iDEN Measurement Guide

Agilent Technologies E4406A VSA Series Transmitter Tester Option HN1

Agilent Technologies

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1 Understanding iDEN

What is iDEN

Option HN1 adds iDEN (Motorola's Integrated Digital Enhanced Network) capability to the Agilent Technologies E4406A. iDEN is a trademark of the Motorola Company. This chapter introduces you to the iDEN measurement personality. For instructions on how to install the option, see "Installing Optional Measurement Personalities" on page 17.

The iDEN standard combines four communication technologies into a single network: radio, telephone, messaging, and data communications capabilities. The system uses TDMA in a QAM modulation format with multiple-carriers (M-QAM.) The modulated signal consists of four frequency division multiplexed sub-channels, each carrying a 16-QAM or 64-QAM signal. The sub-channel approach allows you to use a lower symbol rate which provides resistance to time dispersion.

Option HN1 adds the following measurements:

- The **ACP** key measures adjacent channel power ratio.
- The **BER** key measures bit error rate.
- The **OBW** key measures occupied power bandwidth.
- The **Spectrum** key measures standard spectrum analyzer signals in the frequency domain.
- The **Waveform** key measures standard spectrum analyzer signals in the time domain.

Option HN1 operates the same as other analyzer options. This documentation describes option specific information. Refer to the standard instrument manuals for descriptions of other functionality.

What Does the E4406A VSA Series Transmitter Tester Do?

The E4406A VSA Series Transmitter Tester makes measurements that conform to the Motorola iDEN standards specifications.

This standards document defines complex multi-part measurements, like occupied power bandwidth. The E4406A automatically makes these measurements using the measurement methods and limits defined in the standard. The detailed results displayed when the measurements are made, allow you to analyze iDEN system performance. You may alter the measurement parameters for specialized analysis.

With Option HN1 installed, you can run measurements on an iDEN signal. Selecting the iDEN **Mode** key automatically configures the instrument to measure iDEN signals. For example, selecting iDEN sets the default adjacent channel bandwidth (for the adjacent channel power test) to 10 kHz.

Base stations can be tested in a number of ways. One of the most common is to take the signal from the antenna input or from the base station power amp output. This can be done using a splitter or coupler and external attenuator.

To measure iDEN signals you must first select the iDEN mode and choose the mode setup parameters. Some of the modes setup choices include measuring both inbound and outbound signals in M-16QAM, M-64QAM, or D-JSMR. Mode settings will be used globally in all the measurements. You can then select the desired measurement and change any of the measurement setup parameters that you want altered from the default settings. Refer to the following chapters for information on the measurement process.

Other Sources of Measurement Information

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

- Application Note 1298
  Digital Modulation in Communications Systems - An Introduction
  Agilent Technologies part number 5965-7160E
- Application Note 1324
  Understanding PDC and NADC Transmitter Measurements for Base Transceiver Stations and Mobile Stations
  Agilent Technologies part number 5968-5537E
- Application Note 1312
  Understanding GSM Transmitter Measurements for Base Transceiver Stations and Mobile Stations
  Agilent Technologies part number 5966-2833E
- Application Note 1311
  Understanding CDMA Measurements for Base Stations and Their Components
  Agilent Technologies part number 5968-0953E

Instrument Updates at www.agilent.com/find/vsa

This web location can be used to access the latest information about the transmitter tester.

2 Setting Up the iDEN Mode

iDEN Mode

You may want to install a new personality or reinstall a personality that you had previously. Instructions can be found in "Installing Optional Measurement Personalities" on page 17.

At the 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 iDEN measurement personality press the **Mode** key and select the **iDEN** softkey.

If you want to set the iDEN 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. These defaults are based on iDEN's M-16QAM, M-64QAM, or D-JSMR specifications.

NOTE Pressing the **Preset** key does not switch instrument modes.

How to Make a Measurement

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

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

Changing the Mode Setup

Numerous settings can be changed at the mode level by pressing the **Mode Setup** key. This will access the selection menu listed below. These settings affect only the measurements in the iDEN mode.

Radio

The **Radio** key accesses the menu as follows:

- **QAM format** - Selects the modulation format of M-16QAM, M-64QAM, or D-JSMR.
- **Device** - Sets the test device to inbound (mobile station) or outbound

(base station). The base station must be put in the test mode to transmit known bit patterns, before testing.

Radio Default Settings	
QAM format	M16QAM
Device	Inbound

Input

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

- **RF Input Range** - Allows you to toggle the RF input range between **Auto** and **Man (manual)**. **Auto** is not used for spectrum measurements. If **Auto** is chosen, the instrument automatically takes data to determine the proper attenuator setting, based on the carrier power level where it is tuned.Once you change the **Max Total Pwr** or **Input Atten** value with the **RPG** knob, for example, the **RF Input Range** key is automatically set to **Man**.You may 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. It is generally recommended to set this to **Auto**.
- **Max Total Pwr** - Allows you to set the maximum mean carrier power from the UUT (Unit Under Test). The range is –200.00 to +50.00 dBm with 0.01 dB resolution. This is the expected maximum value of the mean carrier power referenced to the output of the UUT. 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 **RF Input Range** key is automatically set to **Man**.
- **Input Atten** - Allows you to control the 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 attenuator value is used in a single measurement, the value used at the carrier frequency will be displayed. The **Input Atten** setting is coupled together with the **Max Total Pwr** setting. Once you change the **Input Atten** value with the **RPG** knob, for example, the **RF Input Range** key is automatically set to **Man**.

NOTE

The **Max Total Pwr** and **Input Atten** settings are coupled together, so for a given measurement, changing the input **Max Total Pwr** setting by x dB changes the **Input Atten** setting by x dB, and vice-versa. When you switch to a different measurement, the **Max Total Pwr** setting is kept constant, but the **Input Atten** may change if the two measurements have different mixer margins. Thus, you can directly set the transmitter

tester input attenuator, or you can set it indirectly by specifying the expected maximum power from the UUT.

Input Default Settings	
RF input range	Auto[a]
Maximum total power	0 dBm[b]
Input attenuation	0 dB[b]
External attenuation M.S.	0.00 dB

a. Auto is not used for spectrum measurements.
b. In auto mode, the maximum total power and the input attenuation will increase from the defaults, if the input power is more than 0 dBm.

- **Ext Atten** - Allows you to enter the external attenuation value for the mobile station. The range is –50.00 to +50.00 dB with 0.01 dB resolution. This will allow the instrument to display the measurement results referred to the output of the UUT.
- **IF Align Signal** - Allows you to modify the IF alignment signal.

  Signal Rate - Changes the rate of the IF alignment signal. You must enter a divider number from 1 to 12. Each divider number increment halves the signal frequency. For example, at the default DAC setting of 1 the signal is set to 234.375 kHz. If the rate is set to 2 the signal is half that frequency, or 117.188 kHz.

  Signal Amptd - Modifies the signal amplitude by entering a DAC value between 0 - 4095. The amplitude range is approximately 50 dB. Incrementing the DAC value increases the amplitude of the signal, and will be visible on screen.

  Signal Type - Allows you to select a CW, comb, or pulse type signal as the IF align signal.

Trigger

The **Trigger** key allows you: (1) to access the **RF Burst (Wideband)**, **Video (IF Envlp)**, **Ext Front** and **Ext Rear** trigger source selection menu to specify the triggering conditions for each trigger source, (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 separately for each measurement under the **Meas Setup** key.

- **RF Burst (Wideband)**, **Video (IF Envlp)**, **Ext Front** and **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 numerical values to modify the delay time. The range is –500.000 to +500.000 ms with 1 ns 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** selection, the RF level range is –200.00 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** selection, 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 –40 dBm, depending on the noise level of the signal.

  — For **Ext Front** or **Ext Rear** selection, the level range is –5.00 to +5.00 V with 1 mV resolution.

  Slope Pos Neg - 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.

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

- **Trig Holdoff** - Allows you to set the period of time before the next trigger can occur. The range is 0.000 to 1000 s with 1 µs resolution.
- **Auto Trig** - Allows you to specify a time for a trigger timeout. The range is 0.000 to 1000 sec with 1 µs resolution. If no trigger occurs by the specified time, a trigger is automatically generated.
- **Frame Timer** - Allows you to access the **Frame Timer** menu to manually control the frame timer:

  Period - Allows you to set the period of the frame clock. The range is 1.000 to 559.0 ms. Finest resolution is 1 ns.

Trigger Default Settings	
RF burst:	
Delay	0.000 sec
Peak level	–6.0 dB
Slope	Pos

Trigger Default Settings	
Video:	
Delay	0.000 s
Level	–20.00 dBm
Slope	Pos
Ext Front & Ext Rear:	
Delay	0.000 s
Level	2.00 V
Slope	Pos
Trigger holdoff	20.00 ms
Auto trigger	200.0 ms, Off
Frame timer period	90.0 ms

Changing the Frequency Channel

After selecting the desired mode setup, you will need to select the desired center frequency. Press the **Frequency Channel** key to access the following menu:

- **Center Freq** - Enter a frequency value that corresponds to the desired RF channel to be measured.This is the current instrument center frequency for any measurement function.

When the iDEN mode is selected, the instrument will default to the following setting.

Frequency Channel Default Settings	
Center Frequency	806 MHz

Installing Optional Measurement Personalities

Installing a measurement personality is a two step process.

1. The measurement personality firmware must be installed into the instrument.
2. A license key number must be entered which enables the measurement personality to run. (Refer to the “License Key Numbers” section.)

Adding additional measurement personalities requires purchasing a retrofit kit for the desired option. The retrofit kit includes the measurement personality firmware, usually supplied on a zip disk. The license key certificate, included in the kit, contains the license key number. Every retrofit kit will have installation instructions.

The installation instructions require you to know three pieces of information about your instrument; the amount of memory installed, the Host ID, and the instrument serial number.

To find:	Key Path:
Instrument Memory: _____	**System**, **File System** (the amount of memory in your instrument will be the sum of the Used memory and the Free memory)
Host ID: _____	**System**, **Show System**, **Host ID**
Instrument Serial Number: _____	**System**, **Show System**, **Serial Number**

Exit Main Firmware key. This key is only for use when you want to update firmware using a LAN connection. The **Exit Main Firmware** key halts the operation of the resident firmware code so you can install an updated version of firmware using a LAN connection. Instructions for loading future firmware updates are available at the following URL: **www.agilent.com/find/vsa/**

Available Personality Options

The option designation consists of three characters, as shown in the **Option** column of the table below.

Available Personality Options[a]	Option
GSM with EDGE, measurement personality	**BAH**
cdmaOne measurement personality	**BAC**
NADC, PDC measurement personalities	**BAE**
iDEN measurement personality	**HN1**
W-CDMA measurement personality	**BAF**
cdma2000 measurement personality	**B78**

a. As of the print date of this measurement guide.

License Key Numbers

The measurement personality you have purchased with your instrument has been installed and enabled at the factory. With the purchase of the measurement personality, and with any future purchase of a new personality, you will receive a unique license key number. The license key number is a hexadecimal number that is for your specific measurement personality and instrument serial number. The license key enables you to install, or reactivate any personality you have purchased.

Follow these steps to locate the unique license key number for the measurement personality that has come installed in your instrument:

1. Press **System**, **More (1 of 3)**, **More (2 of 3)**, **Install**, **Choose Option.** When you press the **Choose Option** key the alpha editor will be activated. Use the alpha editor to enter the letters (upper-case) and the front-panel numeric keyboard to enter the numbers (if required) for the personality option that has been installed in the instrument.
2. Press the **Done** key on the alpha editor menu. The unique license key number for your instrument will now appear on the **License Key** softkey.

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

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

If you purchase an option later, you will receive a certificate which displays the unique license key number that you will need to install that option.

NOTE You will need to use a license key number only if you purchase an additional measurement personality, or if you want to reactivate a measurement personality that has been deactivated.

Installing a License Key Number

NOTE Follow this procedure to reinstall a license key number which has been deleted during the uninstall process, or lost due to a memory failure.

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

1. Press **System**, **More(1 of 3)**, **More(2 of 3)**, **Install**, **Choose Option**. Pressing the **Choose 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 numbers (if required) for the option designation, then press the **Done** key. As you enter the option, you will see your entry in the active function area of the display.
2. Press **License Key**. Entering the license key number will require entry of both letters and numbers. Use the alpha editor to enter letters. Use the front-panel numeric keyboard to enter numbers. You will see your entry in the active function area of the display. When you have completed entering the license key number, press the **Done** key.

3. Press the **Install Now** key after you have entered the active license key number and the personality option. When pressed, a message may appear in the function area of the display which reads, "`Insert disk and power cycle the instrument`". Disregard this message. Press the **No** key only if you wish to cancel the installation process. If you want to proceed with the installation, press the **Yes** key and cycle the instrument power off and then on.

Using the Uninstall Key

The following procedure removes the license key number for the selected option. This will make the option unavailable for use, and the message "`Application Not Licensed`" will appear in the Status/Info bar at the bottom of the display. Please write down the 12-digit license key number for the option before proceeding. If that measurement personality is to be used at a later date you will need the license key number to reactivate the personality firmware.

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

1. Press **System**, **More(1 of 3)**, **More(2 of 3)**, **Uninstall**, **Choose Option**. Pressing the **Choose 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 numbers (if required) for the option, then press the **Done** key. As you enter the option, you will see your entry in the active function area of the display.
2. Press the **Uninstall Now** key after you have entered the personality option. Press the **No** key only if you wish to cancel the uninstall process. Press the **Yes** key if you want to continue the uninstall process.
3. Cycle the instrument power off and then on to complete the uninstall process.

3 Making iDEN Measurements

iDEN Measurements

Once you've selected the iDEN mode, the following measurements are available by pressing the **Measure** key.

Adjacent Channel Power (ACP)
Bit Error Rate (BER)
Occupied Bandwidth (OBW)
Spectrum (frequency domain) Measurements
Waveform (time domain) Measurements

This chapter includes information on:

- **Meas Control** keys in "Measure Control" on page 24
- **Meas Setup** keys to change parameters common to many iDEN measurements in "Measurement Setup" on page 24
- ACP **Meas Setup** keys in "Making the Adjacent Channel Power Measurement" on page 27
- BER **Meas Setup** keys in "Making the Bit Error Rate Measurement" on page 31
- OBW **Meas Setup** keys in "Making the Occupied Bandwidth Measurement" on page 34
- Spectrum **Meas Setup** keys in "Making the Spectrum (Frequency Domain) Measurement" on page 37
- Waveform **Meas Setup** keys in "Making the Waveform (Time Domain) Measurement" on page 45

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 iDEN 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 Pressing the **Preset** key does not change the instrument mode.

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

Initial Setup

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

How to Make a Measurement

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

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

Measure Control

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

- **Measure** softkey. 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 Continuous, the measurement will run continuously, and perform averaging according to the current average type (repeat or exponential). The default setting is continuous.
- **Pause** key. Press **Meas Control**, **Pause** to pause the current measurement. Once toggled, the label of the **Pause** key changes to read **Resume**. The **Resume** key, once pressed, continues the active measurement from the point at which it was paused.
- **Restart** key. The **Restart** front panel key repeats 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 the **Meas Type**, **Trig Source**, **Offs & Limits**, and **Advanced** measurement setup features.

The following measure setup features can be used with some or all measurements.

- **Res BW** key. Press **Meas Setup**, **Res BW** to change the resolution of a given measurement. Selection of a narrower bandwidth will result in a longer data acquisition time.
- **% Power** key. Press **Meas Setup**, **% Power** to choose the percentage of the total channel power that you want to measure. The bandwidth of that amount of power will be measured. This selection is only for occupied bandwidth measurements.
- **Frames** key. Press **Meas Setup**, **Frames** to choose the number of frames that you want to measure bit error rate for. This selection is only for bit error rate measurements.
- **Meas Type** key. Press **Meas Setup**, **Meas Type** to choose to measure the total power or the power spectral density. This selection is only for adjacent channel power measurements.

- **Limit Test** key. Press **Meas Setup**, **Limit Test** to turn limit testing on and off. The limits that you want to test against can be selected.
- **Restore Meas Defaults** key. To preset only the settings that are specific to the selected measurement, press **Meas Setup**, **More**, **Restore Meas Defaults**. 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, averaging mode, and type of averaging you use for the currently selected measurement.

- **Avg Number** - will allow you to change the number of N averages to be used when making the measurement.
- **Avg Mode Exp Repeat** - will allow you to choose either exponential or repeat averaging. This selection only effects the averaging after the number of N averages is reached (set using the **Avg Number** key).
  - **Single measurements**: Normal (linear) averaging is always used until the specified number of N averages is reached. When **Measure** is set at **Single**, data acquisitions are stopped when the number of averages is reached for a single measurement. 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 the **Averages**, **Avg Bursts**, or Avg Number key.
  - **Repeat averaging**: When **Measure** is set at **Cont**, data acquisitions will continue indefinitely. After N averages is reached, all previous result data is cleared and the average count is set back to 1. This is equivalent to being in **Measure Single** and pressing the **Restart** key each time the Single measurement finishes.

Trig 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. Note that the **RF Burst (Wideband)**, **Video (IF Envlp)**, **Ext Front**, and **Ext Rear** menu keys found in the **Trigger** menu enable you to change settings to modify the delay, level, and slope for each of these trigger sources. Choose one of the following trigger sources:

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

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

Making the Adjacent Channel Power Measurement

Purpose

To maintain a quality call by avoiding channel interference, it is quite important to measure and reduce an 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.

Adjacent channel leakage power is defined by the iDEN standard as the total power within the bandwidth of 10 kHz, centered at 25 kHz offset from the carrier frequency.

Measurement Method

This measurement analyzes the total power levels within the defined bandwidth of 10 kHz at given frequency offsets on both sides of the carrier frequency using Fast Fourier Transform (FFT).

The total peak power is measured, using a resolution bandwidth (automatically set) much narrower than the channel bandwidth, through the entire iDEN bandwidth of 18 kHz. Both the absolute power levels and the power levels relative to the center power band are displayed.

The measurement functions, such as averaging, trigger source, limit test, offsets and limits, need to be set up to make a measurement and establish pass/fail testing.

Making the Measurement

NOTE The factory default settings provide an iDEN compliant measurement. For special requirements, you may need to change some of the settings. Press **Meas Setup**, **More (1 of 2)**, **Restore Meas Defaults** at any time to return all parameters for the current measurement to their default settings.

Select the desired center frequency as described in “Changing the Frequency Channel” on page 16.

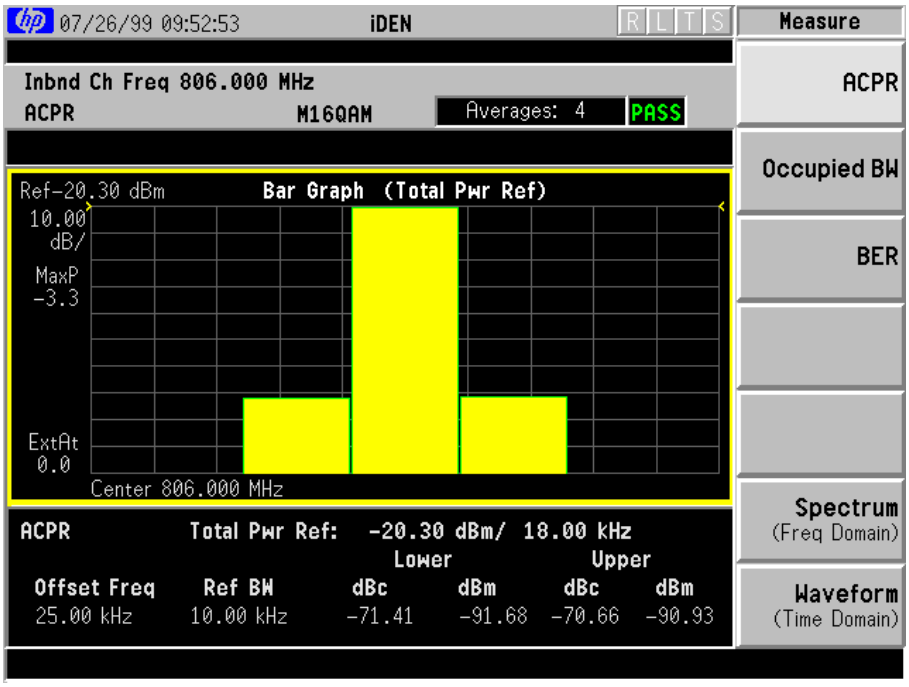
Press **Measure**, **ACPR** to immediately make an adjacent channel power measurement.

To change any of the measurement parameters from the factory default values, refer to “Changing the Measurement Setup” on page 28 for this measurement.

Results

The next figure shows an example result of adjacent channel power measurements in the bar graph window. The power levels at both sides of the carrier frequency are displayed in the graphic window and text window.

Figure 3-1 Adjacent Channel Power Measurement Result - Bar Graph



Changing the Measurement Setup

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

Table 3-1 Adjacent Channel Power Measurement Defaults

Measurement Parameter	Factory Default Condition
Average number	20, On
Average mode	Exponential
Trigger source	RF burst (inbound)
Limit Test	On
Reference BW	18 kHz
Offset frequency	25.000 kHz
Offset bandwidth	10.000 kHz
Absolute limit	0.00 dBm
Fail	Relative
Relative limit (carrier)	–60 dB
Relative limit (PSD)	–57.45 dB

Make sure the adjacent channel power measurement is selected under the **Measure** menu. The **Meas Setup** key accesses the menu which allows you to modify the average number, average mode and trigger source for this measurement as described in “Measurement Setup” earlier in this chapter. However, the trigger source does not include **Video** or **Line**. In addition, the following parameters for adjacent channel power measurements can be modified:

- **Limit Test** - Allows you to toggle the limit test function between **On** and **Off**. If set to **On**, **Abs Lim** and/or **Rel Lim** need to be specified to execute pass/fail tests with the logical judgement under the **Fail** key. Pass/fail results are shown in the active display window with the number of averages. In the text window, a red character F is shown on the right side of each measurement result, either relative or absolute, if it exceeds the limits with its logical judgement.
- **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.
- **Offs & Limits** - Allows you to access the menu to change the following parameters for pass/fail tests:

  Offset Freq - Allows you to store a frequency offset value. For iDEN the offset for the measurement is specified as 25 kHz. The offset selection is shown on the key label.

  Offset BW - Allows you to select bandwidth of the carrier and offset channels that you want to measure.

Abs Limit - Allows you to enter an absolute limit value ranging from –200.00 to +50.00 dBm with 0.01 dB finest 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 ACP measurement results is larger than **Rel Lim** AND the absolute ACP measurement result is larger than **Abs Limit**.

OR - Fail is shown if one of the relative ACP measurement results is larger than **Rel Lim** OR one of the absolute ACP measurement results is larger than **Abs Limit**.

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

Relative - Fail is shown if one of the relative ACP measurement results is larger than **Rel Lim**.

Rel Lim (Car)- Allows you to enter a limit value, relative to the carrier, ranging from –200.00 to +50.00 dB with 0.01 dB finest resolution.

Rel Lim (PSD)- Allows you to enter a limit value, relative to the power spectral density, ranging from –200.00 to +50.00 dB with 0.01 dB finest resolution.

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 ACP 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.

Making the Bit Error Rate Measurement

Purpose

The BER test lets you test for bit errors in your iDEN signal. Prepare to run the BER test by first reviewing the information in “Setting Up the iDEN Mode” on page 11.

Measurement Method

The BER test takes data from the RF input and then performs analysis on that data to find bit errors. It measures BER on all four channels.

The **num frames** softkey determines the number of 90 milli-second frames that the BER test demodulates. Since each frame has multiple slots, the BER test uses the 1st slot that contains data. If the data in that slot matches one of the 16 transmission unit data words defined by iDEN, the BER test displays the number of the WORD that it found. The number of frames that were actually found is indicated.

Making the Measurement

NOTE The factory default settings provide an iDEN compliant measurement. For special requirements, you may need to change some of the settings. Press **Meas Setup**, **More (1 of 2)**, **Restore Meas Defaults** at any time to return all parameters for the current measurement to their default settings.

Press **Measure**, **BER** to immediately make a bit error rate measurement. The bit error rate will be measured on all four channels. To change any of the measurement parameters from the factory default values, refer to the **Meas Setup** key and “Changing the Measurement Setup” on page 33 for this measurement.

Results

By default, the BER test displays two traces. The BER test also displays the following results at the bottom of the display:

- Bit error rate, shown as a percentage total for all frames
- Current frame BER, shown as a percentage
- Bits failed, which is the number of bits that failed
- Bits tested, which is the number of bits tested
- Frames found
- Frames tested
- Current identified word

The BER test computes the bit error rate as follows:

Equation 3-1 Bit Error Rate Calculation

$$\text{BER (\%)} = \frac{\text{Number of bits failed}}{\text{Number of bits tested}} \times 100\%$$

The results, from all frames that were tested, are shown. It also shows the number of frames successfully demodulated and the number of frames tested.

The BER test changes the results as follows if it cannot demodulate a frame:

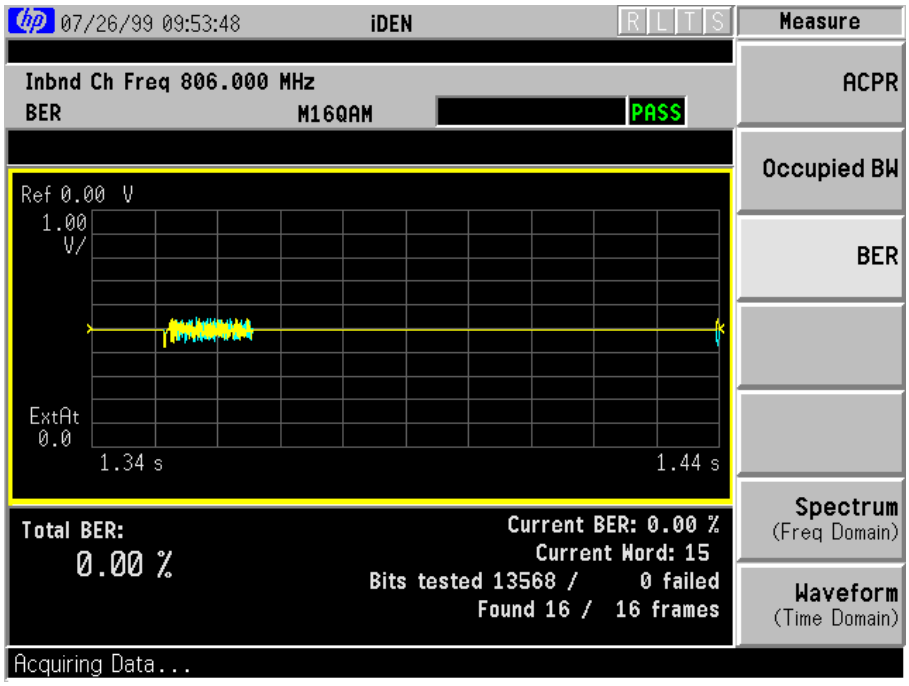
`Bits Failed` is increased by half the number of bits in the frame. Statistically, a pure noise signal should have a BER of 50%. `Bits Tested` is increased by the number of bits in the frame. `Found`, shows two numbers: the first number shows the number of frames successfully demodulated; the second number shows the number of frames tested. For example, `Found: 4/15 frames` means 15 frames were tested. Of these frames, only 4 were successfully demodulated. The other 11 frames could not be found. The sync, word, or pulse were not found.

The results use some of the following terminology:

Word is the transmission data unit word that contained the symbol with the bit errors.

Total is the total number of bit errors in the composite symbol.

Figure 3-2 Bit Error Rate Measurement Results



Changing the Measurement Setup

Frames determines the number of frames used by each test. The default is 16. The measurement requires *n* frames for demodulation and BER measurement. One additional frame is acquired for a preliminary carrier frequency estimation. For example, if **Frames** is 16, the BER test acquires 17 frames of data (*n* + 1), and then searches for the first frame that it can demodulate. The measurement demodulates the selected number of frames using the specified trigger conditions.

Table 3-2 Bit Error Rate Measurement Defaults

Measurement Parameter	Factory Default Condition
Frames	16
Trigger source	Video (IF envelope)
Limit Test	On
Bit error rate	5%

Making the Occupied Bandwidth Measurement

Purpose

To utilize the limited resource of radio frequency bands to provide as many communication channels as possible, it is critical to measure and control the occupied bandwidth transmitted from a mobile phone. This occupied bandwidth is defined as the frequency bandwidth in which 99% of the total power is measured.

The occupied bandwidth of a mobile phone tends to be improved if its adjacent channel power is reduced. To provide as many channels as possible to meet the increasing number of subscribers, both of these characteristics of a mobile phone need to be measured and analyzed for further performance improvement.

Measurement Method

This is the frequency bandwidth in which 99% of the total power is measured, based on Fast Fourier Transform (FFT) theory.

In the actual measuring process, first the total channel power is measured using a sampling method. Then each power sample is integrated up to 0.5% of the total power from the lowest and highest frequency sides to determine the low and high limit frequencies. The difference derived from these frequencies is the occupied bandwidth.

The measurement functions such as averaging, trigger source, limit test and limit need to be set up to make a measurement and pass/fail test. The test results are displayed in the graphic window and in the text window.

Making the Measurement

NOTE The factory default settings provide an iDEN compliant measurement. For special requirements, you may need to change some of the settings. Press **Meas Setup**, **More (1 of 2)**, **Restore Meas Defaults** at any time to return all parameters for the current measurement to their default settings.

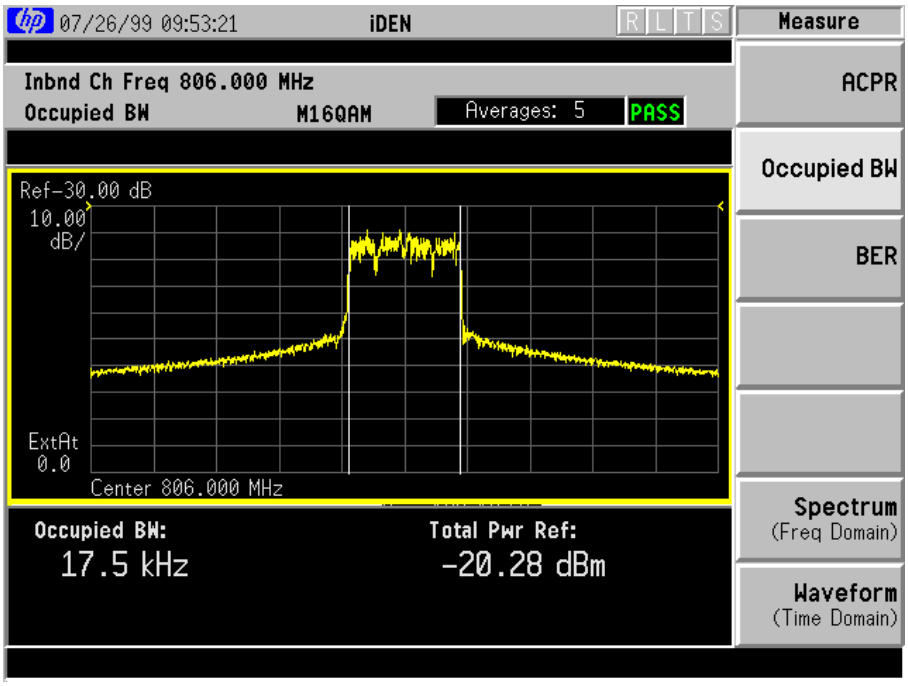
Select the desired center frequency as described in “Changing the Frequency Channel” on page 16.

Press **Measure**, **Occupied BW** to immediately make the occupied bandwidth measurement. To change any of the measurement parameters from the factory default values, refer to “Changing the Measurement Setup” on page 35 for this measurement.

Results

In the upper window the sampled power distribution is displayed with 0.5% frequency marker lines. The actual measured data of the occupied bandwidth and the total channel power are shown in the lower window.

Figure 3-3 Occupied Bandwidth Measurement Results



Changing the Measurement Setup

The next table shows the factory default settings for occupied bandwidth measurements.

Table 3-3 Occupied Bandwidth Measurement Defaults

Measurement Parameter	Factory Default Condition
Log Scale	10.00 dB/div
Avg Number	10, On
Avg Mode	Repeat
Trigger Source	Video (IF envelope)
% (percent) power	99%
Limit Test	On
Limit	20.0 kHz

Make sure the occupied bandwidth measurement is selected under the **Measure** menu. The **Meas Setup** key accesses the menu which allows you to modify the averaging and trigger source for this measurement as described in “Preparing for Measurements” earlier in this chapter. In addition, the following occupied bandwidth measurement parameters can be modified:

- **Limit Test** - Allows you to toggle the limit test function between **On** and **Off**. If set to **On**, the **Limit** key needs to be pressed to specify the limit value. Pass/fail results are shown in the active display window with the number of averages.
- **Limit** - Allows you to specify the frequency limit value ranging from 10.000 to 60.000 kHz with 0.1 kHz resolution.

Troubleshooting Hints

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

Making the Measurement

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

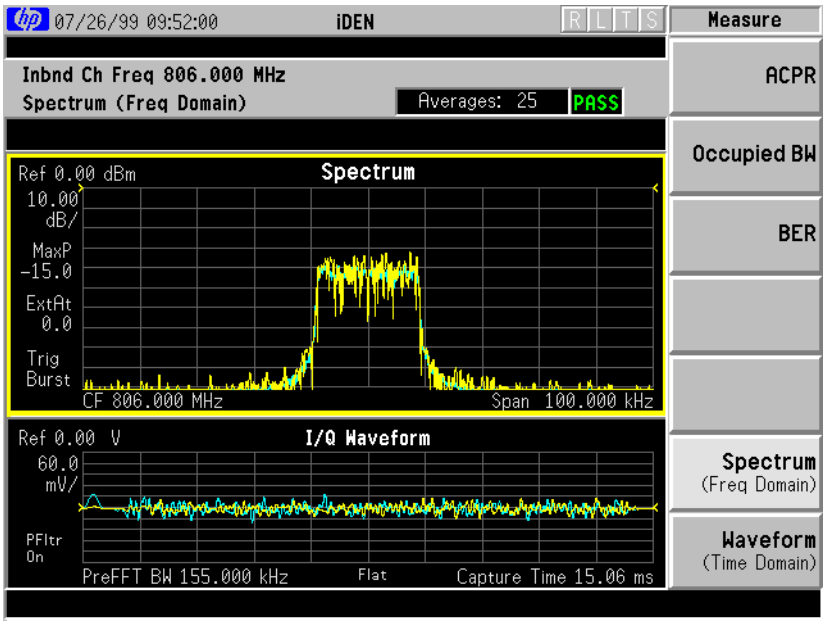
Press **Measure**, **Spectrum (Freq Domain)** to immediately make Spectrum (Frequency Domain) the active measurement.

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 1 **Spectrum Measurement Result- Spectrum Window**



Changing the Measurement Setup

Table 1 Spectrum (Frequency Domain) Measurement Defaults

Measurement Parameter	Factory Default Condition
Res BW	250.000 Hz
Averaging: Avg Number Avg Mode Avg Type	 25 On Exp Log-Pwr Avg (Video)
Trigger Source	RF Burst (Wideband)
Measurement Time (Service mode only)	1.0 ms (Auto)
Spectrum Window: Span Scale/Div - Amplitude Y Scale	 100.000 kHz 10.00 dB
I/Q Waveform Window: Capture Time Scale/Div - Amplitude Y Scale	 15.06 ms 60 mV
Advanced	
Pre-ADC BPF	On
Pre-FFT Filter	Flat
Pre-FFT BW	155.000 kHz (Auto)
FFT Window	Flat Top (High AmptdAcc)
FFT Size: Length Control Min Points/RBW Window Length FFT Length	 Auto 1.300000 5648 32768
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** - This key allows you to modify the frequency span. Changing the span causes the bandwidth to change automatically, and will affect data acquisition time.
- **Res BW** - This feature sets the resolution bandwidth for the FFT, and allows manual or automatic settings. A narrower bandwidth will result in a longer data acquisition time. In Auto mode the resolution bandwidth is set to Span/50 (2% of the span).
- **Advanced** - The following 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 - This key allows you to toggle the pre-ADC bandpass filter to On or Off states. 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 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 - The Pre-FFT bandwidth allows you to select between a manual or an automatic setting. The pre FFT-bandwidth filter can be set between 1 Hz and 10 MHz. In Auto mode this 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 a filter for best amplitude accuracy, by reducing scalloping error.
- **Uniform** - You can select to have no window active by using the uniform setting.
- **Hanning**
- **Hamming**
- **Gaussian** - Selects a gaussian filter with an alpha of 3.5.
- **Blackman**
- **Blackman Harris**
- **K-B 70dB / 90dB/ 110dB (Kaiser-Bessel)** - Allows selection of Kaiser-Bessel filters with sidelobes of –70, –90, or –110 dBc.

FFT Size - This menu contains the following features:

- **Length Ctrl** - This feature allows you to set the FFT and window lengths either automatically or manually.
- **Min Pts in RBW** - This feature allows you to set the minimum number of data points that will be used inside the resolution bandwidth. This adjustment is only available if the **Length Ctrl** key is set to Auto.
- **Window Length** - This feature allows you to enter the FFT window length ranging from 8 to 1048576. This length represents the actual quantity of I/Q samples that are captured for processing by the FFT. This value can only be entered if length control is set to Manual.
- **FFT Length** - This feature allows you to enter the FFT length in the number of captured samples, ranging from 4096 to 1048576. The FFT length setting is automatically limited so that it is equal or greater than the FFT window length setting. Any amount greater than the window length is implemented by zero-padding. This value can be entered only if length control is set to Man (manual).

ADC Range - Allows you to access the following selection 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.

- **AutoPeakLock** - 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: **–6 dB**, **0 dB**, **+6 dB**, **+12 dB**, **+18 dB**, **+24 dB**, to set the ADC range level. Also note that manual ranging is best for CW signals.

Data Packing - Allows you to access the following selection menu to define one of the following data packing methods:

- **Auto** - Data is automatically packed. This is the default setting and most recommended.
- **Short (16 bit)** - Data is packed by every 16 bits.
- **Medium (24 bit)** - Data is packed by every 24 bits.
- **Long (32 bit)** - Data is packed by every 32 bits.

ADC Dither - Allows you to toggle the ADC dither function between **Auto**, **On**, and **Off**. When set to auto (the default), ADC dither 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.

IF Flatness - Allows you to toggle between **On** and **Off**. When toggled 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 the transmitter tester.

Changing the View

View/Trace menu keys are used to activate a view of a measurement with preset X and Y scale parameters, called a “window”. Using the X and Y Scale keys you can then modify these parameter settings. You can also activate specific traces, using the **Trace Display** menu key.

Windows Available for Spectrum Measurements

The spectrum and the I/Q windows can be viewed at the same time, or individually. You can use the **Next Window** and **Zoom** keys to move between these different views.

Spectrum window Select this window if you want to view frequency and power. Changes to frequency span or power will sometimes affect data acquisition.

I/Q Waveform window. Select this window to view the I and Q signal characteristics of the current measurement in parameters of voltage and time.

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

Using the Markers

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

- **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, for example, which 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 a **Diamond**, **Line**, **Square**, or **Cross**. The default is a **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.

Band Power

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

Press the **Marker** key.

Press **Trace**, **Spectrum** to activate a marker on the instantaneous spectrum signal. Press the **Spectrum Avg** key to activate a marker on the average spectrum trace.

Press **Function, Band Power**.

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.

Press **Delta** to bring marker 2 to the same place as marker 1.

Move marker 1 to the other desired position by rotating the **RPG** knob. Band power measures the average power between the two markers. 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 waveforms in the time domain. This measurement is how the instrument performs the zero span functionality found in traditional spectrum analyzers. Also available under basic mode waveform measurements is an I/Q window, which shows the I and Q signal in parameters of voltage and time. The advantage of having an I/Q view available while in the waveform measurement is that it allows you to view complex components of the same signal without changing settings or measurements.

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

Measurement Method

The transmitter tester 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 transmitter tester relies on a high rates of sampling to create an accurate representation of a time domain signal.

Making the Measurement

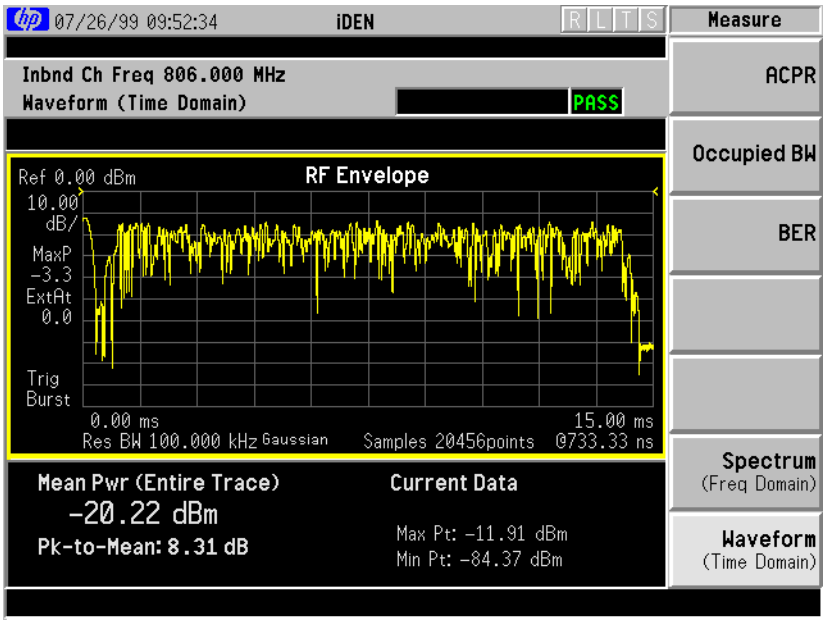
NOTE The factory default parameters provide a good starting point.You will likely want to change some of the settings. Press **Meas Setup**, **More (1 of 2)**, **Restore Meas Defaults** at any time to return all parameters for the current measurement to their default settings.

Press **Measure**, **Waveform (Time Domain)** to immediately make Waveform (Time Domain) the active 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

Figure 2 Waveform Measurement Results- RF Envelope Window



Changing the Measurement Setup

Table 2 Waveform (Time Domain) Measurement Defaults

Measurement Parameter	Factory Default Condition
View/Trace	RF Envelope
Sweep Time	15.00 ms
Res BW	100.000 kHz
Averaging: Avg Number Avg Mode Avg Type	 10 Off Exp Pwr Avg (RMS)
Trigger Source	RF Burst
RF Envelope Window: Amplitude Y Scale Scale/Div Reference	 10.00 dB 0.00 dBm (Top)
I/Q Waveform Window: Amplitude Y Scale Scale/Div Reference	 100.0 mv 0.00 V (Ctr)
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** - This key allows you to select the measurement acquisition time. It is used to specify the length of the time capture record. Values between 10 µs and 50 s can be entered, depending upon the resolution bandwidth setting.
- **Res BW** - This key sets the measurement bandwidth. A larger bandwidth results in a larger number of acquisition points and reduces the maximum allowed for sweep time. You can enter values between 10 Hz. and 7.5 MHz.

- **Advanced** menu key. This key accesses the features listed below.

  Pre-ADC BPF - This key allows you to toggle the pre-ADC bandpass filter to On or Off states. 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 - This key toggles to select a flat top or a Gaussian resolution bandwidth filter. A Gaussian filter provides more even time domain response, particularly for bursts. A flat top 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, and it is the default filter for waveform measurements.

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

  - **Auto** - This key causes the instrument to automatically adjust the signal range for optimal measurement results.
  - **AutoPeak** - This key causes the instrument to continuously seek the highest peak signal.
  - **AutoPeakLock** - This key causes 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: –**6 dB**, **0 dB**, **+6 dB**, **+12 dB**, **+18 dB**, **+24 dB**, to set the ADC range level. Also note that manual ranging is best for CW signals.

Data Packing - Allows you to access the following selection menu to define one of the following data packing methods:

- **Auto** - Data is automatically packed. This is the default setting and most recommended.
- **Short (16 bit)** - Data is packed by every 16 bits.
- **Medium (24 bit)** - Data is packed by every 24 bits.
- **Long (32 bit)** - Data is packed by every 32 bits.

ADC Dither - Allows you to toggle the ADC dither function between **On** and **Off**. Activation of the ADC dither results in better amplitude linearity and resolution in low level signals. However, it also results in reduced dynamic range. ADC dither is set to Off by default.

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 transmitter tester data acquisition memory. Decimation numbers 1 to 4 describe the factor by which the number of points are reduced. A decimation figure of 1, which results in no data point reduction, is the default.

Changing the View

The **View/Trace** menu keys are used to activate a view of a measurement with preset X and Y scale parameters; this view is called a "window." Using the X and Y scale keys, you can then modify these parameters. You can also activate traces, using the **Traces Display** menu key.

Windows Available for Waveform Measurements

RF Envelope window. Select this window if you want to view power (in dBm) vs. time. Remember that data acquisition will be affected when you change the sweep time.

I/Q Waveform window. Select this window to view the I and Q signal characteristics of the current measurement in parameters of voltage and time.

Using the Markers

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

- **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, for example, which 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 a **Diamond**, **Line**, **Square**, or **Cross**. The default is a **Diamond**.
- **Marker All Off** - Allows you to turn off all of the markers.

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

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

Band Power

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

Press the **Marker** key.

Press **Function**, **Band Power**.

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.

Press **Delta** to bring marker 2 to the same place as marker 1.

Move marker 1 to the other desired position by rotating the **RPG** knob. Band power measures the average power between the two markers. 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 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.

4 iDEN Specifications

All specifications apply over 0 °C to +55 °C, except when otherwise specified. The instrument will meet its specifications after 2 hours of storage at a constant temperature, within the operating temperature range, 1 hour after the instrument is turned on and within 24 hours after “Align All Now” has been run. The specifications for each measurement apply for the measurement’s factory default setup.

Measurements

Measurement	Specifications	Supplemental Information
Adjacent Channel Power Ratio		
Carrier power range at UUT[a] Mobile station	+46 to –20 dBm	With ≥20 dB external atten.
Carrier power range at RF Input	+26 to –40 dBm	
Adjacent channel power ratio range at 25 kHz offset		0 to –70 dBc, characteristic For 18 kHz reference BW and 10 kHz offset BW.
Resolution	0.01 dB	

a. UUT = Unit Under Test

Measurement	Specifications	Supplemental Information
Occupied Bandwidth		
Carrier power range at UUT Mobile station	+46 to –20 dBm	With ≥20 dB external atten.
Carrier power range at RF Input	+26 to –40 dBm	
Frequency resolution of occupied bandwidth	10 Hz	
Frequency accuracy of occupied bandwidth	300 Hz	
Frequency resolution of carrier frequency error	10 Hz	
Frequency accuracy of carrier frequency error		±50 Hz Excludes frequency reference

Measurement	Specifications	Supplemental Information
M16QAM Bit Error Rate		
Carrier power range at UUT	+46 to –20 dBm	With 20 dB external atten.
Carrier power range at RF Input	+26 to –40 dBm	
Minimum BER	< 1%	
Frequency error: Input frequency error range		±5 kHz, characteristic
Frequency accuracy of carrier frequency		±10 Hz, characteristic

Measurement	Specifications	Supplemental Information
Waveform (Time Domain)	See “Waveform Measurement” under Transmitter Tester Specifications (Measurements)	

Measurement	Specifications	Supplemental Information
Spectrum	See “Spectrum Measurement” under Transmitter Tester Specifications (Measurements)	

Frequency

Measurements	Specifications	Supplemental Information
In-Band Frequency Range	700 to 1600 MHz	

General

Measurements	Specifications	Supplemental Information
Trigger		
Trigger source		RF burst (wideband), Video (IF envelope), Ext Front, Ext Rear, Frame Timer. Actual available choices are dependent on measurement. Default is video (IF envelope) for Occupied BW and BER. It is RF burst (wideband) for ACPR.
Trigger delay		
Range	–500 to +500 ms	
Accuracy	±33 ns	
Resolution	33 ns	
External trigger input		
Level		–5 to +5V, characteristic
Impedance		>10 kΩ, nominal

5 iDEN Programming Commands

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

SCPI Command Subsystems

CALCulate on page 61

CONFigure on page 78

DISPlay on page 79

FETCh on page 83

MEASure on page 84

READ on page 96

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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.

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 and *RST: On

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

Bit Error Rate—Frame Count

:CALCulate:BER:FRAMes <integer>

:CALCulate:BER:FRAMes?

Indicates the number of frames to be used for calculating the bit error rate.

Factory Preset and *RST: 16

Factory Preset and *RST: 1 to 1024 frames

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

History: Version A.03.00 or later

Bit Error Rate—Error Limit

:CALCulate:BER:LIMit:ERATe <percent>

:CALCulate:BER:LIMit:ERATe?

Set the percent error limit on the bit error rate.

Factory Preset and *RST: 5%

Range: 0.1 to 20%

Default Unit: Hz

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

History: Version A.03.00 or later

Bit Error Rate—Limit Testing

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

:CALCulate:BER:LIMit:STATe?

Turn limit testing on or off.

Factory Preset and *RST: On

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

History: Version A.03.00 or later

Query the Current Measurement Status

:CALCulate:CLIMits:FAIL?

Checks if the current measurement is outside its limits. It returns a 0 (zero) if it is passing or a 1 (one) if it is failing.

Front Panel Access: None

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 84 for information on the data that can be returned for each measurement.

Calculate/Compress Trace Data Query

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

Returns the designated trace data for the currently selected measurement. The command can be used with sub-opcodes (*n*) for measurement results that are trace data. See the following table.

This command is used to compress/decimate a long trace to extract the desired data and only return to the computer the necessary data. A typical example would be to acquire N bursts of GSM data and return the mean power of each burst.

The command can also be used to identify the best curve fit for the data.

Curve Fit - applies curve fitting routines to the data. Where <soffset> and <length> are required, and <roffset> is an optional parameter for the desired order of the curve equation. The query will return the following values: the x-offset (in points) and the curve coefficients ((order + 1) values).

<Start offset> - is an optional integer. It specifies the amount of data, at the beginning of the trace, that will be ignored before the decimation process starts. It is an integer index (that starts counting at zero) for all the elements in the trace. The default value is zero.

<Length> - is an optional integer that defines how many trace elements will be compressed into one value. This parameter has a default value equal to the current trace length.

<Repeat offset> - is an optional real number. 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. Select a number such that repeated additions will round to the correct starting index.

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

1. Set the waveform measurement sweep time to acquire the required number of bursts.
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,62,1315,1442.3`** (These parameter values correspond to GSM signals.)

Remarks: The optional parameters must be entered in the specified order. If you want to specify <length>, you must also specify <soffset> or it's default. (e.g. **`CALC:DATA2:COMP? MEAN,62,1315`**

This command uses the data setting specified by the FORMat:DATA command and can return binary or ascii data.

History: Added in revision A.03.00 and later

Measurement	Available Traces	Markers Available?
ACP - adjacent channel power (Basic, cdmaOne, cdma2000, W-CDMA, iDEN, NADC, PDC modes)	no traces	no markers
BER - bit error rate (iDEN mode)	no traces	no markers
CDPower - code domain power (cdmaOne mode)	POWer (*n*=2)[a] TIMing (*n*=3)[a] PHASe (*n*=4)[a]	yes
CDPower - code domain power (W-CDMA mode)	CDPower (*n*=2)[a] EVM (*n*=4)[a] MERRor (*n*=5)[a] PERRor (*n*=6)[a] SPOWer (*n*=8)[a]	yes
CHPower - channel power (Basic, cdmaOne, cdma2000, W-CDMA mode)	SPECtrum (*n*=2)[a]	no markers
CSPur - spurs close (cdmaOne mode)	SPECtrum (*n*=2)[a] ULIMit (*n*=3)[a]	yes

Measurement	Available Traces	Markers Available?
EVM - error vector magnitude (NADC, PDC modes)	EVM (*n*=2)[a] MERRor (*n*=3)[a] PERRor (*n*=4)[a]	yes
EVMQpsk - QPSK error vector magnitude (cdma2000, W-CDMA modes)	EVM (*n*=2)[a] MERRor (*n*=3)[a] PERRor (*n*=4)[a]	yes
OBW - occupied bandwidth (iDEN, PDC modes)	no traces	no markers
ORFSpectrum - output RF spectrum (GSM mode)	RFEModulation (*n*=2)[a] RFESwitching (*n*=3)[a]	no markers
PFERror - phase and frequency error (GSM mode)	PERRor (*n*=2)[a] PFERror (*n*=3)[a] RFENvelope (*n*=4)[a]	yes
PSTatistic - power statistics CCDF (cdma2000, W-CDMA modes)	MEASured (*n*=2)[a] GAUSsian (*n*=3)[a] REFerence (*n*=4)[a]	yes
PVTime - power versus time (GSM, Service modes)	RFENvelope (*n*=2)[a] UMASK (*n*=3)[a] LMASK (*n*=4)[a]	yes
RHO - modulation quality (cdmaOne, cdma2000, W-CDMA mode)	EVM (*n*=2)[a] MERRor (*n*=3)[a] PERRor (*n*=4)[a]	yes
TSPur - transmit band spurs (GSM mode)	SPECtrum (*n*=2)[a] ULIMit (*n*=3)[a]	yes
TXPower - transmit power (GSM mode)	RFENvelope (*n*=2)[a] IQ (*n*=8)[a]	yes

Measurement	Available Traces	Markers Available?
SPECtrum - (frequency domain) (all modes)	RFENvelope (*n*=2)[a] for Service mode IQ (*n*=3)[a] SPECtrum (*n*=4)[a] ASPectrum (*n*=7)[a]	yes
WAVEform - (time domain) (all modes)	RFENvelope (*n*=2)[a] IQ (*n*=8)[a]	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 be used with sub-opcodes (*n*) for any measurement results that are trace data. See the table above. Subopcode *n*=0, raw trace data cannot be searched for peaks. Both real and complex traces can be searched, but complex traces are converted to magnitude in dBm.

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

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

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

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

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

Example: Select the spectrum measurement.

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

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

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

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

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

History: 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.

iDEN Mode - <measurement> key words

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

Example:

Suppose you are using the Spectrum measurement. 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. Using the MEASure or READ command, before the marker command, 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.

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

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

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

Marker Function

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

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

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

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

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

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

Off – turns off the marker functions

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

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

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

Marker Function Result

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

Quires 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)

Front Panel Access: None

Marker Mode

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

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

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.

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: M**arker, 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, NADC, PDC modes)	no traces	no markers

Measurement	Available Traces	Markers Available?
BER - bit error rate (iDEN mode)	no traces	no markers
CDPower - code domain power (cdmaOne mode)	POWer (*n*=2)[a] TIMing (*n*=3)[a] PHASe (*n*=4)[a]	yes
CDPower - code domain power (W-CDMA mode)	CDPower (*n*=2)[a] EVM (*n*=4)[a] MERRor (*n*=5)[a] PERRor (*n*=6)[a] SPOWer (*n*=8)[a]	yes
CHPower - channel power (Basic, cdmaOne, cdma2000, W-CDMA mode)	SPECtrum (*n*=2)[a]	no markers
CSPur - spurs close (cdmaOne mode)	SPECtrum (*n*=2)[a] ULIMit (*n*=3)[a]	yes
EVM - error vector magnitude (NADC, PDC modes)	EVM (*n*=2)[a] MERRor (*n*=3)[a] PERRor (*n*=4)[a]	yes
EVMQpsk - QPSK error vector magnitude (cdma2000, W-CDMA modes)	EVM (*n*=2)[a] MERRor (*n*=3)[a] PERRor (*n*=4)[a]	yes
OBW - occupied bandwidth (iDEN, PDC modes)	no traces	no markers
ORFSpectrum - output RF spectrum (GSM mode)	RFEModulation (*n*=2)[a] RFESwitching (*n*=3)[a]	no markers
PFERror - phase and frequency error (GSM mode)	PERRor (*n*=2)[a] PFERror (*n*=3)[a] RFENvelope (*n*=4)[a]	yes

Measurement	Available Traces	Markers Available?
PSTatistic - power statistics CCDF (cdma2000, W-CDMA modes)	MEASured (*n*=2)[a] GAUSian (*n*=3)[a] REFerence (*n*=4)[a]	yes
PVTime - power versus time (GSM, Service modes)	RFENvelope (*n*=2)[a] UMASK (*n*=3)[a] LMASK (*n*=4)[a]	yes
RHO - modulation quality (cdmaOne, cdma2000, W-CDMA mode)	EVM (*n*=2)[a] MERRor (*n*=3)[a] PERRor (*n*=4)[a]	yes
TSPur - transmit band spurs (GSM mode)	SPECtrum (*n*=2)[a] ULIMit (*n*=3)[a]	yes
TXPower - transmit power (GSM mode)	RFENvelope (*n*=2)[a] IQ (*n*=8)[a]	yes
SPECtrum - (frequency domain) (all modes)	RFENvelope (*n*=2)[a] for Service mode IQ (*n*=3)[a] SPECtrum (*n*=4)[a] ASPectrum (*n*=7)[a]	yes
WAVEform - (time domain) (all modes)	RFENvelope (*n*=2)[a] IQ (*n*=8)[a]	yes

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

Marker X Value

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

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

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

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

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

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

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

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

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

Marker X Position

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

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

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

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

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

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

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

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

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

Marker Readout Y Value

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

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

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

The measurement must be completed before querying the marker.

Example: **CALC:SPEC:MARK1:Y -20 dB**

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

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

Occupied Bandwidth—Frequency Band Limit

PDC mode

:CALCulate:OBW:LIMit:FBLimit <freq>

:CALCulate:OBW:LIMit:FBLimit?

iDEN mode

:CALCulate:OBWidth:LIMit:FBLimit?

:CALCulate:OBWidth:LIMit:FBLimit?

Set the frequency bandwidth limit in Hz.

Factory Preset and *RST:	PDC, 32 kHz
	iDEN, 20 kHz
Range:	10 kHz to 60 kHz
Default Unit:	Hz
Remarks:	You must be in the iDEN or PDC mode to use this command. Use INSTrument:SELect to set the mode.
History:	Version A.02.00 or later

Occupied Bandwidth—Limit Test

iDEN mode

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

:CALCulate:OBWidth:LIMit:STATe?

PDC mode

:CALCulate:OBW:LIMit[:TEST] OFF|ON|0|1

:CALCulate:OBW:LIMit[:TEST]?

Turn limit testing on or off.

Factory Preset and *RST:	On
Remarks:	You must be in the iDEN or PDC mode to use this command. Use INSTrument:SELect to set the mode.
History:	Version A.02.00 or later

CONFigure Subsystem

:CONFigure:<measurement>

The CONFigure commands are used with several other commands and are documented in the section on the “MEASure Group of Commands” on page 84.

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.

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 Spectrum.

— n=1, Spectrum

— n=2, I/Q Waveform

— n=3, numeric data (service mode)

— n=4, RF Envelope (service mode)

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

Factory Preset and *RST:	0 dBm, for Spectrum
Range:	–250 to 250 dBm, for Spectrum
Default Unit:	dBm, for Spectrum
Remarks:	May affect input attenuator setting. To use this command, the appropriate mode should be selected with INSTrument:SELect.
Front Panel Access:	When in Spectrum measurement: **Amplitude Y Scale, Ref Level**

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 84 for more information about sub-opcodes.

Factory Preset and *RST: 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: To use this command, the appropriate mode should be selected with INSTrument:SELect.

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

Measurement	Available Traces	Markers Available?
ACP - adjacent channel power (Basic, cdmaOne, cdma2000, W-CDMA, iDEN, NADC, PDC modes)	no traces	no markers
BER - bit error rate (iDEN mode)	no traces	no markers
CDPower - code domain power (cdmaOne mode)	POWer (*n*=2)[a] TIMing (*n*=3)[a] PHASe (*n*=4)[a]	yes
CDPower - code domain power (W-CDMA mode)	CDPower (*n*=2)[a] EVM (*n*=4)[a] MERRor (*n*=5)[a] PERRor (*n*=6)[a] SPOWer (*n*=8)[a]	yes
CHPower - channel power (Basic, cdmaOne, cdma2000, W-CDMA mode)	SPECtrum (*n*=2)[a]	no markers
CSPur - spurs close (cdmaOne mode)	SPECtrum (*n*=2)[a] ULIMit (*n*=3)[a]	yes
EVM - error vector magnitude (NADC, PDC modes)	EVM (*n*=2)[a] MERRor (*n*=3)[a] PERRor (*n*=4)[a]	yes

Measurement	Available Traces	Markers Available?
EVMQpsk - QPSK error vector magnitude (cdma2000, W-CDMA modes)	EVM (*n*=2)[a] MERRor (*n*=3)[a] PERRor (*n*=4)[a]	yes
OBW - occupied bandwidth (iDEN, PDC modes)	no traces	no markers
ORFSpectrum - output RF spectrum (GSM mode)	RFEModulation (*n*=2)[a] RFESwitching (*n*=3)[a]	no markers
PFERror - phase and frequency error (GSM mode)	PERRor (*n*=2)[a] PFERror (*n*=3)[a] RFENvelope (*n*=4)[a]	yes
PSTatistic - power statistics CCDF (cdma2000, W-CDMA modes)	MEASured (*n*=2)[a] GAUSian (*n*=3)[a] REFerence (*n*=4)[a]	yes
PVTime - power versus time (GSM, Service modes)	RFENvelope (*n*=2)[a] UMASK (*n*=3)[a] LMASK (*n*=4)[a]	yes
RHO - modulation quality (cdmaOne, cdma2000, W-CDMA mode)	EVM (*n*=2)[a] MERRor (*n*=3)[a] PERRor (*n*=4)[a]	yes
TSPur - transmit band spurs (GSM mode)	SPECtrum (*n*=2)[a] ULIMit (*n*=3)[a]	yes
TXPower - transmit power (GSM mode)	RFENvelope (*n*=2)[a] IQ (*n*=8)[a]	yes

Measurement	Available Traces	Markers Available?
SPECtrum - (frequency domain) (all modes)	RFENvelope (*n*=2)[a] for Service mode IQ (*n*=3)[a] SPECtrum (*n*=4)[a] ASPectrum (*n*=7)[a]	yes
WAVEform - (time domain) (all modes)	RFENvelope (*n*=2)[a] IQ (*n*=8)[a]	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 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, RF envelope

n=2, I/Q waveform

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

Factory Preset and *RST:	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. To use this command, the appropriate mode should be selected with INSTrument:SELect.
Front Panel Access:	When in Waveform measurement: **Amplitude Y Scale, Ref Level**

FETCh Subsystem

:FETCh:<measurement>[n]?

The FETCh? commands are used with several other commands and are documented in the section on the "MEASure Group of Commands" on page 84.

MEASure Group of Commands

This group includes commands used to make measurements and return results. The different commands can be used to provide fine control of the overall measurement process. Most measurements should be done in single measurement mode, rather than doing the measurement continuously.

Each measurement sets the instrument state that is appropriate for that measurement. Other commands are available for each **Mode** to allow changing settings, view, limits, etc. Refer to:

SENSe:<measurement>, SENSe:CHANnel, SENSe:CORRection, SENSe:FREQuency, SENSe:POWer, SENSe:RADio, SENSe:SNYC
CALCulate:<measurement>, CALCulate:CLIMits/DATA
DISPlay:<measurement>
TRIGger

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 Standard.

- Stops the current measurement 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.

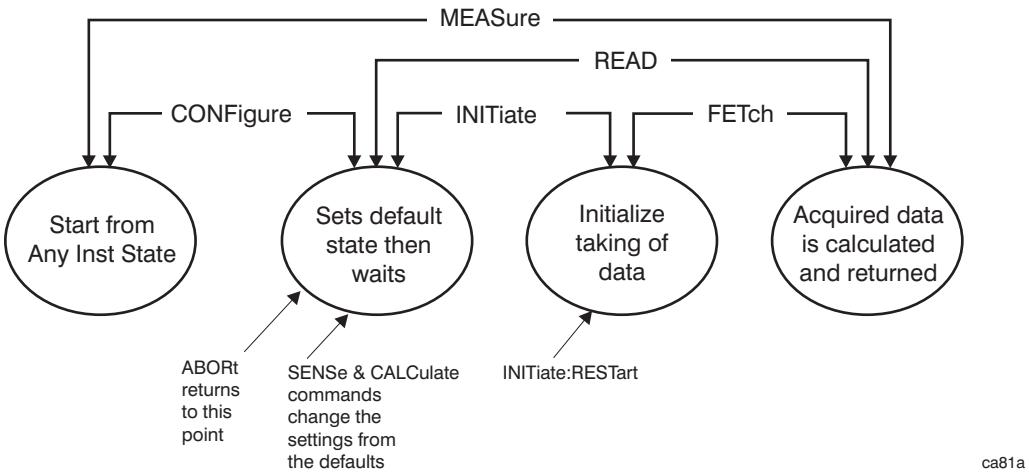
  If the optional [n] value is not included, or is set to 1, the scalar measurement results will be returned. If the [n] value is set to a value other than 1, the selected trace data results will be returned. See each command for details of what types of scalar results or trace data results are available.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

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, or the INITiate and FETCh? commands, to initiate the measurement and query the results. See Figure 5-1.

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 or INITiate and FETCh? commands, to initiate the measurement and query results.

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

Figure 5-1 Measurement Group of Commands



Configure Commands

:CONFigure:<measurement>

This command sets up the instrument for the specified measurement using the factory default instrument settings and stops the current measurement. It does not initiate the taking of measurement data.

The CONFigure? query returns the current measurement name.

Fetch Commands

:FETCh:<measurement>[n]?

This command puts valid data into the output buffer, but does not initiate data acquisition. Use the INITiate[:IMMediate] command to acquire data before you use the FETCh command. You can only fetch results from the measurement that is currently selected.

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 for handling large blocks of data since they are smaller and faster then the ASCII format.

Read Commands

:READ:<measurement>[n]?

- Does not preset the measurement to the factory defaults. (The MEASure? command does preset.) It uses the settings from the last measurement.
- 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.
- 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.

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>?.

Adjacent Channel Power Ratio (ACP) Measurement

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.

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

: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: Added to Basic mode, version A.03.00 or later

Front Panel Access: **Measure, 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 comma-separated trace points, in volts. The I values are listed first in each pair, using the 0 through even-indexed values. The Q values are the odd-indexed values.

Measurement Type	n	Results Returned
	not specified or n=1 iDEN mode	Returns 13 comma-separated scalar results, in the following order: Center freq – relative power (dB) Center freq – absolute power (dBm) Lower offset freq – relative power (dB) Lower offset freq– absolute power (dBm) Upper offset freq – relative power (dB) Upper offset freq – absolute power (dBm) Total power (dBm) Offset frequency (Hz) Reference BW (Hz) Offset BW (Hz) Carrier/center frequency (Hz) Frequency span (Hz) Average count
	2 iDEN mode	Returns 3 comma-separated scalar values of the histogram absolute power trace: Lower offset frequency – absolute power Reference frequency – absolute power Upper offset frequency – absolute power
	3 iDEN mode	Returns 3 comma-separated scalar values of the histogram relative power trace: Lower offset frequency – relative power Reference frequency – relative power Upper offset frequency – relative power
	4 iDEN mode	Returns 4 comma-separated absolute power results for the reference and offset channels. Reference channel – absolute power Reference channel – absolute power (duplicate of above) Lower offset channel – absolute power Upper offset channel – absolute power
	5 iDEN mode	Returns 4 comma-separated relative power values for the reference and offset channels: Reference channel – relative power Reference channel – relative power (duplicate of above) Lower offset channel – relative power Upper offset channel – relative power

Measurement Type	n	Results Returned
	6 iDEN mode	Returns 4 comma-separated pass/fail test results for the absolute power of the reference and offset channels: Reference channel absolute power pass/fail Reference channel absolute power pass/fail (duplicate of above) Lower offset channel absolute power pass/fail Upper offset channel absolute power pass/fail
	7 iDEN mode	Returns 4 comma-separated pass/fail test results for the relative power of the reference and offset channels: Reference channel relative power pass/fail Reference channel relative power pass/fail (duplicate of above) Lower offset channel relative power pass/fail Upper offset channel relative power pass/fail

Bit Error Rate Measurement

This tests for bit errors in the demodulated signal. You must be in the iDEN 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:BER commands for more measurement related commands.

:CONFigure:BER

:FETCh:BER[n]?

:READ:BER[n]?

:MEASure:BER[n]?

History: Version A.03.00 or later

Front Panel Access: **Measure, Bit Error Rate**

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

Measurement Results Available

n	Results Returned
0	Returns unprocessed I/Q trace data, as a series of comma-separated trace points, in volts. The I values are listed first in each pair, using the 0 through even-indexed values. The Q values are the odd-indexed values.
not specified or n=1	Returns these 15 comma-separated scalar results in the following order: 1. Total bit error rate (BER in %) 2. Total number of bits tested 3. Total number of bits failed 4. Total number of frames tested 5. Total number of frames attempted to find 6. Current frame word found 7. Bit error rate for current word 8. Measured carrier frequency 9. Calculated center frequency error 10. Frequency span 11. Average count 12. EVM for first sub-channel 13. EVM for second sub-channel 14. EVM for third sub-channel 15. EVM for fourth sub-channel
2	Returns unprocessed frame I/Q data, as a data array of comma-separated trace points, in volts.

Occupied Bandwidth Measurement

This measures the bandwidth of the carrier signal in the occupied part of the channel. You must be in the PDC or iDEN mode to use these commands. Use INSTrument:SELect to set the mode.

This measures the bandwidth of the carrier signal. 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:OBW commands for more measurement related commands.

:CONFigure:OBW

:FETCh:OBW[n]?

:READ:OBW[n]?

:MEASure:OBW[n]?

History: Version A.02.00 or later

Front Panel Access: **Measure, Occupied BW**

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 data array of comma-separated trace points, in volts.
1 (default) iDEN mode	Returns the following 7 comma-separated scalar results, in order. 1. Absolute power of occupied bandwidth (dBm) 2. Relative power of occupied bandwidth (dB) 3. Bandwidth for specified power percentage 4. Power percentage 5. Measured carrier frequency 6. Frequency span 7. Average count
2, spectrum display only iDEN mode	Returns the frequency-domain spectrum trace (data array) for the entire frequency range (9003 points) being measured.

Spectrum (Frequency Domain) Measurement

This measures the amplitude of your input signal with respect to the frequency. It provides spectrum analysis capability using FFT (fast Fourier transform) measurement techniques. You must select the appropriate mode using INSTrument:SELect, to use these commands.

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

:CONFigure:SPECtrum

:FETCh:SPECtrum[n]?

:READ:SPECtrum[n]?

:MEASure:SPECtrum[n]?

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

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

Measurement Results Available

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

n	Results Returned
not specified or n=1	Returns the following comma-separated scalar results: 1. **FFT peak** is the FFT peak amplitude. 2. **FFT frequency** is the FFT frequency of the peak amplitude. 3. **FFT points** is the Number of points in the FFT spectrum. 4. **First FFT frequency** is the frequency of the first FFT point of the spectrum. 5. **FFT spacing** is the frequency spacing between the FFT points of the spectrum. 6. **Time domain points** is the number of points in the time domain trace used for the FFT. 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. 9. **Time domain** returns a 1, if time domain is complex (I/Q), or 0 if it is real. (raw ADC samples) 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.
10, **Service** mode only	Returns trace data of the phase of the FFT versus frequency.

Waveform (Time Domain) Measurement

This measures the power in your input signal with respect to time and is equivalent to zero-span operation in a traditional spectrum analyzer. You must select the appropriate mode using INSTrument:SELect, to use these commands.

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

:CONFigure:WAVeform

:FETCh:WAVeform[n]?

:READ:WAVeform[n]?

:MEASure:WAVeform[n]?

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

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

Measurement Results Available

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

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

READ Subsystem

:READ:<measurement>[n]?

The READ? commands are used with several other commands and are documented in the section on the “MEASure Group of Commands” on page 84.

SENSe Subsystem

Sets the instrument state parameters so that you can measure the input signal.

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 84. The equivalent front panel keys for the parameters described in the following commands, are found under the **Meas Setup** key, after the **ACP** 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 averaged. After the specified number of average counts, the average mode (termination control) setting determines the average action.

Factory Preset and *RST: 10, for cdma2000, W-CDMA mode

20, for Basic, cdmaOne, iDEN mode

Range: 1 to 10,000

Remarks: Use INSTrument:SELect to set the mode.

Adjacent Channel Power—Averaging State

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

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

Turn average on or off.

Factory Preset and *RST: On

Off, for iDEN mode

Remarks: Use INSTrument:SELect to set the mode.

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 and *RST: Repeat, for basic, cdmaOne, cdma2000, W-CDMA mode

Exponential, for NADC, PDC, iDEN mode

Remarks: Use INSTrument:SELect to set the mode.

Adjacent Channel Power—Channel Integration BW

Basic, iDEN mode

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

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

cdmaOne, cdma2000, W-CMDA mode

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

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

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

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

List[n]

cdmaOne mode n=1 is cellular bands and 2 is pcs bands. The default is cellular.

cdma2000 mode n=1 is SR1, 2 is SR3 DS, and 3 is SR3 MC. The default is SR1 (1).

W-CDMA mode n=1 is ARIB, 2 is 3GPP, and 3 is Trial. The default is ARIB (1).

Factory Preset and *RST:

Mode	Format (Modulation Standard)		
Basic	1.23 MHz		
cdmaOne	1.23 MHz		
iDEN	18 kHz		
cdma2000	SR1 (n=1)	SR3 DC (n=2)	SR3 MC (n=3)
	1.23 MHz	3.69 MHz	3.69 MHz
W-CDMA	ARIB (n=1)	3GPP (n=2)	Trial (n=3)
	4.069 MHz	3.84 MHz	4.096 MHz

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

1 kHz to 5 MHz for iDEN

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.

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

Adjacent Channel Power—Absolute Amplitude Limits

iDEN mode

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

[:SENSe]:ACP:OFFSet:ABSolute?

Basic mode

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

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

cdmaOne, cdma2000, W-CDMA mode

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

[:SENSe]:ACP:OFFSet[n]:LIST[n]: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. ACP:OFFS[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 SENS:ACP:OFFSet:LIST:STATe command.

The query returns five (5) 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]

cdmaOne mode n=1 is cellular bands and 2 is pcs bands. The default is cellular.

cdma2000 mode n=1 is SR1, 2 is SR3 DS, and 3 is SR3 MC. The default is SR1 (1).

W-CDMA mode n=1 is ARIB, 2 is 3GPP, and 3 is Trial. The default is ARIB (1).

Factory Preset and *RST:

Mode	Variant	Offset A	Offset B	Offset C	Offset D	Offset E
Basic		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		0 dBm	n/a	n/a	n/a	n/a

Range: –200 dBm to 50 dBm

Default Unit: dBm

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

Adjacent Channel Power—Define Resolution Bandwidth List

iDEN mode

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

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

Basic mode

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

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

cdmaOne, cdma2000, W-CDMA 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 ACP:OFFSet[n]:LIST[n][:FREQ. 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]

cdmaOne mode n=1 is cellular bands and 2 is pcs bands. The default is cellular.

cdma2000 mode n=1 is SR1, 2 is SR3 DS, and 3 is SR3 MC. The default is SR1 (1).

W-CDMA mode n=1 is ARIB, 2 is 3GPP, and 3 is Trial. The default is ARIB (1).

Factory Preset and *RST:

Mode	Variant	Offset A	Offset B	Offset C	Offset D	Offset E
iDEN		10 kHz	n/a	n/a	n/a	n/a
Basic		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	Trial and ARIB	4.096 MHz	4.096 MHz	4.096 MHz	4.096 MHz	4.096 MHz
	3GPP	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

Default Unit: Hz

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

Adjacent Channel Power—Define Offset Frequency List

iDEN mode

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

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

Basic mode

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

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

cdmaOne, cdma2000, W-CDMA 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 resolution 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 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]

cdmaOne mode n=1 is cellular bands and 2 is pcs bands. The default is cellular.

cdma2000 mode n=1 is SR1, 2 is SR3 DS, and 3 is SR3 MC. The default is SR1 (1).

W-CDMA mode n=1 is ARIB, 2 is 3GPP, and 3 is Trial. The default is ARIB (1).

Factory Preset and *RST:

Mode	Variant	Offset A	Offset B	Offset C	Offset D	Offset E
iDEN		25 kHz	n/a	n/a	n/a	n/a
Basic		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	885 kHz	1.25625 MHz	2.75 MHz	0 Hz	0 Hz
cdma2000	BTS SR1	750 kHz	1.98 MHz	0 Hz	0 Hz	0 Hz
	BTS SR3 DS	2.655 MHz	3.75 MHz	0 Hz	0 Hz	0 Hz
	BTS SR3 MC	2.135 kHz	2.5 MHz	0 Hz	0 Hz	0 Hz
	MS SR1	885 kHz	1.98 MHz	0 Hz	0 Hz	0 Hz
	MS SR3 DS	2.655 MHz	3.75 MHz	0 Hz	0 Hz	0 Hz
	MS SR3 MC	2.655 kHz	3.75 MHz	0 Hz	0 Hz	0 Hz
W-CDMA		5 MHz	10 MHz	15 MHz	20 MHz	25 MHz

Range: 0 Hz to 20 MHz for iDEN, Basic mode

0 Hz to 45 MHz for cdmaOne mode

0 Hz to 100 MHz for cdma2000, W-CDMA mode

Default Unit: Hz

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

Adjacent Channel Power—Amplitude Limits Relative to the Carrier

iDEN mode

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

[:SENSe]:ACP:OFFSet:RCARrier?

Basic mode

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

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

cdmaOne, cdma2000, W-CDMA mode

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

[: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. ACP:OFFS[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 SENS:ACP:OFFSet:LIST:STATe command.

The query returns five (5) 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]

cdmaOne mode n=1 is cellular bands and 2 is pcs bands. The default is cellular.

cdma2000 mode n=1 is SR1, 2 is SR3 DS, and 3 is SR3 MC. The default is SR1 (1).

W-CDMA mode n=1 is ARIB, 2 is 3GPP, and 3 is Trial. The default is ARIB (1).

Factory Preset and *RST:

Mode	Variant	Offset A	Offset B	Offset C	Offset D	Offset E
iDEN		0 dBc	n/a	n/a	n/a	n/a
Basic		–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
cdmaOne		0 dBc	0 dBc	0 dBc	0 dBc	0 dBc
W-CDMA		0 dBc	0 dBc	0 dBc	0 dBc	0 dBc

Range: –150 dB to 50 dB for cdmaOne, Basic mode

–200 dB to 50 dB for cdma2000, W-CDMA, iDEN mode

Default Unit: dB

Remarks: You must be in Basic, cdmaOne, cdma2000, W-CDMA, 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

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

[:SENSe]:ACP:OFFSet:RPSDensity?

Basic mode

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

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

cdmaOne, cdma2000, W-CDMA mode

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

[: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.
ACP:OFFS[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 SENS:ACP:OFFSet:LIST:STATe command.

The query returns five (5) 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]

cdmaOne mode n=1 is cellular bands and 2 is pcs bands. The default is cellular.

cdma2000 mode n=1 is SR1, 2 is SR3 DS, and 3 is SR3 MC. The default is SR1 (1).

W-CDMA mode n=1 is ARIB, 2 is 3GPP, and 3 is Trial. The default is ARIB (1).

Factory Preset and *RST:

Mode	Variant	Offset A	Offset B	Offset C	Offset D	Offset E
iDEN		0 dB	n/a	n/a	n/a	n/a
Basic		–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
W-CDMA		0 dB	0 dB	0 dB	0 dB	0 dB

Range: –150 dB to 50 dB for cdmaOne, Basic, cdma2000, W-CDMA mode

–200 dB to 50 dB for iDEN mode

Default Unit: dB

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

Adjacent Channel Power—Define Type of Offset Frequency List

iDEN mode

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

[:SENSe]:ACP:OFFSet:TEST?

Basic mode

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

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

cdmaOne, cdma2000, W-CDMA mode

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

[: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 ACP:OFFS[n]:LIST[n]:ABS, or the relative values defined with ACP:OFFS[n]:LIST[n]:RPSD and ACP:OFFS[n]:LIST[n]:RCAR.

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]

cdmaOne mode n=1 is cellular bands and 2 is pcs bands. The default is cellular.

cdma2000 mode n=1 is SR1, 2 is SR3 DS, and 3 is SR3 MC. The default is SR1 (1).

W-CDMA mode n=1 is ARIB, 2 is 3GPP, and 3 is Trial. The default is ARIB (1).

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

- 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.
- Absolute - Test the absolute power measurement. If it fails, 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.

Factory Preset and *RST:

Mode	Variant	Offset A	Offset B	Offset C	Offset D	Offset E
iDEN		REL	n/a	n/a	n/a	n/a
Basic		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: You must be in Basic, cdmaOne, cdma2000, W-CDMA, iDEN mode to use this command. Use INSTrument:SELect to set the mode.

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 and *RST: On

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

History: Revision A.03.27 or later

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).

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

Factory Preset and *RST:	IMMediate for BS
	RFBurst for MS
Range:	EXT1 | EXT2 | IMM | RFB for Basic mode
Remarks:	You must be in Basic, 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.

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 and *RST: 0 dB

Range: 0 to 100 dB for cdmaOne

–50 to 50 dB for Basic, iDEN, NADC or PDC

Default Unit: dB

Remarks: You must be in the Basic, iDEN, 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 Mobile Station 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 and *RST: 0 dB

Range: –50 to 50 dB for cdma2000, W-CDMA, iDEN, NADC or PDC

Default Unit: dB

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

Value is global to the current mode.

Occupied Bandwidth Measurement

Commands for querying the occupied bandwidth measurement results and for setting to the default values are found in the "MEASure Group of Commands" on page 84. The equivalent front panel keys for the parameters described in the following commands, are found under the **Meas Setup** key, after the **Occupied BW** measurement has been selected from the **MEASURE** key menu.

Occupied Bandwidth—Percent of Total Power

[:SENSe]:OBWidth:PERCent <number>

[:SENSe]:OBWidth:PERCent?

Set the percentage of the total power for which the occupied bandwidth is calculated.

Factory Preset and *RST:	99%
Range:	0.1% to 99.9%
Default Unit:	percent
Remarks:	You must be in the iDEN mode to use this command. Use INSTrument:SELect to set the mode.
Front Panel Access:	**Meas Setup**, **Occ BW % Pwr**

Occupied Bandwidth—Trigger Source

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

[:SENSe]:OBWidth:TRIGger:SOURce?

Select the trigger source used to control the data acquisitions for the occupied bandwidth measurement.

External 1 – rear panel external trigger input

External 2 – front panel external trigger input

IF – internal IF envelope (video) trigger

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

RF Burst – internal wideband RF burst envelope trigger that has automatic level control for periodic burst signals

Factory Preset and *RST: Immediate

Immediate for BS

RF Burst for MS

RF Burst for iDEN

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

History: Version A.02.00 or later

RF Port Input Attenuation

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

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

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

Factory Preset and *RST: 0 dB

12.0 dB for iDEN

Range: 0 to 40 dB

Default Unit: dB

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

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 and *RST: –15.0 dBm

Range: –100 to 80 dBm for GSM

–100 to 27.7 dBm for cdmaOne, iDEN

–200 to 50 dBm for NADC, PDC

–200 to 100 dBm for cdma2000, W-CDMA

Default Unit: dBm

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

You must be in the Service, cdmaOne, GSM, 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)**

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.

Factory Preset and *RST: Single

Remarks: You must be in the , iDEN 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 INBound|OUTBound

[:SENSe]:RADio:DEVice?

Select the type of radio device to be tested. If you are testing a base station, it must be put into the test mode to transmit known bit patterns.

Outbound – Base station transmitter test

Inbound – Mobile station transmitter test

Factory Preset and *RST: BS

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

Global to current mode.

Front Panel Access: **Mode Setup, Radio, Device**

Radio Format (Standard)

[:SENSe]:RADio:FORMat M16QAM|M64QAM|DJSMR

[:SENSe]:RADio:FORMat?

Select the format that testing will be compliant with when measurements are made.

M16QAM, is the standard iDEN format defined by Motorola

M64QAM, is the standard iDEN format defined by Motorola

DJSMR, is Japanese standard format that is based on the ARIB RCR-32A standard

Factory Preset and *RST: iDEN

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

History: Version A.03.00 or later

Front Panel Access: **Mode Setup, Radio, Format**

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 84. 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 and *RST: Auto

Remarks: To use this command, the appropriate mode should be selected with INSTrument:SELect.

Back door for all meas DIAG:ACQ:PACKmode]

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 and *RST: Auto

Remarks: To use this command, the appropriate mode should be selected with INSTrument:SELect.

Spectrum—ADC Range

[:SENSe]:SPECtrum:ADC:RANGe AUTO|APEak|APLock|M6|P0|P6|P12|P18|P24|

[: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 - 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 - 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.

- M6 - manually selects an ADC range that subtracts 6 dB of fixed gain across the range. Manual ranging is best for CW signals.
- P0 to 24 - 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 and *RST: Auto peak

Remarks: To use this command, the appropriate mode should be selected with INSTrument:SELect.

Backdoor for all meas DIAG:ADC:RANGe

Spectrum—Average Clear

[:SENSe]:SPECtrum:AVERage:CLEAr

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

Remarks: To use this command, the appropriate mode should be selected with INSTrument:SELect.

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 and *RST: 25

Range: 1 to 10,000

Remarks: To use this command, the appropriate mode should be selected with INSTrument:SELect.

Spectrum—Averaging State

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

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

Turn averaging on or off.

Factory Preset and *RST: On

Remarks: To use this command, the appropriate mode should be selected with INSTrument:SELect.

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 and *RST: Exponential

Remarks: To use this command, the appropriate mode should be selected with INSTrument:SELect.

Exponential means:

$$\mathrm{Avg}_N = \frac{\mathrm{Avg}_{N-1}}{\mathrm{N}}(\mathrm{N}-1) + \frac{\text{Next Measurement}}{\mathrm{N}}$$

Repeat means: reset to zero when N is reached.

Exponential means: continue averaging after N is reached, but keep N fixed.

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 and *RST: Log

Remarks: To use this command, the appropriate mode should be selected with INSTrument:SELect.

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, the appropriate mode should be selected with INSTrument:SELect.

Spectrum—Pre-FFT BW Auto

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

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

Select auto or manual control of the pre-FFT BW. This is an advanced control that normally does not need to be changed.

Auto - couples the pre-FFT BW to the frequency span.

Manual - the pre-FFT BW is uncoupled from the frequency span.

Remarks: To use this command, the appropriate mode should be selected with INSTrument:SELect.

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 and *RST: 1.55 MHz

1.25 MHz for cdmaOne

155 kHz, for iDEN mode

Range: 1 Hz to 10 MHz

Remarks: To use this command, the appropriate mode should be selected with INSTrument:SELect.

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- 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 and *RST: Flat top

Remarks: To use this command, the appropriate mode should be selected with INSTrument:SELect.

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 and *RST: 20 kHz

250 Hz, for iDEN mode

Range: 0.10 Hz to 3 MHz

Remarks: To use this command, the appropriate mode should be selected with INSTrument:SELect.

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 and *RST: On

Off, for iDEN mode

Remarks: To use this command, the appropriate mode should be selected with INSTrument:SELect.

Decimation of Spectrum Display

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

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

Set the amount of data decimation done by the hardware and/or the software. 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 and *RST:	0
Range:	0 to 1000, where 0 sets the function to automatic
Remarks:	To use this command, the appropriate mode should be selected with INSTrument:SELect. Decimation of 1-4 uses Natasha hardware. Decimation. Beyond 4 uses a combination of software and hardware decimation.
History:	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 and *RST:	4096 32768, for iDEN mode
Range:	8 to 1,048,576
Remarks:	To use this command, the appropriate mode should be selected with INSTrument:SELect.
History:	Short form changed from LENgth to LENGth, A.03.00

Spectrum—FFT Length Auto

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

[:SENSe]:SPECtum: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.

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

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

Factory Preset and *RST: Auto

Remarks: To use this command, the appropriate mode should be selected with INSTrument:SELect.

History: Short form changed from LENgth to LENGth, A.03.00

Spectrum—FFT Minimum Points in Resolution BW

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

[:SENSe]:SPECtum: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 and *RST: 1.30

Range: 0.1 to 100

Remarks: To use this command, the appropriate mode should be selected with INSTrument:SELect.

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 and *RST: 706

5648, for iDEN mode

Range: 8 to 1,048,576

Remarks: To use this command, the appropriate mode should be selected with INSTrument:SELect.

History: 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

Flat Top - 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 and *RST: Flat top

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

To use this command, the appropriate mode should be selected with INSTrument:SELect.

Spectrum—Frequency Span

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

[:SENSe]:SPECtrum:FREQuency:SPAN?

Set the frequency span to be measured.

Factory Preset and *RST: 1 MHz

100 kHz for iDEN mode

Range: 10 Hz to 10 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, the appropriate mode should be selected with INSTrument:SELect.

Spectrum—Trigger Source

[:SENSe]:SPECtrum:TRIGger:SOURce EXTernal[1]|EXTernal 2|FRAMe|IF|LINE|IMMediate|RFBurst

[:SENSe]:SPECtrum: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

Line - internal line trigger

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

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

Factory Preset and *RST: Immediate (free run)

RF burst, for GSM, iDEN mode

Remarks: To use this command, the appropriate mode should be selected with INSTrument:SELect.

Burst Sync Delay

[:SENSe]:SYNC:BURSt:DELay <time>

[:SENSe]:SYNC:BURSt:DELay?

Set the delay for the burst measurement position from the reference position that is determined by sync word or the burst rising/falling edges.

Factory Preset and *RST: 0 sec

Range: –500 ms to 500 ms

Default Unit: seconds

Remarks: You must be in the iDEN, NADC or PDC mode to use this command. Use INSTrument:SELect to set the mode.

Burst Search Threshold

[:SENSe]:SYNC:STHReshold <rel_power>

[:SENSe]:SYNC:STHReshold?

Set the power threshold, relative to the peak power, that is used to determine the burst rising edge and falling edge.

Factory Preset and *RST: –30 dB

Range: –200 to –0.01 dB

Default Unit: dB

Remarks: You must be in the iDEN, NADC or PDC mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access: **Mode Setup, Trigger, Burst Search Threshold**

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 84. 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—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, the appropriate mode should be selected with INSTrument:SELect.

Waveform—ADC Range

[:SENSe]:WAVeform:ADC:RANGe AUTO|APEak|APLock|GROund|M6|P0|P6|P12|P18|P24|

[: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 - automatically peak the range

Auto Peak Lock - automatically peak lock the range

Ground - ground

M6 - subtracts 6 dB of fixed gain across the range

P0 to 24 - adds 0 to 24 dB of fixed gain across the range

Factory Preset and *RST: Auto

Remarks: To use this command, the appropriate mode should be selected with INSTrument:SELect.

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 and *RST: 10

Range: 1 to 10,000

Remarks: To use this command, the appropriate mode should be selected with INSTrument:SELect.

Waveform—Averaging State

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

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

Turn averaging on or off.

Factory Preset and *RST: Off

Remarks: To use this command, the appropriate mode should be selected with INSTrument:SELect.

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 and *RST: Exponential

Remarks: To use this command, the appropriate mode should be selected with INSTrument:SELect.

$$\mathrm{Avg}_N = \frac{\mathrm{Avg}_{N-1}}{\mathrm{N}}(\mathrm{N}-1) + \frac{\text{Next Measurement}}{\mathrm{N}}$$

Repeat means: reset to zero when N is reached.

Exponential means:

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 and *RST: RMS

Remarks: To use this command, the appropriate mode should be selected with INSTrument:SELect.

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 and *RST: 100 kHz, for NADC, PDC, cdma2000, W-CDMA, basic, service mode
500 kHz, for GSM mode
2 MHz. for cdmaOne

Range: 1 kHz to 5 MHz

Remarks: To use this command, the appropriate mode should be selected with INSTrument:SELect.

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.

Flat top - 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 and *RST: Gaussian

Remarks: To use this command, the appropriate mode should be selected with INSTrument:SELect.

Decimation of Waveform Display

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

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

Set the amount of data decimation done by the hardware and/or the firmware. 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 and *RST: 1

Range: 1 to 4

Remarks: To use this command, the appropriate mode should be selected with INSTrument:SELect.

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 and *RST: Off

Remarks: To use this command, the appropriate mode should be selected with INSTrument:SELect.

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 and *RST: 2.0 ms

10.0 ms, for NADC, PDC

15.0 ms, for iDEN mode

Range: 1 µs to 100 s

Default Unit: seconds

Remarks: To use this command, the appropriate mode should be selected with INSTrument:SELect.

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

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

Factory Preset and *RST: Immediate (free run), for Basic, cdmaOne, NADC, PDC mode

RF burst, for GSM, iDEN mode

Remarks: To use this command, the appropriate mode should be selected with INSTrument:SELect.