers greater than the active set threshold level.
- POWer - Measures the code domain power of all 64 Walsh Channels.
- Timing & Phase (TPHase)- Measures the code domain power, code domain timing, and code domain phase of all 64 Walsh channels.

Factory Preset:	FPOWer
Remarks	You must be in the cdmaOne mode to use this command. Use INSTrument:SELect to set the mode.

Code Domain—Spectrum Normal/Invert

[:SENSe]:CDPower:SPECtrum INVert|NORMal

[:SENSe]:CDPower:SPECtrum?

Set a spectrum either to normal or inverted for the demodulation related measurements. If set to INVert, the upper and lower spectrums are swapped.

Factory Preset:	NORMal
Remarks	You must be in the cdmaOne, cdma2000, W-CDMA, or 1xEV-DO mode to use this command. Use INSTrument:SELect to set the mode.

Code Domain—Measurement Interval

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

[:SENSe]:CDPower:SWEep:TIME?

Set the length of the measurement interval that will be used.

Factory Preset:	1.250 ms
Range:	0.5 ms to 30 ms
Default Unit:	seconds
Remarks:	You must be in the cdmaOne mode to use this command. Use INSTrument:SELect to set the mode.

Channel Commands

Digital Demod PN Offset

[:SENSe]:CHANnel:PNOFfset <integer>

[:SENSe]:CHANnel:PNOFfset?

Set the PN offset number for the base station being tested.

Factory Preset:	0
Range:	0 to 511
Default Unit:	None
Remarks:	Global to the current mode. You must be in the cdmaOne mode to use this command. Use INSTrument:SELect to set the mode.
Front Panel Access:	**FREQUENCY Channel**, **PN Offset** or **Mode Setup**, **Demod**, PN Offset

Channel Power Measurement

Commands for querying the channel power measurement results and for setting to the default values are found in the "MEASure Group of Commands" on page 169. The equivalent front panel keys for the parameters described in the following commands, are found under the **Meas Setup** key, after the **Channel Power** measurement has been selected from the **MEASURE** key menu.

Channel Power—Average Count

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

[:SENSe]:CHPower:AVERage:COUNt?

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

Factory Preset:	20
	200, for W-CDMA
Range:	1 to 10,000
Remarks:	For PSA you must be in the cdmaOne, cdma2000, W-CDMA, or 1xEV-DO mode to use this command. Use INSTrument:SELect to set the mode. For E4406A you must be in the Basic, cdmaOne, cdma2000, W-CDMA, or 1xEV-DO mode to use this command. Use INSTrument:SELect to set the mode.

Channel Power—Averaging State

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

[:SENSe]:CHPower:AVERage[:STATe]?

Turn averaging on or off.

Factory Preset:	ON
Remarks:	For PSA you must be in the cdmaOne, cdma2000, W-CDMA, or 1xEV-DO mode to use this command. Use INSTrument:SELect to set the mode. For E4406A you must be in the Basic, cdmaOne, cdma2000, W-CDMA, or 1xEV-DO mode to use this command. Use INSTrument:SELect to set the mode.

Channel Power—Averaging Termination Control

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

[:SENSe]:CHPower:AVERage:TCONtrol?

Select the type of termination control used for the averaging function. This determines the averaging action after the specified number of data acquisitions (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:	REPeat
Remarks:	For PSA you must be in the cdmaOne, cdma2000, W-CDMA, or 1xEV-DO mode to use this command. Use INSTrument:SELect to set the mode. For E4406A you must be in the Basic, cdmaOne, cdma2000, W-CDMA, or 1xEV-DO mode to use this command. Use INSTrument:SELect to set the mode.

Channel Power—Integration BW

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

[:SENSe]:CHPower:BANDwidth|BWIDth:INTegration?

Set the Integration BW (IBW) that will be used.

Factory Preset:	1.23 MHz for Basic (E4406A), cdmaOne, cdma2000, 1xEV-DO 5.0 MHz for W-CDMA
Range:	1 kHz to 10 MHz
Default Unit:	Hz
Remarks:	For PSA you must be in the cdmaOne, cdma2000, W-CDMA, or 1xEV-DO mode to use this command. Use INSTrument:SELect to set the mode. For E4406A you must be in the Basic, cdmaOne, cdma2000, W-CDMA, or 1xEV-DO mode to use this command. Use INSTrument:SELect to set the mode.

Channel Power—Span

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

[:SENSe]:CHPower:FREQuency:SPAN?

Set the frequency span that will be used.

Factory Preset:	2.0 MHz for Basic, cdmaOne, cdma2000, 1xEV-DO 6.0 MHz for W-CDMA
Range:	Dependent on the current setting of the channel power integration bandwidth
Default Unit:	Hz
Remarks:	For PSA you must be in the cdmaOne, cdma2000, W-CDMA, or 1xEV-DO mode to use this command. Use INSTrument:SELect to set the mode. For E4406A you must be in the Basic, cdmaOne, cdma2000, W-CDMA, or 1xEV-DO mode to use this command. Use INSTrument:SELect to set the mode.

Channel Power—Data Points

[:SENSe]:CHPower:POINts <integer>

[:SENSe]:CHPower:POINts?

Set the number of data points that will be used. Changing this will change the time record length and resolution BW that are used.

Factory Preset:	512
Range:	64 to 32768, in a 2^n sequence
Remarks:	For PSA you must be in the cdmaOne, cdma2000, W-CDMA, or 1xEV-DO mode to use this command. Use INSTrument:SELect to set the mode. For E4406A you must be in the Basic, cdmaOne, cdma2000, W-CDMA, or 1xEV-DO mode to use this command. Use INSTrument:SELect to set the mode.

Channel Power—Data Points Auto

[:SENSe]:CHPower:POINts:AUTO OFF|ON|0|1

[:SENSe]:CHPower:POINts:AUTO?

Select auto or manual control of the data points. This is an advanced control that normally does not need to be changed. Setting this to a value other than the factory default, may cause invalid measurement results.

OFF - the Data Points is uncoupled from the Integration BW.

ON - couples the Data Points to the Integration BW.

Factory Preset: ON

Remarks: You must be in the Basic (E4406A), cdmaOne, cdma2000, W-CDMA, 1xEV-DO mode to use this command. Use INSTrument:SELect to set the mode.

Channel Power—Sweep Time

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

[:SENSe]:CHPower:SWEep:TIME?

Sets the sweep time when using the sweep mode.

Factory Preset:	68.27 μs 17.07 μs for W-CDMA
Range:	1 μs to 50 ms
Default Unit:	seconds
Remarks:	You must be in the Basic (E4406A), cdmaOne, cdma2000, W-CDMA, or 1xEV-DO mode to use this command. Use INSTrument:SELect to set the mode.
History:	E4406A: Version A.03.00 and later

Channel Power—Sweep Time

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

[:SENSe]:CHPower:SWEep:TIME:AUTO?

Selects the automatic sweep time, optimizing the measurement.

Factory Preset:	ON
Remarks:	You must be in the Basic (E4406A), cdmaOne, cdma2000, W-CDMA, or 1xEV-DO mode to use this command. Use INSTrument:SELect to set the mode.
History:	E4406A: Version A.03.00 and later

Channel Power—Trigger Source

[:SENSe]:CHPower:TRIGger:SOURce EXTernal[1]|EXTernal2|IMMediate

[:SENSe]:CHPower:TRIGger:SOURce?

Select the trigger source used to control the data acquisitions. This is an Advanced control that normally does not need to be changed.

EXTernal 1 - front panel external trigger input

EXTernal 2 - rear panel external trigger input

IMMediate - the next data acquisition is immediately taken (also called Free Run).

Factory Preset: IMMediate

Remarks: For PSA you must be in the cdmaOne, cdma2000, W-CDMA, or 1xEV-DO mode to use this command. Use INSTrument:SELect to set the mode.

For E4406A you must be in the Basic, cdmaOne, cdma2000, W-CDMA, or 1xEV-DO mode to use this command. Use INSTrument:SELect to set the mode.

Signal Corrections Commands

Correction for Base Station RF Port External Attenuation

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

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

Set the correction equal to the external attenuation used when measuring base stations.

Factory Preset:	0 dB
Range:	–50 to 100 dB for cdmaOne, iDEN (E4406A)
	–50 to 50 dB for NADC or PDC
Default Unit:	dB
Remarks:	You must be in the iDEN (E4406A), cdmaOne, NADC or PDC mode to use this command. Use INSTrument:SELect to set the mode.
	Value is global to the current mode.

Correction for MS RF Port External Attenuation

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

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

Set the correction equal to the external attenuation used when measuring mobile stations.

Factory Preset:	0.0 dB
Range:	–50 to 100.0 dB for cdmaOne, GSM, EDGE, iDEN
	–100.0 to 100.0 dB for cdma2000, W-CDMA, 1xEV-DO
	–50.0 to 50.0 dB for NADC, PDC
Default Unit:	dB
Remarks:	For E4406A you must be in the cdmaOne, GSM, EDGE (w/GSM), cdma2000, W-CDMA, iDEN, NADC, PDC, or 1xEV-DO mode to use this command. Use INSTrument:SELect to set the mode.
	For PSA you must be in the cdmaOne, GSM (w/EDGE), cdma2000, W-CDMA, NADC, PDC, or 1xEV-DO mode to use this command. Use INSTrument:SELect to set the mode.
	Value is global to the current mode.

Spur Close—Measurement

Commands for querying the close spurs measurement results and for setting to the default values are found in the “MEASure Group of Commands” on page 169. The equivalent front panel keys for the parameters described in the following commands, are found under the **Meas Setup** key, after the **Spur Close** measurement has been selected from the **MEASURE** key menu.

Spur Close—Average Count

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

[:SENSe]:CSPur:AVERage:COUNt?

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

Factory Preset:	15
Range:	1 to 10,000
Remarks:	You must be in the cdmaOne mode to use this command. Use INSTrument:SELect to set the mode.
Front Panel Access:	**Meas Setup**

Spur Close—Averaging State

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

[:SENSe]:CSPur:AVERage[:STATe]?

Turn averaging on or off.

Factory Preset:	ON
Remarks:	You must be in the cdmaOne mode to use this command. Use INSTrument:SELect to set the mode.
Front Panel Access:	**Meas Setup**

Spur Close—Averaging Termination Control

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

[:SENSe]:CSPur:AVERage:TCONtrol?

Select the type of termination control used for the averaging function. This determines the averaging action after the specified number of data acquisitions (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: REPeat

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

Front Panel Access: **Meas Setup**

Spur Close—Averaging Type

[:SENSe]:CSPur:AVERage:TYPE LOG|MAXimum|RMS|SCALar

[:SENSe]:CSPur: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.

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

SCALar - The voltage is averaged.

Factory Preset: RMS

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

Spur Close—Type

[:SENSe]:CSPur:TYPE EXAMine|FULL

[:SENSe]:CSPur:TYPE?

Select the measurement type.

EXAMine - measures spurs in the upper, lower, and center segments and then displays the worst spur

FULL - continuously measures the spurs in the upper, lower, and center segments

Factory Preset: FULL

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

Front Panel Access: **Meas Setup, Advanced** (E4406A)

RF Input Signal Alignments

Select the Input Signal

(PSA)
`[:SENSe]:FEED RF|AREFerence|IFAlign`

(E4406A)
`[:SENSe]:FEED RF|IQ|IONLy|QONLy|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.

For E4406A if the baseband IQ option (Option B7C) is installed, I and Q input ports are added to the front panel. The I and Q ports accept the in-phase and quadrature components of the IQ signal, respectively. The input signal can be taken from either or both ports.

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

IQ selects the combined signals from the front panel optional I and Q input ports. (E4406A with Option B7C in Basic, W-CDMA, cdma2000, EDGE(w/GSM) modes)

IONLy selects the signal from the front panel optional I input port. (E4406A with Option B7C in Basic mode)

QONLy selects the signal from the front panel optional Q input port. (E4406A with Option B7C in Basic mode)

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**
History:	E4406A: modified in version A.05.00

RF Power Commands

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 RF input attenuation is set to auto.

Factory Preset:	0 dB 12 dB for iDEN (E4406A)
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, iDEN (E4406A)
	–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
	For E4406A you must be in the Service, cdmaOne, EDGE(w/GSM), GSM, iDEN, NADC, PDC, cdma2000, or W-CDMA mode to use this command. Use INSTrument:SELect to set the mode.
	For PSA you must be in the cdmaOne, GSM, EDGE, NADC, PDC, cdma2000, or W-CDMA mode to use this command. Use INSTrument:SELect to set the mode.
Front Panel Access:	**Input, Max Total Pwr (at UUT)**

Radio Standards Commands

Radio Carrier Multiple

[:SENSe]:RADio:CARRier:NUMBer SINGle|MULTiple

[:SENSe]:RADio:CARRier:NUMBer?

Select if single or multiple carriers are present on the output of the base station under test. This enables/disables a software filter for the rho and code domain power measurements.

SINGle – disable software filter.

MULTiple – enable software filter to mitigate the adjacent carrier effects.

Factory Preset: SINGle

Remarks: You must be in the cdmaOne, cdma2000, 1xEV-DO, or iDEN (E4406A) mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: **Mode Setup, Demod, RF Carrier**

Radio Device Under Test

[:SENSe]:RADio:DEVice BS|MS

[:SENSe]:RADio:DEVice?

Select the type of radio device to be tested.

BS – Base station transceiver test

MS – Mobile station transceiver test

Factory Preset: BS

Remarks: You must be in the NADC, or PDC mode to use this command. Use INSTrument:SELect to set the mode.

Global to current mode.

Front Panel Access: **Mode Setup, Radio, Device**

Radio Standard Band

[:SENSe]:RADio:STANdard:BAND ARIBT53|C95B|CKOR|IS95A|JSTD8|P95B|PKOR|CUSTom

[:SENSe]:RADio:STANdard:BAND?

Select the standard variant that applies to the radio to be tested.

ARIBT53 - ARIB STD-T53

C95B - EIA/TIA-95B Cellular

CKOR - TTA.KO-06.0003 (Korea Cell)

IS95A - IS-95A Cellular

JSTD8 - J-STD-008 PCS

P95B - EIA/TIA-95B (PCS)

PKOR - TTA.KO-06.0013 (Korea PCS)

Factory Preset: IS-95A Cellular

Remarks: Global to the current mode.

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

Front Panel Access: **Mode Setup, Radio, Band**

Modulation Accuracy (Rho) Measurement

Commands for querying the rho measurement results and for setting to the default values are found in the "MEASure Group of Commands" on page 169. The equivalent front panel keys for the parameters described in the following commands, are found under the **Meas Setup** key, after the **Mod Accuracy (Rho)** or **Mod Accuracy (Composite Rho)** measurement has been selected from the **MEASURE** key menu.

Modulation Accuracy (Rho)—Average Count

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

[:SENSe]:RHO:AVERage:COUNt?

Set the number of data acquisitions that will be averaged. After the specified number of averaging counts, the averaging mode (termination control) setting determines the averaging action.

Factory Preset: 10

Range: 1 to 10,000

Remarks: You must be in the cdmaOne, cdma2000, W-CDMA, or 1xEV-DO mode to use this command. Use INSTrument:SELect to set the mode.

Modulation Accuracy (Rho)—Averaging State

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

[:SENSe]:RHO:AVERage[:STATe]?

Turn the modulation accuracy averaging function on or off.

Factory Preset: OFF

ON for cdma2000, W-CDMA, 1xEV-DO

Remarks: You must be in the cdmaOne, cdma2000, W-CDMA, or 1xEV-DO mode to use this command. Use INSTrument:SELect to set the mode.

Modulation Accuracy (Rho)—Averaging Termination Control

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

[:SENSe]:RHO:AVERage:TCONtrol?

Select the type of termination control used for the averaging function. This determines the averaging action after the specified number of frames (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: REPeat for cdmaOne, cdma2000, W-CDMA, 1xEV-DO

Remarks: You must be in the cdmaOne, cdma2000, W-CDMA, or 1xEV-DO mode to use this command. Use INSTrument:SELect to set the mode.

Modulation Accuracy (Rho)—Spectrum Normal/Invert

[:SENSe]:RHO:SPECtrum INVert|NORMal

[:SENSe]:RHO:SPECtrum?

Set a spectrum either to normal or inverted for the demodulation related measurements. If set to INVert, the upper and lower spectrums are swapped.

Factory Preset: NORMal

Remarks You must be in the cdmaOne, cdma2000, W-CDMA, or 1xEV-DO mode to use this command. Use

INSTrument:SELect to set the mode.

Modulation Accuracy (Rho)—Sweep Time (Measurement Interval)

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

[:SENSe]:RHO:SWEep:TIME?

Set the length of the measurement interval that will be used.

Factory Preset:	1.250 ms
Range:	0.5 ms to 30 ms
Default Unit:	seconds
Remarks:	You must be in the cdmaOne mode to use this command. Use INSTrument:SELect to set the mode.

Modulation Accuracy (Rho)—Trigger Source

[:SENSe]:RHO:TRIGger:SOURce EXTernal[1]|External2|FRAMe|IF|IMMediate|RFBurst

[:SENSe]:RHO: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 trigger

IF – internal IF envelope (video) trigger

IMMediate – the next data acquisition is immediately taken, capturing the signal asynchronously (also called free run).

RFBurst – internal wideband RF burst envelope trigger that has automatic level control for periodic burst signals.

Factory Preset:	IMMediate
Remarks:	You must be in the cdmaOne, cdma2000, W-CDMA, or 1xEV-DO mode to use this command. Use INSTrument:SELect to set the mode.
Front Panel Access:	**Meas Setup**, **Trig Source**

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 169. 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: To use this command for E4406A, the appropriate mode should be selected with INSTrument:SELect.

For PSA you must be in the Basic, cdmaOne, cdma2000, 1xEV-DO, 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: To use this command for E4406A, the appropriate mode should be selected with INSTrument:SELect.

For PSA you must be in the Basic, cdmaOne, cdma2000, 1xEV-DO, W-CDMA, GSM, EDGE, NADC, or PDC mode to use this command. Use INSTrument:SELect to set the mode.

Spectrum—ADC Range

E4406A

`[:SENSe]:SPECtrum:ADC:RANGe AUTO|APEak|APLock|M6|P0|P6|P12|P18|P24`

PSA
`[: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: M6, P0 - P24. 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.

- NONE - (PSA) turns off any auto-ranging without making any changes to the current setting.

- M6 - (E4406A) manually selects an ADC range that subtracts 6 dB of fixed gain across the range. Manual ranging is best for CW signals.

- P0 to P18 - (PSA) manually selects ADC ranges that add 0 to 18 dB of fixed gain across the range. Manual ranging is best for CW signals.

- P0 to 24 - (E4406A) manually selects ADC ranges that add 0 to 24 dB of fixed gain across the range. Manual ranging is best for CW signals.

Factory Preset: APEak

Remarks: To use this command for E4406A, the appropriate mode should be selected with INSTrument:SELect.

For PSA you must be in the Basic, cdmaOne, cdma2000, 1xEV-DO, 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: To use this command for E4406A, the appropriate mode should be selected with INSTrument:SELect.

For PSA you must be in the Basic, cdmaOne, cdma2000, 1xEV-DO, 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: To use this command for E4406A, the appropriate mode should be selected with INSTrument:SELect.

For PSA you must be in the Basic, cdmaOne, cdma2000, 1xEV-DO, 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:	To use this command for E4406A, the appropriate mode should be selected with INSTrument:SELect. For PSA you must be in the Basic, cdmaOne, cdma2000, 1xEV-DO, 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:	To use this command for E4406A, the appropriate mode should be selected with INSTrument:SELect. For PSA you must be in the Basic, cdmaOne, cdma2000, 1xEV-DO, 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: To use this command for E4406A, the appropriate mode should be selected with INSTrument:SELect.

For PSA you must be in the Basic, cdmaOne, cdma2000, 1xEV-DO, 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: To use this command for E4406A, the appropriate mode should be selected with INSTrument:SELect.

For PSA you must be in the Basic, cdmaOne, cdma2000, 1xEV-DO, 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:	To use this command for E4406A, the appropriate mode should be selected with INSTrument:SELect.
	For PSA you must be in the Basic, cdmaOne, cdma2000, 1xEV-DO, 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:	To use this command for E4406A, the appropriate mode should be selected with INSTrument:SELect.
	For PSA you must be in the Basic, cdmaOne, cdma2000, 1xEV-DO, 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
	155.0 kHz, for iDEN mode (E4406A)
Range:	1 Hz to 10.0 MHz
Remarks:	To use this command for E4406A, the appropriate mode should be selected with INSTrument:SELect.
	For PSA you must be in the Basic, cdmaOne, cdma2000,

1xEV-DO, 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: To use this command for E4406A, the appropriate mode should be selected with INSTrument:SELect.

For PSA you must be in the Basic, cdmaOne, cdma2000, 1xEV-DO, 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

250.0 Hz, for iDEN mode (E4406A)

Range: 0.10 Hz to 3.0 MHz

Remarks: To use this command for E4406A, the appropriate mode should be selected with INSTrument:SELect.

For PSA you must be in the Basic, cdmaOne, cdma2000,

1xEV-DO, 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
	OFF, for iDEN mode (E4406A)
Remarks:	To use this command for E4406A, the appropriate mode should be selected with INSTrument:SELect.
	For PSA 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:	To use this command for E4406A, the appropriate mode should be selected with INSTrument:SELect.
	For PSA you must be in the Basic, cdmaOne, cdma2000,

1xEV-DO, W-CDMA, GSM, EDGE, NADC, or PDC mode to use this command. Use INSTrument:SELect to set the mode.

History: E4406A:
Version A.02.00 or later

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: To use this command for E4406A, the appropriate mode should be selected with INSTrument:SELect.

For PSA you must be in the Basic, cdmaOne, cdma2000, 1xEV-DO, W-CDMA, GSM, EDGE, NADC, or PDC mode to use this command. Use INSTrument:SELect to set the mode.

History: E4406A:
Short form changed from LENgth to LENGth, A.03.00

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: To use this command for E4406A, the appropriate mode should be selected with INSTrument:SELect.

For PSA you must be in the Basic, cdmaOne, cdma2000, 1xEV-DO, W-CDMA, GSM, EDGE, NADC, or PDC mode to use this command. Use INSTrument:SELect to set the mode.

History: E4406A:
Short form changed from LENgth to LENGth, A.03.00

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: To use this command for E4406A, the appropriate mode should be selected with INSTrument:SELect.

For PSA you must be in the Basic, cdmaOne, cdma2000, 1xEV-DO, 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: To use this command for E4406A, the appropriate mode should be selected with INSTrument:SELect.

For PSA you must be in the Basic, cdmaOne, cdma2000, 1xEV-DO, 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:	To use this command for E4406A, the appropriate mode should be selected with INSTrument:SELect. For PSA you must be in the Basic, cdmaOne, cdma2000, 1xEV-DO, W-CDMA, GSM, EDGE, NADC, or PDC mode to use this command. Use INSTrument:SELect to set the mode.
History:	E4406A: Short form changed from LENgth to LENGth, A.03.00

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.

To use this command for E4406A, the appropriate mode should be selected with INSTrument:SELect.

For PSA you must be in the Basic, cdmaOne, cdma2000, 1xEV-DO, 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

100.0 kHz for iDEN mode (E4406A)

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.

To use this command for E4406A, the appropriate mode should be selected with INSTrument:SELect.

For PSA you must be in the Basic, cdmaOne, cdma2000, 1xEV-DO, 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 15.059 ms, for iDEN mode (E4406A)
Range:	100 ns to 10 s
Default Unit:	seconds
Remarks:	To use this command for E4406A, the appropriate mode should be selected with INSTrument:SELect. For PSA you must be in the Basic, cdmaOne, cdma2000, 1xEV-DO, 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:	To use this command for E4406A, the appropriate mode should be selected with INSTrument:SELect. For PSA you must be in the Basic, cdmaOne, cdma2000, 1xEV-DO, 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, iDEN mode

Remarks: To use this command for E4406A, the appropriate mode should be selected with INSTrument:SELect.

For PSA you must be in the Basic, cdmaOne, cdma2000, 1xEV-DO, W-CDMA, GSM, EDGE, NADC, or PDC mode to use this command. Use INSTrument:SELect to set the mode.

Synchronization Commands

Sync Type

**[:SENSe]:SYNC
ESECond|EXTernal[1]|EXTernal2|NONE|PSEQuence**

[:SENSe]:SYNC?

Select the demodulation sync type for the waveform accuracy (Rho) and code domain power measurements.

Even Second (ESECond) - Even second clock

EXTernal 1 - front panel external trigger input

EXTernal 2 - rear panel external trigger input

NONE - no demod sync (uses free run trigger)

Pilot Sequence (PSEQuence) - pilot sequence sync (uses frame trigger)

Factory Preset: ESECond

Remarks:	Global to the current mode. You must be in the cdmaOne mode to use this command. Use INSTrument:SELect to set the mode.
Front Panel Access:	**Mode Setup, Trigger, Sync Type**
History:	E4406A: Front/Rear panel swapped EXT2/EXT1, A.03.00

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 169. 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: To use this command for E4406A, the appropriate mode should be selected with INSTrument:SELect.

For PSA you must be in the Basic, cdmaOne, cdma2000, 1xEV-DO, 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: To use this command for E4406A, the appropriate mode should be selected with INSTrument:SELect.

For PSA you must be in the Basic, cdmaOne, cdma2000, 1xEV-DO, 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:	To use this command for E4406A, the appropriate mode should be selected with INSTrument:SELect. For PSA you must be in the Basic, cdmaOne, cdma2000, 1xEV-DO, W-CDMA, GSM, EDGE, NADC, or PDC mode to use this command. Use INSTrument:SELect to set the mode.

Waveform—ADC Range

E4406A
`[:SENSe]:WAVeform:ADC:RANGe`
`AUTO|APEak|APLock|GROund|M6|P0|P6|P12|P18|P24`

PSA
`[: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

NONE - (PSA) turn off auto-ranging without making any changes to the current setting.

M6 - (E4406A) subtracts 6 dB of fixed gain across the range

P0 to P18 - (PSA) adds 0 to 18 dB of fixed gain across the range

P0 to P24 - (E4406A) adds 0 to 24 dB of fixed gain across the range

Factory Preset:	AUTO
Remarks:	To use this command for E4406A, the appropriate mode should be selected with INSTrument:SELect. For PSA you must be in the Basic, cdmaOne, cdma2000, 1xEV-DO, 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: To use this command for E4406A, the appropriate mode should be selected with INSTrument:SELect.

For PSA you must be in the Basic, cdmaOne, cdma2000, 1xEV-DO, 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: To use this command for E4406A, the appropriate mode should be selected with INSTrument:SELect.

For PSA you must be in the Basic, cdmaOne, cdma2000, 1xEV-DO, 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: To use this command for E4406A, the appropriate mode should be selected with INSTrument:SELect.

For PSA you must be in the Basic, cdmaOne, cdma2000, 1xEV-DO, 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: To use this command for E4406A, the appropriate mode should be selected with INSTrument:SELect.

For PSA you must be in the Basic, cdmaOne, cdma2000, 1xEV-DO, 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: To use this command for E4406A, the appropriate mode should be selected with INSTrument:SELect.

For PSA you must be in the Basic, cdmaOne, cdma2000, 1xEV-DO, 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, Service (E4406A) 500.0 kHz for GSM 2.0 MHz for cdmaOne
Range:	1.0 kHz to 8.0 MHz when `[:SENSe]:WAVeform:BANDwidth|BWIDth [:RESolution]:TYPE GAUSsian` 1.0 kHz to 10.0 MHz when `[:SENSe]:WAVeform:BANDwidth|BWIDth [:RESolution]:TYPE FLATtop`
Remarks:	To use this command for E4406A, the appropriate mode should be selected with INSTrument:SELect. For PSA you must be in the Basic, cdmaOne, cdma2000, 1xEV-DO, W-CDMA, GSM, EDGE, NADC, or PDC mode to use this command. Use INSTrument:SELect to set the mode. Bandwidths > 6.7 MHz will require a slight increase in measurement time.

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:	To use this command for E4406A, the appropriate mode should be selected with INSTrument:SELect. For PSA you must be in the Basic, cdmaOne, cdma2000, 1xEV-DO, W-CDMA, GSM, EDGE, NADC, or PDC mode to use this command. Use INSTrument:SELect to

set the mode.

History: E4406A:
Version A.05.00 or later

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: To use this command for E4406A, the appropriate mode should be selected with INSTrument:SELect.

For PSA you must be in the Basic, cdmaOne, cdma2000, 1xEV-DO, 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: To use this command for E4406A, the appropriate mode should be selected with INSTrument:SELect.

For PSA you must be in the Basic, cdmaOne, cdma2000, 1xEV-DO, 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:	To use this command for E4406A, the appropriate mode should be selected with INSTrument:SELect. For PSA you must be in the Basic, cdmaOne, cdma2000, 1xEV-DO, 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 15.0 ms, for iDEN mode (E4406A)
Range:	1 µs to 100 s
Default Unit:	seconds
Remarks:	To use this command for E4406A, the appropriate mode should be selected with INSTrument:SELect. For PSA you must be in the Basic, cdmaOne, cdma2000, 1xEV-DO, 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, iDEN (E4406A) modes

Remarks: To use this command for E4406A, the appropriate mode should be selected with INSTrument:SELect.

For PSA you must be in the Basic, cdmaOne, cdma2000, 1xEV-DO, 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, PDC, 1xEV-DO
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, 1xEV-DO

Default Unit: seconds

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

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 500.0 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** (or **Ext Front**), **Level**

External Trigger Slope

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

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

Sets the trigger slope of an external trigger input to either NEGative or POSitive.

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 and 1xEV-DO
	10.0 ms (1 radio frame) for W-CDMA
	90.0 ms for iDEN (E4406A)
	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, 1xEV-DO
	1.0 ms to 559.0 ms for iDEN (E4406A), 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, iDEN (E4406A), 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, iDEN (E4406A), 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 a value of 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 20.0 ms for iDEN (E4406A) 10.0 ms for NADC or PDC
Range:	0.0 to 500.0 ms
Default Unit:	seconds
Front Panel Access:	**Mode Setup**, **Trigger**, **Trigger Holdoff**

Video (IF) Trigger Delay

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

:TRIGger[:SEQuence]:IF:DELay?

Set a value of the trigger delay of the IF (video) trigger (signal after the resolution BW filter).

Factory Preset:	0.0 s
Range:	–100.0 ms to 500.0 ms
Default Unit:	seconds
Front Panel Access:	**Mode Setup**, **Trigger**, **Video (IF Envlp)**, **Delay**

Video (IF) Trigger Level

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

:TRIGger[:SEQuence]:IF:LEVel?

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

Factory Preset:	–6.0 dBm for cdmaOne, GSM, EDGE, Basic, Service (E4406A), cdma2000, W-CDMA, 1xEV-DO

	–20.0 dBm for iDEN (E4406A)
	–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, to either NEGative or POSitive.

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 µs
Range:	–100.0 ms to 500.0 ms
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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