NADC, PDC Guide

Agilent Technologies
E4406A VSA Series
Transmitter Tester

Option BAE

Agilent Technologies

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Supersedes E4406-90059 and E4406-90060

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1 Understanding NADC

What is the NADC Communications System?

The North American Dual-Mode Cellular (NADC) is one of the cellular communications systems. NADC is also referred to as North American Digital Cellular, or American Digital Cellular (ADC). Occasionally it is also referred to as Digital Advanced Mobile Phone Service (D-AMPS) or NADC-TDMA.

The NADC communications system is defined in the Electronics Industry Alliance (EIA) and Telecommunication Industry Association (TIA) standard documents. The following is a list of all relevant and applicable standard documents:

- TIA/EIA IS-136.1

  TDMA Cellular/PCS - Radio Interface - Mobile Station - Base Station Compatibility - Digital Control Channel

- TIA/EIA IS-136.2

  TDMA Cellular/PCS - Radio Interface - Mobile Station - Base Station Compatibility - Traffic Channels and FSK Control Channel

- TIA/EIA IS-137

  TDMA Cellular/PCS - Radio Interface - Minimum Performance Standards for Mobile Stations

- TIA/EIA IS-138

  TDMA Cellular/PCS - Radio Interface - Minimum Performance Standards for Base Stations

- TIA/EIA-627

  800 MHz Cellular System, TDMA Radio Interface, Dual-Mode Mobile Station - Base Station Compatibility Standard (ANSI/TIA/EIA-627-96), which replaced IS-54-B

- TIA/EIA-628

  800 MHz Cellular System, TDMA Radio Interface, Minimum Performance Standards for Dual-Mode Mobile Stations (TIA/EIA-628-96), which replaced IS-55-A

- TIA/EIA-629

  800 MHz Cellular System, TDMA Radio Interface, Minimum Performance Standards for Base Stations Supporting Dual-Mode Mobile Stations (ANSI/TIA/EIA-629-96), which replaced IS-56-A

Each base station retains the analog control channels and analog traffic channels of the advanced mobile phone service (AMPS) system. In addition, a base station can have digital traffic channels. The mobile stations are dual mode and access the network via the analog control channel. They are capable of using either analog or digital traffic channel. Digital control channel and digital only mobile stations are also currently being produced.

The AMPS system and the analog part of the NADC IS-54 system employ a frequency division multiple access (FDMA). FDMA means that each traffic channel is assigned to a separate RF frequency. A pair of frequencies with 45 MHz apart (80 MHz apart for 1900 MHz band) is used to provide full duplex operation of the NADC system. The RF channel spacing is 30 kHz. The modulation for the analog portion is frequency modulation (FM).

The digital part of the NADC system employs a combination of FDMA and time division multiple access (TDMA). The NADC time division multiple access structure allows up to six users to share a single carrier frequency. The TDMA frame structure divides time on a carrier into a stream of frames. Each frame is 40 ms long consisting of 6 timeslots; thus, one timeslot is 6.67 ms long. A digital traffic channel is defined by a carrier frequency (or channel number) and a timeslot number. Each user must transmit data only on his carrier frequency, at a time defined by timeslot number. Currently, 2 timeslots per frame are required for each user because more time is required to transmit voice using full-rate speech codecs presently available. When half-rate speech codecs are incorporated into the system, each traffic channel will require just one timeslot per frame.

NADC digital mobile stations transmit a burst of data when their assigned timeslot occurs. This means a mobile station transmits a bursted amplitude modulation signal, ramping transmission power on and off. An NADC digital base station transmits continuously, switching digital modulation on at the appropriate timeslots.

The digital modulation format used in the NADC system is the π/4 differential quadrature phase shift keying (π/4 DQPSK). The π/4 DQPSK modulation causes both phase and amplitude variations on the RF signal. The quadrature nature of this modulation allows 2 bits to be transmitted at the same time on orthogonal carriers. These 2 bits make one NADC symbol. The digital modulation operates at 162 symbols, or 324 bits in each timeslot. Since there are 1944 bits in 6 timeslots and 25 frames in one second, the transmission bit rate is 48,600 bits per second.

The key objectives of the NADC system are to increase the subscriber capacity, provide more secure voice communications, and be backwards compatible with the existing AMPS analog cellular system.

Since the system transmits all information in a digital form, it will be much harder to listen to someone else's cellular phone conversation. This is a key benefit for people using cellular phones that convey confidential information. The NADC is backwards compatible with the existing AMPS system so that analog cellular phones would not be obsolete. Therefore, all NADC mobiles have the capability to operate using the existing analog base stations as well as the digital base stations.

Following is a summary of the NADC air interface. Note that the frequency range is the same as the analog cellular. Since it is a dual-mode system, NADC will use the same frequency band currently assigned to the AMPS cellular. The available channels are divided into analog and digital channels. The channel spacing is 30 kHz each, and the RX/TX frequency difference is 45 MHz as in the AMPS cellular. NADC has a RX/TX time spacing of 1.85 ms. It uses the π/4 DQPSK modulation and the modulation rate is 24.3 ksymbols/sec. NADC will initially allow 3 users per frequency pair and will allow 6 when implemented with the half-rate voice coder. One frame is 40 ms and consists of 6 timeslots that are each 6.667 ms long. There are 162 symbols per timeslot and the symbol period is 41.16 μs.

800 MHz	Uplink	825.030 to 848.970 MHz	824.040 to 825.000 MHz
	Downlink	870.030 to 893.970 MHz	869.040 to 870.000 MHz
	Channel Numbers	1 to 799	991 to 1023
1900 MHz	Uplink	1850.040 to 1909.920 MHz	
	Downlink	1930.080 to 1989.990 MHz	
	Channel Numbers	2 to 1998	

What does the Agilent E4406A VSA Do?

This instrument can help determine if an NADC transmitter operates correctly. When configured for NADC, the instrument can be used to test an NADC transmitter according to the TIA/EIA standards, 627, 628, 629, IS-136, IS-137, and IS-138. Your instrument is guaranteed to be in compliance with the latest published standards that are in effect as of the publication date of this manual.

This document defines complex and multiple-part measurements used to maintain an interference-free environment. For example, the document includes the testing method for carrier power. The instrument automatically makes these measurements based on the TIA/EIA standards. The detailed measurement result displays allow you to analyze NADC system performance. You may alter the measuring parameters for your specific measurement and analysis.

Other Sources of Measurement Information

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

- Application Note 1298
  Digital Modulation in Communications Systems - An Introduction
  part number 5965-7160E
- Application Note 1324
  Understanding PDC and NADC Transmitter Measurements for Base Transceiver Stations and Mobile Stations
  part number 5968-5537E

Instrument Updates at www.agilent.com

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

www.agilent.com/find/vsa

2 Setting Up the NADC Mode

NADC Mode

You may want to install a new personality, reinstall a personality that you have previously uninstalled, or uninstall a personality option. Instructions can be found in "Installing Optional Measurement Personalities" on page 61.

To access the NADC measurement personality press the **Mode** key and select **NADC**.

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

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

Making a Measurement

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

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

1. Select a mode or personality which corresponds to a digital communications format, like cdma2000, W-CDMA, or EDGE. Use the Basic mode to make measurements of signals with non-standard formats. After selection of the mode, adjustments to the mode settings may be made as required.
2. Select a specific measurement to be performed, like ACP, Channel Power, or EVM, etc. After selection of a measurement, adjustments to the measurement settings may be made as required.

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

If you have a problem, and get an error message, see the “If You Have a Problem” section.

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

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

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

Changing the Mode Setup

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

Radio

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

- **Traffic Rate** - Allows you to toggle the traffic rate between **Full** and **Half**.
- **Device** - Allows you to toggle the test device between **BS** (Base Station) and **MS** (Mobile Station).

Radio Default Settings	
Traffic Rate	Full
Device	BS

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 sets the attenuator 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**. If there are multiple carriers present, the total power might overdrive the front end amplifiers. In this case you need to set the **RF Input Range** to **Man** and enter the expected maximum total power by activating the **Max Total Pwr** key. **Man** is also useful to hold the input attenuation constant for the best relative power accuracy. For single carriers it is generally recommended to set this to **Auto**.
- **Max Total Pwr** - Allows you to set the maximum total power 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; it may include multiple carriers. The **Max Total Pwr** setting is coupled together with the **Input Atten** and **Ext Atten** settings. Once you change the **Max Total Pwr** value with the **RPG** knob, for example, the **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**.
- **Ext Atten** - Allows you to enter the external attenuation value for either BS or MS. 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.

NOTE The **Max Total Pwr** and **Input Atten** settings are coupled together, so changing the input **Max Total Pwr** setting by x dB changes the **Input Atten** setting by x dB. 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. Therefore, you can set the input attenuator manually, or you can set it indirectly by specifying the expected maximum power from the UUT.

Input Default Settings	
RF Input Range	Auto[a]
Max Total Power	–15.00 dBm[b]
Input Atten	0.00 dB[b]
Ext Atten MS	0.00 dB
Ext Atten BS	0.00 dB

a. **Auto** is not used for Spectrum measurements.
b. This may differ if the maximum input power is more than –15.00 dBm.

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 500.0 ms 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. When **Traffic Rate** is **Full**, the default is 20.0 ms. When **Traffic Rate** is **Half**, the default is 40.0 ms.

Trigger Default Settings	
RF Burst:	
Delay	0.000 sec
Peak Level	–10.0 dB
Slope	Pos
Video:	
Delay	0.000 s
Level	–30.00 dBm
Slope	Pos
Ext Front & Ext Rear:	
Delay	0.000 s
Level	2.00 V
Slope	Pos
Trig Holdoff	10.00 ms
Auto Trig	100.0 ms, On
Frame Timer Period	20.00000 ms when Traffic Rate is Full 40.00000 ms when Traffic Rate is Half

Burst

The **Burst** key allows you to access the following menu to set the trigger condition for the ACP and EVM measurements.

- **Delay** - Allows you to set the delay time after searching a threshold level of NADC bursts. The range is –500.0 to +500.0 ms with 1 ns resolution.
- **Search Threshold** - Allows you to set the threshold level used in search for NADC bursts after data is acquired. The range is –200.00 to –0.01 dB with 0.01 dB resolution. The realistic lower range can be down to the noise floor level of the signal.

Burst Default Settings	
Delay	0.000 s
Search Threshold	–30.00 dB

Changing the Frequency Channel

After selecting the desired mode setup, you will need to select the desired center frequency, burst type and slot. 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.

- **Burst Type** - Choose an NADC burst type from the following selections only when **Device** under **Radio** is previously set to **MS,** otherwise this key is unavailable. This is used only when making EVM measurements.

  Traffic (TCH) - Sets to the traffic channel burst signal of which burst length is 324 bits or 162 symbols.
  Control (CCH) - Sets to the control channel burst signal of which burst length is 280 bits or 140 symbols.

- **Slot (Std)** - Allows you to toggle the slot selection function between **Auto** and **Man**, and also to specify the particular timeslot to be measured when **Man** is selected. This is used only when making EVM measurements.

  Auto - In auto, the measurement is made on the first timeslot found to have any one of the valid sync words, corresponding to slots 1 to 6. The measurement may be made on various timeslots if more than one timeslot has a valid sync word.

Man - In manual, the measurement is made on the first timeslot found to have the selected sync word in the range of 1 to 6. The measurement will be made only on the specified timeslot.

When the NADC mode is selected, the instrument will default to the following settings.

Frequency Channel Default Settings	
Center Frequency	1.00000 GHz
Burst Type[a]	Traffic (TCH)
Slot (Std)	1, Auto

[a] This is used only when Device is MS.

NADC Measurement Key Flow

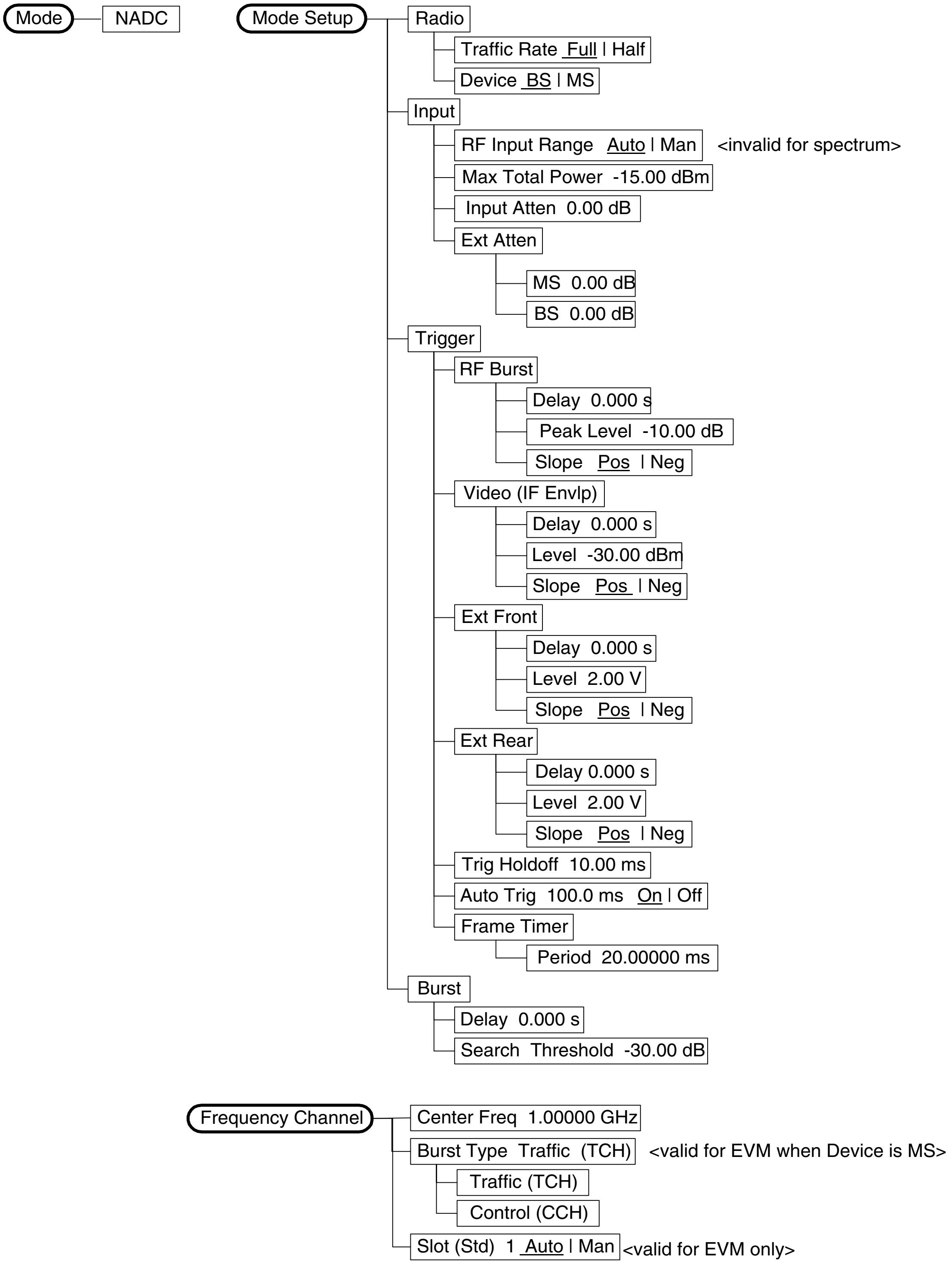
The key flow diagrams, shown in a hierarchical manner on the following pages, will help the user to grasp the overall functional relationships for the front-panel keys and the softkeys displayed at the extreme right side of the screen. The diagrams are:

“Mode Setup / Frequency Channel Key Flow” on page 53.
“ACP Measurement Key Flow” on page 54.
“EVM Measurement Key Flow” on page 55.
“Spectrum Measurement Key Flow (1 of 3)” on page 56.
“Waveform Measurement Key Flow (1 of 2)” on page 59.

Use these flow diagrams as follows:

1. There are some basic conventions:
Mode Setup An oval represents one of the front-panel keys.
Radio This box represents one of the softkeys displayed.
Device BS | MS Default conditions are shown as much as possible (underlined).
2. Start from the extreme upper left corner of each measurement diagram to the right direction.
3. Proceed from the top to the bottom.
4. When defining a key from auto to manual, for example, just press that key one time.
5. When entering a numeric value of **Frequency**, for example, use the numeric keypad by terminating with the appropriate unit selection from the keys displayed.
6. When entering a numeric value of **Slot**, for example, use the numeric keypad by terminating with the **Enter** front-panel key.
7. Instead of using the numeric keypad to enter a value, it may be easier to use the **RPG** knob or **Up/Down** keys depending on the input field of a parameter.

Figure 2-1 Mode Setup / Frequency Channel Key Flow


Mode
NADC
Mode Setup
Radio
Traffic Rate Full | Half
Device BS | MS
Input
RF Input Range Auto | Man
<invalid for spectrum>
Max Total Power -15.00 dBm
Input Atten 0.00 dB
Ext Atten
MS 0.00 dB
BS 0.00 dB
Trigger
RF Burst
Delay 0.000 s
Peak Level -10.00 dB
Slope Pos | Neg
Video (IF Envlp)
Delay 0.000 s
Level -30.00 dBm
Slope Pos | Neg
Ext Front
Delay 0.000 s
Level 2.00 V
Slope Pos | Neg
Ext Rear
Delay 0.000 s
Level 2.00 V
Slope Pos | Neg
Trig Holdoff 10.00 ms
Auto Trig 100.0 ms On | Off
Frame Timer
Period 20.00000 ms
Burst
Delay 0.000 s
Search Threshold -30.00 dB
Frequency Channel
Center Freq 1.00000 GHz
Burst Type Traffic (TCH)
<valid for EVM when Device is MS>
Traffic (TCH)
Control (CCH)
Slot (Std) 1 Auto | Man
<valid for EVM only>

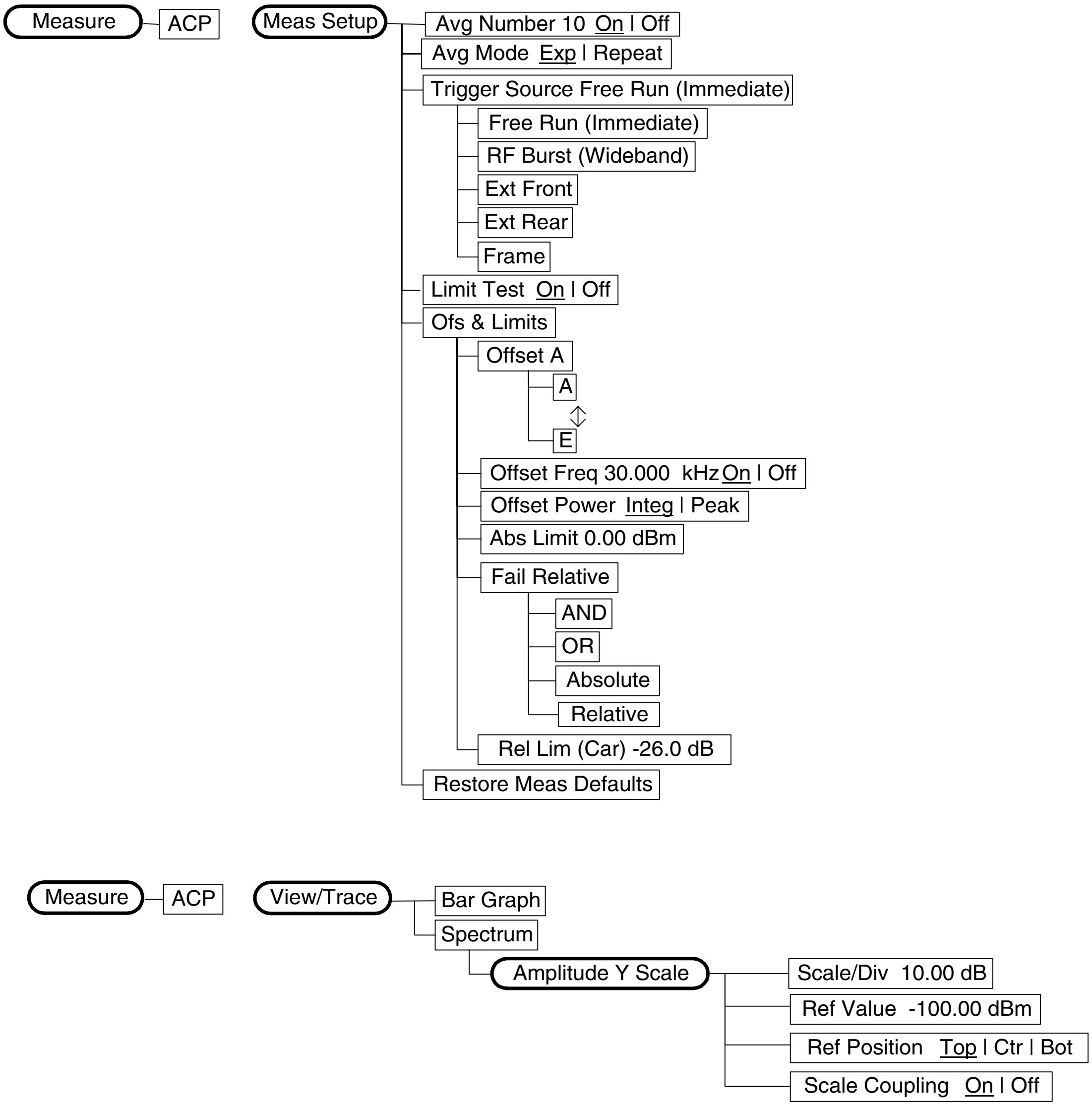

Measure
ACP
Meas Setup
Avg Number 10 On | Off
Avg Mode Exp | Repeat
Trigger Source Free Run (Immediate)
Free Run (Immediate)
RF Burst (Wideband)
Ext Front
Ext Rear
Frame
Limit Test On | Off
Ofs & Limits
Offset A
A
E
Offset Freq 30.000 kHz On | Off
Offset Power Integ | Peak
Abs Limit 0.00 dBm
Fail Relative
AND
OR
Absolute
Relative
Rel Lim (Car) -26.0 dB
Restore Meas Defaults
Measure
ACP
View/Trace
Bar Graph
Spectrum
Amplitude Y Scale
Scale/Div 10.00 dB
Ref Value -100.00 dBm
Ref Position Top | Ctr | Bot
Scale Coupling On | Off

Figure 2-2 ACP Measurement Key Flow

Figure 2-3 EVM Measurement Key Flow

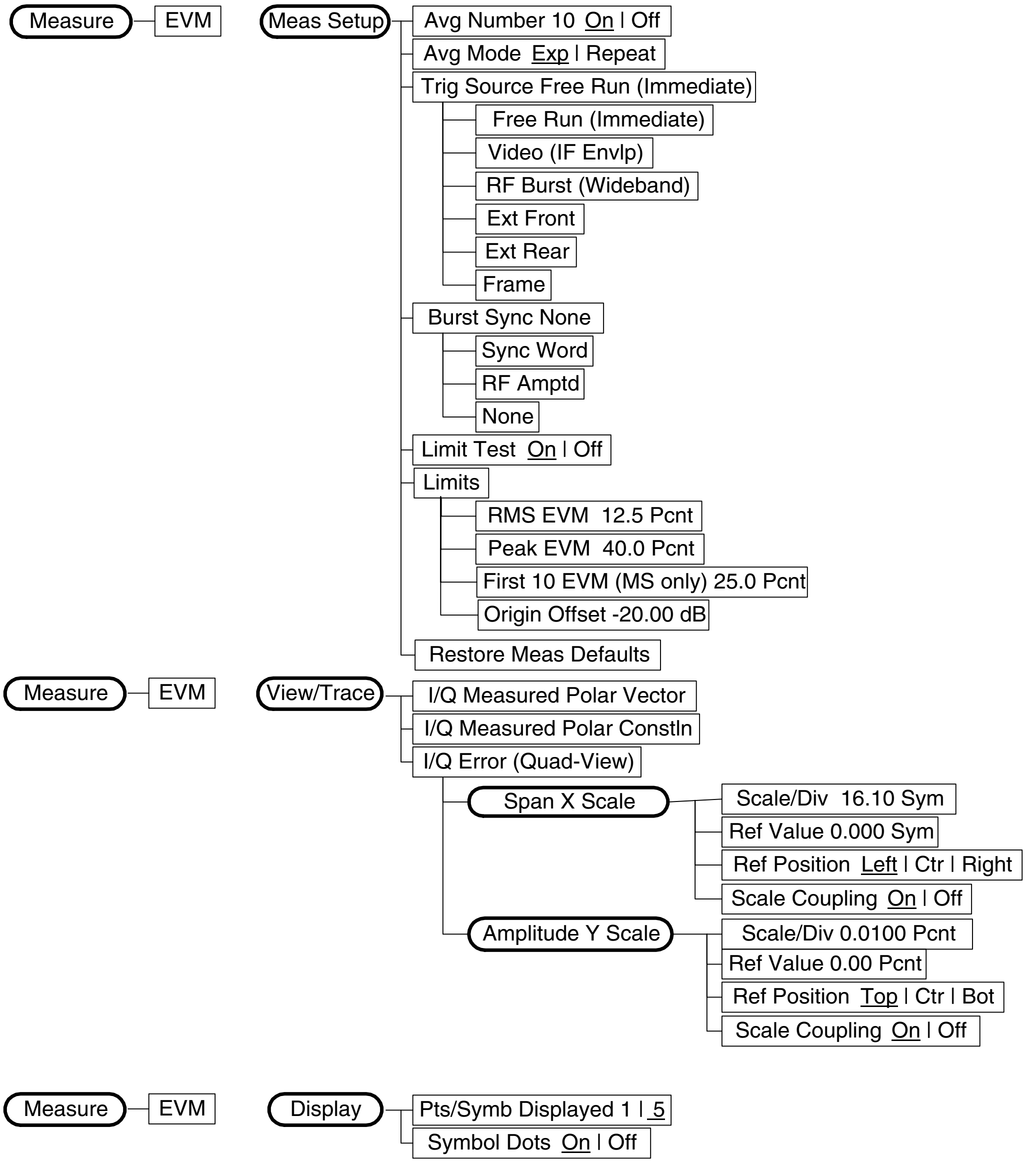

Measure
EVM
Meas Setup
Avg Number 10 On | Off
Avg Mode Exp | Repeat
Trig Source Free Run (Immediate)
Free Run (Immediate)
Video (IF Envlp)
RF Burst (Wideband)
Ext Front
Ext Rear
Frame
Burst Sync None
Sync Word
RF Amptd
None
Limit Test On | Off
Limits
RMS EVM 12.5 Pcnt
Peak EVM 40.0 Pcnt
First 10 EVM (MS only) 25.0 Pcnt
Origin Offset -20.00 dB
Restore Meas Defaults
Measure
EVM
View/Trace
I/Q Measured Polar Vector
I/Q Measured Polar Constln
I/Q Error (Quad-View)
Span X Scale
Scale/Div 16.10 Sym
Ref Value 0.000 Sym
Ref Position Left | Ctr | Right
Scale Coupling On | Off
Amplitude Y Scale
Scale/Div 0.0100 Pcnt
Ref Value 0.00 Pcnt
Ref Position Top | Ctr | Bot
Scale Coupling On | Off
Measure
EVM
Display
Pts/Symb Displayed 1 | 5
Symbol Dots On | Off

Figure 2-4 Spectrum Measurement Key Flow (1 of 3)

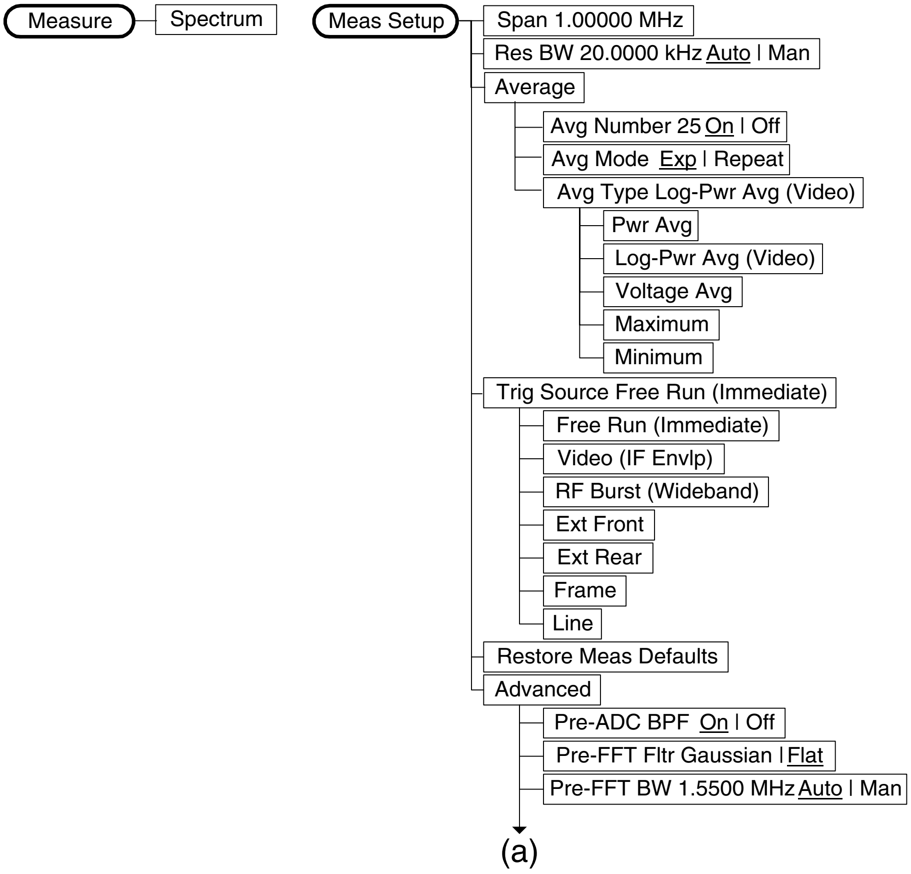

Measure
Spectrum
Meas Setup
Span 1.00000 MHz
Res BW 20.0000 kHz Auto | Man
Average
Avg Number 25 On | Off
Avg Mode Exp | Repeat
Avg Type Log-Pwr Avg (Video)
Pwr Avg
Log-Pwr Avg (Video)
Voltage Avg
Maximum
Minimum
Trig Source Free Run (Immediate)
Free Run (Immediate)
Video (IF Envlp)
RF Burst (Wideband)
Ext Front
Ext Rear
Frame
Line
Restore Meas Defaults
Advanced
Pre-ADC BPF On | Off
Pre-FFT Fltr Gaussian | Flat
Pre-FFT BW 1.5500 MHz Auto | Man
(a)

Figure 2-5 Spectrum Measurement (2 of 3)

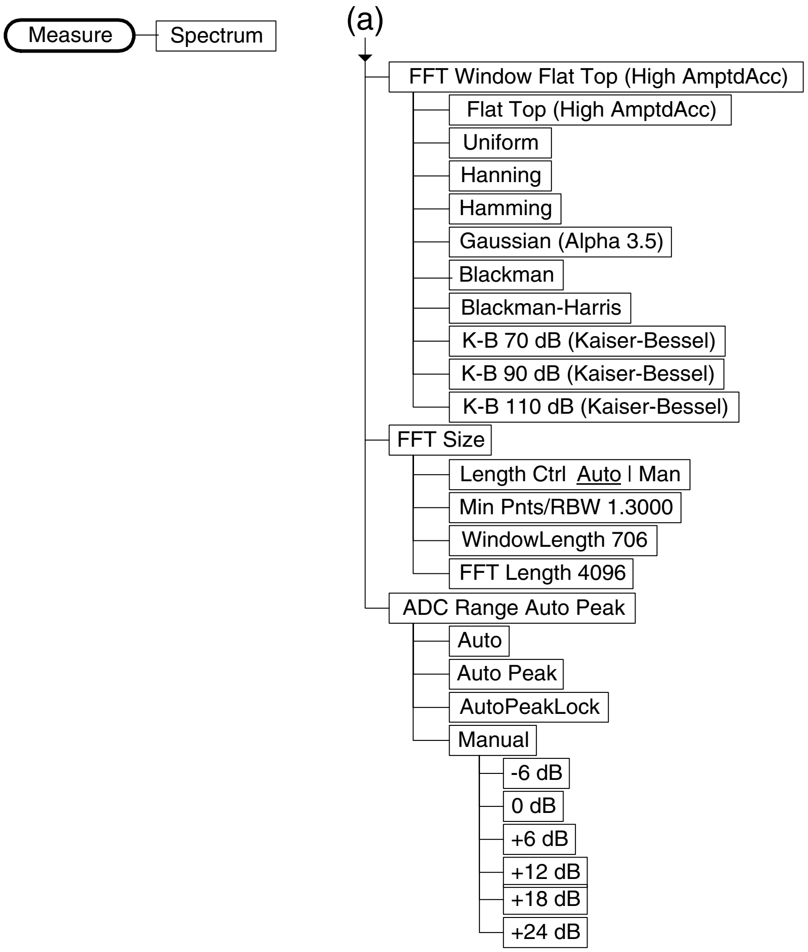

Measure
Spectrum
(a)
FFT Window Flat Top (High AmptdAcc)
Flat Top (High AmptdAcc)
Uniform
Hanning
Hamming
Gaussian (Alpha 3.5)
Blackman
Blackman-Harris
K-B 70 dB (Kaiser-Bessel)
K-B 90 dB (Kaiser-Bessel)
K-B 110 dB (Kaiser-Bessel)
FFT Size
Length Ctrl Auto | Man
Min Pnts/RBW 1.3000
WindowLength 706
FFT Length 4096
ADC Range Auto Peak
Auto
Auto Peak
AutoPeakLock
Manual
-6 dB
0 dB
+6 dB
+12 dB
+18 dB
+24 dB

Figure 2-6 **Spectrum Measurement (3 of 3)**

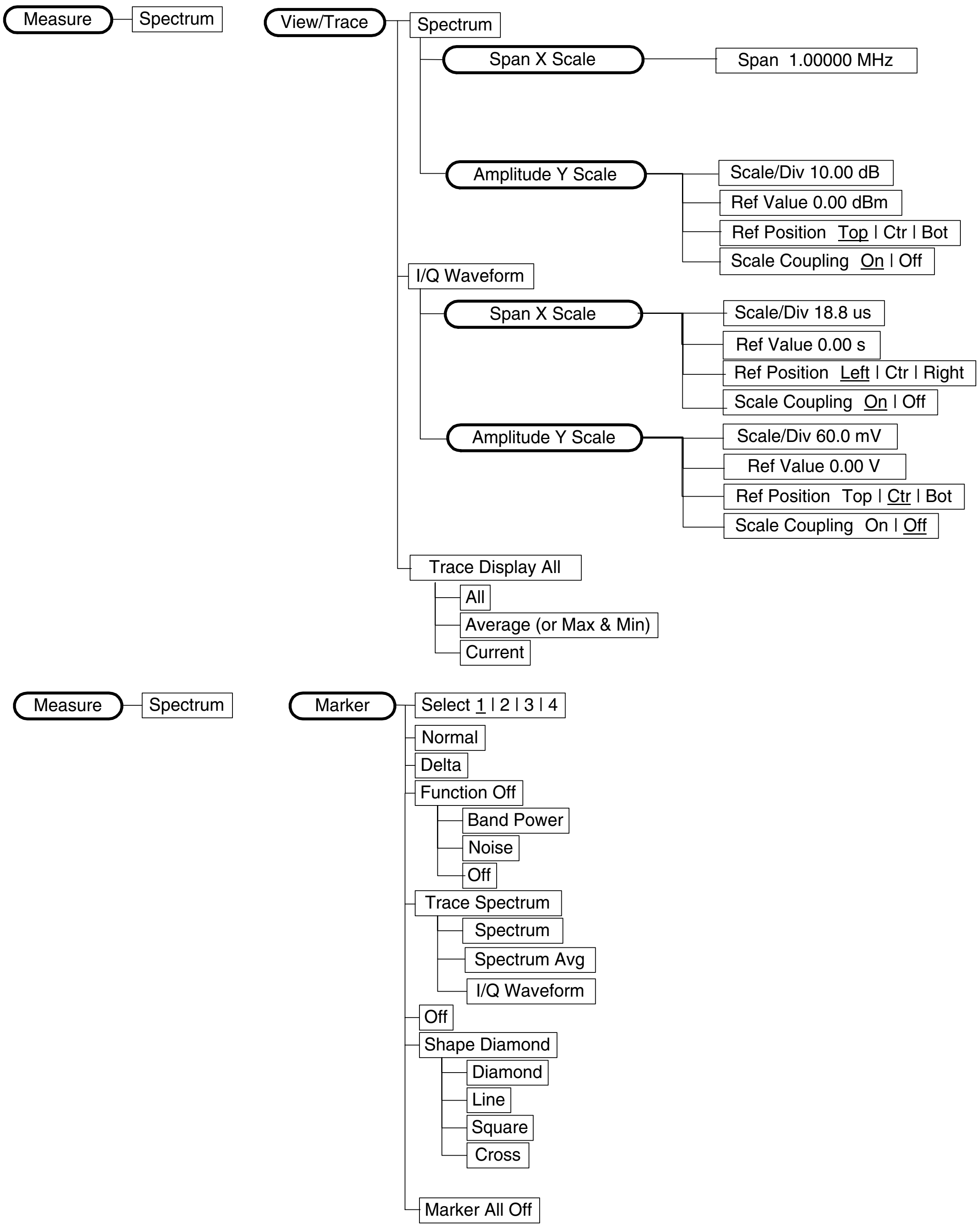

Measure
Spectrum
View/Trace
Spectrum
Span X Scale
Span 1.00000 MHz
Amplitude Y Scale
Scale/Div 10.00 dB
Ref Value 0.00 dBm
Ref Position Top | Ctr | Bot
Scale Coupling On | Off
I/Q Waveform
Span X Scale
Scale/Div 18.8 us
Ref Value 0.00 s
Ref Position Left | Ctr | Right
Scale Coupling On | Off
Amplitude Y Scale
Scale/Div 60.0 mV
Ref Value 0.00 V
Ref Position Top | Ctr | Bot
Scale Coupling On | Off
Trace Display All
All
Average (or Max & Min)
Current
Measure
Spectrum
Marker
Select 1 | 2 | 3 | 4
Normal
Delta
Function Off
Band Power
Noise
Off
Trace Spectrum
Spectrum
Spectrum Avg
I/Q Waveform
Off
Shape Diamond
Diamond
Line
Square
Cross
Marker All Off

Figure 2-7 Waveform Measurement Key Flow (1 of 2)

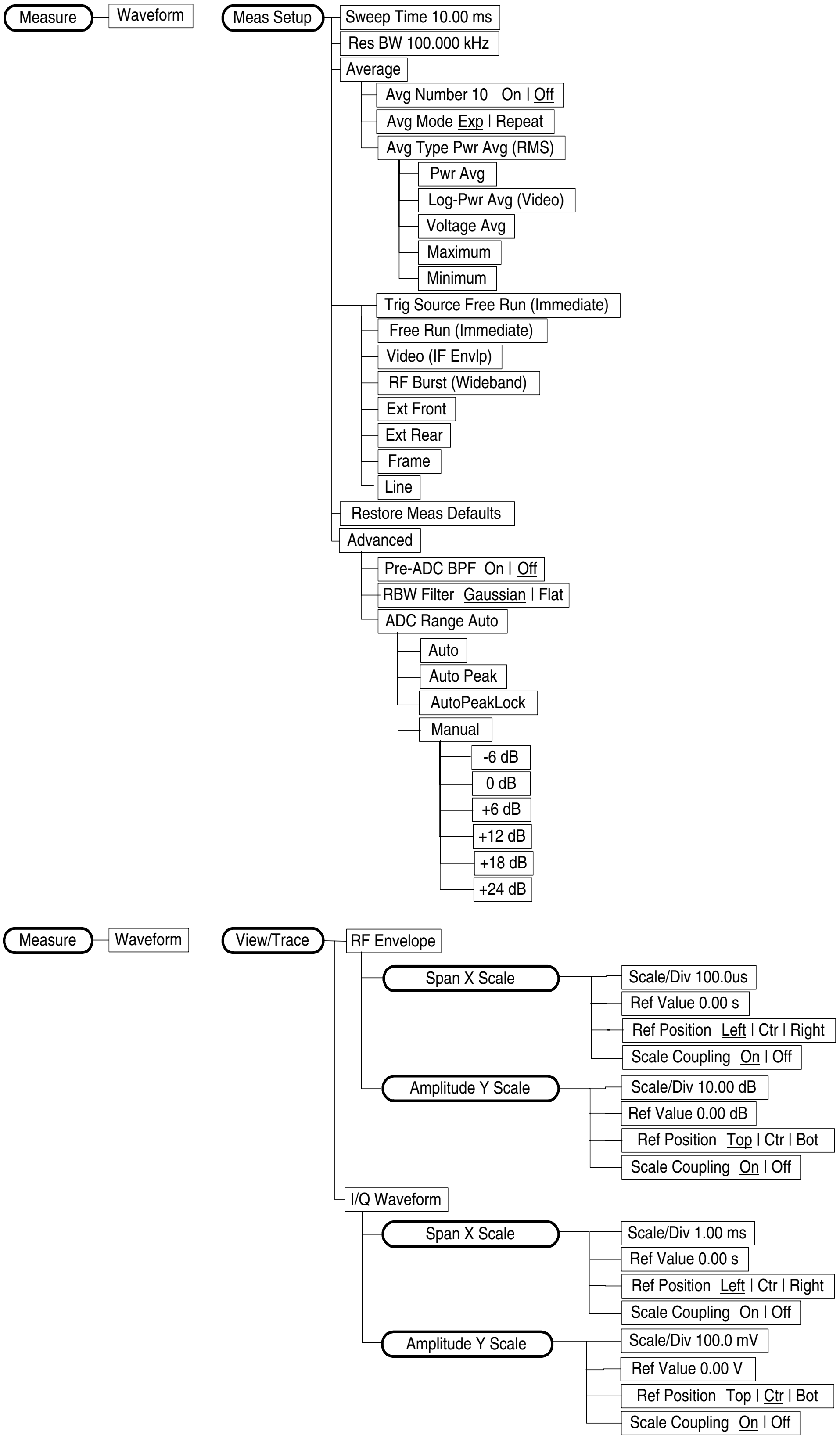
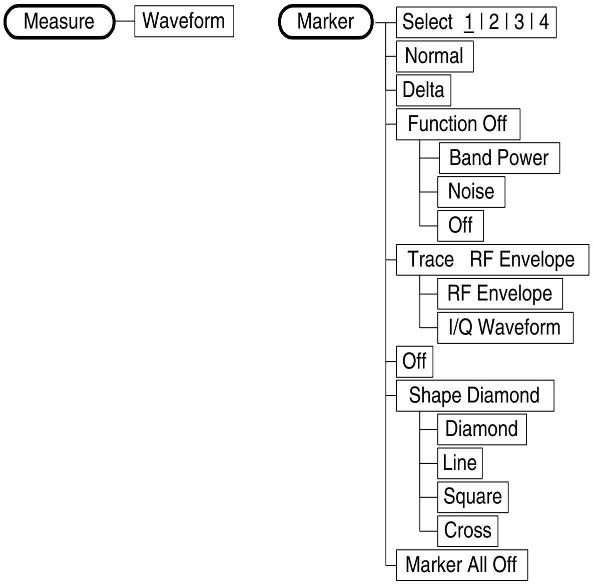

Measure
Waveform
Meas Setup
Sweep Time 10.00 ms
Res BW 100.000 kHz
Average
Avg Number 10 On | Off
Avg Mode Exp | Repeat
Avg Type Pwr Avg (RMS)
Pwr Avg
Log-Pwr Avg (Video)
Voltage Avg
Maximum
Minimum
Trig Source Free Run (Immediate)
Free Run (Immediate)
Video (IF Envlp)
RF Burst (Wideband)
Ext Front
Ext Rear
Frame
Line
Restore Meas Defaults
Advanced
Pre-ADC BPF On | Off
RBW Filter Gaussian | Flat
ADC Range Auto
Auto
Auto Peak
AutoPeakLock
Manual
-6 dB
0 dB
+6 dB
+12 dB
+18 dB
+24 dB
Measure
Waveform
View/Trace
RF Envelope
Span X Scale
Scale/Div 100.0us
Ref Value 0.00 s
Ref Position Left | Ctr | Right
Scale Coupling On | Off
Amplitude Y Scale
Scale/Div 10.00 dB
Ref Value 0.00 dB
Ref Position Top | Ctr | Bot
Scale Coupling On | Off
I/Q Waveform
Span X Scale
Scale/Div 1.00 ms
Ref Value 0.00 s
Ref Position Left | Ctr | Right
Scale Coupling On | Off
Amplitude Y Scale
Scale/Div 100.0 mV
Ref Value 0.00 V
Ref Position Top | Ctr | Bot
Scale Coupling On | Off

Figure 2-8 Waveform Measurement (2 of 2)


Measure
Waveform
Marker
Select 1 | 2 | 3 | 4
Normal
Delta
Function Off
Band Power
Noise
Off
Trace RF Envelope
RF Envelope
I/Q Waveform
Off
Shape Diamond
Diamond
Line
Square
Cross
Marker All Off

Installing Optional Measurement Personalities

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

1. Install the measurement personality firmware into the instrument memory. See “Loading an Optional Measurement Personality” on page 62.
2. Enter a license key number that activates the measurement personality. See “Installing a License Key” on page 63.

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

Available Measurement Personality Options

Available Personality Options[a]	**Option**
GSM measurement personality	**BAH**
EDGE (with GSM) measurement personality[b]	**202**
cdmaOne measurement personality	**BAC**
NADC, PDC measurement personalities	**BAE**
iDEN measurement personality	**HN1**
W-CDMA measurement personality	**BAF**
cdma2000 measurement personality	**B78**

a. Available as of the print date of this guide.
b. For instruments that already have Option BAH licensed, order E4406AU Option 252 to add EDGE (with GSM).

You need two pieces of information about your instrument to order a retrofit kit adding an option. You need the Host ID, and the instrument serial number. You may also want/need to add optional memory.

Required Information:	**Key Path:**
Host ID: ____________________	**System**, **Show System**

Required Information:	**Key Path:**
Instrument Serial Number: ________________	**System**, **Show System**

Loading an Optional Measurement Personality

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

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

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

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

Available Personality Options	**File Size (VSA - A.05.20)**
GSM measurement personality	2.4 MB
EDGE (with GSM) measurement personality	3.3 MB
cdmaOne measurement personality	2.0 MB
NADC measurement personalities	1.3 MB
PDC measurement personalities	1.4 MB
iDEN measurement personality	1.7 MB
W-CDMA measurement personality	4.2 MB[a]
cdma2000 measurement personality	3.8 MB[a]
**Shared measurement library	1.5 MB

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

The **Exit Main Firmware** key is used during the firmware installation process. This key is only for use when you want to update core firmware using a LAN connection. The **Exit Main Firmware** key halts the operation of the instrument firmware 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/**

Installing a License Key

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

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

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

NOTE Note: that you must already have entered the license key for the GSM option BAH before you can enter the license key for the EDGE retrofit option 252.

2. Press **License Key**. Enter the letters/digits of your license key. You will see your entry in the active function area of the display. When you have completed entering the license key number, press the **Done**key.
3. Press the **Install Now** key.

   The message “ `New option keys become active after reboot.`” will appear. If you want to proceed with the installation, press the **Yes** key and cycle the instrument power off and then on. Press the **No** key if you wish to cancel the installation process.

Viewing a License Key

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

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

1. Press **System**, **Install**, **Choose Option.** The **Choose Option** key accesses the alpha editor. Use the alpha editor to enter letters (upper-case) and the front-panel numeric keys to enter digits for a personality option that is already 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 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 ____________________

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 digits (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 **Yes** key if you want to continue the uninstall process. Press the **No** key to cancel the uninstall process.
3. Cycle the instrument power off and then on to complete the uninstall process.

3 Making NADC Measurements

NADC Measurements

Once in the NADC mode the following measurements for the NADC band are available by pressing the *Measure* key.

- "Making the Adjacent Channel Power Measurement" on page 75.
- "Making the Error Vector Magnitude (EVM) Measurement" on page 82.
- "Making the Spectrum (Frequency Domain) Measurement" on page 89.
- "Making the Waveform (Time Domain) Measurement" on page 99.

These are referred to as one-button measurements. When you press the key to select a measurement, it will become active using settings and a display unique to that measurement. Data acquisitions will automatically begin when trigger requirements, if any, are met.

Preparing for Measurements

If you want to set the NADC mode to a known, factory default state, press *Preset*. This will preset the mode setup and all of the measurements to the factory default parameters. You should often be able to make a measurement using these defaults.

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

To preset only the settings that are specific to the selected measurement, press *Meas Setup*, *More (1 of 2)*, *Restore Meas Defaults*. This will reset 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 “Making a Measurement” and “Changing the Frequency Channel” in the previous chapter.

Measure

The *Measure* front-panel key accesses the menu to select one of the following measurements:

- *ACP* - Press this key to make adjacent channel power measurements. The following menu is activated by the *View/Trace* front-panel key:

  Bar Graph - Displays the ACP bar graph at ±30, ±60 and ±90 kHz offsets from the center frequency of the carrier signal. The summary data is also available in the text window.

  Spectrum - Displays the ACP spectrum graph (with ±24.3 kHz bandwidth marker lines) at ±30, ±60 and ±90 kHz offsets from the center frequency of the carrier signal. The summary data is also available in the text window.

- *EVM* - Press this key to make error vector magnitude measurements. The following menu is activated by the *View/Trace* front-panel key:

  I/Q Measured Polar Vector - Displays the EVM polar vector graph of the I/Q demodulated signal. The summary data is also available in the text window.

  I/Q Measured Polar Constln - Displays the EVM polar constellation graph of the I/Q demodulated signal. The summary data is also available in the text window.

  I/Q Error (Quad-View) - Displays four windows for the *EVM*, *Magnitude Error*, *Phase Error* graphs and the *EVM* summary data. By selecting one of the windows with the *Next Window* front-panel key, you can enlarge it to the full display area by pressing the *Zoom* key.

- *Spectrum (Freq Domain)* - Press this key to make spectrum measurements with the spectrum and I/Q waveform display windows. The following menu is activated by the *View/Trace* front-panel key:

  Spectrum - Switches from the *I/Q Waveform* window to *Spectrum* window. This is equivalent to the *Next Window* front-panel key.

  I/Q Waveform - Switches the display window from the *Spectrum* window. This is equivalent to the *Next Window* front-panel key.

  Trace Display - Allows you to control the traces displayed for the current measurement data and/or the averaged data as follows:

    All - Displays both current and average traces if the *Average* function is already activated.

    Average (or Max & Min) - Displays only the average trace if it is already activated.

    Current - Displays only the current data trace.

- *Waveform (Time Domain)* - Press this key to make time-domain waveform measurements with either display of the *RF Envelope* graph and summary data windows or the *I/Q Waveform* window. The following menu is activated by the *View/Trace* front-panel key:

  RF Envelope - Changes to display the RF envelope graph window and the summary data window. This is the default selection for waveform (time domain) measurements.

  I/Q Waveform - Changes to display the I/Q waveform graph window.

Measure Control

The *Meas Control* front-panel key accesses the menu to control processes that affect the running of the current measurement.

- *Restart* - Press this *Restart* key to repeat the current measurement from the beginning, while retaining the current measurement settings. This is equivalent to the *Restart* front-panel key.
- *Measure* - Press *Meas Control*, *Measure* (not to be confused with the front-panel *Measure* key which has a different function) to toggle the measurement state between *Single* and *Cont* (Continuous). 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 execute averaging according to the current average type, either repeat or exponential. The default setting is *Cont*.
- *Pause* - Press *Meas Control*, *Pause* to pause the current measurement until you reactivate the 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.

Measurement Setup

The *Meas Setup* key accesses the 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 *Avg Number, Avg Mode* and *Trig Source* keys.

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

- *Restore Meas Defaults* - Allows you to preset only the settings that are specific to the selected measurement by pressing *Meas Setup*, *More (1 of 2)*, *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 average number and averaging mode you use for the currently selected measurement. For spectrum (frequency domain) and waveform (time domain) measurements, the *Average* key activates the following menu:

- *Avg Number* - Allows you to change the number of N averages to be made.

- *Avg Mode Exp Repeat* - Allows you to choose either exponential or repeat averaging mode. This selection only effects the averaging result after the number of N averages is reached. The N is set using the *Avg Number* key.

  Normal averaging: Normal (linear) averaging is always used until the specified number of N averages is reached. When the *Measure* key under *Meas Control* is set to *Single*, data acquisition is stopped when the number of N averages is reached, thus *Avg Mode* has no effect in *Single* measurement mode.

  Exponential averaging: When *Measure* is set to *Cont*, data acquisition will continue indefinitely. Exponential averaging is used with a weighting factor of N (the displayed count of averages stops at N). Exponential averaging weights new data more heavily than old data, which allows tracking of slow-changing signals. The weighting factor N is set using the *Avg Number* key.

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

- *Avg Type* - Allows you to access the following menu only for making spectrum (frequency domain) and waveform (time domain) measurements:

  Pwr Avg (RMS) - Executes the true power averaging which is equivalent to taking the rms of the voltage. This is the most accurate type.

  Log-Pwr Avg (Video) - Simulates the traditional spectrum analyzer type of averaging by calculating an average of the log power.

  Voltage Avg - Executes the voltage averaging.

  Maximum - Executes the maximum voltage averaging by capturing peak data.

  Minimum - Executes the minimum voltage averaging.

Trigger Source

Changing the selection in the *Trig Source* menu alters the trigger source for the selected measurement only. Not all of the selections are available for all measurements. Choose one of the following trigger sources:

NOTE The *RF Burst (Wideband)*, *Video (IF Envlp)*, *Ext Front* and *Ext Rear* keys found under the *Trigger* menu enable you to change the default settings of the delay, level and slope for each of these trigger sources.

- *Free Run (Immediate)* - A trigger occurs at the time the data is requested, completely asynchronous with the RF or IF signal.
- *RF Burst (Wideband)* - An internal wideband RF burst trigger that has the automatic level control for burst signals. It triggers at the level that is set relative to the peak RF signal (12 MHz bandwidth) input level.
- *Video (IF Envlp)* - An internal IF envelope trigger that occurs at the absolute threshold level of the IF signal level. This source is not available for ACP measurements.
- *Ext Front* - Activates the front-panel external trigger input (*EXT TRIGGER INPUT*) port. The external signal must be between –5.00 and +5.00 V with 1 mV resolution.
- *Ext Rear* - Activates the rear panel external trigger input (*TRIGGER IN*) port. The external signal must be between –5.00 and +5.00 V with 1 mV resolution.
- *Frame* - Uses the internal frame clock to generate a trigger signal. The clock parameters are controlled under the *Mode Setup* key or the measurement firmware, but not both. See the specific measurement for details.
- *Line* - Sets the trigger to the line mode. Sweep triggers occur at intervals synchronous to the line frequency. This trigger source is available for spectrum and waveform measurements.

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

Burst Sync

This menu is only used for EVM measurements. Pressing the *Burst Sync* key allows you to choose the source used to synchronize the measurement to the “point 0” of the NADC burst. The “point 0” is defined as the start of symbol 1 in a timeslot. The *Search Threshold* setting in the *Burst* menu under *Mode Setup* applies to the *RF Amptd*. Pressing the *Burst Sync* key accesses the menu with some or all of the following choices:

- *Sync Word* - Synchronizes the measurement to the sync word which is one of the six possible 28-bit NADC timeslot synchronization words contained in the signal. This is the default when *Device* is set to *MS*.
- *RF Amptd* - Synchronizes the measurement to the rising edge of the bursted RF carrier.
- *None* - Measurements are made without synchronizing with the NADC burst. This is the default when *Device* is set to *BS*.

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 power (ACP) transmitted from an NADC mobile phone. The characteristics of adjacent channel power are mainly determined by the transmitter design, including a digital filter called a root Nyquist filter.

Adjacent channel power is defined by the NADC standard as the total power within the defined bandwidth, centered at Δf kHz offset from the carrier frequency. The carrier is modulated by the standard coding test signal which has the same coding speed as the NADC modulation signal. The following specifications from the TIA/EIA IS-136, IS-137 and IS-138 standards apply to both base stations and mobile stations:

(1) At ±30 kHz offsets: Less than –26 dBc

(2) At ±60 kHz offsets: Less than –45 dBc

(3) At ±90 kHz offsets: Less than –45 dBc or –13 dBm, whichever is the lowest power

For Tx power >50 W: –60 dBc

Measurement Method

This measurement analyzes the total power levels within the defined bandwidth at given offset frequencies on both sides of the carrier frequency using Fast Fourier Transform (FFT). If *Offset Power* is set to *Integ* (integration), the total power within the 32.8 kHz bandwidth, using the root-raised cosine weighting filter, is measured at each offset frequency. The equivalent 3-dB bandwidth is 24.3 kHz. If *Offset Power* is set to *Peak*, the total peak power is measured with 1 kHz resolution bandwidth through the entire NADC bandwidth of 30 kHz.

The measurement functions, such as averaging, trigger source, limit test, offsets and limits, need to be set up to make a measurement and pass/fail test based on the NADC channel width and weighting prescribed in the NADC standard. The test result is displayed in either bar graph window or spectrum window. Both the absolute power levels and the power levels relative to the center power band are displayed in the text window. When *Spectrum View* is selected, the vertical scale can be varied for your optimum observation by pressing the *Amplitude Y Scale* front-panel key.

Making the Measurement

NOTE

The factory default parameters provided for this measurement will give you an NADC compliant measurement for the instrument setup. You should be able to make a measurement often using these defaults.

Select the desired center frequency as described in "Changing the Frequency Channel" in Chapter 2.

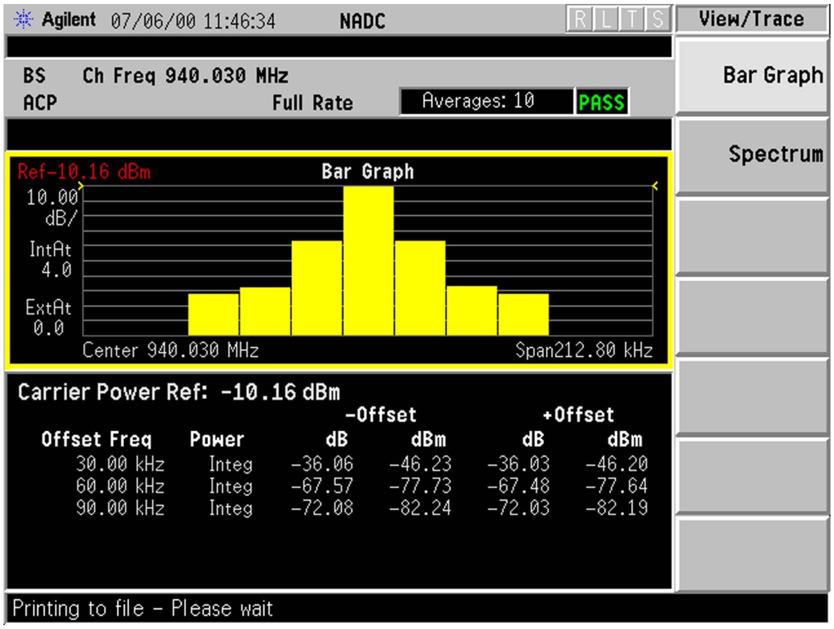
Press *Measure*, *ACP* to immediately make an adjacent channel power measurement.

To change any of the measurement parameters from the factory default values, refer to "Changing the Measurement Setup" on page 77 for this measurement.

Results

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

Figure 3-1 **Adjacent Channel Power Measurement - Bar Graph View**



```
07/06/00 11:46:34        NADC
BS     Ch Freq 940.030 MHz
ACP                    Full Rate    Averages: 10   PASS

Carrier Power Ref: -10.16 dBm
                              -Offset            +Offset
  Offset Freq   Power        dB      dBm        dB      dBm
     30.00 kHz   Integ    -36.06   -46.23    -36.03   -46.20
     60.00 kHz   Integ    -67.57   -77.73    -67.48   -77.64
     90.00 kHz   Integ    -72.08   -82.24    -72.03   -82.19

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```

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
View/Trace	Bar Graph
Meas Setup:	
Avg Number	10, On
Avg Mode	Exp
Trig Source:	
(when Device is MS)	Free Run (Immediate)
(when Device is BS)	RF Burst (Wideband)
Limit Test	On
Ofs & Limits:	
Offset	A
Offset Freq:	
A	30.000 kHz, On
B	60.000 kHz, On
C	90.000 kHz, On
D	120.000 kHz, Off
E	0.0 Hz, Off
Offset Power	Integ
Abs Limit:	
A, B, D, E	0.00 dBm
C	–13.00 dBm
Fail:	
A, B	Relative
C	OR
D, E	AND
Rel Lim (Car):	
A	–26.00 dB
B, C	–45.00 dB
D, E	0.00 dB

Make sure the *ACP* 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" on page 71. However, the trigger source does not include *Video* and *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 Limit* and/or *Rel Lim (Car)* 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.

- *Ofs & Limits* - Allows you to access the menu to change the following parameters for pass/fail tests:

  Offset - Allows you to access the memory selection menu to store 5 offset frequency values in *A* through *E*. Only one selection at a time (A, B, C, D, or E) is shown on this key label. The default selection is A.

  Offset Freq - Allows you to enter an offset frequency value and toggle the offset frequency function between *On* and *Off*, according to each offset key selected. The allowable range is 0 Hz to 200.000 kHz. While this key is activated, enter an offset value from the numeric keypad by terminating with one of the frequency unit keys shown. For NADC measurements offsets A, B and C are defaulted to 30.000 kHz On, 60.000 kHz On, and 90.000 kHz On, respectively. Offset D is temporarily defaulted to 120.000 kHz Off while offset E is defaulted to 0.00 Hz Off. One offset frequency value selected from the *Offset* menu is shown on this key label. The default state shows 30.000 kHz On.

  Offset Power - Allows you to select either one of the following power measurement methods:

    Integ (integration) - Measures the total power within the NADC bandwidth of 32.8 kHz with the root-raised cosine weighting filter.

Peak - In a 1 kHz resolution bandwidth, the peak frequency amplitude across the 30 kHz channel is reported. When averaging is on, an rms average is computed prior to the peak selection. This creates a banded limit line measurement, similar to other standards which call for a close-in spurious response measurement. Limits can be relative or absolute. When the limits are relative, the average power in the reference channel, normalized to a 1 kHz bandwidth, is used to compute the ratio.

Abs Limit - Allows you to enter an absolute limit value ranging from –200.00 to +50.00 dBm with the best resolution of 0.01 dB. The default settings for offsets A, B, D and E are 0.00 dBm, while offset C is defaulted to –13.00 dBm to make the OR logical judgement with its relative limit of –45.00 dB.

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 (Car)* AND one of the absolute ACP measurement results is larger than *Abs Limit*. This is the default setting for offsets D and E.

OR - Fail is shown if one of the relative ACP measurement results is larger than *Rel Lim (Car)* OR one of the absolute ACP measurement results is larger than *Abs Limit*. This is the default setting for offset C.

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 (Car)*. This is the default setting for offsets A and B.

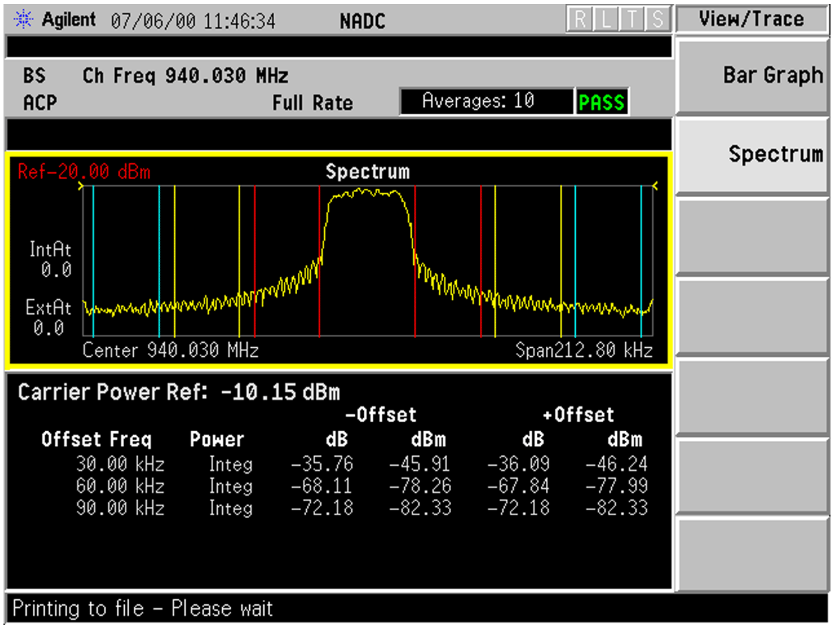
Rel Lim (Car)- Allows you to enter a relative limit value ranging from –200.00 to +50.00 dB with the best resolution of 0.01 dB. The default settings for offsets A, B and C are –26.00, –45.00 and –45.00 dB, respectively, while offsets D and E are defaulted to 0.00 dB.

Changing the View

The *View/Trace* key accesses the menu which allows you to select the desired measurement view from the following selections:

- *Bar Graph* - In the factory default condition, 7 of the total integration power levels, centered at the carrier frequency and ±30 kHz, ±60 kHz and ±90 kHz offset frequencies, are shown in the bar graph window. The corresponding measured data is shown in the text window as shown in Figure 3-1 on page 76.
- *Spectrum* - Once this view is selected, Figure 3-1 on page 76 changes as shown below. In the factory default condition, the swept frequency spectrum is displayed with the bandwidth marker lines in the spectrum graph window. The corresponding measured data in the text window is the total integration power within the defined bandwidth. While in this view, you can change the vertical scale by pressing the *Amplitude Y Scale* key.

Figure 3-2 **Adjacent Channel Power Measurement - Spectrum View**


Agilent 07/06/00 11:46:34 NADC
R L T S
View/Trace
BS Ch Freq 940.030 MHz
ACP Full Rate
Averages: 10
PASS
Ref-20.00 dBm
Spectrum
IntAt
0.0
ExtAt
0.0
Center 940.030 MHz
Span212.80 kHz
Bar Graph
Spectrum

Carrier Power Ref: -10.15 dBm

		-Offset		+Offset	
Offset Freq	Power	dB	dBm	dB	dBm
30.00 kHz	Integ	-35.76	-45.91	-36.09	-46.24
60.00 kHz	Integ	-68.11	-78.26	-67.84	-77.99
90.00 kHz	Integ	-72.18	-82.33	-72.18	-82.33

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Troubleshooting Hints

The adjacent channel power measurements suggest us numerous faults in the transmitter section of the UUT, as follows:

(1) Faults caused by a malfunction of the baseband circuitry consisting of a code generator, a digital filter, digital-to-analog converters, 90-degree phase shifter, and I/Q modulators.

(2) Faults due to high phase noise levels from the local oscillators.

(3) Faults due to excessive noise floor levels from the up-converter, output amplifier, and/or analog filters.

Making the Error Vector Magnitude (EVM) Measurement

Purpose

Phase and frequency errors are the measures of modulation quality for the NADC system. Since the NADC system uses the π/4 DQPSK modulation technique, the phase and frequency accuracies of the NADC transmitter are critical to the communications system performance and ultimately affect range.

NADC receivers rely on the phase and frequency quality of the π/4 DQPSK modulation signal in order to achieve the expected carrier to noise ratio. A transmitter with high phase and frequency errors will often still be able to support phone calls during a functional test. However, it will tend to provide difficulty for mobiles trying to maintain service at the edge of the cell with low signal levels or under difficult fading and Doppler conditions.

Measurement Method

The phase error of the unit under test is measured by computing the difference between the phase of the transmitted signal and the phase of a theoretically perfect signal.

The instrument samples the transmitter output in order to capture the actual phase trajectory. This is then demodulated and the ideal phase trajectory is mathematically derived. Subtracting one from the other results in an error signal.

For base stations, the NADC standard specifies that the phase error should not exceed 5 degrees rms or 20 degrees peak, and that the mean frequency error across the burst must not exceed 0.05 ppm. These specifications hold true for normal and extreme temperature conditions, and with exposure to vibration.

This measurement allows you to display these errors numerically and graphically on the instrument display. There are graphs for `EVM`, `Phase Error` and `Mag Error` in the graph windows. In the text window, there are `EVM:` in % rms, in % peak at the highest symbol number, in % rms on the first 10 symbols (only when Device is MS), `Mag Error:` in % rms, `Phase Error:` in degrees, `Freq Error:` in Hz, and `I/Q Offset:` in dB.

Making the Measurement

NOTE The factory default settings provide an NADC 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, burst type, and slot as described in "Changing the Frequency Channel" on page 50.

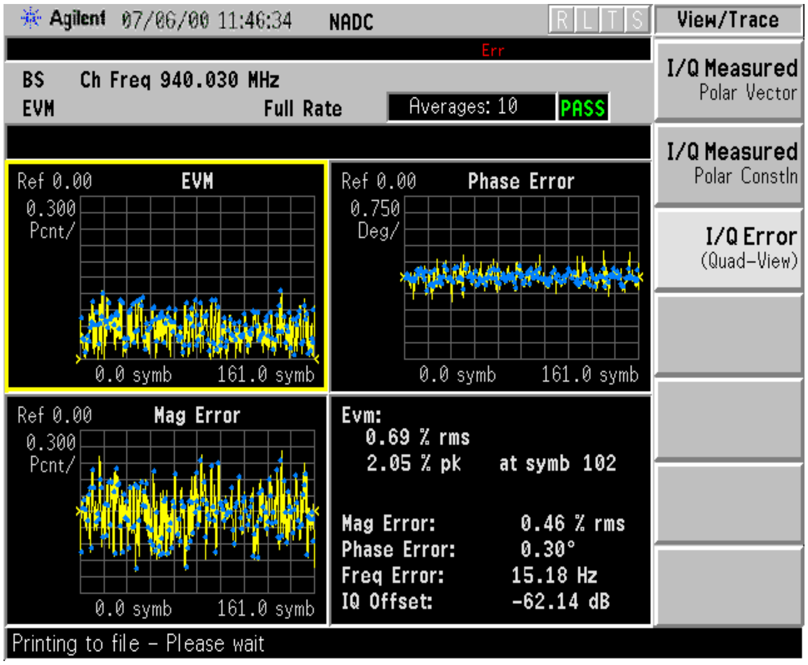
Press *Measure*, *EVM* to immediately make the error vector magnitude measurement.

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

Results

The next figure shows an example of measurement result with the graphic and text windows. The measured summary data is shown on the left window and the dynamic vector trajectory of the I/Q demodulated signal is shown as a polar vector display in the right window. When *Device* is set to *MS*, the *First 10 Symbols EVM* result is also shown in the left window.

Figure 3-3 **Error Vector Magnitude Measurement - Polar Vector View**


Agilent 07/06/00 11:46:34 NADC
R L T S
View/Trace
Err
I/Q Measured Polar Vector
I/Q Measured Polar Constln
I/Q Error (Quad-View)
Ref 0.00 EVM
0.300 Pcnt/
0.0 symb 161.0 symb
Ref 0.00 Phase Error
0.750 Deg/
0.0 symb 161.0 symb
Ref 0.00 Mag Error
0.300 Pcnt/
0.0 symb 161.0 symb

BS Ch Freq 940.030 MHz
EVM Full Rate Averages: 10 PASS

Evm:
0.69 % rms
2.05 % pk at symb 102

Mag Error: 0.46 % rms
Phase Error: 0.30°
Freq Error: 15.18 Hz
IQ Offset: -62.14 dB

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Changing the Measurement Setup

The next table shows the factory default settings for error vector magnitude measurements.

Table 3-2 **Error Vector Magnitude Measurement Defaults**

Measurement Parameter	**Factory Default Condition**
Avg Number	10, On
Avg Mode	Exponential
Trigger Source	Free Run when Device is BS RF Burst when Device is MS
Burst Sync	None when Device is BS Sync Word when Device is MS
View/Trace	I/Q Measured Polar Vector
Limit Test	On
Limits: RMS EVM	12.5%
Limits: Peak EVM	40.0%
Limits: First 10 EVM (MS only)	25.0%
Limits: Origin Offset	–20 dB

Make sure the *Error Vector Magnitude (EVM)* measurement is selected under the *Measure* menu. The *Meas Setup* key accesses a menu which allows you to modify the averaging, trigger source and burst sync for this measurement as described in "Measurement Setup" earlier in this chapter. However, the trigger source does not include *Line*. In addition, the following error vector magnitude measurement parameters can be modified:

- *Limit Test* - Allows you to toggle the limit test function between *On* and *Off*. If set to *On*, the *Limits* key needs to be pressed to specify the limit values for rms EVM, peak EVM and origin offset. Pass/fail results are shown in the active display window with the number of averages.
- *Limits* - Allows you to access the menu to change the following test parameter limits:

  RMS EVM - Allows you to enter a limit value ranging from 0.0 to 50.0% for the pass/fail test of the rms error vector magnitude measured on all of the symbols. The default setting is 12.5%.

  Peak EVM - Allows you to enter a limit value ranging from 0.0 to 50.0% for the pass/fail test of the peak error vector magnitude measured on all of the symbols. The default setting is 40.0%.

  First 10 EVM (MS only) - Allows you to enter a limit value ranging from 0.0 to 50.0% for the Pass/Fail test of the error vector magnitude measured on the first 10 symbols. The default setting is 25.0%. This is valid when *Devise* is set to *MS*

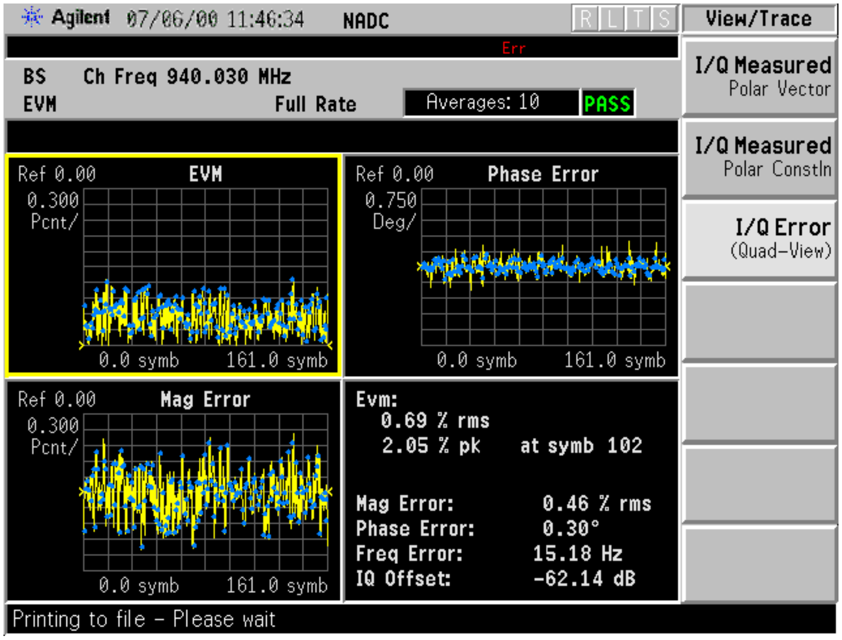
Origin Offset - Allows you to enter an offset value ranging from –100.00 to 0.00 dB for the pass/fail test of the origin offset.The default setting is –20.00 dB.

Changing the View

The *View/Trace* key accesses the menu which allows you to select the desired measurement view from the following selections:

- *I/Q Measured Polar Vector* - The measured summary data is shown in the left window and the dynamic vector trajectory of the I/Q demodulated signal is shown as a polar vector display in the right window, as shown in Figure 3-3 on page 83.
- *I/Q Measured Polar Constln* - The measured summary data is shown in the left window and the dynamic vector constellation of the I/Q demodulated signal is shown as a polar vector display in the right window, as shown in Figure 3-4.
- *I/Q Error (Quad-View)* - Four display windows show `EVM`, `Mag Error` and `Phase Error` graphs, and the EVM summary data text.

Figure 3-4 Error Vector Magnitude Measurement - Polar Constln



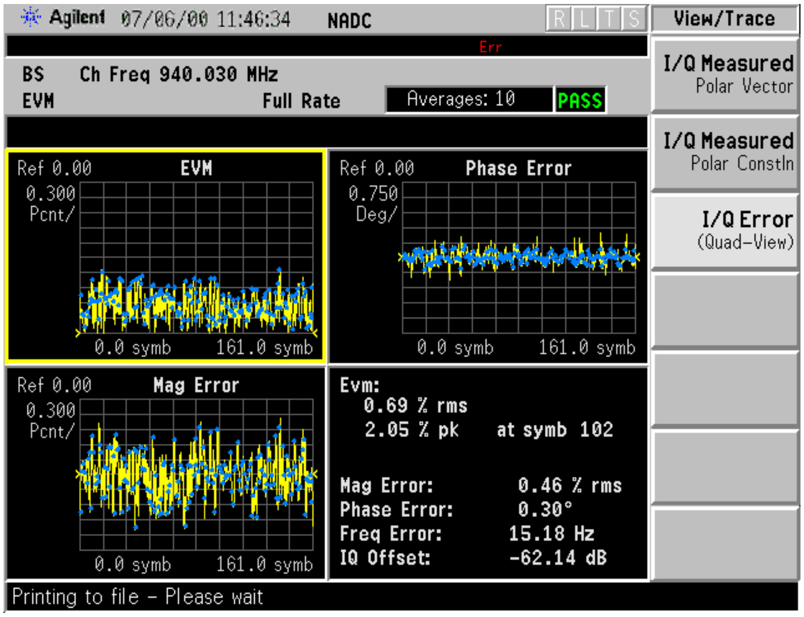
Agilent
R
L
T
S
Err
Ref 0.00
EVM
0.300
Pcnt/
0.0 symb
161.0 symb
Ref 0.00
Phase Error
0.750
Deg/
0.0 symb
161.0 symb
Ref 0.00
Mag Error
0.300
Pcnt/
0.0 symb
161.0 symb
View/Trace
I/Q Measured
Polar Vector
I/Q Measured
Polar Constln
I/Q Error
(Quad-View)

```
07/06/00 11:46:34    NADC
BS    Ch Freq 940.030 MHz
EVM                  Full Rate    Averages: 10   PASS

Evm:
   0.69 % rms
   2.05 % pk     at symb  102

Mag Error:          0.46 % rms
Phase Error:        0.30°
Freq Error:        15.18 Hz
IQ Offset:        -62.14 dB
Printing to file - Please wait
```

Figure 3-5 Error Vector Magnitude Measurement - Quad View


Agilent 07/06/00 11:46:34 NADC
R L T S
Err
View/Trace
I/Q Measured Polar Vector
I/Q Measured Polar Constln
I/Q Error (Quad-View)
Ref 0.00 EVM
0.300 Pcnt/
0.0 symb 161.0 symb
Ref 0.00 Phase Error
0.750 Deg/
0.0 symb 161.0 symb
Ref 0.00 Mag Error
0.300 Pcnt/
0.0 symb 161.0 symb

```
BS    Ch Freq 940.030 MHz
EVM                      Full Rate   Averages: 10  PASS

Evm:
  0.69 % rms
  2.05 % pk     at symb 102

Mag Error:       0.46 % rms
Phase Error:     0.30°
Freq Error:     15.18 Hz
IQ Offset:     -62.14 dB

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```

Changing the Display

The *Display* key accesses the menu to allow the following selections for changing the graph displays:

- *Pts/Symb Displayed* - Allows you to specify the number of displayed points per symbol, either 1 or 5. The default setting is 5.
- *Symbol Dots* - Allows you to toggle the symbol dots between *On* and *Off*. The default setting is *On*.

When either `EVM`, `Phase Error` or `Mag Error` window is active in the I/Q Error (Quad-View) display, the *Span X Scale* key accesses the menu to allow the following selections:

- *Scale/Div* - Allows you to define the horizontal scale by changing the symbol value per division. The range is 1 to 100 symbols per division. The default setting is 16.1 (for BS) or 15.6 for MS) symbols per division.
- *Ref Value* - Allows you to set the symbol reference value ranging from 0 to 1000 symbols. The default setting is 0.
- *Ref Position* - Allows you to set the reference position to either *Left*, *Ctr* (center) or *Right*. The default setting is *Left*.
- *Scale Coupling* - Allows you to toggle the scale coupling function between *On* and *Off*. The default setting is *On*. This function automatically determines the scale per division and reference value by the magnitude of the measurement results.

When either `EVM:` or `Mag Error:` window is active in the I/Q Error (Quad-View) display, the *Amplitude Y Scale* key accesses the menu to allow the following selections:

- *Scale/Div* - Allows you to define the vertical scale by changing the value per division. The range is 0.1 to 50% per division. The default setting is 20.0%. However, since the *Scale Coupling* default is set to *On*, this value is automatically determined by the measurement results.
- *Ref Value* - Allows you to set the reference value ranging from 0 to 500%. The default setting is 0%.
- *Ref Position* - Allows you to set the reference position to either *Top*, *Ctr* (center) or *Bot* (bottom). For the `EVM:` graph, the default setting is *Bot*. For the `Mag Error:` graph the default setting is *Ctr*.
- *Scale Coupling* - Allows you to toggle the scale coupling function between *On* and *Off*. The default setting is *On*. This function automatically determines the scale per division and reference value by the magnitude of the measurement results.

When the `Phase Error:` window is active in the I/Q Error display, the *Amplitude Y Scale* key accesses the menu to allow the following selections:

- *Scale/Div* - Allows you to define the vertical scale by changing the value per division. The range is 0.01 to 3600 degrees. The default setting is 20.0 degrees per division. However, since the *Scale Coupling* default is set to *On*, this value is automatically determined by the measurement results.
- *Ref Value* - Allows you to set the reference value ranging from 0 to 500%. The default setting is 0%.
- *Ref Position* - Allows you to set the reference position to either *Top*, *Ctr* (center) or *Bot* (bottom). For the EVM graph, the default setting is *Bot*. For the Mag Error graph, the default setting is *Ctr*.
- *Scale Coupling* - Allows you to toggle the scale coupling function between *On* and *Off*. The default setting is *On*. This function automatically determines the scale per division and reference value by the magnitude of the measurement results.

Troubleshooting Hints

First use the spectrum (frequency domain) measurement to verify that the signal is present and approximately centered on the display.

Poor phase error indicates a problem at the I/Q baseband generator, filters, and/or modulator in the transmitter circuitry. The output amplifier in the transmitter can also create distortion that causes unacceptably high phase error. In a real system, poor phase error will reduce the ability of a receiver to correctly demodulate the signal, especially in marginal signal conditions.

Making the Spectrum (Frequency Domain) Measurement

Purpose

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

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

Measurement Method

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

This measurement is available for both the RF input and baseband I/Q inputs. For details on baseband I/Q operation see the section on baseband I/Q measurements in the VSA E4406A Transmitter Tester User's Guide.

Making the Measurement

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

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

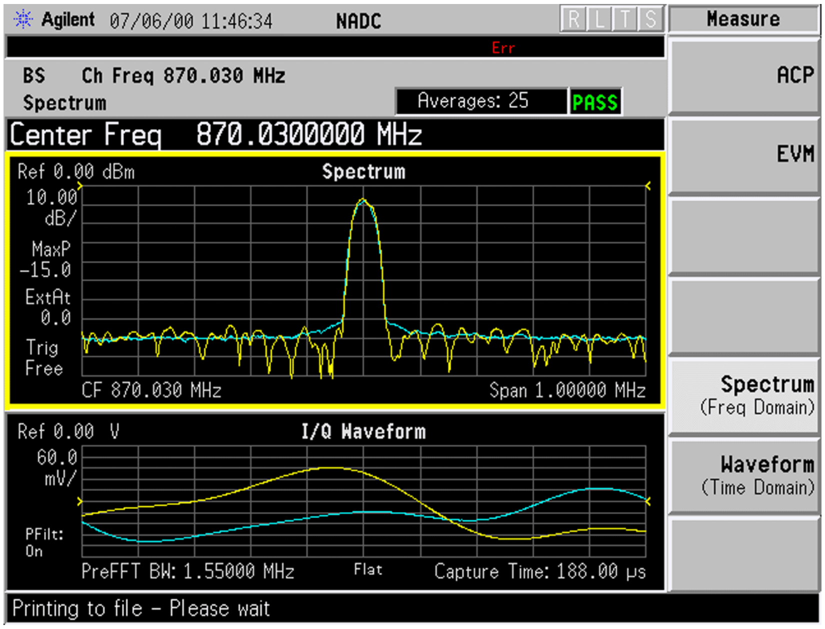
To change any of the measurement parameters from the factory default values, refer to the "Changing the Measurement Setup" section for this measurement.

When using the baseband I/Q inputs, set *Input Port* to *I/Q*, *I only*, or *Q only*, configure the *I/Q Setup* parameters, and supply the baseband I/Q signals to the front-panel I/Q inputs. The available trigger sources for this measurement includes *I/Q Level*.

Results

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

Figure 3-6 **Spectrum Measurement - Spectrum and I/Q Waveform View**


Agilent 07/06/00 11:46:34
NADC
R L T S
Err
Measure
BS Ch Freq 870.030 MHz
Spectrum
Averages: 25
PASS
Center Freq 870.0300000 MHz
ACP
EVM
Ref 0.00 dBm
Spectrum
10.00
dB/
MaxP
-15.0
ExtAt
0.0
Trig
Free
CF 870.030 MHz
Span 1.00000 MHz
Spectrum
(Freq Domain)
Ref 0.00 V
I/Q Waveform
60.0
mV/
PFilt:
On
PreFFT BW: 1.55000 MHz
Flat
Capture Time: 188.00 µs
Waveform
(Time Domain)
Printing to file - Please wait

Changing the Measurement Setup

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

Table 3-3 **Spectrum (Frequency Domain) Measurement Defaults**

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

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

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

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

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

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

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

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

  - o *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.
  - o *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 select *Auto* (the default) or the *Short (16 bit)*, *Medium (24 bit*) and *Long (32 bit)* methods of data packing. The short, medium, and long methods are not compatible with all settings and should not be used unless you are familiar with data packing methods. *Auto* is the preferred choice.
  - *Auto* - The data packing value most appropriate for current instrument settings is selected automatically.
  - *Short (16 bit)* - Select this to pack data every 16 bits.
  - *Medium (24 bit)* - Select this to pack data every 24 bits.
  - *Long (32 bit)* - Select this to pack data every 32 bits.
- *ADC Dither* - Allows you to toggle the ADC dither function between *Auto*, *On*, and *Off*. When set to *Auto* (the default), the ADC dither function will be activated when a narrow bandwidth is being measured, and deactivated when a wide bandwidth is being measured. “ADC dither” refers to the introduction of noise to the digitized steps of the analog-to-digital converter; the result is an improvement in amplitude accuracy. Use of the ADC dither, however, reduces dynamic range by approximately 3 dB.
- *Decimation* - Allows you to toggle the decimation function between *Auto* and *Man*, and to set the decimation value. *Auto* is the preferred setting, and the only setting that guarantees alias-free FFT spectrum measurements. If you are familiar with the decimation feature, you can change the decimation value by setting to *Man*, but be aware that aliasing can result in higher values. Decimation numbers 1 to 4 describe the factor by which the number of points are reduced. The default setting is 1, which results in no data point reduction.
- *IF Flatness* - Allows you to toggle the IF flatness function between *On* and *Off*. If set to *On* (the default), the IF flatness feature causes background amplitude corrections to be performed on the FFT spectrum. The *Off* setting is used for adjustment and troubleshooting of the test instrument.

Changing the View

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

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

Changing the Display

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

Selecting Displayed Traces Within Windows

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

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

Using the Markers

The *Marker* front-panel key accesses the menu to configure the markers. If you want to use the marker function in the I waveform window, press *View/Trace*, *I and Q Waveform*, *Marker*, *Trace*, *I 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. Marker postion 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*, trace. The default is *Spectrum*.
- *Off* - Allows you to turn off the selected marker.
- *Shape Diamond* - Allows you to access the menu to define the selected marker shape to be *Diamond*, *Line*, *Square*, or *Cross*. The default shape is *Diamond*.
- *Marker All Off* - Allows you to turn off all of the markers.

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

Measuring Band Power

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

1. Press the *Marker* key.
2. Press *Trace*, *Spectrum* to activate a marker on the instantaneous spectrum signal.
3. Press the *Spectrum Avg* key to activate a marker on the average spectrum trace.
4. Press *Function, Band Power*.
5. Two marker lines are activated at the extreme left side of the horizontal scale. Press *Normal* and move marker 1 to the desired place by rotating the *RPG* knob.

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

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

8. When the band power markers are active, the results are shown in the results window as `Mean Pwr (Between Mks)`. When the band power function is off the results window reads `Mean Pwr (Entire Trace)`.

Troubleshooting Hints

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

Making the Waveform (Time Domain) Measurement

Purpose

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

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

Measurement Method

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

This measurement is available for both the RF input and baseband I/Q inputs. For details on Baseband I/Q operation see the section on baseband I/Q measurements in the VSA E4406A Transmitter Tester User’s Guide.

Making the Measurement

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

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

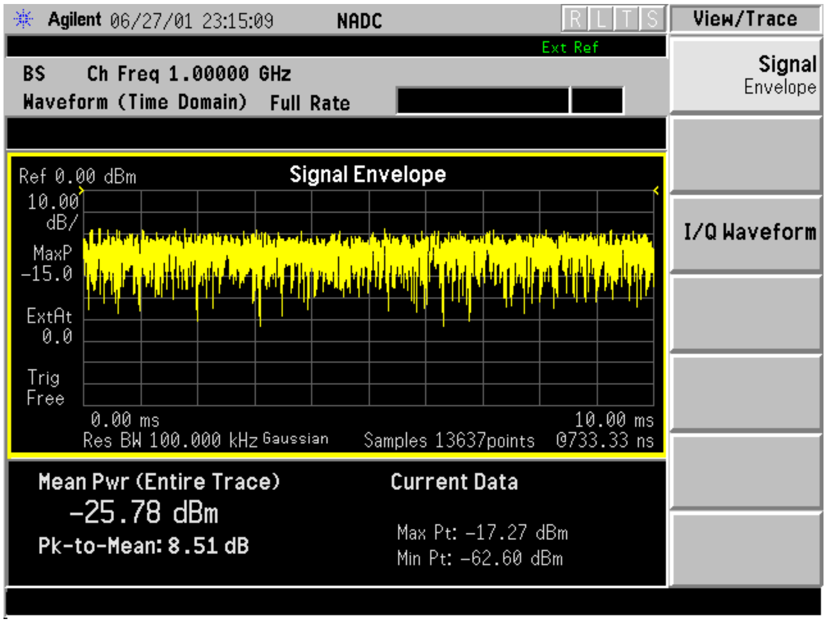
To change any of the measurement parameters from the factory default values, refer to the “Changing the Measurement Setup” section for this measurement.

When using the baseband I/Q inputs, set *Input Port* to *I/Q*, *I only*, or *Q only*, configure the *I/Q Setup* parameters, and supply the baseband I/Q signals to the front-panel I/Q inputs. The available trigger sources for this measurement includes *I/Q Level*.

Results

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

Figure 3-7 **Waveform Measurement - Signal Envelope View**



Agilent 06/27/01 23:15:09 NADC

Ext Ref

BS Ch Freq 1.00000 GHz

Waveform (Time Domain) Full Rate

Ref 0.00 dBm

10.00 dB/

MaxP -15.0

ExtAt 0.0

Trig Free

0.00 ms 10.00 ms

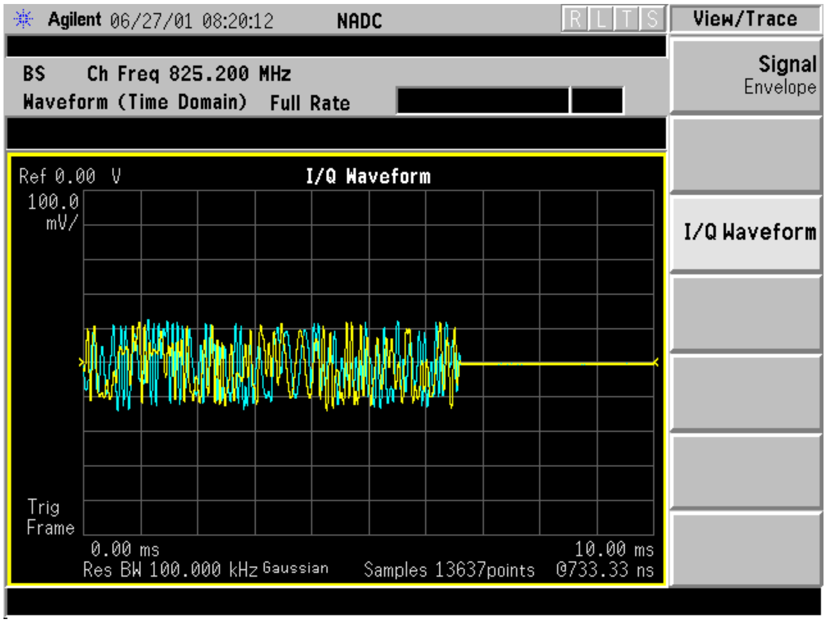
Res BW 100.000 kHz Gaussian Samples 13637points @733.33 ns

Mean Pwr (Entire Trace)
-25.78 dBm
Pk-to-Mean: 8.51 dB

Current Data
Max Pt: -17.27 dBm
Min Pt: -62.60 dBm

The next figure shows an example result when using the baseband I/Q inputs.

Figure 3-8 **Waveform Measurement - I/Q Waveform View**



Agilent 06/27/01 08:20:12 NADC

BS Ch Freq 825.200 MHz

Waveform (Time Domain) Full Rate

Ref 0.00 V

100.0 mV/

Res BW 100.000 kHz Gaussian

Samples 13637points @733.33 ns

R
L
T
S
View/Trace
Signal
Envelope
I/Q Waveform
I/Q Waveform
Trig
Frame
0.00 ms
10.00 ms

Changing the Measurement Setup

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

Table 3-4 **Waveform (Time Domain) Measurement Defaults**

Measurement Parameter	**Factory Default Condition**
View/Trace	RF Envelope
Sweep Time	10.00 ms
Res BW	100.000 kHz
Averaging:	
Avg Number	10; Off
Avg Mode	Exp
Avg Type	Pwr Avg (RMS)
Trig Source	Free Run (Immediate)
Signal Envelope View:	
SPAN X Scale - Scale/Div	200.0 µs
AMPLITUDE Y Scale - Scale/Div	10.00 dB
I /Q Waveform View:	
SPAN X Scale -Scale/Div	1 ms
AMPLITUDE Y Scale - Scale/Div	100.0 mV
Advanced	
Pre-ADC BPF	Off
RBW Filter	Gaussian
ADC Range	Auto
Data Packing	Auto
ADC Dither	Off
Decimation	Off

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

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

In addition, the following parameters can be modified:

- *Sweep Time* - Allows you to specify the measurement acquisition time which is used as the length of the time capture record. The range is 1.0 µs and 100.0 s, depending upon the resolution bandwidth setting and the available internal memory size for acquisition points.
- *Res BW* - Allows you to set the measurement bandwidth. The range is 10 Hz to 7.5 MHz. A larger bandwidth results in a larger number of acquisition points and reduces the maximum value allowed for the sweep time.
- *Advanced* - Allows you to access the menu to change the following parameters. Changes from the default values may result in invalid data.
    - — *Pre-ADC BPF* - Allows you to toggle the pre-ADC bandpass filter function between *On* or *Off*. The default setting is *Off*. The pre-ADC bandpass filter is useful for rejecting nearby signals, so that sensitivity within the span range can be improved by increasing the ADC range gain.
    - — *RBW Filter* - Allows you toggle the resolution bandwidth filter selection between *Flat* and *Gaussian*. If set to *Gaussian*, the filter provides more even time-domain response, particularly for “bursts”. If set to *Flat*, the filter provides a flatter bandwidth but is less accurate for “pulse responses”. A flat top filter also requires less memory and allows longer data acquisition times. For most waveform applications, the Gaussian filter is recommended.
    - — *ADC Range* - Allows you to access the menu to select one of the ADC ranging functions:
        - o *Auto* - Select this to cause the instrument to automatically adjust the signal range for optimal measurement results.
        - o *AutoPeak* - Select this to cause the instrument to continuously seek the highest peak signal.
        - o *AutoPeakLock* - Select this to cause the instrument to adjust the range for the highest peak signal it identifies, and retains the range settings determined by that peak signal, even when the peak signal is no longer present.
        - o *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 select *Auto* (the default) or the *Short (16 bit)*, *Medium (24 bit)* and *Long (32 bit)* methods of data packing. The short, medium, and long methods are not compatible with all settings and should not be used unless you are familiar with data packing methods. *Auto* is the preferred choice.
    - *Auto* - The data packing value most appropriate for current instrument settings is selected automatically.
    - *Short (16 bit)* - Select this to pack data every 16 bits.
    - *Medium (24 bit)* - Select this to pack data every 24 bits.
    - *Long (32 bit)* - Select this to pack data every 32 bits.
- *ADC Dither* - Allows you to toggle the ADC dither function between *On* and *Off*. The default setting is *Off*. If set to *On*, the ADC dither refers to the introduction of noise to the digitized steps of the analog-to-digital converter, and results in better amplitude linearity and resolution in low level signals. However, it also results in reduced dynamic range by approximately 3 dB.
- *Decimation* - Allows you to toggle the decimation function between *On* and *Off*, and to set the decimation value. Decimation allows longer acquisition times for a given bandwidth by eliminating data points. Long time captures can be limited by the instrument data acquisition memory. Decimation numbers 1 to 4 describe the factor by which the number of points are reduced. The default setting is 1, which results in no data point reduction.

Changing the View

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

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

Changing the Display

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

- *Scale/Div* - Allows you to set the horizontal scale by changing a time value per division. The range is 1.0 ns to 1.000 s per division with 0.01 ns resolution. The default setting is 200.0 µs per division. However, since *Scale Coupling* is defaulted to *On*, this value is automatically determined by the measurement result.
- *Ref Value* - Allows you to set the reference value ranging from –1.0 to 10.0 s. The default setting is 0.00 s. However, since *Scale Coupling* is defaulted to *On*, this value is automatically determined by the measurement results.
- *Ref Position* - Allows you to set the reference position to either *Left*, *Ctr* (center) or *Right*. The default setting is *Left*.
- *Scale Coupling* - Allows you to toggle the scale coupling function between *On* and *Off*. The default setting is *On*. Upon pressing the *Restart* front-panel key or *Restart* softkey under the *Meas Control* menu, this function automatically determines the scale per division and reference values based on the measurement results.

If the `Signal Envelope` window is active in the *Signal Envelope* view, the *AMPLITUDE Y Scale* key accesses the menu to modify the following parameters:

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

If the `Linear Envelope` window is active in the *Linear Envelope* view, the *AMPLITUDE Y Scale* key accesses the menu to modify the following parameters:

- *Scale/Div* - Allows you to set the vertical scale by changing an amplitude value per division. The range is 1.00 nV to 20.00 V per division. The default setting is 100.0 mV per division. However, since *Scale Coupling* is defaulted to *On*, this value is automatically determined by the measurement result.
- *Ref Value* - Allows you to set the reference value ranging from –250.00 to 250.00 V. The default setting is 0.00 V. However, since *Scale Coupling* is defaulted to *On*, this value is automatically determined by the measurement results.
- *Ref Position* - Allows you to set the reference position to either *Top*, *Ctr* (center) or *Bot* (bottom). The default setting is *Top*.
- *Scale Coupling* - Allows you to toggle the scale coupling function between *On* and *Off*. The default setting is *On*. Upon pressing the *Restart* front-panel key or *Restart* softkey under the *Meas Control* menu, this function automatically determines the scale per division and reference values based on the measurement results.

If the `Phase` window is active in the *Linear Envelope* view, the *AMPLITUDE Y Scale* key accesses the menu to modify the following parameters:

- *Scale/Div* - Allows you to set the vertical scale by changing an amplitude value per division. The range is 0.10 to 3600.0 deg per division. The default setting is 30.00 deg. However, since *Scale Coupling* is defaulted to *On*, this value is automatically determined by the measurement result.
- *Ref Value* - Allows you to set the reference value ranging from –36000.0 to 36000.0 deg. The default setting is 0.00 deg. However, since *Scale Coupling* is defaulted to *On*, this value is automatically determined by the measurement results.
- *Ref Position* - Allows you to set the reference position to either *Top*, *Ctr* (center) or *Bot* (bottom). The default setting is *Ctr*.
- *Scale Coupling* - Allows you to toggle the scale coupling function between *On* and *Off*. The default setting is *On*. Upon pressing the *Restart* front-panel key or *Restart* softkey under the *Meas Control* menu, this function automatically determines the scale per division and reference values based on the measurement results.

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

- *Scale/Div* - Allows you to set the vertical scale by changing an amplitude value per division. The range is 1.00 nV to 20.00 V per division. The default setting is 100.0 mV. However, since *Scale Coupling* is defaulted to *On*, this value is automatically determined by the measurement result.
- *Ref Value* - Allows you to set the reference value ranging from

–250.00 to 250.00 V. The default setting is 0.00 V. However, since *Scale Coupling* is defaulted to *On*, this value is automatically determined by the measurement results.

- *Ref Position* - Allows you to set the reference position to either *Top*, *Ctr* (center) or *Bot* (bottom). The default setting is *Ctr*.
- *Scale Coupling* - Allows you to toggle the scale coupling function between *On* and *Off*. The default setting is *On*. Upon pressing the *Restart* front-panel key or *Restart* softkey under the *Meas Control* menu, this function automatically determines the scale per division and reference values based on the measurement results.

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

Using the Markers

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

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

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

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

Troubleshooting Hints

Changes made 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 NADC Programming Commands

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

SCPI Command Subsystems

"CALCulate Subsystem" on page 111.

"CONFigure Subsystem" on page 132.

"DISPlay Subsystem" on page 133.

"FETCh Subsystem" on page 142.

"INSTrument Subsystem" on page 143.

"MEASure Group of Commands" on page 146.

"READ Subsystem" on page 167.

"SENSe Subsystem" on page 168.

"TRIGger Subsystem" on page 230.

CALCulate Subsystem

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

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

ACP - Limits

Adjacent Channel Power—Limit Test

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

`:CALCulate:ACP:LIMit:STATe?`

Turn limit test on or off.

Factory Preset and *RST:	On
Remarks:	You must be in Basic, cdmaOne, iDEN mode to use this command. Use INSTrument:SELect to set the mode.

Adjacent Channel Power—Limit Test

`:CALCulate:ACP:LIMit[:TEST] OFF|ON|0|1`

`:CALCulate:ACP:LIMit[:TEST]?`

Turn limit test on or off.

Factory Preset and *RST:	On
Remarks:	You must be in the NADC, cdmaOne, or PDC mode to use this command. Use INSTrument:SELect to set the mode.

Baseband I/Q - Spectrum I/Q Marker Query

`:CALCulate:SPECtrum:MARKer:IQ [1]|2|3|4?`

Reads out current I and Q marker values.

Remarks:	You must in the Basic, W-CDMA, cdma2000 mode to use this command. Use INSTrument:SELect to set the mode.
History:	Added revision A.05.00

Baseband I/Q - Waveform I/Q Marker Query

`:CALCulate:WAVeform:MARKer:IQ [1]|2|3|4?`

Reads out current I and Q marker values.

Remarks:	You must be in the Basic, W-CDMA, cdma2000 mode to use this command. Use INSTrument:SELect to set the mode.
History:	Added revision A.05.00

Test Current Results Against all Limits

`:CALCulate:CLIMits:FAIL?`

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

Data Query

`:CALCulate:DATA[n]?`

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

n = any valid sub-opcode for the current measurement. See the "MEASure Group of Commands" on page 146 for information on the data that can be returned for each measurement.

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

Calculate/Compress Trace Data Query

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

Returns compressed data for the designated trace data in the currently selected measurement. The command can be used with sub-opcodes (*n*) for measurements that return several types of trace data. The data is returned in the same units as the original trace. See the following table for the sub-opcodes for the trace names available in each measurement. For sub-opcodes that return scalar data use the :CALCulate:DATA[n]? command above.

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

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

BLOCk or block data - returns whole segments from the queried trace. For example, it could be used to return a portion of an input signal over several timeslots.

CFIT or 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 seconds) and the curve coefficients ((order + 1) values).

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

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

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

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

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

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

NOTE There is a more detailed example in the “Improving the Speed of Your Measurements” section in the E4406A programmer’s guide.

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

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

History: Added in revision A.03.00

Changed in revision A.05.00

Measurement	Available Traces	Markers Available?
ACP - adjacent channel power (Basic, cdmaOne, cdma2000, W-CDMA (3GPP), 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 (cdma2000, W-CDMA (3GPP) modes)	CDPower (n=2)[a] EVM (n=5)[a] MERRor (n=6)[a] PERRor (n=7)[a] SPOWer (n=9)[a] CPOWer (n=10)[a]	yes

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

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

EVM - Limits

Error Vector Magnitude—First 10 Symbols EVM Limit

`:CALCulate:EVM:LIMit:F10 <percent>`

`:CALCulate:EVM:LIMit:F10?`

Set the first 10 symbols EVM limit in percent. This functionality is only for mobile testing.

Factory Preset and *RST:	25.0%
Range:	0 to 50%
Remarks:	You must be in the NADC mode to use this command. Use INSTrument:SELect to set the mode.
History:	Version A.02.00 or later

Error Vector Magnitude—I/Q Origin Offset Error Limit

`:CALCulate:EVM:LIMit:IQOOffset <dB>`

`:CALCulate:EVM:LIMit:IQOOffset?`

Set the I/Q origin offset error limit in dB.

Factory Preset and *RST:	–20 dB
Range:	–100 dB to 0 dB
Remarks:	You must be in the NADC or PDC mode to use this command. Use INSTrument:SELect to set the mode.
History:	Version A.02.00 or later

Error Vector Magnitude—Peak EVM Limit

`:CALCulate:EVM:LIMit:PEAK <percent>`

`:CALCulate:EVM:LIMit:PEAK?`

Set the peak EVM limit in percent.

Factory Preset and *RST:	40.0%
Range:	0 to 50%
Remarks:	You must be in the NADC or PDC mode to use this command. Use INSTrument:SELect to set the mode.
History:	Version A.02.00 or later

Error Vector Magnitude—RMS EVM Limit

`:CALCulate:EVM:LIMit:RMS <percent>`

`:CALCulate:EVM:LIMit:RMS?`

Set the RMS EVM limit in percent.

Factory Preset and *RST:	12.5%
Range:	0 to 50%
Remarks:	You must be in the NADC or PDC mode to use this command. Use INSTrument:SELect to set the mode.
History:	Version A.02.00 or later

Error Vector Magnitude—Limit Test

`:CALCulate:EVM:LIMit[:TEST] OFF|ON|0|1`

`:CALCulate:EVM:LIMit[:TEST]?`

Turn limit test on or off.

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

Error Vector Magnitude—Time to Sync Word

`:CALCulate:EVM:TTSWord?`

Query returns the time between the trigger and the start of the first sync word.

Default Unit:	Seconds
Remarks:	You must be in the NADC or PDC mode to use this command. Use INSTrument:SELect to set the mode.
History:	Version A.03.00 or later

CALCulate:MARKers Subsystem

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

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

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

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

Basic Mode - <measurement> key words

- ACPr - no markers
- CHPower - no markers
- PSTATistic - markers available
- SPECtrum - markers available
- WAVeform - markers available

Service Mode - <measurement> key words

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

cdmaOne Mode - <measurement> key words

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

cdma2000 Mode - <measurement> key words

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

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

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

GSM Mode - <measurement> key words

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

iDEN Mode - <measurement> key words

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

NADC Mode - <measurement> key words

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

PDC Mode - <measurement> key words

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

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

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

W-CDMA (Trial & Arib) Mode - <measurement> key words

- ACP - no markers
- CDPower - markers available
- CHPower - no markers
- EVMQpsk - markers available
- PSTatistic - markers available
- RHO - markers available
- 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. Use the MEASure or READ command before using the marker command. This forces the measurement to complete before allowing the next command to be executed.

Markers All Off on All Traces

`:CALCulate:<measurement>:MARKer:AOFF`

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

Example:	`CALC:SPEC:MARK:AOFF`
Remarks:	The keyword for the current measurement must be specified in the command. (Some examples include: SPECtrum, WAVeform)
Front Panel Access:	**Marker, More, Marker All Off**

Marker Function

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

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

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

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

> Band Power – is the integrated power between the two markers for traces in the frequency domain and is the mean power between the two markers for traces in the time domain.
>
> Noise – is the noise power spectral density in a 1 Hz bandwidth. It is averaged over 32 horizontal trace points.
>
> Off – turns off the marker functions

Example:	`CALC:SPEC:MARK3:FUNC Noise`
Remarks:	The keyword for the current measurement must be specified in the command. (Some examples include: SPECtrum, WAVeform)
Front Panel Access:	**Marker, Marker Function**

Marker Function Result

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

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)

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: **Marker, Select** then **Marker Normal** or **Marker On Off**

Marker to Trace

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

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

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

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

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

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

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

Measurement	Available Traces	Markers Available?
ACP - adjacent channel power (Basic, cdmaOne, cdma2000, W-CDMA (3GPP), 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 (cdma2000, W-CDMA (3GPP) modes)	CDPower (n=2)[a] EVM (n=5)[a] MERRor (n=6)[a] PERRor (n=7)[a] SPOWer (n=9)[a] CPOWer (n=10)[a]	yes

Measurement	Available Traces	Markers Available?
CHPower - channel power (Basic, cdmaOne, cdma2000, W-CDMA (3GPP) modes)	SPECtrum (n=2)[a]	no markers
CSPur - spurs close (cdmaOne mode)	SPECtrum (n=2)[a] ULIMit (n=3)[a]	yes
EEVM - EDGE error vector magnitude (EDGE mode)	EVMerror (n=2)[a] MERRor (n=3)[a] PERRor (n=4)[a]	yes
EORFspectr - EDGE output RF spectrum (EDGE mode)	RFEMod (n=2)[a] RFESwitching (n=3)[a] SPEMod (n=4)[a] LIMMod (n=5)[a]	yes, only for a single offset yes, only for multiple offsets
EPVTime - EDGE power versus time (EDGE mode)	RFENvelope (n=2)[a] UMASk (n=3)[a] LMASk (n=4)[a]	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 (3GPP) modes)	EVM (n=2)[a] MERRor (n=3)[a] PERRor (n=4)[a]	yes
IM - intermodulation (cdma2000, W-CDMA (3GPP) modes)	SPECtrum (n=2)[a]	yes
MCPower - multi-carrier power (W-CDMA (3GPP) mode)	no traces	no markers
OBW - occupied bandwidth (cdmaOne, cdma2000, iDEN, PDC modes)	no traces	no markers

Measurement	Available Traces	Markers Available?
ORFSpectrum - output RF spectrum (GSM, EDGE mode)	RFEMod (n=2)[a] RFESwitching (n=3)[a] SPEMod (n=4)[a] LIMMod (n=5)[a]	yes, only for a single offset yes, only for multiple offsets
PFERror - phase and frequency error (GSM, EDGE mode)	PERRor (n=2)[a] PFERror (n=3)[a] RFENvelope (n=4)[a]	yes
PSTatistic - power statistics CCDF (Basic, cdma2000, W-CDMA (3GPP) modes)	MEASured (n=2)[a] GAUSian (n=3)[a] REFerence (n=4)[a]	yes
PVTime - power versus time (GSM, EDGE, Service modes)	RFENvelope (n=2)[a] UMASk (n=3)[a] LMASk (n=4)[a]	yes
RHO - modulation quality (cdmaOne, cdma2000, W-CDMA (3GPP) modes)	EVM (n=2)[a] MERRor (n=3)[a] PERRor (n=4)[a]	yes
SEMask - spectrum emissions mask (cdma2000, W-CDMA (3GPP) mode)	SPECtrum (n=2)[a]	yes
TSPur - transmit band spurs (GSM, EDGE mode)	SPECtrum (n=2)[a] ULIMit (n=3)[a]	yes
TXPower - transmit power (GSM, EDGE 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

Measurement	Available Traces	Markers Available?
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?`
Default Unit:	Matches the units of the trace on which the marker is positioned
Remarks:	The keyword for the current measurement must be specified in the command. (Some examples include: SPECtrum, WAVeform)

CONFigure Subsystem

The CONFigure commands are used with several other commands to control the measurement process. The full set of commands are described in the section “MEASure Group of Commands” on page 146.

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

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

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

Configure the Selected Measurement

`:CONFigure:<measurement>`

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

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

Configure Query

`:CONFigure?`

The CONFigure query returns the name of the current measurement.

DISPlay Subsystem

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

Adjacent Channel Power - View Selection

`:DISPlay:ACP:VIEW BGRaph|SPECtrum`

`:DISPlay:ACP:VIEW?`

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

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

Factory Preset and *RST:	Bar Graph (BGRaph)
Remarks:	You must be in the Basic, cdmaOne, cdma2000, W-CDMA (3GPP), W-CDMA (Trial & ARIB), NADC or PDC mode to use this command. Use INSTrument:SELect to set the mode.
Front Panel Access:	**ACP, View/Trace**

Turn the Display On/Off

`:DISPlay:ENABle OFF|ON|0|1`

`:DISPlay:ENABle?`

Controls the display. If enable is set to off, the display will appear to “freeze” in its current state. Measurements may run faster since the instrument doesn’t have to update the display after every data acquisition. There is often no need to update the display information when using remote operation. An instrument preset will turn the display back on.

Factory Preset and *RST:	On
Remarks:	The following key presses will turn display enable back on: 1. If in local, press any key

2. If in remote, press the local (system) key
3. If in local lockout, no key

Front Panel Access:	**System**, **Disp Updates** for VSA

Error Vector Magnitude - View Selection

`:DISPlay:EVMagnitude:VIEW POLar|CONStln|QUAD`

`:DISPlay:EVMagnitude:VIEW?`

Select the view of EVM measurement

Factory Preset and *RST:	POLar
Remarks:	You must be in the NADC or PDC mode to use this command. Use INSTrument:SELect to set the mode.

Turn the Display On/Off

`:DISPlay:ENABle OFF|ON|0|1`

`:DISPlay:ENABle?`

Controls the display. If enable is set to off, the display is blanked though the measurement continues to run. Measurements may run faster since the instrument doesn’t have to update the display after every data acquisition. There is often no need to update the display information when using remote operation. An instrument preset will turn the display back on.

Factory Preset and *RST:	On
Remarks:	The following key presses will turn display enable back on:

1. If in local, press any key
2. If in remote, press the local (system) key
3. If in local lockout, no key

Front Panel Access:	**System**, **Disp Updates** for VSA

Select Display Format

`:DISPlay:FORMat:TILE`

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

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

Select Display Format

`:DISPlay:FORMat:ZOOM`

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

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

Spectrum - Y-Axis Scale/Div

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

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

Sets the amplitude reference level for the y-axis.

n – selects the view, the default is Spectrum.

— n=1, m=1 Spectrum

— n=1, m=2 I/Q Waveform

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

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

— n=1, m=4 RF envelope (Service mode)

— n=2, m=1 I Waveform (Option B7C)

— n=2, m=2 Q Waveform (Option B7C)

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

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

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

Factory Preset: 10 dB per division, for Spectrum

Range:	.1 dB to 20 dB per division, for Spectrum
Default Unit:	10 dB per division, for Spectrum
Remarks:	May affect input attenuator setting. To use this command, the appropriate mode should be selected with INSTrument:SELect.
Front Panel Access:	When in Spectrum measurement: **Amplitude Y Scale, Scale/Div.**
History:	Modified revision A.05.00

Spectrum - Y-Axis Reference Level

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

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

Sets the amplitude reference level for the y-axis.

n – selects the view, the default is Spectrum.

- n=1, m=1 Spectrum
- n=1, m=2 I/Q Waveform
- n=1, m=2 I and Q Waveform (Basic, W-CDMA, cdma2000)
- n=1, m=3 numeric data (Service mode)
- n=1, m=4 RF envelope (Service mode)
- n=2, m=1 I Waveform (Option B7C)
- n=2, m=2 Q Waveform (Option B7C)
- n=3, m=1 I/Q Polar (Basic, W-CDMA, cdma2000)
- n=4, m=1 Linear Spectrum (Basic, W-CDMA, cdma2000)

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

Factory Preset:	0 dBm, for Spectrum
Range:	–250 to 250 dBm, for Spectrum
Default Unit:	dBm, for Spectrum
Remarks:	May affect input attenuator setting. 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 146 for more information about sub-opcodes.

Factory Preset: On

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

The trace name assignment is independent of the window number.

Remarks: 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 (3GPP), 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 (cdma2000, W-CDMA (3GPP) modes)	CDPower (n=2)[a] EVM (n=5)[a] MERRor (n=6)[a] PERRor (n=7)[a] SPOWer (n=9)[a] CPOWer (n=10)[a]	yes

Measurement	Available Traces	Markers Available?
CHPower - channel power (Basic, cdmaOne, cdma2000, W-CDMA (3GPP) modes)	SPECtrum (*n*=2)[a]	no markers
CSPur - spurs close (cdmaOne mode)	SPECtrum (*n*=2)[a] ULIMit (*n*=3)[a]	yes
EEVM - EDGE error vector magnitude (EDGE mode)	EVMerror (*n*=2)[a] MERRor (*n*=3)[a] PERRor (*n*=4)[a]	yes
EORFspectr - EDGE output RF spectrum (EDGE mode)	RFEMod (*n*=2)[a] RFESwitching (*n*=3)[a] SPEMod (*n*=4)[a] LIMMod (*n*=5)[a]	yes, only for a single offset yes, only for multiple offsets
EPVTime - EDGE power versus time (EDGE mode)	RFENvelope (*n*=2)[a] UMASk (*n*=3)[a] LMASk (*n*=4)[a]	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 (3GPP) modes)	EVM (*n*=2)[a] MERRor (*n*=3)[a] PERRor (*n*=4)[a]	yes
IM - intermodulation (cdma2000, W-CDMA (3GPP) modes)	SPECtrum (*n*=2)[a]	yes
MCPower - multi-carrier power (W-CDMA (3GPP) mode)	no traces	no markers
OBW - occupied bandwidth (cdmaOne, cdma2000, iDEN, PDC, W-CDMA (3GPP) modes)	no traces	no markers

Measurement	**Available Traces**	**Markers Available?**
ORFSpectrum - output RF spectrum (GSM, EDGE mode)	RFEMod (n=2)[a] RFESwitching (n=3)[a] SPEMod (n=4)[a] LIMMod (n=5)[a]	yes, only for a single offset yes, only for multiple offsets
PFERror - phase and frequency error (GSM, EDGE mode)	PERRor (n=2)[a] PFERror (n=3)[a] RFENvelope (n=4)[a]	yes
PSTatistic - power statistics CCDF (Basic, cdma2000, W-CDMA (3GPP) modes)	MEASured (n=2)[a] GAUSian (n=3)[a] REFerence (n=4)[a]	yes
PVTime - power versus time (GSM, EDGE, Service modes)	RFENvelope (n=2)[a] UMASk (n=3)[a] LMASk (n=4)[a]	yes
RHO - modulation quality (cdmaOne, cdma2000, W-CDMA (3GPP) modes)	EVM (n=2)[a] MERRor (n=3)[a] PERRor (n=4)[a]	yes
SEMask - spectrum emissions mask (cdma2000, W-CDMA (3GPP) modes)	SPECtrum (n=2)[a]	yes
TSPur - transmit band spurs (GSM, EDGE mode)	SPECtrum (n=2)[a] ULIMit (n=3)[a]	yes
TXPower - transmit power (GSM, EDGE 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

Measurement	**Available Traces**	**Markers Available?**
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 Scale/Div

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

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

Sets the scale per division for the y-axis.

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

n=1, m=1 RF envelope

n=2, m=1 I/Q Waveform

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

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

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

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

Factory Preset:	10 dBm, for RF envelope
Range:	.1 dB to 20 dB, for RF envelope
Default Unit:	dBm, for RF envelope
Remarks:	May affect input attenuator setting. To use this command, the appropriate mode should be selected with INSTrument:SELect.
Front Panel Access:	When in Waveform measurement: **Amplitude Y Scale, Scale/Div.**
History:	Modified revision A.05.00

Waveform - Y-Axis Reference Level

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

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

Sets the amplitude reference level for the y-axis.

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

n=1, m=1 RF envelope

n=2, m=1 I/Q Waveform

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

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

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

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

Factory Preset:	0 dBm, for RF envelope
Range:	–250 to 250 dBm, for RF envelope
Default Unit:	dBm, for RF envelope
Remarks:	May affect input attenuator setting. 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

The FETCh? commands are used with several other commands to control the measurement process. These commands are described in the section on the “MEASure Group of Commands” on page 146.

Fetch the Current Measurement Results

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

A FETCh? command must specify the desired measurement. It will return the valid results that are currently available, but will not initiate the taking of any new data. You can only fetch results from the measurement that is currently selected. The code number n selects the kind of results that will be returned. The available measurements and data results are described in the “MEASure Group of Commands” on page 146.

INSTrument Subsystem

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

Catalog Query

`:INSTrument:CATalog?`

Returns a comma separated list of strings which contains the names of all the installed applications. These names can only be used with the **`INST:SELECT`** command. If the optional keyword **`FULL`** is specified, each name is immediately followed by its associated instrument number. These instrument numbers can only be used with the **`INST:NSELect`** command.

Example:	INST:CAT?
	Query response: ”CDMA”4,”PNOISE”14

Select Application by Number

`:INSTrument:NSELect <integer>`

`:INSTrument:NSELect?`

Select the measurement mode by its instrument number. The actual available choices depends upon which applications are installed in the instrument. These instrument numbers can be obtained with **`INST:CATalog:FULL?`**

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

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

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

Example:	INST:NSEL 3
Factory Preset:	Persistent state with factory default of 1
Range:	1 to x, where x depends upon which applications are installed.
Front Panel Access:	**Mode**

Select Application

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

```
:INSTrument[:SELect]?
```

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

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

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

NOTE

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

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

Example:	INST:SEL GSM
Factory Preset:	Persistent state with factory default of Basic mode.
Front Panel Access:	**Mode**

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

CONFigure, FETCh, MEASure, READ Interactions

Measure Commands

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

This is a fast single-command way to make a measurement using the factory default instrument settings. These are the settings and units that conform to the Radio Standard that you have currently selected.

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

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

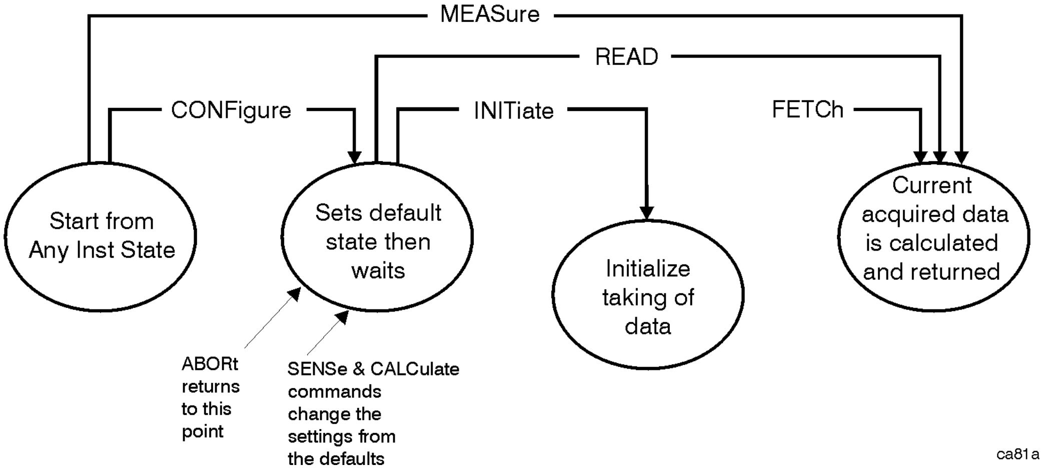
  ASCII is the default format for the data output. The binary data formats should be used for handling large blocks of data since they are smaller and faster then the ASCII format. Refer to the FORMat:DATA command for more information.

If you need to change some of the measurement parameters from the factory default settings you can set up the measurement with the CONFigure command. Use the commands in the SENSe:<measurement> and CALCulate:<measurement> subsystems to change the settings. Then you can use the READ? command to initiate the measurement and query the results. See Figure 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 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 1 **Measurement Group of Commands**


MEASure
READ
CONFigure
INITiate
FETCh
Start from Any Inst State
Sets default state then waits
Initialize taking of data
Current acquired data is calculated and returned
ABORt returns to this point
SENSe & CALCulate commands change the settings from the defaults
ca81a

Configure Commands

`:CONFigure:<measurement>`

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

NOTE In instruments with firmware older then A.05.00 CONFigure initiates the taking of data. The data should be ignored. Other SCPI commands can be processed immediately after sending CONFigure. You do not need to wait for the CONF command to complete this ’false’ data acquisition.

The CONFigure? query returns the current measurement name.

Fetch Commands

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

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

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

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

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

Read Commands

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

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

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

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

Adjacent Channel Power Ratio (ACP) Measurement

This measures the total rms power in the specified channel and in 5 offset channels. You must be in Basic, cdmaOne, cdma2000, W-CDMA (3GPP), W-CDMA (Trial & Arib), 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**, **ACP** or **ACPR** After the measurement is selected, press **Restore Meas Defaults** to restore factory defaults.

Measurement Results Available

Measurement Type	n	Results Returned
	0	Returns unprocessed I/Q trace data, as a series of 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 NADC and PDC mode	Returns 22 comma-separated scalar results, in the following order: 1. Center frequency – absolute power (dBm) 2. Center frequency – absolute power (W) 3. Negative offset frequency (1) – relative power (dB) 4. Negative offset frequency (1) – absolute power (dBm) 5. Positive offset frequency (1) – relative power (dB) 6. Positive offset frequency (1) – absolute power (dBm) . . . 21. Positive offset frequency (5) – relative power (dB) 22. Positive offset frequency (5) – absolute power (dBm)

Measurement Type	**n**	**Results Returned**
	not specified or n=1 iDEN mode	Returns 13 comma-separated scalar results, in the following order: 1. Center frequency – relative power (dB) 2. Center frequency – absolute power (dBm) 3. Lower offset frequency – relative power (dB) 4. Lower offset freq– absolute power (dBm) 5. Upper offset frequency – relative power (dB) 6. Upper offset frequency – absolute power (dBm) 7. Total power (dBm) 8. Offset frequency (Hz) 9. Reference BW (Hz) 10. Offset BW (Hz) 11. Carrier/center frequency (Hz) 12. Frequency span (Hz) 13. Average count
Total power reference	not specified or n=1 Basic, cdmaOne, cdma2000, W-CDMA (3GPP), or W-CDMA (Trial & Arib) mode	Returns 24 comma-separated scalar results, in the following order: 1. Upper adjacent chan center frequency - relative power (dB) 2. Upper adjacent chan center frequency - absolute power (dBm) 3. Lower adjacent chan center frequency - relative power (dB) (same as upper) 4. Lower adjacent chan center frequency - absolute power (dBm) (same as upper) 5. Negative offset frequency (1) - relative power (dB), 6. Negative offset frequency (1) - absolute power (dBm) 7. Positive offset frequency (1) - relative power (dB) 8. Positive offset frequency (1) - absolute power (dBm) . . . 23. Positive offset frequency (5) - relative power (dB) 24. Positive offset frequency (5) - absolute power (dBm)

Measurement Type	**n**	**Results Returned**
Power spectral density reference	not specified or n=1 Basic, cdmaOne, cdma2000, W-CDMA (3GPP), or W-CDMA (Trial & Arib) mode	Returns 24 comma-separated scalar results, in the following order: 1. Upper adjacent chan center frequency - relative power (dB) 2. Upper adjacent chan center frequency - absolute power (dBm/Hz) 3. Lower adjacent chan center frequency - relative power (dB) (same as upper) 4. Lower adjacent chan center frequency - absolute power (dBm/Hz) (same as upper) 5. Negative offset frequency (1) - relative power (dB) 6. Negative offset frequency (1) - absolute power (dBm/Hz) 7. Positive offset frequency (1) - relative power (dB) 8. Positive offset frequency (1) - absolute power (dBm/Hz) . . . 23. Positive offset frequency (5) - relative power (dB) 24. Positive offset frequency (5) - absolute power (dBm/Hz)
	2 NADC and PDC mode	Returns 10 comma-separated scalar values of the pass/fail (0=passed, or 1=failed) results determined by testing the absolute power of the offset frequencies: 1. Negative offset frequency (1) absolute power 2. Positive offset frequency (1) absolute power . . . 9. Negative offset frequency (5) absolute power 10. Positive offset frequency (5) absolute power
	2 iDEN mode	Returns 3 comma-separated scalar values of the histogram absolute power trace: 1. Lower offset frequency – absolute power 2. Reference frequency – absolute power 3. Upper offset frequency – absolute power
Total power reference	2 Basic, cdmaOne, cdma2000, W-CDMA (3GPP), or W-CDMA (Trial & Arib) mode	Returns 11 comma-separated scalar values (in dBm) corresponding to the total power histogram display. The values are returned in ascending frequency order: 1. Negative offset frequency (5) 2. Negative offset frequency (4) . . . 6. Center frequency 7. Positive offset frequency (1) . . . 11. Positive offset frequency (5)

Measurement Type	n	Results Returned
	3 NADC and PDC mode	Returns 10 comma-separated scalar values of the pass/fail (0=passed, or 1=failed) results determined by testing the relative power of the offset frequencies: 1. Negative offset frequency (1) relative power 2. Positive offset frequency (1) relative power . . . 9. Negative offset frequency (5) relative power 10. Positive offset frequency (5) relative power
	3 iDEN mode	Returns 3 comma-separated scalar values of the histogram relative power trace: 1. Lower offset frequency – relative power 2. Reference frequency – relative power 3. Upper offset frequency – relative power
Power spectral density reference	3 Basic, cdmaOne, cdma2000, W-CDMA (3GPP), or W-CDMA (Trial & Arib) mode	Returns 11 comma-separated scalar values (in dBm/Hz) corresponding to the power spectral density histogram display. The values are returned in ascending frequency order: 1. Negative offset frequency (5) 2. Negative offset frequency (4) . . . 6. Center frequency 7. Positive offset frequency (1) . . . 11. Positive offset frequency (5)
	4 NADC and PDC mode	Returns the frequency-domain spectrum trace (data array) for the entire frequency range being measured. In order to return spectrum data, the ACP display must be in the spectrum view and you must not turn off the spectrum trace.
	4 iDEN mode	Returns 4 comma-separated absolute power results for the reference and offset channels. 1. Reference channel – absolute power 2. Reference channel – absolute power (duplicate of above) 3. Lower offset channel – absolute power 4. Upper offset channel – absolute power

Measurement Type	**n**	**Results Returned**
(For cdma2000 and W-CDMA the data is only available with spectrum display selected)	4 Basic, cdmaOne, cdma2000, W-CDMA (3GPP), or W-CDMA (Trial & Arib) mode	Returns the frequency-domain spectrum trace data for the entire frequency range being measured. With the spectrum view selected (DISPlay:ACP:VIEW SPECtrum) and the spectrum trace on (SENSe:ACP:SPECtrum:ENABle): • In FFT mode (SENSe:ACP:SWEep:TYPE FFT) the number of trace points returned are 343 (cdma2000) or 1715 (W-CDMA). This is with the default span of 5 MHz (cdma2000) or 25 MHz (W-CDMA). The number of points also varies if another offset frequency is set. • In sweep mode (SENSe:ACP:SWEep:TYPE SWEep), the number of trace points returned is 601 (for cdma2000 or W-CDMA) for any span. With bar graph display selected, one point of –999.0 will be returned.
	5 iDEN mode	Returns 4 comma-separated relative power values for the reference and offset channels: 1. Reference channel – relative power 2. Reference channel – relative power (duplicate of above) 3. Lower offset channel – relative power 4. Upper offset channel – relative power
Total power reference	5 Basic, cdmaOne, cdma2000, W-CDMA (3GPP), or W-CDMA (Trial & Arib) mode	Returns 12 comma-separated scalar values (in dBm) of the absolute power of the center and the offset frequencies: 1. Upper adjacent chan center frequency 2. Lower adjacent chan center frequency 3. Negative offset frequency (1) 4. Positive offset frequency (1) . . . 11. Negative offset frequency (5) 12. Positive offset frequency (5)
Power spectral density reference	5 Basic, cdmaOne, cdma2000, W-CDMA (3GPP), or W-CDMA (Trial & Arib) mode	Returns 12 comma-separated scalar values (in dBm/Hz) of the absolute power of the center and the offset frequencies: 1. Upper adjacent chan center frequency 2. Lower adjacent chan center frequency 3. Negative offset frequency (1) 4. Positive offset frequency (1) . . . 11. Negative offset frequency (5) 12. Positive offset frequency (5)

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: 1. Reference channel absolute power pass/fail 2. Reference channel absolute power pass/fail (duplicate of above) 3. Lower offset channel absolute power pass/fail 4. Upper offset channel absolute power pass/fail
Total power reference	6 Basic, cdmaOne, cdma2000, W-CDMA (3GPP), or W-CDMA (Trial & Arib) mode	Returns 12 comma-separated scalar values (total power in dB) of the power relative to the carrier at the center and the offset frequencies: 1. Upper adjacent chan center frequency 2. Lower adjacent chan center frequency 3. Negative offset frequency (1) 4. Positive offset frequency (1) 5. Negative offset frequency (5) . . . 11. Negative offset frequency (5) 12. Positive offset frequency (5)
Power spectral density reference	6 Basic, cdmaOne, cdma2000, W-CDMA (3GPP), or W-CDMA (Trial & Arib) mode	Returns 12 comma-separated scalar values (power spectral density in dB) of the power relative to the carrier at the center and offset frequencies: 1. Upper adjacent chan center frequency 2. Lower adjacent chan center frequency 3. Negative offset frequency (1) 4. Positive offset frequency (1) . . . 11. Negative offset frequency (5) 12. Positive offset frequency (5)
	7 iDEN mode	Returns 4 comma-separated pass/fail test results for the relative power of the reference and offset channels: 1. Reference channel relative power pass/fail 2. Reference channel relative power pass/fail (duplicate of above) 3. Lower offset channel relative power pass/fail 4. Upper offset channel relative power pass/fail

Measurement Type	**n**	**Results Returned**
Total power reference	7 Basic, cdmaOne, cdma2000, W-CDMA (3GPP), or W-CDMA (Trial & Arib) mode	Returns 12 comma-separated scalar values of the pass/fail (0=passed, or 1=failed) results determined by testing the absolute power limit of the center and offset frequencies (measured as total power in dB): 1. Upper adjacent chan center frequency 2. Lower adjacent chan center frequency 3. Negative offset frequency (1) 4. Positive offset frequency (1) . . . 11. Negative offset frequency (5) 12. Positive offset frequency (5)
Power spectral density reference	7 Basic, cdmaOne, cdma2000, W-CDMA (3GPP), or W-CDMA (Trial & Arib) mode	Returns 12 comma-separated scalar values of the pass/fail (0=passed, or 1=failed) results determined by testing the absolute power limit of the center and offset frequencies (measured as power spectral density in dB): 1. Upper adjacent chan center frequency 2. Lower adjacent chan center frequency 3. Negative offset frequency (1) 4. Positive offset frequency (1) . . . 11. Negative offset frequency (5) 12. Positive offset frequency (5)
Total power reference	8 Basic, cdmaOne, cdma2000, W-CDMA (3GPP), or W-CDMA (Trial & Arib) mode	Returns 12 comma-separated scalar values of the pass/fail (0=passed, or 1=failed) results determined by testing the power limit relative to the center frequency (measured as total power spectral in dB): 1. Upper adjacent chan center frequency 2. Lower adjacent chan center frequency 3. Negative offset frequency (1) 4. Positive offset frequency (1) . . . 11. Negative offset frequency (5) 12. Positive offset frequency (5)

Measurement Type	**n**	**Results Returned**
Power spectral density reference	8 Basic, cdmaOne, cdma2000, W-CDMA (3GPP), or W-CDMA (Trial & Arib) mode	Returns 12 comma-separated scalar values of the pass/fail (0=passed, or 1=failed) results determined by testing the power limit relative to the center frequency (measured as power spectral density in dB): 1. Upper adjacent chan center frequency 2. Lower adjacent chan center frequency 3. Negative offset frequency (1) 4. Positive offset frequency (1) . . . 11. Negative offset frequency (5) 12. Positive offset frequency (5)

Error Vector Magnitude Measurement

This measures the vector error of the magnitude of each symbol. You must be in the 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:EVM commands for more measurement related commands.

:CONFigure:EVM

:FETCh:EVM[n]?

:READ:EVM[n]?

:MEASure:EVM[n]?

History:	Version A.02.00 or later
Front Panel Access:	**Measure, EVM** 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.

n	Results Returned
1 (default) EDGE GSM mode	Returns the following 8 comma-separated scalar results, in order. 1. RMS EVM – a floating point number (in percent) of EVM over the entire measurement area. 2. Peak EVM error – a floating point number (in percent) of the peak EVM in the measurement area. 3. Symbol position of the peak EVM error – an integer number of the symbol position where the peak EVM error is detected. 4. First 10 symbols EVM error – a floating point number (in percent) of EVM over the first 10 symbols. 5. Magnitude error – a floating point number (in percent) of average magnitude error over the entire measurement area. 6. Phase error – a floating point number (in degree) of average phase error over the entire measurement area. 7. Frequency error – a floating point number (in Hz) of the frequency error in the measured signal. 8. I/Q origin offset – a floating point number (in dB) of the I and Q error (magnitude squared) offset from the origin.
1 (default) NADC mode	Returns the following 8 comma-separated scalar results, in order. 1. RMS EVM – a floating point number (in percent) of EVM over the entire measurement area. 2. Peak EVM error – a floating point number (in percent) of the peak EVM in the measurement area. 3. Symbol position of the peak EVM error – an integer number of the symbol position where the peak EVM error is detected. 4. First 10 symbols EVM error – a floating point number (in percent) of EVM over the first 10 symbols. 5. Magnitude error – a floating point number (in percent) of average magnitude error over the entire measurement area. 6. Phase error – a floating point number (in degree) of average phase error over the entire measurement area. 7. Frequency error – a floating point number (in Hz) of the frequency error in the measured signal. 8. I/Q origin offset – a floating point number (in dB) of the I and Q error (magnitude squared) offset from the origin.

n	Results Returned
1 (default) PDC mode	Returns the following 7 comma-separated scalar results, in order. 1. RMS EVM – a floating point number (in percent) of EVM over the entire measurement area. 2. Peak EVM error – a floating point number (in percent) of peak EVM in the measurement area. 3. Symbol position of the peak EVM error – an integer number of the symbol position where the peak EVM error is detected. 4. Magnitude error – a floating point number (in percent) of average magnitude error over the entire measurement area. 5. Phase error – a floating point number (in degree) of average phase error over the entire measurement area. 6. Frequency error – a floating point number (in Hz) of the frequency error in the measured signal. 7. I/Q origin offset – a floating point number (in dB) of the I and Q error (magnitude squared) offset from the origin.
2	Returns series of floating point numbers (in percent) that represent each sample in the EVM trace. The first number is the symbol 0 decision point and there are 5 points per symbol. Therefore, the decision points are at 0, 5, 10, 15. . . .
3	Returns series of floating point numbers (in percent) that represent each sample in the magnitude error trace. The first number is the symbol 0 decision point and there are 5 points per symbol. Therefore, the decision points are at 0, 5, 10, 15. . . .
4	Returns series of floating point numbers (in degree) that represent each sample in the phase error trace. The first number is the symbol 0 decision point and there are 5 points per symbol. Therefore, the decision points are at 0, 5, 10, 15. . . .
5	Returns series of floating point numbers that alternately represent I and Q pairs of the corrected measured trace. The magnitude of each I and Q pair are normalized to 1.0. The first number is the in-phase (I) sample of symbol 0 decision point and the second is the quadrature-phase (Q) sample of symbol 0 decision point. As in the EVM, there are 5 points per symbol, so the series of numbers is: 1st number = I of the symbol 0 decision point 2nd number = Q of the symbol 0 decision point . . . (2 × 5) + 1 (or 11th) number = I of the symbol 1 decision point (2 × 5) + 2 (or 12th) number = Q of the symbol 1 decision point . . . (2 × 5) × N + 1 number = I of the symbol N decision point (2 × 5) × N + 2 number = Q of the symbol N decision point

n	**Results Returned**
6 NADC mode	Returns the following 4 comma-separated scalar values of 1 or 0, in the order given. The pass/fail results (0=passed, or 1=failed) are determined by testing the EVM, peak EVM, first 10 symbols EVM and IQ origin offsets. Test result of EVM Test result of peak EVM Test result of first 10 symbols EVM Test result of IQ origin offset
6 PDC mode	Returns the following 3 comma-separated scalar values of 1 or 0, in the order given. The pass/fail results (0=passed, or 1=failed) are determined by testing the EVM, peak EVM, and IQ origin offsets. Test result of EVM Test result of peak EVM Test result of IQ origin offset

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. The number of points doubles if the data is complex instead of real. See the time domain scaler description below. 7. **First time point** is the time of the first time domain point, where time zero is the trigger event. 8. **Time spacing** is the time spacing between the time domain points. The time spacing value doubles if the data is complex instead of real. See the time domain scaler description below. 9. **Time domain** returns a 1 if time domain is complex (I/Q) and complex data will be returned. It returns a 0 if the data is real. (raw ADC samples) When this value is 1 rather than 0 (complex vs. real data), the time domain points and the time spacing scalers both increase by a factor of two. 10. **Scan time** is the total scan time of the time domain trace used for the FFT. The total scan time = (time spacing) X (time domain points – 1) 11. **Current average count** is the current number of data measurements that have already been combined, in the averaging calculation.
2, **Service** mode only	Returns the trace data of the log-magnitude versus time. (That is, the RF envelope.)
3	Returns the I and Q trace data. It is represented by I and Q pairs (in volts) versus time.
4	Returns spectrum trace data. That is, the trace of log-magnitude versus frequency. (The trace is computed using a FFT.)
5, **Service** mode only	Returns the averaged trace data of log-magnitude versus time. (That is, the RF envelope.)
6	Not used.
7	Returns the averaged spectrum trace data. That is, the trace of the averaged log-magnitude versus frequency.
8	Not used.
9, **Service** mode only	Returns a trace containing the shape of the FFT window.
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

The READ? commands are used with several other commands and are documented in the section on the "MEASure Group of Commands" on page 146.

Initiate and Read Measurement Data

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

A READ? query must specify the desired measurement. It will cause a measurement to occur without changing any of the current settings and will return any valid results. The code number n selects the kind of results that will be returned. The available measurements and data results are described in the "MEASure Group of Commands" on page 146.

SENSe Subsystem

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

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

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 146. The equivalent front panel keys for the parameters described in the following commands, are found under the **Meas Setup** key, after the **ACP** or **ACPR** measurement has been selected from the **MEASURE** key menu.

Adjacent Channel Power—Average Count

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

```
[:SENSe]:ACP:AVERage:COUNt?
```

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

Factory Preset and *RST:	10 for cdma2000, W-CDMA (3GPP), W-CDMA (Trial & Arib) 20 for Basic, cdmaOne, iDEN
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 (3GPP), W-CDMA (Trial & Arib) EXPonential for NADC, PDC, iDEN
Remarks:	Use INSTrument:SELect to set the mode.

Adjacent Channel Power—Type of Carrier Averaging

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

`[:SENSe]:ACP:AVERage:TYPE?`

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

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

Adjacent Channel Power—Carrier Channel BW

Basic, cdmaOne, iDEN mode

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

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

cdma2000, W-CMDA (3GPP) mode

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

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

cdmaOne, W-CMDA (Trial & Arib) mode

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

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

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

BANDwidth[n]|BWIDth[n]:

m=1 is base station and 2 is mobiles. The default is base station (1).

INTegration[n]:

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

W-CDMA (Trial & Arib) 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	1.23 MHz		
W-CDMA (3GPP)	3.84 MHz		
W-CDMA (Trial & Arib)	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 (3GPP), W-CDMA (Trial & Arib) 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 (3GPP), W-CDMA (Trial & Arib), iDEN mode to use this command. Use INSTrument:SELect to set the mode.

Adjacent Channel Power—Reference Channel FFT Segments

`[:SENSe]:ACP:FFTSegment <integer>`

`[:SENSe]:ACP:FFTSegment?`

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

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

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

Adjacent Channel Power—Reference Channel FFT Segments State

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

`[:SENSe]:ACP:FFTSegment:AUTO?`

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

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

Adjacent Channel Power—Frequency Span Query

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

Returns the span of the spectrum view.

Remarks:	You must be in Basic, cdmaOne mode to use this command. Use INSTrument:SELect to set the mode. MEAS|READ|FETC:ACP4? returns the frequency-domain spectrum trace data for the entire frequency range being measured..
History:	Revision A.05.00 or later

Adjacent Channel Power—Offset Frequency Absolute Limit

`[:SENSe]:ACP:LIST:ALIMit <abs_powr>,<abs_powr>,<abs_powr>,<abs_powr>,<abs_powr>`

`[:SENSe]:ACP:LIST:ALIMit?`

Set the absolute limit on offset frequencies relative to the carrier. You can turn off (not use) specific offsets with the [:SENSe]:ACP:LIST:STATe command.

Factory Preset and *RST:

Mode	Offset A	Offset B	Offset C	Offset D	Offset E
NADC	0 dBm	0 dBm	–13 dBm	0 dBm	0 dBm
PDC	0 dBm	0 dBm	0 dBm	0 dBm	0 dBm

Range:	–200 to 50 dBm
Remarks:	You must be in the NADC, cdmaOne, or PDC mode to use this command. Use INSTrument:SELect to set the mode.

Adjacent Channel Power—Offset Frequency

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

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

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

Factory Preset
and *RST:

Mode	Offset A	Offset B	Offset C	Offset D	Offset E
NADC	30 kHz	60 kHz	90 kHz	120 kHz	0 Hz
PDC	50 kHz	100 kHz	0 kHz	0 kHz	0 kHz

Range:	10 Hz to 45 MHz
	0 to 200 kHz
Default Unit:	Hz
Remarks:	You must be in the NADC, cdmaOne, or PDC mode to use this command. Use INSTrument:SELect to set the mode.

Adjacent Channel Power—Offset Frequency Power Mode

```
[:SENSe]:ACP:LIST:POWer
INTeg|PEAK,INTeg|PEAK,INTeg|PEAK,INTeg|PEAK,INTeg|PEAK
```

```
[:SENSe]:ACP:LIST:POWer?
```

Define the power measurement mode for each of the offset frequencies. You can turn off (not use) specific offsets with the SENS:ACP:LIST:STATe command.

Factory Preset and *RST:	INTeg, INTeg, INTeg, INTeg, INTeg
Remarks:	You must be in the NADC mode to use this command. Use INSTrument:SELect to set the mode.

Adjacent Channel Power—Offset Frequency Relative Limit

```
[:SENSe]:ACP:LIST:RLIMit
<rel_powr>,<rel_powr>,<rel_powr>,<rel_powr>,<rel_powr>
```

```
[:SENSe]:ACP:LIST:RLIMit?
```

Set the relative limit on offset frequencies. You can turn off (not use) specific offsets with the SENS:ACP:LIST:STATe command.

Factory Preset
and *RST: –45 dB

Mode	Offset A	Offset B	Offset C	Offset D	Offset E
NADC	–26 dB	–45 dB	–45 dB	0 dB	0 dB
PDC	–45 dB	–60 dB	0 dB	0 dB	0 dB

Range: –200 to 50 dB

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

Adjacent Channel Power—Offset Frequency Control

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

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

Turn measurement on or off for the custom offset frequencies.

Factory Preset
and *RST:

Mode	Offset A	Offset B	Offset C	Offset D	Offset E
NADC	ON	ON	ON	OFF	OFF
PDC	ON	ON	OFF	OFF	OFF

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

Adjacent Channel Power—Offset Frequency Test Mode

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

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

Define the type of testing to be done for the five custom offset frequencies. You can turn off (not use) specific offsets with the SENS:ACP:LIST:STATe command.

Factory Preset
and *RST: RELative, RELative, OR, AND, AND for NADC, PDC mode

Remarks:	You must be in the NADC, cdmaOne, or PDC 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, cdmaOne

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

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

cdma2000, W-CDMA (3GPP) mode

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

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

W-CDMA (Trial & Arib) mode

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

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

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

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

The query returns 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[m]	
cdmaOne mode	m=1 is cellular bands and 2 is pcs bands. The default is cellular.
W-CDMA (Trial & Arib) mode	m=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 (3GPP)		50 dBm	50 dBm	50 dBm	50 dBm	50 dBm
W-CDMA (Trial & Arib)		50 dBm	50 dBm	50 dBm	50 dBm	50 dBm
iDEN		0 dBm	n/a	n/a	n/a	n/a

Range: –200.0 dBm to 50.0 dBm

Default Unit: dBm

Remarks: You must be in Basic, cdmaOne, cdma2000, W-CDMA (3GPP), W-CDMA (Trial & Arib), or iDEN mode to use this command. Use INSTrument:SELect to set the mode.

Adjacent Channel Power—Type of Offset Averaging

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

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

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

Factory Preset
and *RST:

Mode	**Offset A**	**Offset B**	**Offset C**	**Offset D**	**Offset E**
Basic & cdmaOne	RMS	RMS	RMS	RMS	RMS

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

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

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?`

cdma2000, W-CDMA (3GPP) mode

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

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

cdmaOne, W-CDMA (Trial & Arib) mode

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

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

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

Offset[n]	n=1 is base station and 2 is mobiles. The default is base station (1).
List[n]	
cdmaOne mode	n=1 is cellular bands and 2 is pcs bands. The default is cellular.
W-CDMA (Trial & Arib) 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 (3GPP)		3.84 MHz	3.84 MHz	3.84 MHz	3.84 MHz	3.84 MHz
W-CDMA (Trial & Arib)	3GPP	3.84 MHz	3.84 MHz	3.84 MHz	3.84 MHz	3.84 MHz
	Trial, ARIB	4.096 MHz	4.096 MHz	4.096 MHz	4.096 MHz	4.096 MHz

Range:	300 Hz to 20 MHz for cdmaOne, Basic, cdma2000, W-CDMA (3GPP), or W-CDMA (Trial & Arib) mode 1 kHz to 5 MHz for iDEN mode
Default Unit:	Hz
Remarks:	You must be in Basic, cdmaOne, cdma2000, W-CDMA (3GPP), W-CDMA (Trial & Arib), or iDEN mode to use this command. Use INSTrument:SELect to set the mode.

Adjacent Channel Power—FFT Segments

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

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

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

Factory Preset
and *RST:

Mode	**Offset A**	**Offset B**	**Offset C**	**Offset D**	**Offset E**
Basic & cdmaOne	1	1	1	1	1

Range: 1 to 12

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

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

Adjacent Channel Power—Automatic FFT Segments

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

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

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

Factory Preset
and *RST:

Mode	**Offset A**	**Offset B**	**Offset C**	**Offset D**	**Offset E**
Basic & cdmaOne	ON	ON	ON	ON	ON

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

History: Revision A.03.00 or later

Adjacent Channel Power—Define Offset Frequency List

iDEN mode

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

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

Basic mode, cdmaOne

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

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

cdma2000, W-CDMA (3GPP) mode

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

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

cdmaOne, W-CDMA (Trial & Arib) mode

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

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

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

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

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

List[n]

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

W-CDMA (Trial & Arib) 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	750 kHz	1.98 MHz	0 Hz	0 Hz	0 Hz
	MS	885 kHz	1.98 MHz	0 Hz	0 Hz	0 Hz

Mode	Variant	Offset A	Offset B	Offset C	Offset D	Offset E
W-CDMA (3GPP)		5 MHz	10 MHz	15 MHz	20 MHz	25 MHz
W-CDMA (Trial & Arib)		5 MHz	10 MHz	15 MHz	20 MHz	25 MHz

Range:	0 Hz to 20 MHz for iDEN, Basic 0 Hz to 45 MHz for cdmaOne 0 Hz to 100 MHz for cdma2000, W-CDMA (3GPP), W-CDMA (Trial & Arib)
Default Unit:	Hz
Remarks:	You must be in Basic, cdmaOne, cdma2000, W-CDMA (3GPP), W-CDMA (Trial & Arib), or iDEN mode to use this command. Use INSTrument:SELect to set the mode.

Adjacent Channel Power—Number of Measured Points

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

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

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

Factory Preset
and *RST:

Mode	Offset A	Offset B	Offset C	Offset D	Offset E
Basic & cdmaOne	1024	1024	1024	1024	1024

Range:	64 to 65536
Remarks:	The fastest measurement times are obtained when the number of points measured is 2^n. You must be in Basic, cdmaOne mode to use this command. Use INSTrument:SELect to set the mode.

Adjacent Channel Power—Automatic Measurement Points

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

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

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

Factory Preset and *RST:

Mode	Offset A	Offset B	Offset C	Offset D	Offset E
Basic & cdmaOne	ON	ON	ON	ON	ON

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

Adjacent Channel Power—Relative Attenuation

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

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

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

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

Factory Preset and *RST:

Mode	Offset A	Offset B	Offset C	Offset D	Offset E
Basic & cdmaOne	0 dB	0 dB	0 dB	0 dB	0 dB

Range: –40 to 0 dB, but this relative attenuation cannot exceed the absolute attenuation range of 0 to 40 dB.

Default Unit: dB

Remarks:	Remember that the attenuation that you specify is always relative to the amount of attenuation used for the carrier channel. Selecting negative attenuation means that you want less attenuation used. For example, if the measurement must use 20 dB of attenuation for the carrier measurement and you want to use 12 dB less attenuation for the first offset, you would send the value –12 dB. You must be in Basic or cdmaOne mode to use this command. Use INSTrument:SELect to set the mode.

Adjacent Channel Power—Relative Attenuation Control

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

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

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

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

Factory Preset and *RST:	ON
Remarks:	You must be in Basic or cdmaOne 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, cdmaOne

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

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

cdma2000, W-CDMA (3GPP) mode

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

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

cdmaOne, W-CDMA (Trial & Arib) mode

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

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

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

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

The query returns 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.
W-CDMA (Trial & Arib) 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
cdma2000		0 dBc	0 dBc	0 dBc	0 dBc	0 dBc
W-CDMA (3GPP)	BTS	–44.2 dBc	–49.2 dBc	–49.2 dBc	–49.2 dBc	–44.2 dBc
	MS	–32.2 dBc	–42.2 dBc	–42.2 dBc	–42.2 dBc	–42.2 dBc
W-CDMA (Trial & Arib)		0 dBc	0 dBc	0 dBc	0 dBc	0 dBc

Range:	–150.0 dB to 50.0 dB for cdmaOne, cdma2000, W-CDMA (3GPP), W-CDMA (Trial & Arib), Basic –200.0 dB to 50.0 dB for iDEN
Default Unit:	dB
Remarks:	You must be in Basic, cdmaOne, cdma2000, W-CDMA (3GPP), W-CDMA (Trial & Arib), or iDEN mode to use this command. Use INSTrument:SELect to set the mode.

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

iDEN mode

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

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

Basic mode, cdmaOne

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

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

cdma2000, W-CDMA (3GPP) mode

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

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

cdmaOne, W-CDMA (Trial & Arib) mode

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

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

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

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

The query returns 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.

W-CDMA (Trial & Arib) 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 (3GPP)	BTS	–44.2 dBc	–49.2 dBc	–49.2 dBc	–49.2 dBc	–44.2 dBc
	MS	–32.2 dBc	–42.2 dBc	–42.2 dBc	–42.2 dBc	–42.2 dBc
W-CDMA (Trial & Arib)		0 dB	0 dB	0 dB	0 dB	0 dB

Range: –150.0 dB to 50.0 dB for cdmaOne, Basic, cdma2000, W-CDMA (3GPP), W-CDMA (Trial & Arib)

–200.0 dB to 50.0 dB for iDEN

Default Unit: dB

Remarks: You must be in Basic, cdmaOne, cdma2000, W-CDMA (3GPP), W-CDMA (Trial & Arib), or iDEN mode to use this command. Use INSTrument:SELect to set the mode.

Adjacent Channel Power—Select Sideband

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

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

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

Factory Preset
and *RST:

Mode	**Offset A**	**Offset B**	**Offset C**	**Offset D**	**Offset E**
Basic & cdmaOne	BOTH	BOTH	BOTH	BOTH	BOTH

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

Adjacent Channel Power—Control Offset Frequency List

Basic mode, cdmaOne

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

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

cdma2000, W-CDMA (3GPP) mode

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

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

cdmaOne, W-CDMA (Trial & Arib) mode

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

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

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

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.

W-CDMA (Trial & Arib) 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		On	On	On	On	On
cdmaOne	BS cellular	On	On	On	On	On
	BS pcs	On	On	On	On	On
	MS cellular	On	On	On	On	On
	MS pcs	On	On	On	On	On
cdma2000		On	On	Off	Off	Off
W-CDMA (3GPP)		On	On	Off	Off	Off
W-CDMA (Trial & Arib)		On	On	Off	Off	Off

Remarks: You must be in Basic, cdmaOne, cdma2000, W-CDMA (3GPP), or W-CDMA (Trial & Arib) mode to use this command. Use INSTrument:SELect to set the mode.

Adjacent Channel Power—Sweep Time

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

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

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

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

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

Factory Preset
and *RST:

Mode	**Offset A**	**Offset B**	**Offset C**	**Offset D**	**Offset E**
Basic & cdmaOne	11.20 ms	11.20 ms	11.20 ms	11.20 ms	11.20 ms

Range: 1 µs to 50 ms

Default Unit: seconds

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

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

Adjacent Channel Power—Automatic Sweep Time

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

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

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

Factory Preset
and *RST:

Mode	**Offset A**	**Offset B**	**Offset C**	**Offset D**	**Offset E**
Basic & cdmaOne	On	On	On	On	On

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

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

Adjacent Channel Power—Define Type of Offset Frequency List

iDEN mode

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

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

Basic mode, cdmaOne

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

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

cdma2000, W-CDMA (3GPP) mode

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

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

cdmaOne, W-CDMA (Trial & Arib) mode

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

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

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

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

Offset[n]	n=1 is base station and 2 is mobiles. The default is base station (1).
List[n]	
cdmaOne mode	n=1 is cellular bands and 2 is pcs bands. The default is cellular.
W-CDMA (Trial & Arib) 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:

- Absolute - Test the absolute power measurement. If it fails, then return a failure for the measurement at this offset.

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

Factory Preset
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 (3GPP)		REL	REL	REL	REL	REL
W-CDMA (Trial & Arib)		REL	REL	REL	REL	REL

Remarks: You must be in Basic, cdmaOne, cdma2000, W-CDMA (3GPP), W-CDMA (Trial & Arib), or iDEN mode to use this command. Use INSTrument:SELect to set the mode.

Adjacent Channel Power—Number of Measured Points

```
[:SENSe]:ACP:POINts <integer>
```

```
[:SENSe]:ACP:POINts?
```

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

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

Factory Preset and *RST:	1024
Remarks:	The fastest measurement times are obtained when the number of points measured is 2^n. You must be in Basic, cdmaOne mode to use this command. Use INSTrument:SELect to set the mode.
Range:	64 to 65536

Adjacent Channel Power—Automatic Measurement Points

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

`[:SENSe]:ACP:POINts:AUTO?`

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

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

Adjacent Channel Power—Sweep Time

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

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

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

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

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

Factory Preset and *RST:	625 µs (1 slot) for W-CDMA (3GPP), W-CDMA (Trial & Arib) 1.25 ms for cdma2000 11.20 ms for Basic, cdmaOne
Range:	500 µs to 10 ms 1 µs to 50 ms for Basic, cdmaOne
Default Unit:	seconds
Remarks:	You must be in the Basic, cdmaOne, cdma2000, W-CDMA (3GPP), or W-CDMA (Trial & Arib) mode to use this command. Use INSTrument:SELect to set the mode.
History:	Added to Basic revision A.03.00, to cdmaOne revision A.04.00

Adjacent Channel Power—Automatic Sweep Time

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

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

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

Factory Preset and *RST:	ON
Remarks:	You must be in Basic, cdmaOne mode to use this command. Use INSTrument:SELect to set the mode.

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

Adjacent Channel Power—Trigger Source

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

[:SENSe]:ACP:TRIGger:SOURce?

Select the trigger source used to control the data acquisitions.

EXTernal 1 – front panel external trigger input

EXTernal 2 – rear panel external trigger input

FRAMe – internal frame trigger from front panel input

IF – internal IF envelope (video) trigger

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

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

Factory Preset and *RST: IMMediate for BS

RFBurst for MS

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

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

Adjacent Channel Power—Power Reference

[:SENSe]:ACP:TYPE PSDRef|TPRef

[:SENSe]:ACP:TYPE?

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

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

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

Factory Preset and *RST:	Total power reference (TPRef)
Remarks:	You must be in the Basic, cdmaOne, cdma2000, W-CDMA (3GPP), W-CDMA (Trial & Arib), NADC, or PDC mode to use this command. Use INSTrument:SELect to set the mode.

Channel Commands

Select the ARFCN—Absolute RF Channel Number

```
[:SENSe]:CHANnel:ARFCn|RFCHannel <integer>
```

```
[:SENSe]:CHANnel:ARFCn|RFCHannel?
```

Set the analyzer to a frequency that corresponds to the ARFCN (Absolute RF Channel Number).

Factory Preset and *RST:	38
Range:	0 to 124, and 975 to 1023 for E-GSM 1 to 124 for P-GSM 0 to 124, and 955 to 1023 for R-GSM 512 to 885 for DCS1800 512 to 810 for PCS1900 259 to 293 for GSM450 306 to 340 for GSM480 438 to 511 for GSM700 128 to 251 for GSM850
Remarks:	You must be in the EDGE(w/GSM), GSM mode to use this command. Use INSTrument:SELect to set the mode. Global to the current mode.
History:	Version A.03.00 or later
Front Panel Access:	**FREQUENCY Channel, ARFCN**

Select the Lowest ARFCN

`[:SENSe]:CHANnel:ARFCn|RFCHannel:BOTTom`

Set the analyzer to the frequency of the lowest ARFCN (Absolute RF Channel Number) of the selected radio band.

Factory Preset and *RST:	975 for E-GSM 1 for P-GSM 955 for R-GSM 512 for DCS1800 512 PCS1900 259 GSM450 306 GSM480 438 GSM700 128 GSM850
Remarks:	You must be in the EDGE(w/GSM), GSM mode to use this command. Use INSTrument:SELect to set the mode. Global to the current mode.
History:	Version A.03.00 or later
Front Panel Access:	**FREQUENCY Channel, BMT Freq**

Select the Middle ARFCN

`[:SENSe]:CHANnel:ARFCn|RFCHannel:MIDDle`

Set the analyzer to the frequency of the middle ARFCN (Absolute RF Channel Number) of the selected radio band.

Factory Preset and *RST:	38 for E-GSM 63 for P-GSM 28 for R-GSM 699 for DCS1800 661 for PCS1900 276 for GSM450 323 for GSM480

	474 for GSM 700
	189 for GSM850
Remarks:	You must be in the EDGE(w/GSM), GSM mode to use this command. Use INSTrument:SELect to set the mode.
	Global to the current mode.
History:	Version A.03.00 or later
Front Panel Access:	**FREQUENCY Channel, BMT Freq**

Select the Highest ARFCN

`[:SENSe]:CHANnel:ARFCn|RFCHannel:TOP`

Set the analyzer to the frequency of the highest ARFCN (Absolute RF Channel Number) of the selected radio band.

Factory Preset and *RST:	124 for E-GSM
	124 for P-GSM
	124 for R-GSM
	885 for DCS1800
	810 for PCS1900
	293 for GSM450
	340 for GSM480
	511 for GSM700
	251 for GSM850
Remarks:	You must be in the EDGE(w/GSM), GSM mode to use this command. Use INSTrument:SELect to set the mode.
	Global to the current mode.
History:	Version A.03.00 or later
Front Panel Access:	**FREQUENCY Channel, BMT Freq**

Burst Type

`[:SENSe]:CHANnel:BURSt TCH|CCH`

`[:SENSe]:CHANnel:BURSt?`

Set the burst type for mobile station testing.

Traffic Channel (TCH) – burst for traffic channel

Control Channel (CCH) – burst for control channel

Factory Preset and *RST:	TCH
Remarks:	The command is only applicable for mobile station testing, device = MS. You must be in the NADC or PDC mode to use this command. Use INSTrument:SELect to set the mode.

Channel Burst Type

`[:SENSe]:CHANnel:BURSt NORMal|SYNC|ACCess`

`[:SENSe]:CHANnel:BURSt?`

Set the burst type that the analyzer will search for and to which it will sync. This only applies with normal burst selected.

NORMal: Traffic Channel (TCH) and Control Channel (CCH)

SYNC: Synchronization Channel (SCH)

ACCess: Random Access Channel (RACH)

Remarks:	Global to the current mode. You must be in the EDGE(w/GSM), GSM mode to use this command. Use INSTrument:SELect to set the mode.
Front Panel Access:	**FREQUENCY Channel, Burst Type**

Digital Demod PN Offset

`[:SENSe]:CHANnel:PNOFfset <integer>`

`[:SENSe]:CHANnel:PNOFfset?`

Set the PN offset number for the base station being tested.

Factory Preset and *RST:	0

Range: 0 to 511

Default Unit: None

Remarks: Global to the current mode.

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

Front Panel Access: **FREQUENCY Channel**, **PN Offset**

or

Mode Setup, **Demod**, *PN Offset*

Time Slot number

`[:SENSe]:CHANnel:SLOT <integer>`

`[:SENSe]:CHANnel:SLOT?`

Select the slot number that you want to measure.

In GSM mode the measurement frame is divided into the eight expected measurement timeslots.

Factory Preset and *RST: 0 for GSM, PDC mode

1 for NADC mode

Range: 0 to 5 for PDC mode

1 to 6 for NADC mode

0 to 7 for GSM mode

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

Front Panel Access: **Mode Setup, Radio, Frequency Hopping Repetition Factor**

Time Slot Auto

`[:SENSe]:CHANnel:SLOT:AUTO OFF|ON|0|1`

`[:SENSe]:CHANnel:SLOT:AUTO?`

Select auto or manual control for slot searching. The feature is only supported in external and frame trigger source modes. In external trigger mode when timeslot is set on, the demodulation measurement is made on the nth timeslot specified by the external trigger point + n timeslots, where n is the selected timeslot value 0 to 7. In frame trigger mode when timeslot is set on, then demodulation measurement is only made on the nth timeslot specified by bit 0 of frame reference burst + n timeslots, where n is the selected timeslot value 0 to 7 and where the frame reference burst is specified by Ref Burst and Ref TSC (Std) combination.

Factory Preset and *RST:	ON, for NADC, PDC mode OFF, for GSM mode
Remarks:	The command is only applicable for mobile station testing, device = MS. You must be in EDGE(w/GSM), GSM, NADC, PDC mode to use this command.Use INSTrument:SELect to set the mode.
History:	Added GSM mode, version A.03.00 or later

Training Sequence Code (TSC)

`[:SENSe]:CHANnel:TSCode <integer>`

`[:SENSe]:CHANnel:TSCode?`

Set the training sequence code to search for, with normal burst selected and TSC auto set to off.

Factory Preset and *RST:	0
Range:	0 to 7
Remarks:	Global to the current mode. You must be in the EDGE(w/GSM), GSM mode to use this command. Use INSTrument:SELect to set the mode.
History:	Version A.03.00 or later
Front Panel Access:	**FREQUENCY Channel, TSC (Std)**

Training Sequence Code (TSC) Auto

`[:SENSe]:CHANnel:TSCode:AUTO OFF|ON|0|1`

`[:SENSe]:CHANnel:TSCode:AUTO?`

Select auto or manual control for training sequence code (TSC) search. With auto on, the measurement is made on the first burst found to have one of the valid TSCs in the range 0 to 7 (i.e. normal bursts only). With auto off, the measurement is made on the 1st burst found to have the selected TSC.

Factory Preset and *RST:	AUTO
Remarks:	Global to the current mode. You must be in the EDGE(w/GSM), GSM mode to use this command. Use INSTrument:SELect to set the mode.
Front Panel Access:	**FREQUENCY Channel, TSC (Std)**

Signal Corrections Commands

Correction for Base Station RF Port External Attenuation

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

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

Set the correction equal to the external attenuation used when measuring base stations.

Factory Preset and *RST:	0 dB
Range:	–50 to 100 dB for cdmaOne, iDEN –50 to 50 dB for NADC or PDC
Default Unit:	dB
Remarks:	You must be in the 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:	0.0 dB
Range:	–50 to 100.0 dB for cdmaOne, GSM, EDGE, iDEN –100.0 to 100.0 dB for cdma2000, W-CDMA (3GPP) –50.0 to 50.0 dB for W-CDMA (Trial/Arib), NADC, PDC
Default Unit:	dB
Remarks:	You must be in the cdmaOne, GSM, EDGE (w/GSM), cdma2000, W-CDMA (3GPP), W-CDMA (Trial & Arib), iDEN, NADC or PDC mode to use this command. Use INSTrument:SELect to set the mode. Value is global to the current mode.

Correction for RF Port External Attenuation

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

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

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

Factory Preset and *RST:	0 dB
Range:	-50 to +50 dB
Default Unit:	dB
Remarks:	You must be in the Basic mode to use this command. Use INSTrument:SELect to set the mode. Value is global to Basic mode.
Front Panel Access:	**Input**, **Ext Atten**

Error Vector Magnitude Measurement

Commands for querying the error vector magnitude measurement results and for setting to the default values are found in the "SCPI Command Subsystems" on page 110. The equivalent front panel keys for the parameters described in the following commands, are found under the **Meas Setup** key, after the **EVM** measurement has been selected from the **MEASURE** key menu.

Error Vector Magnitude—Average Count

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

```
[:SENSe]:EVM: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
Range:	1 to 10,000
Remarks:	You must be in the NADC or PDC mode to use this command. Use INSTrument:SELect to set the mode.

Error Vector Magnitude—Averaging State

```
[:SENSe]:EVM:AVERage[:STATe] OFF|ON|0|1
```

```
[:SENSe]:EVM:AVERage[:STATe]?
```

Turn average on or off.

Factory Preset and *RST:	ON
Remarks:	You must be in the NADC or PDC mode to use this command. Use INSTrument:SELect to set the mode.

Error Vector Magnitude—Averaging Termination Control

```
[:SENSe]:EVM:AVERage:TCONtrol EXPonential|REPeat
```

```
[:SENSe]:EVM:AVERage:TCONtrol?
```

Select the type of termination control used to 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:	EXPonential
Remarks:	You must be in the NADC or PDC mode to use this command. Use INSTrument:SELect to set the mode.

Error Vector Magnitude—Burst Synchronization Source

`[:SENSe]:EVM:BSYNc:SOURce RFBurst|TSEQuence|NONE`

`[:SENSe]:EVM:BSYNc:SOURce?`

Select the method of synchronizing the measurement to the bursts.

RFBurst – The burst sync approximates the start and stop of the useful part of the burst without demodulation of the burst.

Training Sequence (TSEQuence)– The burst sync performs a demodulation of the burst and determines the start and stop of the useful part of the burst based on the midamble training sync sequence.

NONE – The measurement is performed without searching burst.

Factory Preset and *RST:	NONE for BS TSEQuence for MS
Remarks:	You must be in the NADC or PDC mode to use this command. Use INSTrument:SELect to set the mode.

Error Vector Magnitude—Points/Symbol

`[:SENSe]:EVM:TRACe:PPSYmbol <integer>`

`[:SENSe]:EVM:TRACe:PPSYmbol?`

Select the points/symbol for EVM measurement. Only 1 or 5 are valid entries.

Factory Preset and *RST:	5
Range:	1, 5

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

Error Vector Magnitude—Trigger Source

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

`[:SENSe]:EVM: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

IF – internal IF envelope (video) trigger

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

FRAMe – internal frame trigger from front panel input

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

Factory Preset and *RST:	IMMediate for BS
	RFBurst for MS
Remarks:	You must be in the NADC or PDC mode to use this command. Use INSTrument:SELect to set the mode.

Select the Input Signal [VSA, PSA]

`[:SENSe]:FEED RF|IQ|IONLy|QONLy|AREFerence|IFALign`

`[:SENSe]:FEED?`

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

If the baseband IQ option (Option B7C) is installed, I and Q input ports are added to the front panel. The I and Q ports accept the in-phase and quadrature components of the IQ signal, respectively. The input signal can be taken from either or both ports.

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

IQ selects the combined signals from the front panel optional I and Q input ports.

IONLy selects the signal from the front panel optional I input port.

QONLy selects the signal from the front panel optional Q input port.

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

AREFerence selects the internal 50 MHz amplitude reference signal.

Factory Preset and *RST:	RF
Front Panel Access:	**Input, Input Port**
History:	VSA modified in A.05.00 version

Frequency Commands

Center Frequency

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

`[:SENSe]:FREQuency:CENTer?`

Set the center frequency.

Factory Preset and *RST:	1.0 GHz 942.6 MHz for GSM, EDGE 806.0 MHz for iDEN
Range:	1.0 kHz to 4.3214 GHz

Default Unit:	Hz
Front Panel Access:	**FREQUENCY/Channel, Center Freq**

Center Frequency Step Size Automatic

`[:SENSe]:FREQuency:CENTer:STEP:AUTO OFF|ON|0|1`

`[:SENSe]:FREQuency:CENTer:STEP:AUTO?`

Specifies whether the step size is set automatically based on the span.

Factory Preset and *RST:	ON
History:	Version A.03.00 or later
Front Panel Access:	**FREQUENCY/Channel, CF Step**

Center Frequency Step Size

`[:SENSe]:FREQuency:CENTer:STEP[:INCRement] <freq>`

`[:SENSe]:FREQuency:CENTer:STEP[:INCRement]?`

Specifies the center frequency step size.

Factory Preset and *RST:	5.0 MHz 1.25 MHz for cdma2000
Range:	1.0 kHz to 1.0 GHz, in 10 kHz steps
Default Unit:	Hz
History:	Version A.03.00 or later
Front Panel Access:	**FREQUENCY/Channel, CF Stepl**

RF Power Commands

RF Port Input Attenuation

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

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

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

Factory Preset and *RST:	0 dB 12 dB for iDEN
Range:	0 to 40 dB
Default Unit:	dB
Front Panel Access:	**Input, Input Atten**

RF Port Power Range Auto

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

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

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

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

Factory Preset and *RST:	ON
Remarks:	You must be in the cdmaOne, EDGE(w/GSM), GSM, NADC, PDC, cdma2000, W-CDMA (3GPP), or W-CDMA (Trial & Arib) mode to use this command. Use INSTrument:SELect to set the mode.
Front Panel Access:	**Input, Max Total Pwr (at UUT)**

RF Port Power Range Maximum Total Power

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

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

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

Factory Preset and *RST:	–15.0 dBm
Range:	–100.0 to 80.0 dBm for EDGE, GSM –100.0 to 27.7 dBm for cdmaOne, iDEN –200.0 to 50.0 dBm for NADC, PDC –200.0 to 100.0 dBm for cdma2000, W-CDMA (3GPP), W-CDMA (Trial & Arib)
Default Unit:	dBm
Remarks:	Global to the current mode. This is coupled to the RF input attenuation You must be in the Service, cdmaOne, EDGE(w/GSM), GSM, NADC, PDC, cdma2000, W-CDMA (3GPP), or W-CDMA (Trial & Arib) mode to use this command. Use INSTrument:SELect to set the mode.
Front Panel Access:	**Input, Max Total Pwr (at UUT)**

Radio Standards Commands

Radio Device Under Test

`[:SENSe]:RADio:DEVice BS|MS`

`[:SENSe]:RADio:DEVice?`

Select the type of radio device to be tested.

BS – Base station transmitter test.

MS – Mobile station transmitter test.

Factory Preset and *RST:	BS
Remarks:	You must be in the NADC, or PDC mode to use this command. Use INSTrument:SELect to set the mode. Global to current mode.
Front Panel Access:	**Mode Setup, Radio, Device**

Radio Traffic Rate

`[:SENSe]:RADio:TRATe FULL|HALF`

`[:SENSe]:RADio:TRATe?`

Select the traffic rate.

FULL – full traffic rate (a slot is every 20 ms)

HALF – half traffic rate (a slot is every 40 ms)

Factory Preset and *RST:	FULL
Remarks:	You must be in the NADC or PDC mode to use this command. Use INSTrument:SELect to set the mode.

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 146. 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.

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 (APEak) - automatically peak the range

  For CW signals, the default of auto-peak ranging can be used, but a better FFT measurement of the signal can be made by selecting one of the manual ranges that are available: M6, P0 - P24.
  Auto peaking can cause the ADC range gain to move monotonically down during the data capture. This movement should have negligible effect on the FFT spectrum, but selecting a manual range removes this possibility. Note that if the CW signal being measured is close to the auto-ranging threshold, the noise floor may shift as much as 6 dB from sweep to sweep.

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

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

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

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.

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— Select Pre-FFT Bandwidth

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

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

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

Factory Preset and *RST: AUTO, 1.55 MHz

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

Spectrum — IF Flatness Corrections

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

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

Turns IF flatness corrections on and off.

Factory Preset and *RST: ON

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

Spectrum—Pre-ADC Bandpass Filter

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

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

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

Remarks: To use this command, 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
	155.0 kHz, for iDEN mode
Range:	1 Hz to 10.0 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 (FLAT)- a filter with a flat amplitude response, which provides the best amplitude accuracy.

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

Factory Preset

and *RST: FLAT

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: 20.0 kHz

250.0 Hz, for iDEN mode

Range: 0.10 Hz to 3.0 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]?
```

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

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

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

Factory Preset and *RST:	0
Range:	0 to 1,000, where 0 sets the function to automatic
Remarks:	
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:	706
Range:	min, depends on the current setting of the spectrum window length max, 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]:SPECtrum:FFT:LENGth:AUTO?
```

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

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

> On - the window lengths are coupled to resolution bandwidth, window type (FFT), pre-FFT bandwidth (sample rate) and SENSe:SPECtrum:FFT:RBWPoints.
>
> Off - lets you set `SENSe:SPECtrum:FFT:LENGth` and `SENSe:SPECtrum:FFT:WINDow:LENGth`.

Factory Preset and *RST:	ON
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]:SPECtrum:FFT:RBWPoints?`

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

Factory Preset 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 Delay

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

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

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

Factory Preset and *RST:	0
Range:	–10.0 to +10.0s

Default Unit:	seconds
Remarks:	To use this command, the Service mode must be selected with INSTrument:SELect. In Service mode, it is possible to get an acquisition time that is longer than the window time so that this function can be used.

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
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

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

GAUSsian - Gaussian with alpha of 3.5

HAMMing - Hamming

HANNing - Hanning

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

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

Factory Preset and *RST:	FLATtop

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:	1.0 MHz
	100.0 kHz for iDEN mode
Range:	10 Hz to 10.0 MHz (15 MHz when Service mode is selected)
Default Unit:	Hz
Remarks:	The actual measured span will generally be slightly wider due to the finite resolution of the FFT.
	To use this command, the appropriate mode should be selected with INSTrument:SELect.

Spectrum—Sweep (Acquisition) Time

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

`[:SENSe]:SPECtrum:SWEep:TIME?`

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

Factory Preset and *RST:	188.0 µs
	15.059 ms, for iDEN mode
Range:	100 ns to 10 s
Default Unit:	seconds
Remarks:	You must be in the Service mode to use this command.

Use INSTrument:SELect to set the mode.

This command only effects the RF envelope trace.

Spectrum—Sweep (Acquisition) Time Auto

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

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

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

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

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

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

Spectrum—Trigger Source

```
[:SENSe]:SPECtrum:TRIGger:SOURceEXTernal[1]
|EXTernal2|FRAMe|IF|LINE|IMMediate|RFBurst
```

```
[:SENSe]:SPECtrum:TRIGger:SOURce?
```

Select the trigger source used to control the data acquisitions.

EXTernal1 - front panel external trigger input

EXTernal2 - rear panel external trigger input

FRAMe - internal frame timer from front panel input

IF - internal IF envelope (video) trigger

LINE - internal line trigger

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

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

Factory Preset and *RST:	IMMediate (free run)
	RFBurst, for GSM, iDEN mode
Remarks:	To use this command, the appropriate mode should be selected with INSTrument:SELect.

Synchronization Commands

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 146. The equivalent front panel keys for the parameters described in the following commands, are found under the **Meas Setup** key, after the **Waveform (Time Domain)** measurement has been selected from the **MEASURE** key menu.

Waveform—Data Acquisition Packing

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

`[:SENSe]:WAVeform:ACQuistion:PACKing?`

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

Factory Preset and *RST:	AUTO
Remarks:	You must be in the Service mode to use this command. Use INSTrument:SELect to set the mode.

Waveform—ADC Dither State

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

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

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

Factory Preset and *RST:	OFF
Remarks:	You must be in the Service mode to use this command. Use INSTrument:SELect to set the mode.

Waveform—Pre-ADC Bandpass Filter

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

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

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

Preset:	OFF
Remarks:	To use this command, 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 (APEak) - automatically peak the range

Auto Peak Lock (APLock)- 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 - Query Aperture Setting

[:SENSe]:WAVeform:APERture?

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

Remarks:	To use this command the appropriate mode should be selected with INSTrument:SELect.
History:	Version A.05.00 or later

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.

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:	100.0 kHz for NADC, PDC, cdma2000, W-CDMA (3GPP), W-CDMA (Trial & Arib), basic, service 500.0 kHz for GSM 2.0 MHz for cdmaOne
Range:	1.0 kHz to 5.0 MHz
Remarks:	To use this command, the appropriate mode should be selected with INSTrument:SELect.

Waveform - Query Actual Resolution Bandwidth

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

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

Remarks:	Implemented for users of Glacier and other applications that require precise resolution bandwidth readings. To use this command the appropriate mode should be selected with INSTrument:SELect.
History:	Version A.05.00 or later

Waveform—Resolution BW Filter Type

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

`FLATtop|GAUSsian`

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

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

> FLATtop - a filter with a flat amplitude response, which provides the best amplitude accuracy.
>
> GAUSsian - a filter with Gaussian characteristics, which provides the best pulse response.

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

Waveform—Decimation of Waveform Display

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

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

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

Factory Preset and *RST:	1
Range:	1 to 4
Remarks:	To use this command, the appropriate mode should be selected with INSTrument:SELect.

Waveform—Control Decimation of Waveform Display

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

`[:SENSe]:WAVeform:DECimate:STATe?`

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

Factory Preset 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

RFBurst - 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 RFBurst, for GSM, iDEN mode
Remarks:	To use this command, the appropriate mode should be selected with INSTrument:SELect.

TRIGger Subsystem

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

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

Automatic Trigger Control

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

`:TRIGger[:SEQuence]:AUTO:STATe?`

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

Factory Preset and *RST	Off for cdma2000, W-CDMA (3GPP) , W-CDMA (Trial & ARIB), NADC, and PDC
Front Panel Access	**Mode Setup, Trigger, Auto Trig**

Automatic Trigger Time

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

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

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

Factory Preset and *RST:	100.0 ms
Range:	1.0 ms to 1000.0 s

	0.0 to 1000.0 s for cdma2000, W-CDMA (3GPP), W-CDMA (Trial & ARIB)
Default Unit:	seconds

External Trigger Delay

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

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

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

EXT or EXT1is the front panel trigger input

EXT2 is the rear panel trigger input

Factory Preset and *RST:	0.0 s
Range:	–500.0 ms to 500.0 ms
	–100.0 ms to 500.0 ms for cdma2000, W-CDMA (3GPP), W-CDMA (Trial & ARIB)
Default Unit:	seconds
Front Panel Access:	**Mode Setup, Trigger, Ext Rear (or Ext Front), Delay**

External Trigger Level

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

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

Set the trigger level when using an external trigger input.

EXT or EXT1is the front panel trigger input

EXT2 is the rear panel trigger input

Factory Preset and *RST:	2.0 V
Range:	–5.0 to +5.0 V
Default Unit:	volts
Front Panel Access:	**Mode Setup, Trigger, Ext Rear, Level**
	Mode Setup, Trigger, Ext Front, Level

External Trigger Slope

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

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

Sets the trigger slope when using an external trigger input.

EXT or EXT1is the front panel trigger input

EXT2 is the rear panel trigger input

Factory Preset and *RST:	Positive
Front Panel Access:	**Mode Setup, Trigger, Ext Rear (or Ext Front), Slope**

Frame Trigger Adjust

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

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

Factory Preset and *RST:	0.0 s
Range:	0.0 to 10.0 s
Default Unit:	seconds
Front Panel Access:	*None*

Frame Trigger Period

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

`:TRIGger[:SEQuence]:FRAMe:PERiod?`

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

Factory Preset and *RST:	250.0 μs for Basic, cdmaOne
	4.615383 ms, for GSM
	26.666667 ms for cdma2000

10.0 ms (1 radio frame) for W-CDMA (3GPP), W-CDMA (Trial & ARIB)

90.0 ms for iDEN

20.0 ms with rate=full for NADC, PDC

40.0 ms with rate=half for NADC, PDC

Range: 0.0 ms to 559.0 ms for Basic, cdmaOne, GSM, cdma2000, W-CDMA (3GPP), W-CDMA (Trial & ARIB)

1.0 ms to 559.0 ms for iDEN, NADC, PDC

Default Unit: seconds

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

Frame Trigger Sync Source

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

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

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

Factory Preset and *RST: Off

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

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

Frame Trigger Synchronization Offset

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

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

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

Factory Preset and *RST: 0.0 s

Range: 0.0 to 10.0 s

Default Unit: seconds

Remarks:	You must be in the Basic, cdmaOne, EDGE (w/GSM), GSM, iDEN, NADC, PDC, Service mode to use this command. Use INSTrument:SELect to set the mode.
History:	Revision A.03.27 or later
Front Panel Access:	**Mode Setup, Trigger, Frame Timer, Offset**

Trigger Holdoff

```
:TRIGger[:SEQuence]:HOLDoff <time>
```

```
:TRIGger[:SEQuence]:HOLDoff?
```

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

Factory Preset and *RST:	0.0 s
	20.0 ms for iDEN
	10.0 ms for NADC or PDC
Range:	0.0 to 500.0 ms
Default Unit:	seconds
Front Panel Access:	**Mode Setup, Trigger, Trig Holdoff**

Video (IF) Trigger Delay

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

```
:TRIGger[:SEQuence]:IF:DELay?
```

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

Factory Preset and *RST:	0.0 s
Range:	–500.0 ms to 500.0 ms
	–100.0 ms to 500.0 ms for cdma2000, W-CDMA (3GPP), W-CDMA (Trial & ARIB)
Default Unit:	seconds
Front Panel Access:	**Mode Setup, Trigger, Video (IF Envlp), Delay**

Video (IF) Trigger Level

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

```
:TRIGger[:SEQuence]:IF:LEVel?
```

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

Factory Preset and *RST:	–6.0 dBm for cdmaOne, GSM, Basic, Service, cdma2000, W-CDMA (3GPP), W-CDMA (Trial & ARIB) –20.0 dBm for iDEN –30.0 dBm for NADC, PDC
Range:	–200.0 to 50.0 dBm
Default Unit:	dBm
Front Panel Access:	**Mode Setup, Trigger, Video (IF Envlp), Level**

Video (IF) Trigger Slope

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

```
:TRIGger[:SEQuence]:IF:SLOPe?
```

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

Factory Preset and *RST:	Positive
Front Panel Access:	**Mode Setup, Trigger, Video (IF Envlp), Slope**

RF Burst Trigger Delay

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

```
:TRIGger[:SEQuence]:RFBurst:DELay?
```

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

Factory Preset and *RST:	0.0 s
Range:	–500.0 ms to 500.0 ms –100.0 ms to 500.0 ms for cdma2000, W-CDMA (3GPP), or W-CDMA (Trial & ARIB)

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

RF Burst Trigger Level

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

```
:TRIGger[:SEQuence]:RFBurst:LEVel?
```

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

Factory Preset and *RST:	–6.0 dB
Range:	–25.0 to 0.0 dB
	–200.0 to 0.0 dB for NADC, PDC
Default Unit:	dB
Front Panel Access:	**Mode Setup**, **Trigger, RF Burst, Peak Level**

RF Burst Trigger Slope

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

```
:TRIGger[:SEQuence]:RFBurst:SLOPe?
```

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

Factory Preset and *RST:	Positive
Remarks:	You must be in the cdmaOne, cdma2000, W-CDMA (3GPP), or W-CDMA (Trial & ARIB) mode to use this command. Use :INSTrument:SELect to set the mode.
Front Panel Access:	**Mode Setup, Trigger, RF Burst, Slope**

5 Understanding PDC

What is the PDC Communications System?

Personal Digital Cellular (PDC) is one of the cellular communications systems.

The PDC communications system is defined in the Research and Development Center for Radio Systems document, RCR STD-27, the Personal Digital Cellular Telecommunication System Standard.

The PDC system is a digital communications system that employs a combination of a frequency division multiple access (FDMA) and a time division multiple access (TDMA). A pair of frequencies (130 or 50 MHz apart in the 800 MHz bands and 48 MHz apart in the 1500 MHz band) is used to provide the full duplex operation with RF channels spacing 50 kHz each with interleaving by 25 kHz.

800 MHz	Uplink	940 to 958 MHz	887 to 889 MHz
	Downlink	810 to 828 MHz	832 to 834 MHz
800 MHz	Uplink	898 to 901 MHz	915 to 940MHz
	Downlink	843 to 846 MHz	860 to 885 MHz
1500 MHz	Uplink	1429 to 1453 MHz	
	Downlink	1477 to 1501 MHz	

One TDMA frame is structured with 6 timeslots, so each channel frequency can support up to 6 timeslots. Currently, two timeslots of each frame are used for one traffic channel, which is required for the full-rate speech codec. When half-rate speech codecs are incorporated into the system, each traffic channel will require just one timeslot per frame. One frame is 40 ms long and each timeslot is 6.667 ms long. Thus, the mobile stations have burst carriers that are turned on for two timeslots (full-rate codec) or one timeslot (half-rate codec). When an RF channel is in use by a digital base station, the base station carrier will be turned on for one entire frame. This is true even if only one traffic channel is in use on that RF channel. However, the carrier power can be different at each timeslot.

The digital modulation format used in the PDC system is $\pi/4$ differential quadrature phase shift keying ($\pi/4$ DQPSK). The $\pi/4$ DQPSK modulation causes both phase and amplitude variations on the RF signal. The quadrature nature of this modulation allows 2 bits to be transmitted at the same time on orthogonal carriers. There are 140 symbol periods in each timeslot, and each symbol contains 2 bits of information. Therefore, there are 280 bits in each timeslot. Since there are 1,680 bits in 6 timeslots and 25 frames in one second, the transmission bit rate is 42,000 bits per second.

What Does the Agilent E4406A VSA Do?

When configured for PDC, the instrument can be used to test a PDC transmitter according to the Research and Development Center for Radio Systems (RCR) document, RCR STD-27F or RCR STD-27G. This instrument can help determine if a PDC transmitter operates correctly.

This document defines complex and multiple-part measurements used to maintain an interference-free environment. For example, the document includes the testing method for carrier power. The instrument automatically makes these measurements based on the RCR standard. The detailed measurement result displays allow you to analyze PDC system performance. You may alter the measuring parameters for your specific measurement and analysis.

Other Sources of Measurement Information

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

- Digital Modulation in Communications Systems - An Introduction
  Application Note 1298
  Part number 5965-7160E
- Understanding PDC and NADC Transmitter Measurements for Base Transceiver Stations and Mobile Stations
  Application Note 1324
  Part number 5968-5537E

Instrument Updates at www.agilent.com

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

www.agilent.com/find/vsa

6 Setting Up the PDC Mode

PDC Mode

You may want to install a new personality, reinstall a personality that you have previously uninstalled, or uninstall a personality option. Instructions can be found in "Installing Optional Measurement Personalities" on page 260.

To access the PDC measurement personality press the **Mode** key and select **PDC**.

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

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

Making a Measurement

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

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

1. Select a mode or personality which corresponds to a digital communications format, like cdma2000, W-CDMA, or EDGE. Use the Basic mode to make measurements of signals with non-standard formats. After selection of the mode, adjustments to the mode settings may be made as required.
2. Select a specific measurement to be performed, like ACP, Channel Power, or EVM, etc. After selection of a measurement, adjustments to the measurement settings may be made as required.

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

If you have a problem, and get an error message, see the “If You Have a Problem” section.

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

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

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

Changing the Mode Setup

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

Radio

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

- **Traffic Rate** - Allows you to toggle the traffic rate between **Full** and **Half**.
- **Device** - Allows you to toggle the test device between **BS** (Base Station) and **MS** (Mobile Station).

Radio Default Settings	
Traffic Rate	Full
Device	BS

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 sets the attenuator 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**. If there are multiple carriers present, the total power might overdrive the front end amplifiers. In this case you need to set the **RF Input Range** to **Man** and enter the expected maximum total power by activating the **Max Total Pwr** key. **Man** is also useful to hold the input attenuation constant for the best relative power accuracy. For single carriers it is generally recommended to set this to **Auto**.

- **Max Total Pwr** - Allows you to set the maximum total power 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; it may include multiple carriers. The **Max Total Pwr** setting is coupled together with the **Input Atten** and **Ext Atten** settings. Once you change the **Max Total Pwr** value with the **RPG** knob, for example, the **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**.
- **Ext Atten** - Allows you to enter the external attenuation value for either BS or MS. 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.

NOTE The **Max Total Pwr** and **Input Atten** settings are coupled together, so changing the input **Max Total Pwr** setting by x dB changes the **Input Atten** setting by x dB. 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. Therefore, you can set the input attenuator manually, or you can set it indirectly by specifying the expected maximum power from the UUT.

Input Default Settings	
RF Input Range	Auto[a]
Max Total Power	–15.00 dBm[b]
Input Atten	0.00 dB[b]
Ext Atten MS	0.00 dB
Ext Atten BS	0.00 dB

a. **Auto** is not used for Spectrum measurements.
b. This may differ if the maximum input power is more than –15.00 dBm.

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 500.0 ms 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. When **Traffic Rate** is **Full**, the default is 20.0 ms. When **Traffic Rate** is **Half**, the default is 40.0 ms.

Trigger Default Settings	
RF Burst:	
Delay	0.000 sec
Peak Level	–10.0 dB
Slope	Pos
Video:	
Delay	0.000 s
Level	–30.00 dBm
Slope	Pos
Ext Front & Ext Rear:	
Delay	0.000 s
Level	2.00 V
Slope	Pos
Trig Holdoff	10.00 ms
Auto Trig	100.0 ms, On
Frame Timer Period	20.00000 ms when Traffic Rate is Full 40.00000 ms when Traffic Rate is Half

Burst

The **Burst** key allows you to access the following menu to set the trigger condition for the ACP and EVM measurements.

- **Delay** - Allows you to set the delay time after searching a threshold level of PDC bursts. The range is –500.0 to +500.0 ms with 1 ns resolution.
- **Search Threshold** - Allows you to set the threshold level used in search for PDC bursts after data is acquired. The range is –200.00 to –0.01 dB with 0.01 dB resolution. The realistic lower range can be down to the noise floor level of the signal.

Burst Default Settings	
Delay	0.000 s
Search Threshold	–30.00 dB

Changing the Frequency Channel

After selecting the desired mode setup, you will need to select the desired center frequency, burst type, and slot. The selections made here will apply to all measurements in the mode. 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.
- **Burst Type** - Choose a PDC burst type from the following selections only when **Device** under **Radio** is previously set to **MS,** otherwise this softkey is unavailable:

  Traffic (TCH) - Sets to the traffic channel burst signal of which burst length is 270 bits or 135 symbols.
  Control (CCH) - Sets to the control channel burst signal of which burst length is 258 bits or 129 symbols.

- **Slot (Std)** - Allows you to toggle the slot selection function between **Auto** and **Man**, and also to specify the particular timeslot to be measured when **Man** is selected. This is used only when making EVM measurements.

  Auto - In auto, the measurement is made on the first timeslot found to have any one of the valid sync words in the range of 0 to 5. The measurement may be made on various timeslots if more than one timeslot has the valid sync word.

  Man - In manual, the measurement is made on the first burst found to have the selected sync word in the range of 0 to 5. The measurement will be made only on the specified timeslot.

When the PDC mode is selected, the instrument will default to the following settings:

Frequency Channel Default Settings	
Center Frequency	1.00000 GHz
Burst Type[a]	Traffic (TCH)
Slot (Std)	0, Auto

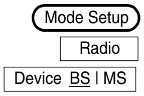
[a] This is valid only when Device is MS.

PDC Measurement Key Flow

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

Figure 6-1, "Mode Setup / Frequency Channel Key Flow,"on page 251.
Figure 6-2, "ACP Measurement Key Flow,"on page 252.
Figure 6-3, "EVM Measurement Key Flow,"on page 253.
Figure 6-4, "Occupied Bandwidth Measurement Key Flow,"on page 254.
Figure 6-5, "Spectrum Measurement Key Flow (1 of 3),"on page 255.
Figure 6-6, "Spectrum Measurement Key Flow (2 of 3),"on page 256.
Figure 6-7, "Spectrum Measurement Key Flow (3 of 3),"on page 257.
Figure 6-8, "Waveform Measurement Key Flow (1 of 2),"on page 258.
Figure 6-9, "Waveform Measurement Key Flow (2 of 2),"on page 259.

Use these flow diagrams as follows:



1. There are some basic conventions:
An oval represents one of the front-panel keys.
This box represents one of the softkeys displayed.
Default conditions are shown as much as possible (underlined).
2. Start from the extreme upper left corner of each measurement diagram to the right direction.
3. Proceed from the top to the bottom.
4. When defining a key from auto to manual, for example, just press that key one time.
5. When entering a numeric value of **Frequency**, for example, use the numeric keypad by terminating with the appropriate unit selection from the keys displayed.
6. When entering a numeric value of **Slot**, for example, use the numeric keypad by terminating with the **Enter** front-panel key.
7. Instead of using the numeric keypad to enter a, it may be easier to use the **RPG** knob or **Up/Down** keys depending on the input field of a parameter.

Figure 6-1 Mode Setup / Frequency Channel Key Flow

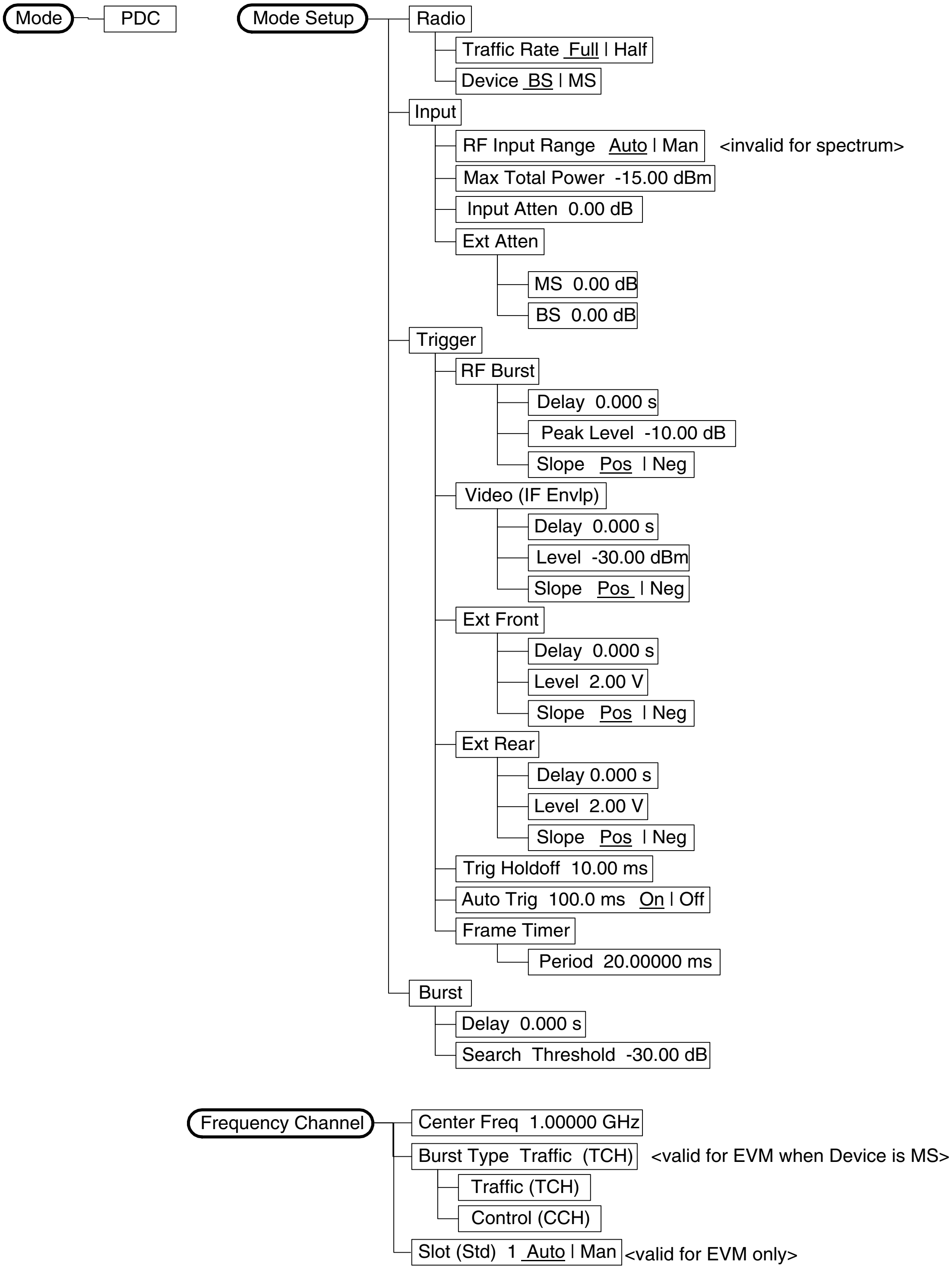

Mode
PDC
Mode Setup
Radio
Traffic Rate Full | Half
Device BS | MS
Input
RF Input Range Auto | Man
<invalid for spectrum>
Max Total Power -15.00 dBm
Input Atten 0.00 dB
Ext Atten
MS 0.00 dB
BS 0.00 dB
Trigger
RF Burst
Delay 0.000 s
Peak Level -10.00 dB
Slope Pos | Neg
Video (IF Envlp)
Delay 0.000 s
Level -30.00 dBm
Slope Pos | Neg
Ext Front
Delay 0.000 s
Level 2.00 V
Slope Pos | Neg
Ext Rear
Delay 0.000 s
Level 2.00 V
Slope Pos | Neg
Trig Holdoff 10.00 ms
Auto Trig 100.0 ms On | Off
Frame Timer
Period 20.00000 ms
Burst
Delay 0.000 s
Search Threshold -30.00 dB
Frequency Channel
Center Freq 1.00000 GHz
Burst Type Traffic (TCH)
<valid for EVM when Device is MS>
Traffic (TCH)
Control (CCH)
Slot (Std) 1 Auto | Man
<valid for EVM only>

Figure 6-2 **ACP Measurement Key Flow**

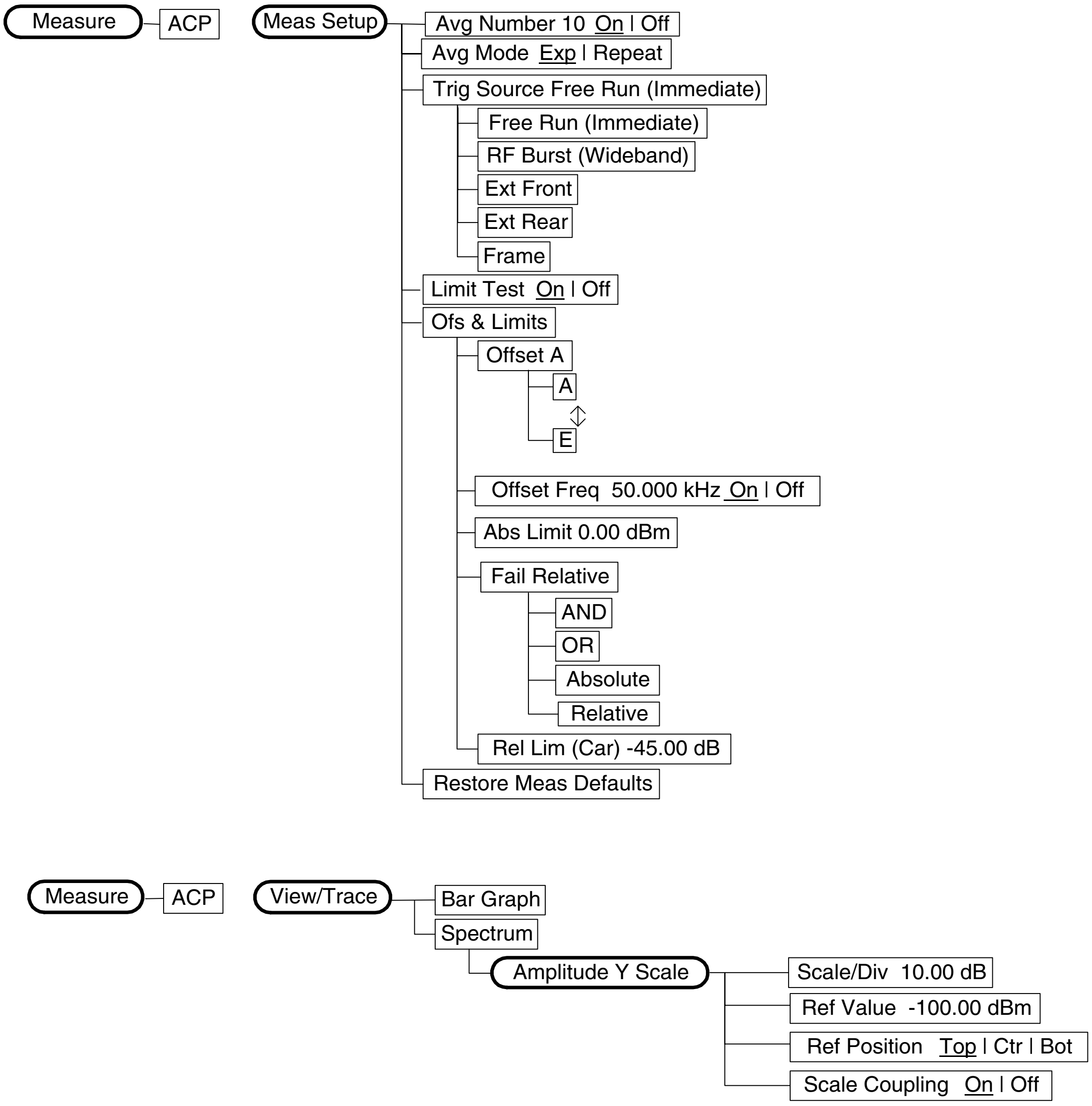

Measure
ACP
Meas Setup
Avg Number 10 On | Off
Avg Mode Exp | Repeat
Trig Source Free Run (Immediate)
Free Run (Immediate)
RF Burst (Wideband)
Ext Front
Ext Rear
Frame
Limit Test On | Off
Ofs & Limits
Offset A
A
E
Offset Freq 50.000 kHz On | Off
Abs Limit 0.00 dBm
Fail Relative
AND
OR
Absolute
Relative
Rel Lim (Car) -45.00 dB
Restore Meas Defaults
Measure
ACP
View/Trace
Bar Graph
Spectrum
Amplitude Y Scale
Scale/Div 10.00 dB
Ref Value -100.00 dBm
Ref Position Top | Ctr | Bot
Scale Coupling On | Off

Figure 6-3 EVM Measurement Key Flow

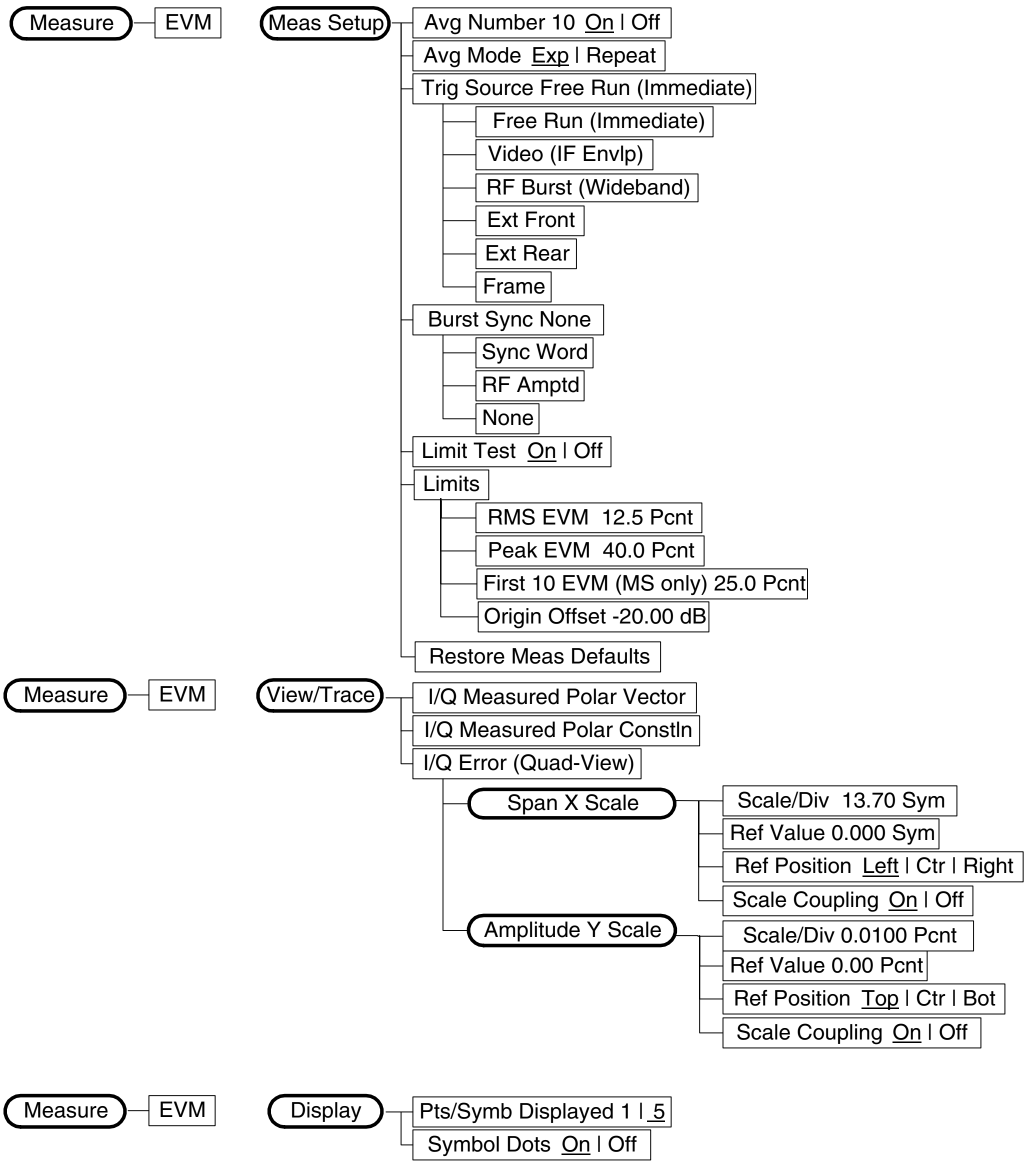

Measure
EVM
Meas Setup
Avg Number 10 On | Off
Avg Mode Exp | Repeat
Trig Source Free Run (Immediate)
Free Run (Immediate)
Video (IF Envlp)
RF Burst (Wideband)
Ext Front
Ext Rear
Frame
Burst Sync None
Sync Word
RF Amptd
None
Limit Test On | Off
Limits
RMS EVM 12.5 Pcnt
Peak EVM 40.0 Pcnt
First 10 EVM (MS only) 25.0 Pcnt
Origin Offset -20.00 dB
Restore Meas Defaults
Measure
EVM
View/Trace
I/Q Measured Polar Vector
I/Q Measured Polar Constln
I/Q Error (Quad-View)
Span X Scale
Scale/Div 13.70 Sym
Ref Value 0.000 Sym
Ref Position Left | Ctr | Right
Scale Coupling On | Off
Amplitude Y Scale
Scale/Div 0.0100 Pcnt
Ref Value 0.00 Pcnt
Ref Position Top | Ctr | Bot
Scale Coupling On | Off
Measure
EVM
Display
Pts/Symb Displayed 1 | 5
Symbol Dots On | Off

Figure 6-4 Occupied Bandwidth Measurement Key Flow

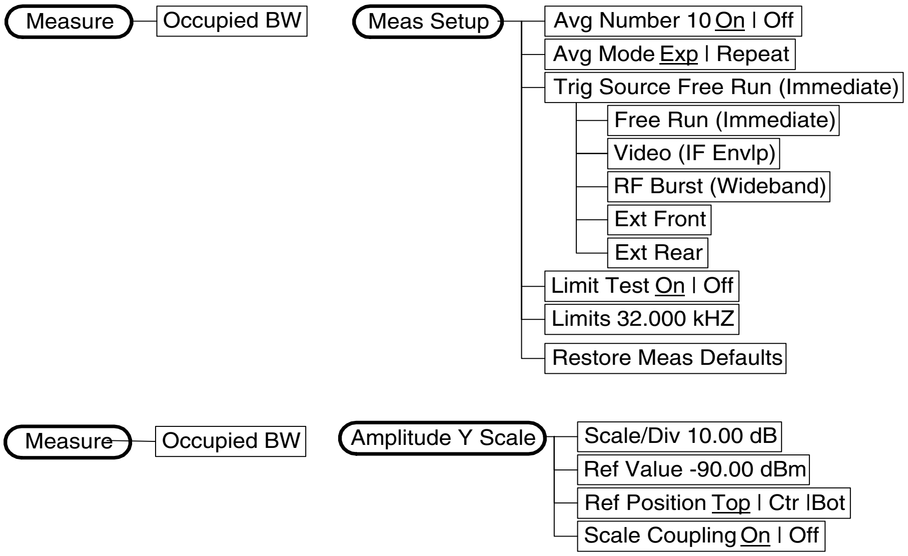

Measure
Occupied BW
Meas Setup
Avg Number 10 On | Off
Avg Mode Exp | Repeat
Trig Source Free Run (Immediate)
Free Run (Immediate)
Video (IF Envlp)
RF Burst (Wideband)
Ext Front
Ext Rear
Limit Test On | Off
Limits 32.000 kHZ
Restore Meas Defaults
Measure
Occupied BW
Amplitude Y Scale
Scale/Div 10.00 dB
Ref Value -90.00 dBm
Ref Position Top | Ctr |Bot
Scale Coupling On | Off

Figure 6-5 **Spectrum Measurement Key Flow (1 of 3)**

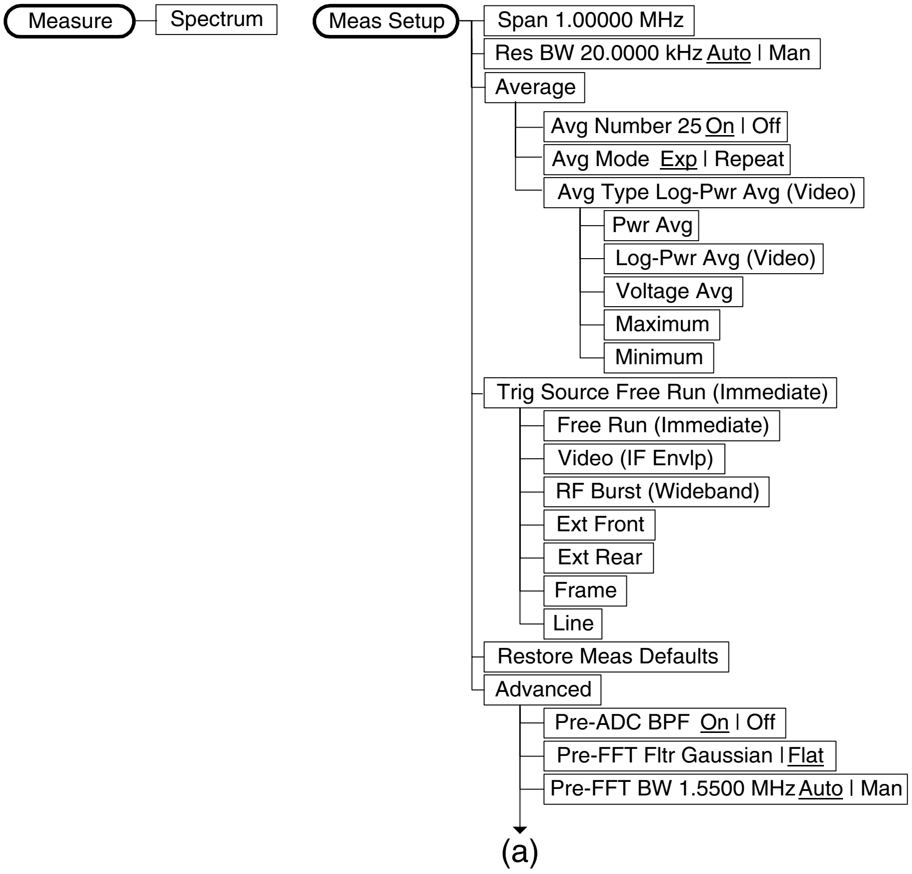

Measure
Spectrum
Meas Setup
Span 1.00000 MHz
Res BW 20.0000 kHz Auto | Man
Average
Avg Number 25 On | Off
Avg Mode Exp | Repeat
Avg Type Log-Pwr Avg (Video)
Pwr Avg
Log-Pwr Avg (Video)
Voltage Avg
Maximum
Minimum
Trig Source Free Run (Immediate)
Free Run (Immediate)
Video (IF Envlp)
RF Burst (Wideband)
Ext Front
Ext Rear
Frame
Line
Restore Meas Defaults
Advanced
Pre-ADC BPF On | Off
Pre-FFT Fltr Gaussian | Flat
Pre-FFT BW 1.5500 MHz Auto | Man
(a)

Figure 6-6 Spectrum Measurement Key Flow (2 of 3)

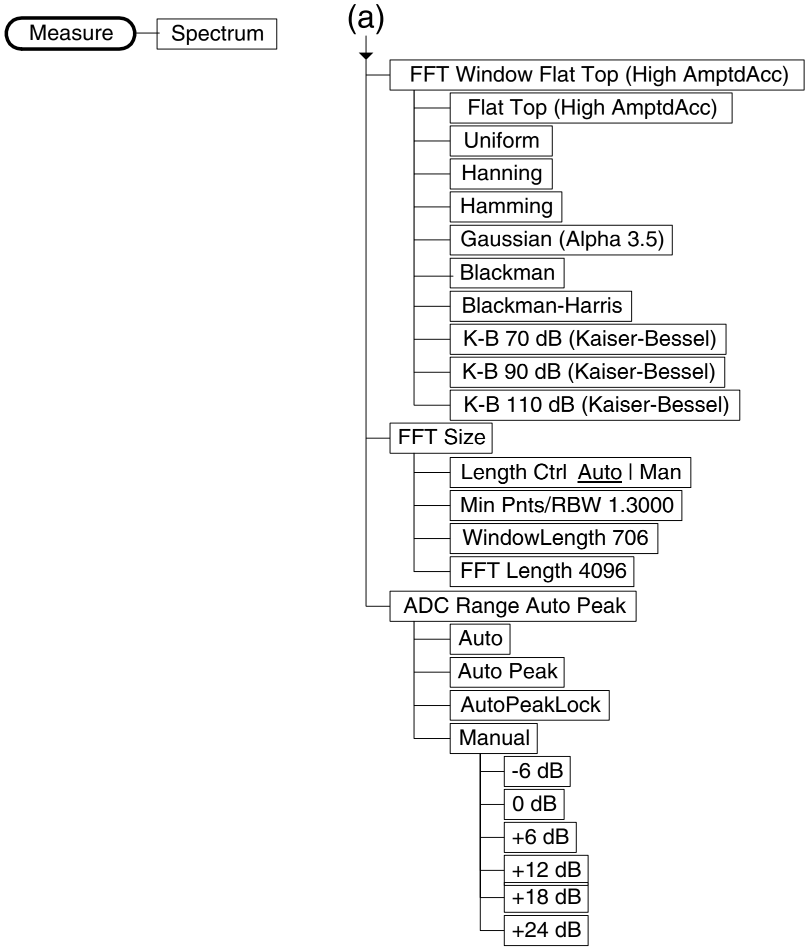

Measure
Spectrum
(a)
FFT Window Flat Top (High AmptdAcc)
Flat Top (High AmptdAcc)
Uniform
Hanning
Hamming
Gaussian (Alpha 3.5)
Blackman
Blackman-Harris
K-B 70 dB (Kaiser-Bessel)
K-B 90 dB (Kaiser-Bessel)
K-B 110 dB (Kaiser-Bessel)
FFT Size
Length Ctrl Auto | Man
Min Pnts/RBW 1.3000
WindowLength 706
FFT Length 4096
ADC Range Auto Peak
Auto
Auto Peak
AutoPeakLock
Manual
-6 dB
0 dB
+6 dB
+12 dB
+18 dB
+24 dB

Figure 6-7 Spectrum Measurement Key Flow (3 of 3)

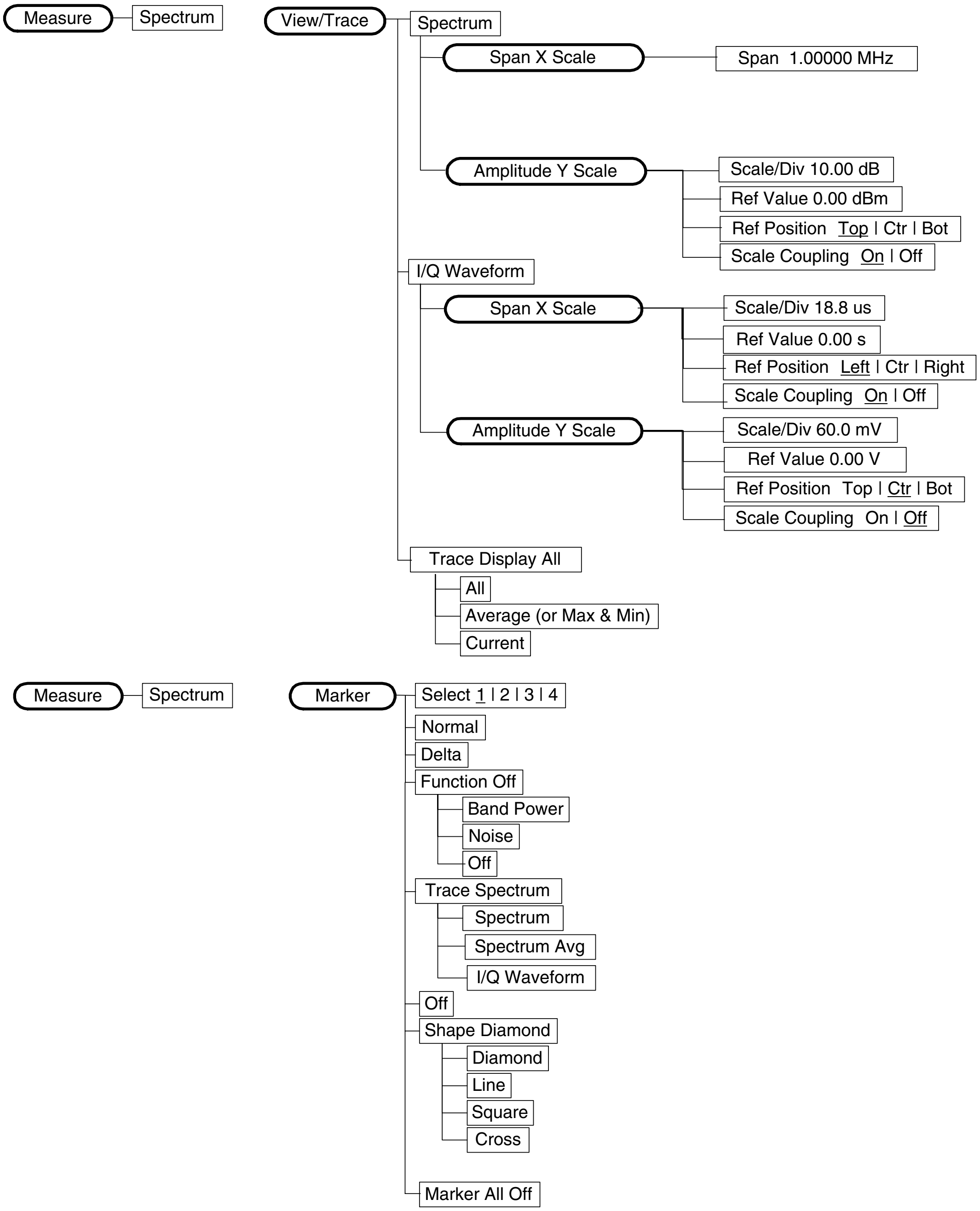

Measure
Spectrum
View/Trace
Spectrum
Span X Scale
Span 1.00000 MHz
Amplitude Y Scale
Scale/Div 10.00 dB
Ref Value 0.00 dBm
Ref Position Top | Ctr | Bot
Scale Coupling On | Off
I/Q Waveform
Span X Scale
Scale/Div 18.8 us
Ref Value 0.00 s
Ref Position Left | Ctr | Right
Scale Coupling On | Off
Amplitude Y Scale
Scale/Div 60.0 mV
Ref Value 0.00 V
Ref Position Top | Ctr | Bot
Scale Coupling On | Off
Trace Display All
All
Average (or Max & Min)
Current
Measure
Spectrum
Marker
Select 1 | 2 | 3 | 4
Normal
Delta
Function Off
Band Power
Noise
Off
Trace Spectrum
Spectrum
Spectrum Avg
I/Q Waveform
Off
Shape Diamond
Diamond
Line
Square
Cross
Marker All Off

Figure 6-8 Waveform Measurement Key Flow (1 of 2)

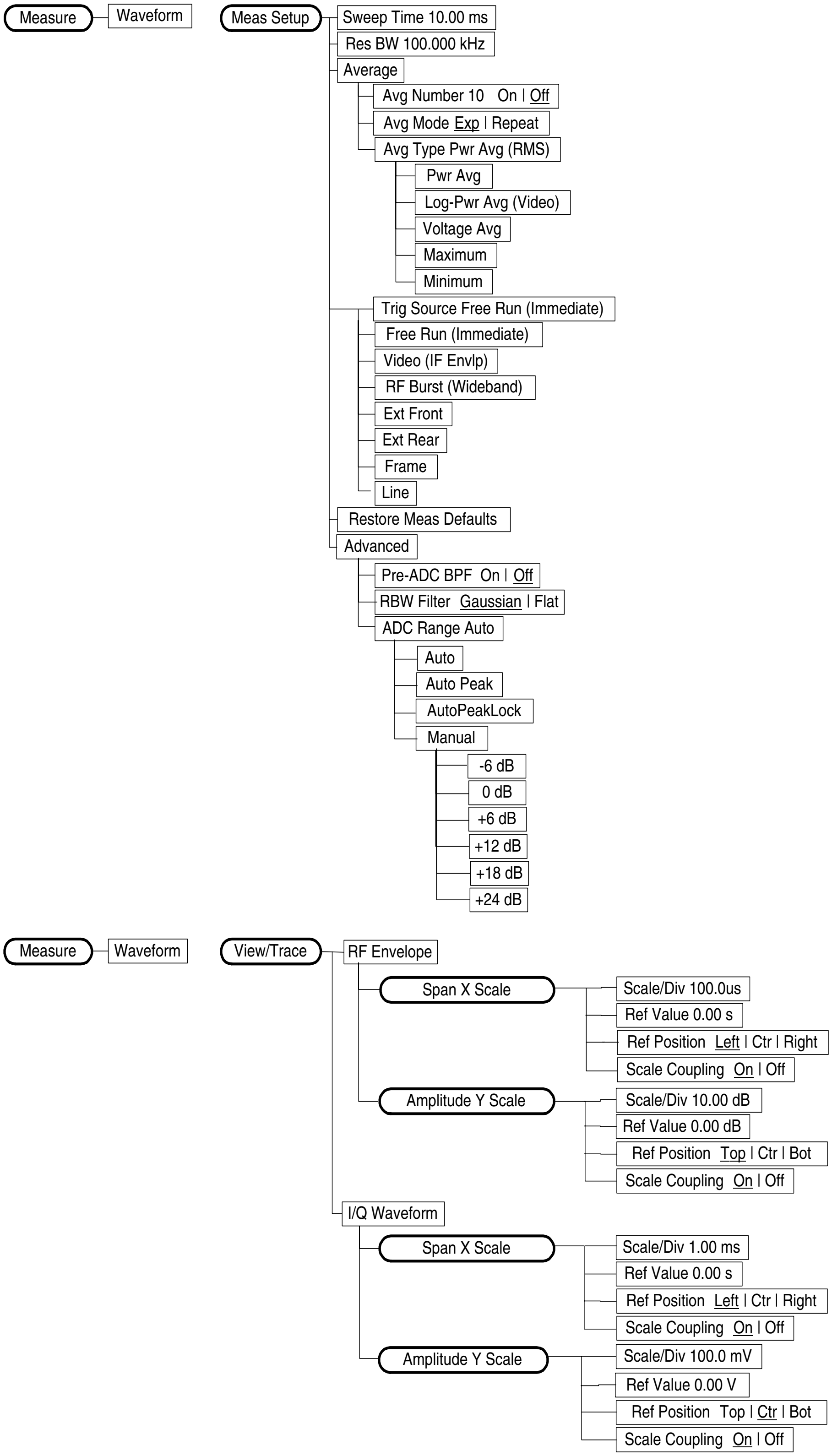
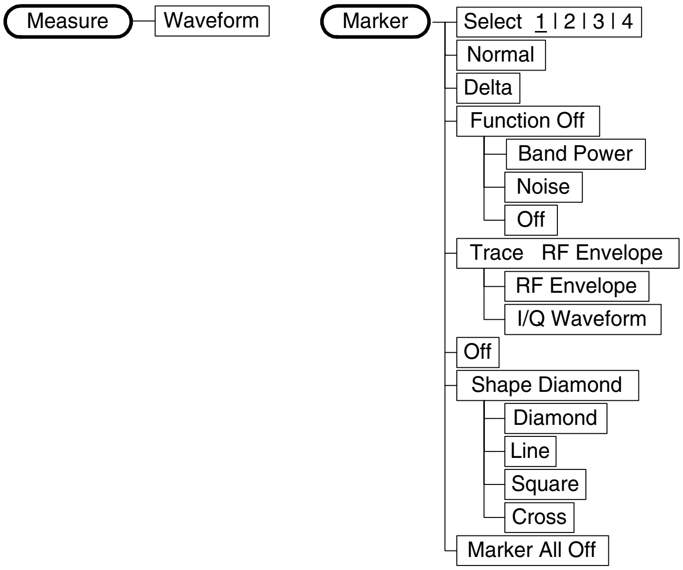

Measure
Waveform
Meas Setup
Sweep Time 10.00 ms
Res BW 100.000 kHz
Average
Avg Number 10 On | Off
Avg Mode Exp | Repeat
Avg Type Pwr Avg (RMS)
Pwr Avg
Log-Pwr Avg (Video)
Voltage Avg
Maximum
Minimum
Trig Source Free Run (Immediate)
Free Run (Immediate)
Video (IF Envlp)
RF Burst (Wideband)
Ext Front
Ext Rear
Frame
Line
Restore Meas Defaults
Advanced
Pre-ADC BPF On | Off
RBW Filter Gaussian | Flat
ADC Range Auto
Auto
Auto Peak
AutoPeakLock
Manual
-6 dB
0 dB
+6 dB
+12 dB
+18 dB
+24 dB
Measure
Waveform
View/Trace
RF Envelope
Span X Scale
Scale/Div 100.0us
Ref Value 0.00 s
Ref Position Left | Ctr | Right
Scale Coupling On | Off
Amplitude Y Scale
Scale/Div 10.00 dB
Ref Value 0.00 dB
Ref Position Top | Ctr | Bot
Scale Coupling On | Off
I/Q Waveform
Span X Scale
Scale/Div 1.00 ms
Ref Value 0.00 s
Ref Position Left | Ctr | Right
Scale Coupling On | Off
Amplitude Y Scale
Scale/Div 100.0 mV
Ref Value 0.00 V
Ref Position Top | Ctr | Bot
Scale Coupling On | Off

Figure 6-9 Waveform Measurement Key Flow (2 of 2)


Measure
Waveform
Marker
Select 1 | 2 | 3 | 4
Normal
Delta
Function Off
Band Power
Noise
Off
Trace RF Envelope
RF Envelope
I/Q Waveform
Off
Shape Diamond
Diamond
Line
Square
Cross
Marker All Off

Installing Optional Measurement Personalities

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

1. Install the measurement personality firmware into the instrument memory. See "Loading an Optional Measurement Personality" on page 261.
2. Enter a license key number that activates the measurement personality. See "Installing a License Key" on page 262.

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

Available Measurement Personality Options

Available Personality Options[a]	**Option**
GSM measurement personality	**BAH**
EDGE (with GSM) measurement personality[b]	**202**
cdmaOne measurement personality	**BAC**
NADC, PDC measurement personalities	**BAE**
iDEN measurement personality	**HN1**
W-CDMA measurement personality	**BAF**
cdma2000 measurement personality	**B78**

[a] Available as of the print date of this guide.
[b] For instruments that already have Option BAH licensed, order E4406AU Option 252 to add EDGE (with GSM).

You need two pieces of information about your instrument to order a retrofit kit adding an option. You need the Host ID, and the instrument serial number. You may also want/need to add optional memory.

Required Information:	**Key Path:**
Host ID: ______________	**System**, **Show System**

Required Information:	**Key Path:**
Instrument Serial Number: ________________	**System**, **Show System**

Loading an Optional Measurement Personality

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

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

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

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

Available Personality Options	**File Size (VSA - A.05.20)**
GSM measurement personality	2.4 MB
EDGE (with GSM) measurement personality	3.3 MB
cdmaOne measurement personality	2.0 MB
NADC measurement personalities	1.3 MB
PDC measurement personalities	1.4 MB
iDEN measurement personality	1.7 MB
W-CDMA measurement personality	4.2 MB[a]
cdma2000 measurement personality	3.8 MB[a]
**Shared measurement library	1.5 MB

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

The **Exit Main Firmware** key is used during the firmware installation process. This key is only for use when you want to update core firmware using a LAN connection. The **Exit Main Firmware** key halts the operation of the instrument firmware 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/**

Installing a License Key

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

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

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

NOTE Note: that you must already have entered the license key for the GSM option BAH before you can enter the license key for the EDGE retrofit option 252.

2. Press **License Key**. Enter the letters/digits of your license key. You will see your entry in the active function area of the display. When you have completed entering the license key number, press the **Done** key.
3. Press the **Install Now** key.

   The message “ `New option keys become active after reboot.`” will appear. If you want to proceed with the installation, press the **Yes** key and cycle the instrument power off and then on. Press the **No** key if you wish to cancel the installation process.

Viewing a License Key

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

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

1. Press **System**, **Install**, **Choose Option.** The **Choose Option** key accesses the alpha editor. Use the alpha editor to enter letters (upper-case) and the front-panel numeric keys to enter digits for a personality option that is already 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 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 _____________________

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/**

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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 digits (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 **Yes** key if you want to continue the uninstall process. Press the **No** key to cancel the uninstall process.
3. Cycle the instrument power off and then on to complete the uninstall process.

7 Making PDC Measurements

PDC Measurements

Once in the PDC mode the following measurements for the PDC band are available by pressing the **Measure** key.

☐ "Making the Adjacent Channel Power Measurement" on page 273.

☐ "Making the Error Vector Magnitude (EVM) Measurement" on page 280.

☐ "Making the Occupied Bandwidth Measurement" on page 287.

☐ "Making the Spectrum (Frequency Domain) Measurement" on page 291.

☐ "Making the Waveform (Time Domain) Measurement" on page 301.

These are referred to as one-button measurements. When you press the key to select a measurement it will become the active measurement, using settings and a display unique to that measurement. Data acquisitions will automatically begin when trigger requirements, if any, are met.

Preparing for Measurements

If you want to set the PDC 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 switch instrument modes.

To preset only the settings that are specific to the selected measurement, press **Meas Setup**, **More**, **Restore Meas Defaults**. This will reset 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:

Measure

The **Measure** front-panel key accesses the menu to select one of the following measurements:

- **ACP** - Press this key to make adjacent channel power measurements. The following menu is activated by the **View/Trace** front-panel key:

  Bar Graph - Displays the ACP bar graph with ±21.0 kHz power bandwidths centered at ±50 and ±100 kHz offsets from the center frequency of the carrier signal. The summary data is also available in the text window.

  Spectrum - Displays the ACP spectrum graph (with ±21.0 kHz bandwidth marker lines) at ±50 and ±100 kHz offsets from the center frequency of the carrier signal. The summary data is also available in the text window.

- **EVM** - Press this key to make error vector magnitude measurements. The following keys are activated by the **View/Trace** front-panel key:

  I/Q Measured Polar Vector - Displays the EVM polar vector graph of the I/Q demodulated signal. The summary data is also available in the text window.

I/Q Measured Polar Constln - Displays the EVM polar constellation graph of the I/Q demodulated signal. The summary data is also available in the text window.

I/Q Error (Quad-View) - Displays four windows for the **EVM**, **Magnitude Error** and **Phase Error** graphs and the **EVM** summary data. By selecting one of the windows with the **Next Window** front-panel key, you can enlarge it by pressing the **Zoom** key.

- **Occupied BW** - Press this key to make occupied bandwidth measurements with the occupied bandwidth graph window and summary data window. Two vertical lines mark the ±0.5% power points on the display. The **View/Trace**, **Span X Scale**, and **Marker** menus are not available for this measurement, but the **Amplitude Y Scale** menu is available.

- **Spectrum (Freq Domain)** - Press this key to make spectrum measurements with the spectrum and I/Q waveform display windows. The following menu is activated by the **View/Trace** front-panel key:

  Spectrum - Switches the display window from the **I/Q Waveform** window. This is equivalent to the **Next Window** front-panel key.

  I/Q Waveform - Switches the display window from the **Spectrum** window. This is equivalent to the **Next Window** front-panel key.

  Trace Display - Allows you to control the traces displayed for the current measurement data and/or the averaged data as follows:

    All - Displays both current and average traces if the **Average** function is already activated.

    Average (or Max & Min) - Displays only the average trace if it is already activated.

    Current - Displays only the current data trace.

- **Waveform (Time Domain)** - Press this key to make time-domain waveform measurements with either display of the **RF Envelope** graph and summary data windows or the **I/Q Waveform** window. The following menu is activated by the **View/Trace** front-panel key:

  RF Envelope - Changes to display the RF envelope graph window and the summary data window. This is the default selection for waveform (time domain) measurements.

  I/Q Waveform - Changes to display the I/Q waveform graph window.

Measure Control

The **Meas Control** front-panel key accesses the menu to control processes that affect on running the current measurement.

- *Restart* - Press this **Restart** key to repeat the current measurement from the beginning, while retaining the current measurement settings. This is equivalent to the **Restart** front-panel key.
- *Measure* - Press **Meas Control**, **Measure** (not to be confused with the front-panel **Measure** key which has a different function) to toggle the measurement state between **Single** and **Cont** (Continuous). 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 execute averaging according to the current average type, either repeat or exponential. The default setting is **Cont**.
- **Pause** - Press **Meas Control**, **Pause** to pause the current measurement until you reactivate the 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.

Measurement Setup

The **Meas Setup** key accesses the 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 **Avg Number**, **Avg Mode**, and **Trig Source** keys.

The following measure setup feature can be used with many or all measurements.

- **Restore Meas Defaults** - Allows you to preset only the settings that are specific to the selected measurement by pressing **Meas Setup**, **More (1 of 2)**, **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 average number and averaging mode you use for the currently selected measurement. For spectrum (frequency domain) and waveform (time domain) measurements, the **Average** key activates the following menu:

- **Avg Number** - Allows you to change the number of N averages to be made.

- **Avg Mode Exp Repeat** - Allows you to choose either exponential or repeat averaging mode. This selection only effects the averaging result after the number of N averages is reached. The N is set using the **Avg Number** key.

  Normal averaging: Normal (linear) averaging is always used until the specified number of N averages is reached. When the **Measure** key under **Meas Control** is set to **Single**, data acquisition is stopped when the number of N averages is reached, thus **Avg Mode** has no effect in **Single** measurement mode.

  Exponential averaging: When **Measure** is set to **Cont**, data acquisition will continue indefinitely. Exponential averaging is used with a weighting factor of N (the displayed count of averages stops at N). Exponential averaging weights new data more heavily than old data, which allows tracking of slow-changing signals. The weighting factor N is set using the *Avg Number* key.

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

- **Avg Type** - Allows you to access the following menu only for making spectrum (frequency domain) and waveform (time domain) measurements:

  Pwr Avg (RMS) - Executes the true power averaging which is equivalent to taking the rms of the voltage. This is the most accurate type.

  Log-Pwr Avg (Video) - Simulates the traditional spectrum analyzer type of averaging by calculating the log of the power.

  Voltage Avg - Executes the voltage averaging.

  Maximum - Executes the maximum voltage averaging by capturing peak data.

  Minimum - Executes the minimum voltage averaging.

Trigger Source

Changing the selection in the **Trig Source** menu alters the trigger source for the selected measurement only. Not all of the selections are available for all measurements. Choose one of the following trigger sources:

NOTE The **RF Burst (Wideband)**, **Video (IF Envlp)**, **Ext Front** and **Ext Rear** keys found under the **Trigger** menu enable you to change the default settings of the delay, level and slope for each of these trigger sources.

- **Free Run (Immediate)** - A trigger occurs at the time the data is requested, completely asynchronous with the RF or IF signal.
- **RF Burst (Wideband)** - An internal wideband RF burst trigger that has the automatic level control for burst signals. It triggers at the level that is set relative to the peak RF signal (12 MHz bandwidth) input level.
- **Video (IF Envlp)** - An internal IF envelope trigger that occurs at the absolute threshold level of the IF signal level. This source is not available for ACP measurements.
- **Ext Front** - Activates the front-panel external trigger input (**EXT TRIGGER INPUT**) port. The external signal must be between –5.00 and +5.00 V with 1 mV resolution.
- **Ext Rear** - Activates the rear panel external trigger input (**TRIGGER IN**) port. The external signal must be between –5.00 and +5.00 V with 1 mV resolution.
- **Frame** - Uses the internal frame clock to generate a trigger signal. The clock parameters are controlled under the **Mode Setup** key or the measurement firmware, but not both. See the specific measurement for details. This trigger source is not available for occupied bandwidth measurements.
- *Line* - Sets the trigger to the line mode. Sweep triggers occur at intervals synchronous to the line frequency. This trigger source is available for spectrum and waveform measurements.

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

Burst Sync

This menu is only used for EVM measurements. Pressing the **Burst Sync** key allows you to choose the source used to synchronize the measurement to the “point 0” of the PDC burst. The “point 0” is defined as the start of symbol 0 in timeslot 0. The **Search Threshold** setting in the **Burst** menu under **Mode Setup** applies to the **RF Amptd**. Pressing the **Burst Sync** key will bring up a menu with some or all of the following choices:

- **Sync Word** - Synchronizes the measurement to the sync word which is one of the six possible 20-bit PDC timeslot synchronization words contained in the signal. This is the default when **Device** is set to **MS**.

- **RF Amptd** - Synchronizes the measurement to the burst transition of the measured RF carrier.
- **None** - Measurements are made without synchronizing with the PDC burst. This is the default when **Device** is set to **BS**.

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 power (ACP) transmitted from a PDC mobile phone. The characteristics of adjacent channel power are mainly determined by the transmitter design, including a digital filter called a root Nyquist filter.

Adjacent channel power is defined by the PDC standard as the total power within the defined bandwidth, centered at Δf kHz offset from the carrier frequency. The carrier is modulated by the standard coding test signal which has the same coding speed as the PDC modulation signal. The following specifications from the RCR STD-27 standards apply to both base stations and mobile stations:

(1) At ±50 kHz offset: Less than –45 dB

(2) At ±100 kHz offset: Less than –60 dB

Measurement Method

This measurement analyzes the total power levels within the defined bandwidth of 21.0 kHz at given offset frequencies on both sides of the carrier frequency using Fast Fourier Transform (FFT).

The measurement functions, such as averaging, trigger source, limit test, offsets and limits, need to be setup for a measurement and pass/fail test. The test result is displayed in either bar graph window or spectrum window. Both the absolute power levels and the power levels relative to the center power band are displayed in the text window. When **Spectrum View** is selected, the vertical scale can be varied for your optimum observation by pressing the **Amplitude Y Scale** front-panel key.

Making the Measurement

NOTE The factory default parameters provided for this measurement will give you a PDC compliant measurement for the instrument setup. You should be able to make a measurement often using these defaults.

Select the desired center frequency as described in "Changing the Frequency Channel" in Chapter 6.

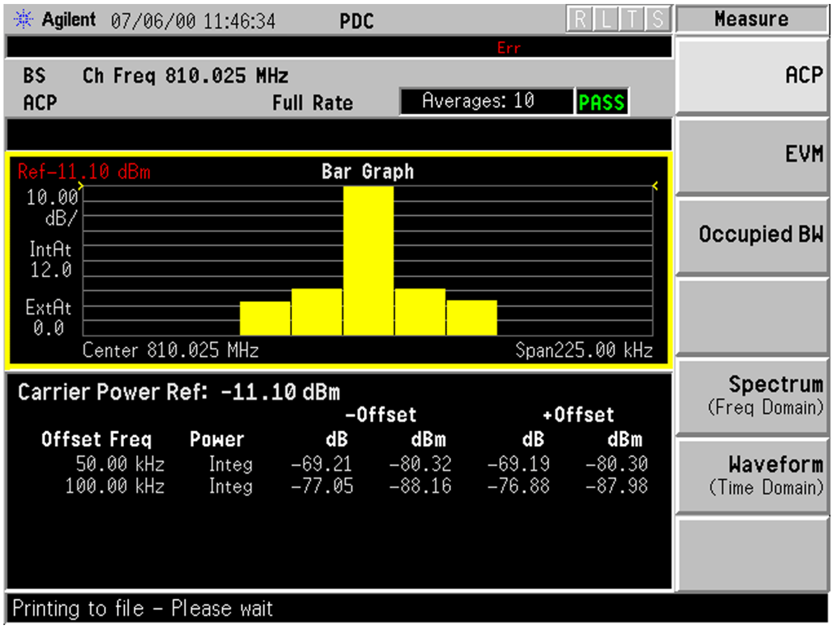
Press **Measure**, **ACP** to immediately make an adjacent channel power measurement.

To change any of the measurement parameters from the factory default values, refer to "Changing the Measurement Setup" on page 275 for this measurement.

Results

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

Figure 7-1 **Adjacent Channel Power Measurement - Bar Graph View**


Agilent
07/06/00 11:46:34
PDC
R L T S
Err
Ref-11.10 dBm
Bar Graph
10.00
dB/
IntAt
12.0
ExtAt
0.0
Center 810.025 MHz
Span225.00 kHz
Measure
ACP
EVM
Occupied BW
Spectrum
(Freq Domain)
Waveform
(Time Domain)

```
BS    Ch Freq 810.025 MHz
ACP                       Full Rate   Averages: 10   PASS

Carrier Power Ref: -11.10 dBm
                               -Offset            +Offset
    Offset Freq    Power      dB      dBm       dB      dBm
      50.00 kHz    Integ   -69.21   -80.32   -69.19   -80.30
     100.00 kHz    Integ   -77.05   -88.16   -76.88   -87.98

Printing to file - Please wait
```

Changing the Measurement Setup

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

Table 7-1 **Adjacent Channel Power Measurement Defaults**

Measurement Parameter	Factory Default Condition
View/Trace	Bar Graph
Meas Setup:	
Avg Number	10, On
Avg Mode	Exp
Trig Source:	
(when Device is MS)	RF Burst (Immediate)
(when Device is BS)	Free Run (Wideband)
Limit Test	On
Offs & Limits:	
Offset	A
Offset Freq:	
A	50.000 kHz, On
B	100.000 kHz, On
C, D, E	0.0 Hz, Off
Abs Limit:	
A, B, C, D, E	0.00 dBm
Fail:	
A, B	Relative
C	OR
D, E	AND
Rel Limit (Car):	
A	–45.00 dB
B	–60.00 dB
C, D, E	0.00 dB

Make sure the **ACP** 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" on page 269. However, the trigger source does not include **Video** and **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 Limit** and/or **Rel Lim (Car)** 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.

- **Ofs & Limits** - Allows you to access the menu to change the following parameters for pass/fail tests:

    Offset - Allows you to access the memory selection menu to store 5 offset frequency values in **A** through **E**. Only one selection at a time (A, B, C, D, or E) is shown on this key label. The default selection is A.

    Offset Freq - Allows you to enter an offset frequency value and toggle the offset frequency function between **On** and **Off**, according to each offset key selected. The allowable range is 0 Hz to 200.000 kHz. While this key is activated, enter an offset value from the numeric keypad by terminating with one of the frequency unit keys shown. For PDC measurements offsets A and B are defaulted to 50.000 kHz On and 100.000 kHz On, respectively, while offsets C, D and E are defaulted to 0.0 Hz Off. One offset frequency value selected from the **Offset** menu is shown on this key label. The default state shows 50.000 kHz On.

    Abs Limit - Allows you to enter an absolute limit value ranging from –200.00 to +50.00 dBm with the best resolution of 0.01 dB. The default settings for all offsets are 0.00 dBm.

    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 (Car)** AND one of the absolute ACP measurement results is larger than **Abs Limit**. This is the default setting for offsets D and E.

        OR - Fail is shown if one of the relative ACP measurement results is larger than **Rel Lim (Car)** OR one of the absolute ACP measurement results is larger than **Abs Limit**. This is the default setting for offset C.

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 (Car)**. This is the default setting for offsets A and B.

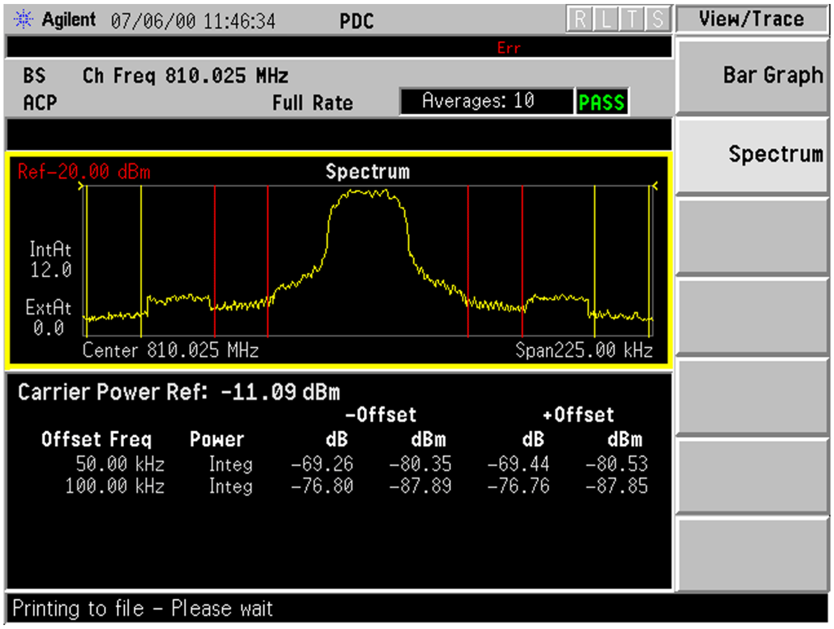
Rel Lim (Car) - Allows you to enter a relative limit value ranging from –200.00 to +50.00 dB with the best resolution of 0.01 dB. The default settings for offsets A and B are –45.00 and –60.00 dB, respectively, while offsets C, D and E are defaulted to 0.00 dB.

Changing the View

The **View/Trace** key accesses the menu which allows you to select the desired measurement view from the following selections:

- **Bar Graph** - In the factory default condition, 5 of the total integration power levels within 21.0 kHz bandwidth, centered at the carrier frequency and ±50 kHz and ±100 kHz offset frequencies, are shown in the bar graph window. The corresponding measured data is shown in the text window as shown in Figure 7-1 on page 274.
- **Spectrum** - Once this view is selected, Figure 7-1 on page 274 changes as shown below. In the factory default condition, the swept frequency spectrum is displayed with the bandwidth marker lines in the spectrum graph window. The corresponding measured data in the text window is the total integration power within the defined bandwidth of 21.0 kHz. While in this view, you can change the vertical scale by pressing the **Amplitude Y Scale** key.

Figure 7-2 **Adjacent Channel Power Measurement - Spectrum View**



```
Agilent  07/06/00 11:46:34        PDC
BS     Ch Freq 810.025 MHz
ACP                        Full Rate    Averages: 10   PASS
```

```
Carrier Power Ref: -11.09 dBm
                                 -Offset            +Offset
   Offset Freq    Power        dB      dBm        dB      dBm
     50.00 kHz    Integ     -69.26   -80.35    -69.44   -80.53
    100.00 kHz    Integ     -76.80   -87.89    -76.76   -87.85
```

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Troubleshooting Hints

The adjacent channel power measurements suggest us numerous faults in the transmitter section of the UUT, as follows:

(1) Faults caused by a malfunction of the baseband circuitry consisting of a code generator, a digital filter, digital-to-analog converters, 90-degree phase shifter, and I/Q modulators.

(2) Faults due to high phase noise levels from the local oscillators.

(3) Faults due to excessive noise floor levels from the up-converter, output amplifier, and/or analog filters.

Making the Error Vector Magnitude (EVM) Measurement

Purpose

Phase and frequency errors are the measures of modulation quality for the PDC system. Since the PDC system uses the π/4 DQPSK modulation technique, the phase and frequency accuracies of the PDC transmitter are critical to the communications system performance and ultimately affect range.

PDC receivers rely on the phase and frequency quality of the π/4 DQPSK modulation signal in order to achieve the expected carrier to noise ratio. A transmitter with high phase and frequency errors will often still be able to support phone calls during a functional test. However, it will tend to provide difficulty for mobiles trying to maintain service at the edge of the cell with low signal levels or under difficult fading and Doppler conditions.

Measurement Method

The phase error of the unit under test is measured by computing the difference between the phase of the transmitted signal and the phase of a theoretically perfect signal.

The instrument samples the transmitter output in order to capture the actual phase trajectory. This is then demodulated and the ideal phase trajectory is mathematically derived. Subtracting one from the other results in an error signal.

For base stations, the PDC standard specifies that the phase error should not exceed 5 degrees rms or 20 degrees peak, and that the mean frequency error across the burst must not exceed 0.05 ppm. These specifications hold true for normal and extreme temperature conditions, and with exposure to vibration.

This measurement allows you to display these errors numerically and graphically on the instrument display. There are graphs for `EVM`, `Phase Error` and `Mag Error` in the graph windows. In the text window, there are `Evm:` in % rms, in % peak at the highest symbol number, `Mag Error:` in % rms, `Phase Error:` in degrees, `Freq Error:` in Hz, and `I/Q Offset:` in dB.

Making the Measurement

NOTE The factory default settings provide a PDC 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, burst type, and slot as described in "Changing the Frequency Channel" on page 248.

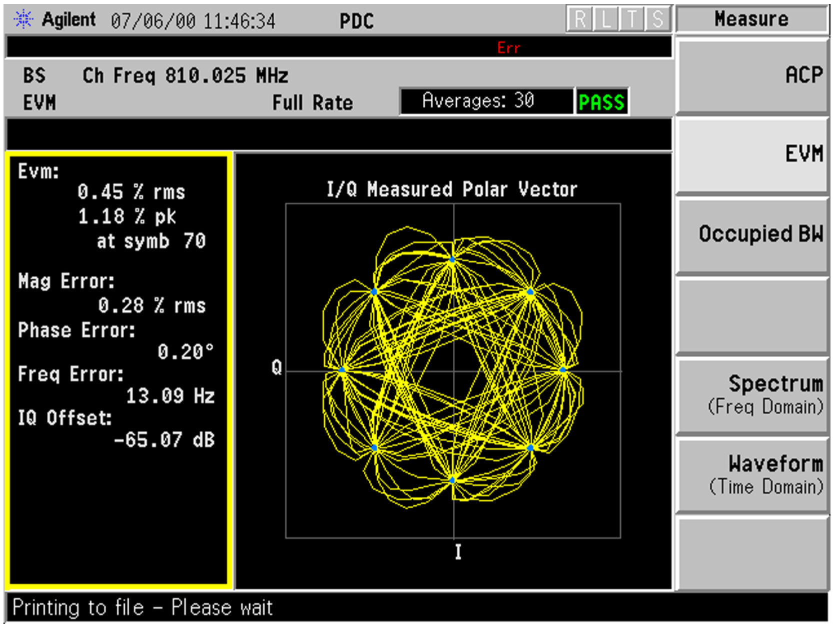
Press **Measure**, **EVM** to immediately make the error vector magnitude measurement.

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

Results

The next figure shows an example of measurement result with the graphic and text windows. The measured summary data is shown in the left window and the dynamic vector trajectory of the I/Q demodulated signal is shown as a polar vector display in the right window.

Figure 7-3 Error Vector Magnitude Measurement - Polar Vector View



Agilent 07/06/00 11:46:34 PDC

Err

BS Ch Freq 810.025 MHz

EVM Full Rate Averages: 30 PASS

Evm:
0.45 % rms
1.18 % pk
at symb 70
Mag Error:
0.28 % rms
Phase Error:
0.20°
Freq Error:
13.09 Hz
IQ Offset:
-65.07 dB

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Changing the Measurement Setup

The next table shows the factory default settings for error vector magnitude measurements.

Table 7-2 **Error Vector Magnitude Measurement Defaults**

Measurement Parameter	Factory Default Condition
Avg Number	10, On
Avg Mode	Exponential
Trigger Source	Free Run when Device is BS RF Burst when Device is MS
Burst Sync	None when Device is BS Sync Word when Device is MS
View/Trace	I/Q Measured Polar Vector
Limit Test	On
Limits: RMS EVM	12.5%
Limits: Peak EVM	40.0%
Limits: Origin Offset	–20 dB

Make sure the **Error Vector Magnitude (EVM)** measurement is selected under the **Measure** menu. The **Meas Setup** key accesses a menu which allows you to modify the averaging, trigger source and burst sync for this measurement as described in "Measurement Setup" earlier in this chapter. However, the trigger source does not include **Line**. In addition, the following error vector magnitude measurement parameters can be modified:

- **Limit Test** - Allows you to toggle between **On** and **Off**. If set to **On**, the **Limits** key needs to be pressed to specify the limit values for rms EVM, peak EVM and origin offset. Pass/fail results are shown in the active display window with the number of averages.
- **Limits** - Allows you to access the menu to change the following test parameter limits:

  RMS EVM - Allows you to enter a limit value ranging from 0.0 to 50.0% for the pass/fail test of the rms error vector magnitude measured on all of the symbols. The default setting is 12.5%.

  Peak EVM - Allows you to enter a limit value ranging from 0.0 to 50.0% for the pass/fail test of the peak error vector magnitude measured on all of the symbols. The default setting is 40.0%.

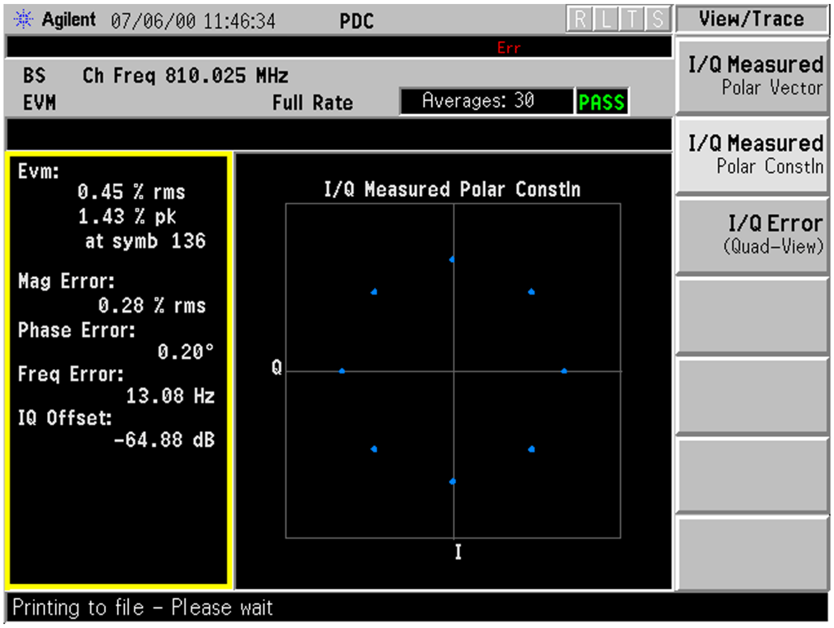
  Origin Offset - Allows you to enter a limit value ranging from –100.00 to 0.00 dB for the pass/fail test of the origin offset. The default setting is –20.00 dB.

Changing the View

The **View/Trace** key accesses the menu which allows you to select the desired measurement view from the following selections:

- **I/Q Measured Polar Vector** - The measured summary data is shown in the left window and the dynamic vector trajectory of I/Q demodulated signal is shown as a polar vector display in the right window, as shown in Figure 7-3 on page 281.
- **I/Q Measured Polar Constln** - The measured summary data is shown in the left window and the dynamic vector constellation of I/Q demodulated signal is shown as a polar vector display in the right window as shown in Figure 7-4 on page 283.

Figure 7-4 Error Vector Magnitude Measurement - Polar Constln



Agilent 07/06/00 11:46:34 PDC
R L T S
Err
I/Q Measured Polar Constln
Q
I
View/Trace
I/Q Measured Polar Vector
I/Q Measured Polar Constln
I/Q Error (Quad-View)

BS Ch Freq 810.025 MHz
EVM Full Rate Averages: 30 PASS

Evm:
0.45 % rms
1.43 % pk
at symb 136
Mag Error:
0.28 % rms
Phase Error:
0.20°
Freq Error:
13.08 Hz
IQ Offset:
-64.88 dB

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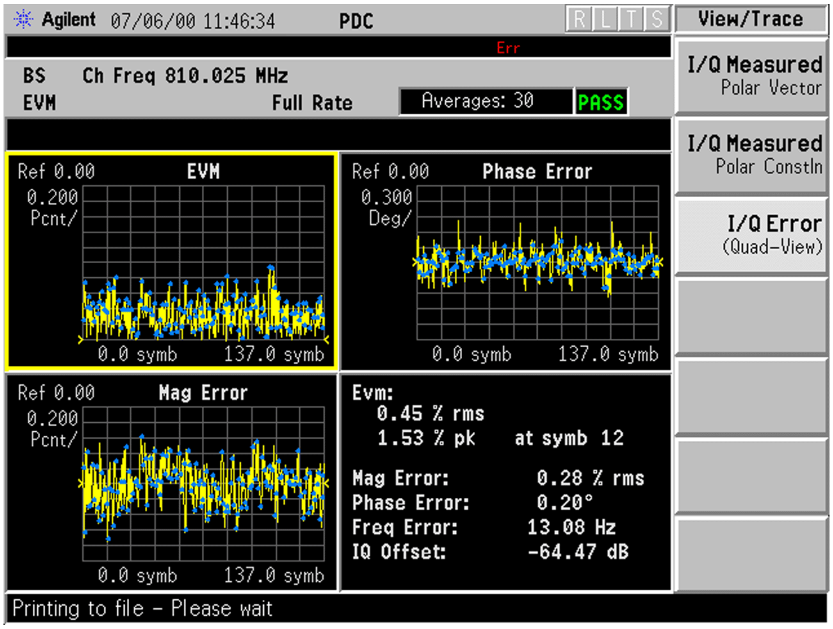
- **I/Q Error (Quad-View)** - Four display windows show EVM, Mag Error and Phase Error graphs, and the EVM summary data text.

Figure 7-5 Error Vector Magnitude Measurement - Quad View


Agilent 07/06/00 11:46:34
PDC
R L T S
Err
View/Trace
I/Q Measured
Polar Vector
I/Q Measured
Polar Constln
I/Q Error
(Quad-View)
Ref 0.00
EVM
0.200
Pcnt/
0.0 symb
137.0 symb
Ref 0.00
Phase Error
0.300
Deg/
0.0 symb
137.0 symb
Ref 0.00
Mag Error
0.200
Pcnt/
0.0 symb
137.0 symb

BS Ch Freq 810.025 MHz
EVM Full Rate
Averages: 30 PASS

Evm:
0.45 % rms
1.53 % pk at symb 12

Mag Error: 0.28 % rms
Phase Error: 0.20°
Freq Error: 13.08 Hz
IQ Offset: -64.47 dB

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Changing the Display

The **Display** key accesses the menu to allow the following selections for changing the graph displays:

- **Pts/Symb Displayed** - Allows you to specify the number of displayed points per symbol, either 1 or 5. The default setting is 5.
- **Symbol Dots** - Allows you to toggle the symbol dots between **On** and **Off**. The default setting is **On**.

When either `EVM`, `Phase Error` or `Mag Error` window is active in the I/Q Error (Quad-View) display, the **Span X Scale** key accesses the menu to allow the following selections:

- **Scale/Div** - Allows you to define the horizontal scale by changing the symbol value per division. The range is 1 to 100 symbols per division. The default setting is 13.7 (for BS) or 13.4 (for MS) symbols per division.
- **Ref Value** - Allows you to set the symbol reference value ranging from 0 to 1000 symbols. The default setting is 0.
- **Ref Position** - Allows you to set the reference position to either **Left**, **Ctr** (center) or **Right**. The default setting is **Left**.

- **Scale Coupling** - Allows you to toggle the scale coupling function between **On** and **Off**. The default setting is **On**. This function automatically determines the scale per division and reference value by the magnitude of the measurement results.

When either `EVM:` or `Mag Error:` window is active in the I/Q Error (Quad-View) display, the **Amplitude Y Scale** key accesses the menu to allow the following selections:

- **Scale/Div** - Allows you to define the vertical scale by changing the value per division. The range is 0.01 to 3600 degrees. The default setting is 20.0 degrees per division. However, since the **Scale Coupling** default is set to **On**, this value is automatically determined by the measurement results.
- **Ref Value** - Allows you to set the reference value ranging from 0 to 500%. The default setting is 0%.
- **Ref Position** - Allows you to set the reference position to either **Top**, **Ctr** (center) or **Bot** (bottom). For the `EVM:` graph the, default setting is **Bot**. For the `Mag Error:` graph the default setting is **Ctr**.
- **Scale Coupling** - Allows you to toggle the scale coupling function between **On** and **Off**. The default setting is **On**. This function automatically determines the scale per division and reference value by the magnitude of the measurement results.

When the `Phase Error:` window is active in the I/Q Error display, the **Amplitude Y Scale** key accesses the menu to allow the following selections:

- **Scale/Div** - Allows you to define the vertical scale by changing the value per division. The range is 0.01 to 3600 degrees. The default setting is 20.0 degrees per division. However, since the **Scale Coupling** default is set to **On**, this value is automatically determined by the measurement results.
- **Ref Value** - Allows you to set the reference value ranging from 0 to 500%. The default setting is 0%.
- **Ref Position** - Allows you to set the reference position to either **Top**, **Ctr** (center) or **Bot** (bottom). For the EVM graph, the default setting is **Bot**. For the Mag Error graph, the default setting is *Ctr.*
- **Scale Coupling** - Allows you to toggle the scale coupling function between **On** and **Off**. The default setting is **On**. This function automatically determines the scale per division and reference value by the magnitude of the measurement results.

Troubleshooting Hints

Use the spectrum (frequency domain) measurement to verify that the signal is present and approximately centered on the display.

Poor phase error indicates a problem at the I/Q baseband generator, filters, and/or modulator in the transmitter circuitry.The output amplifier in the transmitter can also create distortion that causes unacceptably high phase error. In a real system, poor phase error will reduce the ability of a receiver to correctly demodulate the signal, especially in marginal signal conditions.

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 measurement is made to analyze 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 setup 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 a PDC 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 248.

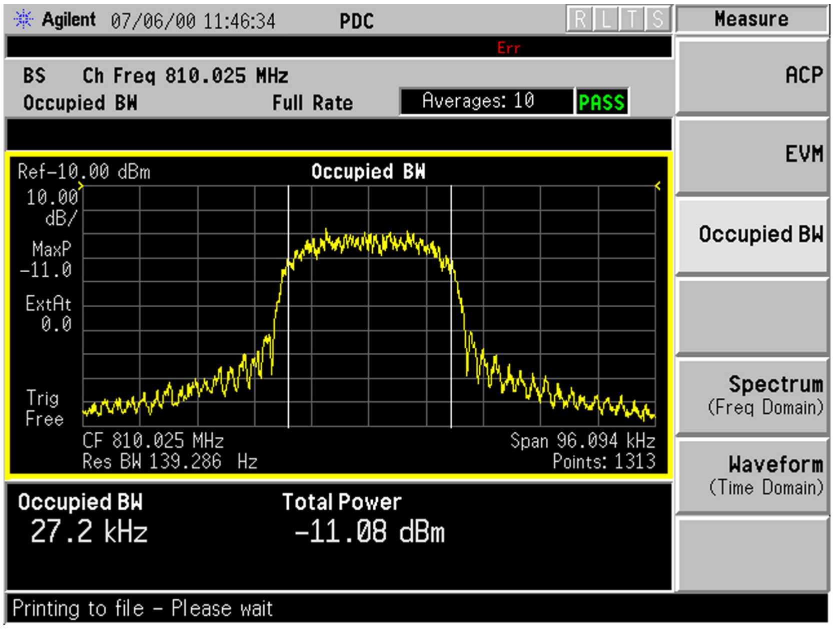
Press **Measure**, **Occupied BW** to immediately make the occupied bandwidth measurement.

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

Results

In the upper window, the spectrum is displayed with vertical lines marking the 0.5% power points. The actual measured data of the occupied bandwidth and the total channel power are shown in the lower window.

Figure 7-6 **Occupied Bandwidth Measurement**



Agilent 07/06/00 11:46:34 PDC

BS Ch Freq 810.025 MHz

Occupied BW Full Rate Averages: 10 PASS

Occupied BW 27.2 kHz

Total Power -11.08 dBm

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R L T S
Err
Ref-10.00 dBm
Occupied BW
10.00
dB/
MaxP
-11.0
ExtAt
0.0
Trig
Free
CF 810.025 MHz
Res BW 139.286 Hz
Span 96.094 kHz
Points: 1313
Measure
ACP
EVM
Occupied BW
Spectrum
(Freq Domain)
Waveform
(Time Domain)

Changing the Measurement Setup

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

Table 7-3 Occupied Bandwidth Measurement Defaults

Measurement Parameter	Factory Default Condition
Log Scale	10.00 dB/div
Avg Number	10, On
Avg Mode	Exponential
Trigger Source	Free Run
Limit Test	On
Limit	32.000 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 "Measurement Setup" earlier in this chapter. However, the trigger source does not include **Frame** and **Line**. 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**. 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. The default value is 32.000 kHz.

Changing the Display

The **Amplitude Y Scale** key accesses the menu to allow the following selections:

- **Scale/Div** - Allows you to change the vertical scale per division. The range is 0.10 to 20.00 dB per division with 0.01 dB resolution. The default setting is 10.00 dB.
- **Ref Value** - Allows you to set the reference value ranging from –250.00 to +250.00 dBm with 0.01 dB resolution. This value is automatically determined in 10 dB steps by the magnitude of measurement results because **Scale Coupling** is defaulted to **On**.
- **Ref Position** - Allows you to set the reference position to either **Top**, **Ctr** (center) or **Bot** (bottom). The default setting is **Top**.

- **Scale Coupling** - Allows you to toggle the scale coupling function between **On** and **Off**. The default setting is **On**. If set to **On**, **Ref Value** automatically changes to the appropriate value by 10 dB increments according to the channel power level.

Troubleshooting Hints

The occupied bandwidth measurements can suggest some defective parts in the I/Q modulator section of the UUT.

Making the Spectrum (Frequency Domain) Measurement

Purpose

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

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

Measurement Method

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

This measurement is available for both the RF input and baseband I/Q inputs. For details on baseband I/Q operation see the section on baseband I/Q measurements in the E4406A VSA Series Transmitter Tester User’s Guide.

Making the Measurement

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

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

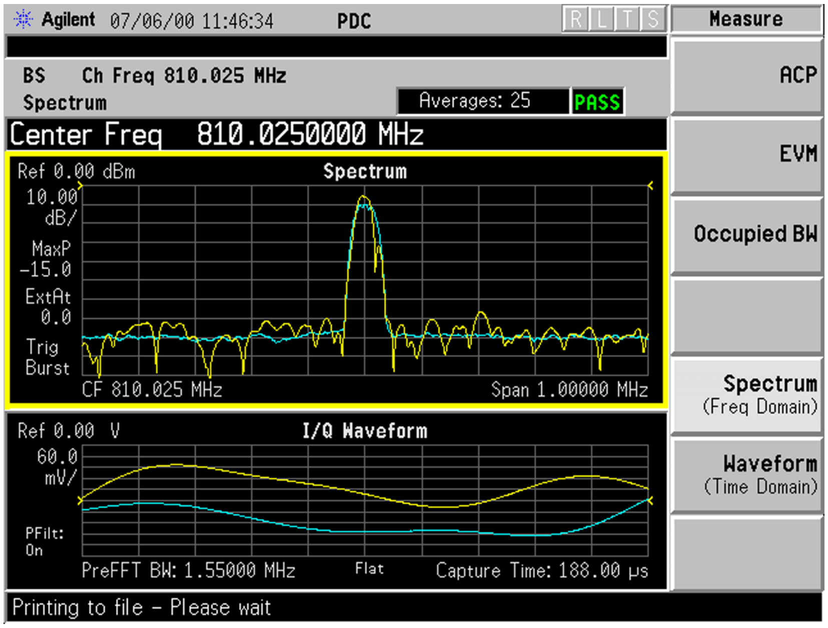
To change any of the measurement parameters from the factory default values, refer to the “Changing the Measurement Setup” section for this measurement.

When using the baseband I/Q inputs, set **Input Port** to **I/Q**, **I only**, or **Q only**, configure the **I/Q Setup** parameters, and supply the baseband I/Q signals to the front-panel I/Q inputs. The available trigger sources for this measurement includes **I/Q Level**.

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 7-7 Spectrum Measurement - Spectrum and I/Q Waveform View



BS Ch Freq 810.025 MHz

Spectrum Averages: 25 PASS

Center Freq 810.0250000 MHz

Printing to file - Please wait

Agilent 07/06/00 11:46:34
PDC
R L T S
Measure
Ref 0.00 dBm
Spectrum
10.00 dB/
MaxP -15.0
ExtAt 0.0
Trig Burst
CF 810.025 MHz
Span 1.00000 MHz
Ref 0.00 V
I/Q Waveform
60.0 mV/
PFilt: On
PreFFT BW: 1.55000 MHz
Flat
Capture Time: 188.00 µs
ACP
EVM
Occupied BW
Spectrum (Freq Domain)
Waveform (Time Domain)

Changing the Measurement Setup

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

Table 7-4 **Spectrum (Frequency Domain) Measurement Defaults**

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

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

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

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

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

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

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

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

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

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

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

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

— **Decimation** - Allows you to toggle the decimation function between **Auto** and **Man**, and to set the decimation value. **Auto** is the preferred setting, and the only setting that guarantees alias-free FFT spectrum measurements. If you are familiar with the decimation feature, you can change the decimation value by setting to **Man**, but be aware that aliasing can result in higher values. Decimation numbers 1 to 4 describe the factor by which the number of points are reduced. The default setting is 1, which results in no data point reduction.

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

Changing the View

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

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

Changing the Display

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

Selecting Displayed Traces Within Windows

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

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

Using the Markers

The **Marker** front-panel key accesses the menu to configure the markers. If you want to use the marker function in the I waveform window, press **View/Trace**, **I and Q Waveform**, **Marker**, **Trace**, **I 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. Marker postion 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**, trace. The default is **Spectrum**.
- **Off** - Allows you to turn off the selected marker.
- **Shape Diamond** - Allows you to access the menu to define the selected marker shape to be **Diamond**, **Line**, **Square**, or **Cross**. The default shape is **Diamond**.
- **Marker All Off** - Allows you to turn off all of the markers.

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

Measuring Band Power

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

1. Press the **Marker** key.
2. Press **Trace**, **Spectrum** to activate a marker on the instantaneous spectrum signal.
3. Press the **Spectrum Avg** key to activate a marker on the average spectrum trace.
4. Press **Function, Band Power**.
5. Two marker lines are activated at the extreme left side of the horizontal scale. Press **Normal** and move marker 1 to the desired place by rotating the **RPG** knob.

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

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

8. When the band power markers are active, the results are shown in the results window as `Mean Pwr (Between Mks)`. When the band power function is off the results window reads `Mean Pwr (Entire Trace)`.

Troubleshooting Hints

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

Making the Waveform (Time Domain) Measurement

Purpose

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

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

Measurement Method

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

This measurement is available for both the RF input and baseband I/Q inputs. For details on Baseband I/Q operation see the section on baseband I/Q measurements in the E4406A VSA Series Transmitter Tester User’s Guide.

Making the Measurement

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

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

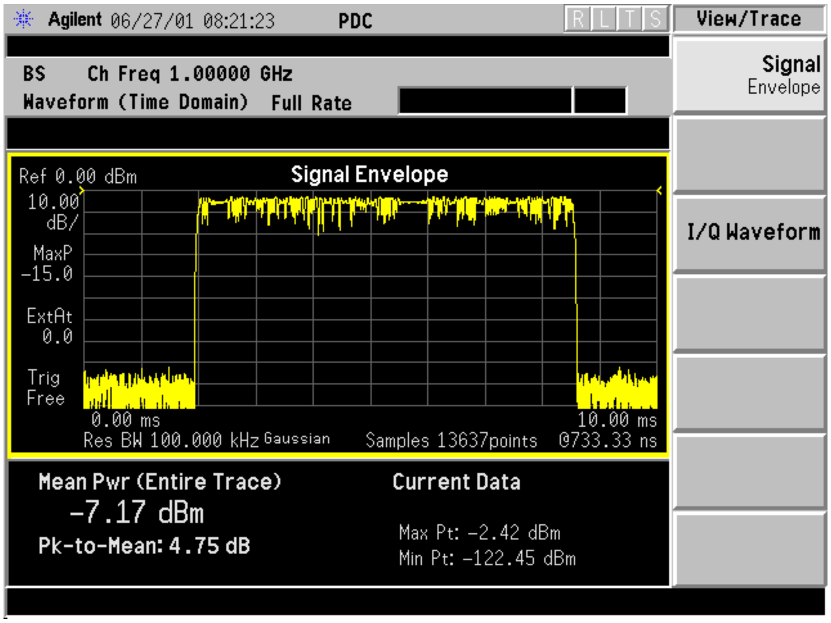
To change any of the measurement parameters from the factory default values, refer to the “Changing the Measurement Setup” section for this measurement.

When using the baseband I/Q inputs, set **Input Port** to **I/Q**, **I only**, or **Q only**, configure the **I/Q Setup** parameters, and supply the baseband I/Q signals to the front-panel I/Q inputs. The available trigger sources for this measurement includes **I/Q Level**.

Results

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

Figure 7-8 Waveform Measurement - Signal Envelope View


Agilent 06/27/01 08:21:23
PDC
R L T S
View/Trace
Signal Envelope
I/Q Waveform
Signal Envelope
10.00 dB/
MaxP -15.0
ExtAt 0.0
Trig Free
0.00 ms
10.00 ms

BS Ch Freq 1.00000 GHz
Waveform (Time Domain) Full Rate

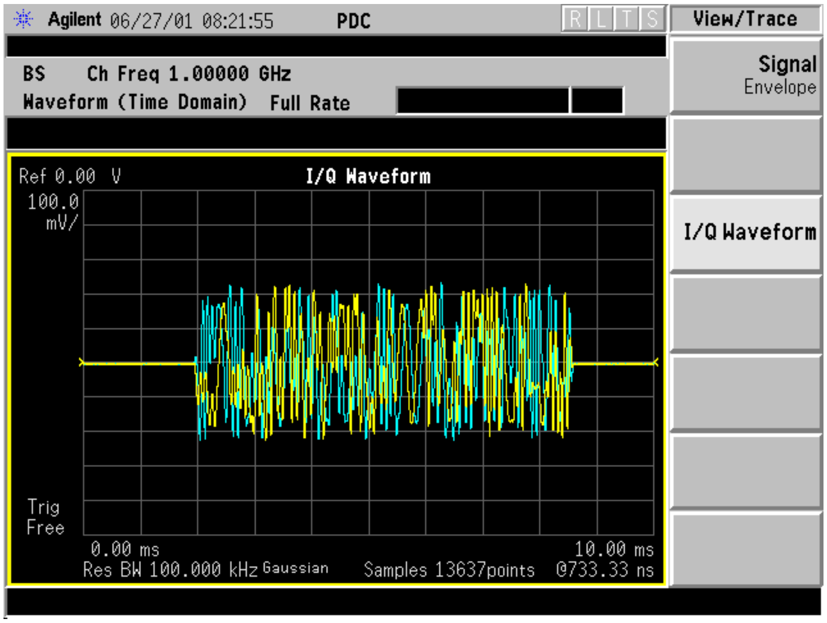
Ref 0.00 dBm
Res BW 100.000 kHz Gaussian
Samples 13637points @733.33 ns

Mean Pwr (Entire Trace)
-7.17 dBm
Pk-to-Mean: 4.75 dB

Current Data
Max Pt: -2.42 dBm
Min Pt: -122.45 dBm

The next figure shows an example result when using the baseband I/Q inputs.

Figure 7-9 **Waveform Measurement - I/Q Waveform View**


Agilent 06/27/01 08:21:55
PDC
R L T S
View/Trace
BS Ch Freq 1.00000 GHz
Waveform (Time Domain) Full Rate
Ref 0.00 V
I/Q Waveform
100.0 mV/
Trig Free
0.00 ms
10.00 ms
Res BW 100.000 kHz Gaussian
Samples 13637points @733.33 ns
Signal Envelope
I/Q Waveform

Changing the Measurement Setup

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

Table 7-5 **Waveform (Time Domain) Measurement Defaults**

Measurement Parameter	**Factory Default Condition**
View/Trace	RF Envelope
Sweep Time	10.00 ms
Res BW	100.000 kHz
Averaging:	
Avg Number	10; Off
Avg Mode	Exp
Avg Type	Pwr Avg (RMS)
Trig Source	Free Run (Immediate)
Signal Envelope View:	
SPAN X Scale - Scale/Div	200.0 µs
AMPLITUDE Y Scale - Scale/Div	10.00 dB
I/Q Waveform View:	
SPAN X Scale -Scale/Div	1.00 ms
AMPLITUDE Y Scale - Scale/Div	100.0 mV
Advanced	
Pre-ADC BPF	Off
RBW Filter	Gaussian
ADC Range	Auto
Data Packing	Auto
ADC Dither	Off
Decimation	Off

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

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

In addition, the following parameters can be modified:

- **Sweep Time** - Allows you to specify the measurement acquisition time which is used as the length of the time capture record. The range is 1.0 µs and 100.0 s, depending upon the resolution bandwidth setting and the available internal memory size for acquisition points.
- **Res BW** - Allows you to set the measurement bandwidth. The range is 10 Hz to 7.5 MHz. A larger bandwidth results in a larger number of acquisition points and reduces the maximum value allowed for the sweep time.
- **Advanced** - Allows you to access the menu to change the following parameters. Changes from the default values may result in invalid data.
  - **Pre-ADC BPF** - Allows you to toggle the pre-ADC bandpass filter function between **On** or **Off**. The default setting is **Off**. The pre-ADC bandpass filter is useful for rejecting nearby signals, so that sensitivity within the span range can be improved by increasing the ADC range gain.
  - **RBW Filter** - Allows you toggle the resolution bandwidth filter selection between **Flat** and **Gaussian**. If set to **Gaussian**, the filter provides more even time-domain response, particularly for “bursts”. If set to **Flat**, the filter provides a flatter bandwidth but is less accurate for “pulse responses”. A flat top filter also requires less memory and allows longer data acquisition times. For most waveform applications, the Gaussian filter is recommended.
  - **ADC Range** - Allows you to access the menu to select one of the ADC ranging functions:
    - ❏ **Auto** - Select this to cause the instrument to automatically adjust the signal range for optimal measurement results.
    - ❏ **AutoPeak** - Select this to cause the instrument to continuously seek the highest peak signal.
    - ❏ **AutoPeakLock** - Select this to cause the instrument to adjust the range for the highest peak signal it identifies, and retains the range settings determined by that peak signal, even when the peak signal is no longer present.
    - ❏ **Manual** - Allows you to access the selection menu: –**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 select **Auto** (the default) or the **Short (16 bit)**, **Medium (24 bit**) and **Long (32 bit)** methods of data packing. The short, medium, and long methods are not compatible with all settings and should not be used unless you are familiar with data packing methods. **Auto** is the preferred choice.

  - ❑ **Auto** - The data packing value most appropriate for current instrument settings is selected automatically.
  - ❑ **Short (16 bit)** - Select this to pack data every 16 bits.
  - ❑ **Medium (24 bit)** - Select this to pack data every 24 bits.
  - ❑ **Long (32 bit)** - Select this to pack data every 32 bits.
- — **ADC Dither** - Allows you to toggle the ADC dither function between **On** and **Off**. The default setting is **Off**. If set to **On**, the ADC dither refers to the introduction of noise to the digitized steps of the analog-to-digital converter, and results in better amplitude linearity and resolution in low level signals. However, it also results in reduced dynamic range by approximately 3 dB.
- — **Decimation** - Allows you to toggle the decimation function between **On** and **Off**, and to set the decimation value. Decimation allows longer acquisition times for a given bandwidth by eliminating data points. Long time captures can be limited by the instrument data acquisition memory. Decimation numbers 1 to 4 describe the factor by which the number of points are reduced. The default setting is 1, which results in no data point reduction.

Changing the View

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

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

Changing the Display

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

- **Scale/Div** - Allows you to set the horizontal scale by changing a time value per division. The range is 1.0 ns to 1.000 s per division with 0.01 ns resolution. The default setting is 200.0 µs per division.

However, since **Scale Coupling** is defaulted to **On**, this value is automatically determined by the measurement result.

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

If the `Signal Envelope` window is active in the **Signal Envelope** view, the **AMPLITUDE Y Scale** key accesses the menu to modify the following parameters:

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

If the `Linear Envelope` window is active in the **Linear Envelope** view, the **AMPLITUDE Y Scale** key accesses the menu to modify the following parameters:

- **Scale/Div** - Allows you to set the vertical scale by changing an amplitude value per division. The range is 1.00 nV to 20.00 V per division. The default setting is 100.0 mV per division. However, since **Scale Coupling** is defaulted to **On**, this value is automatically determined by the measurement result.

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

If the `Phase` window is active in the **Linear Envelope** view, the **AMPLITUDE Y Scale** key accesses the menu to modify the following parameters:

- **Scale/Div** - Allows you to set the vertical scale by changing an amplitude value per division. The range is 0.10 to 3600.0 deg per division. The default setting is 30.00 deg. However, since **Scale Coupling** is defaulted to **On**, this value is automatically determined by the measurement result.
- **Ref Value** - Allows you to set the reference value ranging from –36000.0 to 36000.0 deg. The default setting is 0.00 deg. However, since **Scale Coupling** is defaulted to **On**, this value is automatically determined by the measurement results.
- **Ref Position** - Allows you to set the reference position to either **Top**, **Ctr** (center) or **Bot** (bottom). The default setting is **Ctr**.
- **Scale Coupling** - Allows you to toggle the scale coupling function between **On** and **Off**. The default setting is **On**. Upon pressing the **Restart** front-panel key or **Restart** softkey under the **Meas Control** menu, this function automatically determines the scale per division and reference values based on the measurement results.

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

- **Scale/Div** - Allows you to set the vertical scale by changing an amplitude value per division. The range is 1.00 nV to 20.00 V per division. The default setting is 100.0 mV. However, since **Scale Coupling** is defaulted to **On**, this value is automatically determined by the measurement result.
- **Ref Value** - Allows you to set the reference value ranging from –250.00 to 250.00 V. The default setting is 0.00 V. However, since **Scale Coupling** is defaulted to **On**, this value is automatically determined by the measurement results.

- **Ref Position** - Allows you to set the reference position to either **Top, Ctr** (center) or **Bot** (bottom). The default setting is **Ctr**.
- **Scale Coupling** - Allows you to toggle the scale coupling function between **On** and **Off**. The default setting is **On**. Upon pressing the **Restart** front-panel key or **Restart** softkey under the **Meas Control** menu, this function automatically determines the scale per division and reference values based on the measurement results.

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

Using the Markers

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

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

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

NOTE

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

Troubleshooting Hints

Changes made 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.

8 PDC Programming Commands

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

SCPI Command Subsystems

"CALCulate Subsystem" on page 315.

"CONFigure Subsystem" on page 338.

"DISPlay Subsystem" on page 339.

"FETCh Subsystem" on page 348.

"INSTrument Subsystem" on page 349.

"MEASure Group of Commands" on page 352.

"READ Subsystem" on page 376.

"SENSe Subsystem" on page 377.

"TRIGger Subsystem" on page 443.

CALCulate Subsystem

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

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

ACP - Limits

Adjacent Channel Power—Limit Test

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

`:CALCulate:ACP:LIMit:STATe?`

Turn limit test on or off.

Factory Preset and *RST:	On
Remarks:	You must be in Basic, cdmaOne, iDEN mode to use this command. Use INSTrument:SELect to set the mode.

Adjacent Channel Power—Limit Test

`:CALCulate:ACP:LIMit[:TEST] OFF|ON|0|1`

`:CALCulate:ACP:LIMit[:TEST]?`

Turn limit test on or off.

Factory Preset and *RST:	On
Remarks:	You must be in the NADC, cdmaOne, or PDC mode to use this command. Use INSTrument:SELect to set the mode.

Baseband I/Q - Spectrum I/Q Marker Query

`:CALCulate:SPECtrum:MARKer:IQ [1]|2|3|4?`

Reads out current I and Q marker values.

Remarks:	You must in the Basic, W-CDMA, cdma2000 mode to use this command. Use INSTrument:SELect to set the mode.
History:	Added revision A.05.00

Baseband I/Q - Waveform I/Q Marker Query

`:CALCulate:WAVeform:MARKer:IQ [1]|2|3|4?`

Reads out current I and Q marker values.

Remarks:	You must be in the Basic, W-CDMA, cdma2000 mode to use this command. Use INSTrument:SELect to set the mode.
History:	Added revision A.05.00

Test Current Results Against all Limits

`:CALCulate:CLIMits:FAIL?`

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

Data Query

`:CALCulate:DATA[n]?`

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

n = any valid sub-opcode for the current measurement. See the "MEASure Group of Commands" on page 352 for information on the data that can be returned for each measurement.

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

Calculate/Compress Trace Data Query

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

Returns compressed data for the designated trace data in the currently selected measurement. The command can be used with sub-opcodes (*n*) for measurements that return several types of trace data. The data is returned in the same units as the original trace. See the following table for the sub-opcodes for the trace names available in each measurement. For sub-opcodes that return scalar data use the :CALCulate:DATA[n]? command above.

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

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

BLOCk or block data - returns whole segments from the queried trace. For example, it could be used to return a portion of an input signal over several timeslots.

CFIT or 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 seconds) and the curve coefficients ((order + 1) values).

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

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

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

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

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

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

NOTE There is a more detailed example in the “Improving the Speed of Your Measurements” section in the E4406A programmer’s guide.

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

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

History: Added in revision A.03.00

Changed in revision A.05.00

Measurement	Available Traces	Markers Available?
ACP - adjacent channel power (Basic, cdmaOne, cdma2000, W-CDMA (3GPP), 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 (cdma2000, W-CDMA (3GPP) modes)	CDPower (n=2)[a] EVM (n=5)[a] MERRor (n=6)[a] PERRor (n=7)[a] SPOWer (n=9)[a] CPOWer (n=10)[a]	yes

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

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

EVM - Limits

Error Vector Magnitude—First 10 Symbols EVM Limit

`:CALCulate:EVM:LIMit:F10 <percent>`

`:CALCulate:EVM:LIMit:F10?`

Set the first 10 symbols EVM limit in percent. This functionality is only for mobile testing.

Factory Preset and *RST:	25.0%
Range:	0 to 50%
Remarks:	You must be in the NADC mode to use this command. Use INSTrument:SELect to set the mode.
History:	Version A.02.00 or later

Error Vector Magnitude—I/Q Origin Offset Error Limit

`:CALCulate:EVM:LIMit:IQOOffset <dB>`

`:CALCulate:EVM:LIMit:IQOOffset?`

Set the I/Q origin offset error limit in dB.

Factory Preset and *RST:	–20 dB

Range:	–100 dB to 0 dB
Remarks:	You must be in the NADC or PDC mode to use this command. Use INSTrument:SELect to set the mode.
History:	Version A.02.00 or later

Error Vector Magnitude—Peak EVM Limit

`:CALCulate:EVM:LIMit:PEAK <percent>`

`:CALCulate:EVM:LIMit:PEAK?`

Set the peak EVM limit in percent.

Factory Preset and *RST:	40.0%
Range:	0 to 50%
Remarks:	You must be in the NADC or PDC mode to use this command. Use INSTrument:SELect to set the mode.
History:	Version A.02.00 or later

Error Vector Magnitude—RMS EVM Limit

`:CALCulate:EVM:LIMit:RMS <percent>`

`:CALCulate:EVM:LIMit:RMS?`

Set the RMS EVM limit in percent.

Factory Preset and *RST:	12.5%
Range:	0 to 50%
Remarks:	You must be in the NADC or PDC mode to use this command. Use INSTrument:SELect to set the mode.
History:	Version A.02.00 or later

Error Vector Magnitude—Limit Test

`:CALCulate:EVM:LIMit[:TEST] OFF|ON|0|1`

`:CALCulate:EVM:LIMit[:TEST]?`

Turn limit test on or off.

Factory Preset and *RST:	On
Remarks:	You must be in the NADC or PDC mode to use this command. Use INSTrument:SELect to set the mode.

History:	Version A.02.00 or later

Error Vector Magnitude—Time to Sync Word

`:CALCulate:EVM:TTSWord?`

Query returns the time between the trigger and the start of the first sync word.

Default Unit:	Seconds
Remarks:	You must be in the NADC or PDC mode to use this command. Use INSTrument:SELect to set the mode.
History:	Version A.03.00 or later

CALCulate:MARKers Subsystem

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

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

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

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

Basic Mode - <measurement> key words

- ACPr - no markers
- CHPower - no markers
- PSTATistic - markers available
- SPECtrum - markers available
- WAVeform - markers available

Service Mode - <measurement> key words

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

cdmaOne Mode - <measurement> key words

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

cdma2000 Mode - <measurement> key words

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

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

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

GSM Mode - <measurement> key words

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

iDEN Mode - <measurement> key words

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

NADC Mode - <measurement> key words

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

PDC Mode - <measurement> key words

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

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

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

W-CDMA (Trial & Arib) Mode - <measurement> key words

- ACP - no markers
- CDPower - markers available
- CHPower - no markers
- EVMQpsk - markers available
- PSTatistic - markers available
- RHO - markers available
- 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. Use the MEASure or READ command before using the marker command. This forces the measurement to complete before allowing the next command to be executed.

Markers All Off on All Traces

`:CALCulate:<measurement>:MARKer:AOFF`

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

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

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

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

Marker Function

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

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

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

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

> Band Power – is the integrated power between the two markers for traces in the frequency domain and is the mean power between the two markers for traces in the time domain.
>
> Noise – is the noise power spectral density in a 1 Hz bandwidth. It is averaged over 32 horizontal trace points.
>
> Off – turns off the marker functions

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

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

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

Marker Function Result

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

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)

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: **Marker, Select** then **Marker Normal** or **Marker On Off**

Marker to Trace

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

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

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

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

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

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

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

Measurement	**Available Traces**	**Markers Available?**
ACP - adjacent channel power (Basic, cdmaOne, cdma2000, W-CDMA (3GPP), 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 (cdma2000, W-CDMA (3GPP) modes)	CDPower (n=2)[a] EVM (n=5)[a] MERRor (n=6)[a] PERRor (n=7)[a] SPOWer (n=9)[a] CPOWer (n=10)[a]	yes

Measurement	Available Traces	Markers Available?
CHPower - channel power (Basic, cdmaOne, cdma2000, W-CDMA (3GPP) modes)	SPECtrum (n=2)[a]	no markers
CSPur - spurs close (cdmaOne mode)	SPECtrum (n=2)[a] ULIMit (n=3)[a]	yes
EEVM - EDGE error vector magnitude (EDGE mode)	EVMerror (n=2)[a] MERRor (n=3)[a] PERRor (n=4)[a]	yes
EORFspectr - EDGE output RF spectrum (EDGE mode)	RFEMod (n=2)[a] RFESwitching (n=3)[a] SPEMod (n=4)[a] LIMMod (n=5)[a]	yes, only for a single offset yes, only for multiple offsets
EPVTime - EDGE power versus time (EDGE mode)	RFENvelope (n=2)[a] UMASk (n=3)[a] LMASk (n=4)[a]	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 (3GPP) modes)	EVM (n=2)[a] MERRor (n=3)[a] PERRor (n=4)[a]	yes
IM - intermodulation (cdma2000, W-CDMA (3GPP) modes)	SPECtrum (n=2)[a]	yes
MCPower - multi-carrier power (W-CDMA (3GPP) mode)	no traces	no markers
OBW - occupied bandwidth (cdmaOne, cdma2000, iDEN, PDC modes)	no traces	no markers

Measurement	Available Traces	Markers Available?
ORFSpectrum - output RF spectrum (GSM, EDGE mode)	RFEMod (n=2)[a] RFESwitching (n=3)[a]	yes, only for a single offset
	SPEMod (n=4)[a] LIMMod (n=5)[a]	yes, only for multiple offsets
PFERror - phase and frequency error (GSM, EDGE mode)	PERRor (n=2)[a] PFERror (n=3)[a] RFENvelope (n=4)[a]	yes
PSTatistic - power statistics CCDF (Basic, cdma2000, W-CDMA (3GPP) modes)	MEASured (n=2)[a] GAUSian (n=3)[a] REFerence (n=4)[a]	yes
PVTime - power versus time (GSM, EDGE, Service modes)	RFENvelope (n=2)[a] UMASk (n=3)[a] LMASk (n=4)[a]	yes
RHO - modulation quality (cdmaOne, cdma2000, W-CDMA (3GPP) modes)	EVM (n=2)[a] MERRor (n=3)[a] PERRor (n=4)[a]	yes
SEMask - spectrum emissions mask (cdma2000, W-CDMA (3GPP) mode)	SPECtrum (n=2)[a]	yes
TSPur - transmit band spurs (GSM, EDGE mode)	SPECtrum (n=2)[a] ULIMit (n=3)[a]	yes
TXPower - transmit power (GSM, EDGE 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

Measurement	Available Traces	Markers Available?
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?`**
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 - Limits

Occupied Bandwidth—Frequency Band Limit

PDC, cdma2000, W-CDMA (3GPP) mode

```
:CALCulate:OBW:LIMit:FBLimit <freq>
```

```
:CALCulate:OBW:LIMit:FBLimit?
```

iDEN mode

```
:CALCulate:OBWidth:LIMit:FBLimit <freq>
```

```
:CALCulate:OBWidth:LIMit:FBLimit?
```

Set the frequency bandwidth limit in Hz.

Factory Preset and *RST:	32 kHz for PDC
	20 kHz for iDEN
	1.48 MHz for cdma2000
	5 MHz for W-CDMA (3GPP)
Range:	10 kHz to 60 kHz for PDC, iDEN
	10 kHz to 10 MHz for cdma2000, W-CDMA (3GPP)
Default Unit:	Hz
Remarks:	You must be in the iDEN, PDC, cdma2000, or W-CDMA (3GPP) mode to use this command. Use INSTrument:SELect to set the mode.
History:	Version A.02.00 or later

Occupied Bandwidth—Limit Test

PDC, cdma2000, W-CDMA (3GPP) mode

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

```
:CALCulate:OBW:LIMit[:TEST]?
```

iDEN mode

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

```
:CALCulate:OBWidth:LIMit:STATe?
```

Turn limit testing on or off.

Factory Preset and *RST:	On
Remarks:	You must be in the iDEN, PDC, cdma2000, or W-CDMA (3GPP) mode to use this command. Use INSTrument:SELect to set the mode.
History:	Version A.02.00 or later

CONFigure Subsystem

The CONFigure commands are used with several other commands to control the measurement process. The full set of commands are described in the section “MEASure Group of Commands” on page 352.

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

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

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

Configure the Selected Measurement

`:CONFigure:<measurement>`

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

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

Configure Query

`:CONFigure?`

The CONFigure query returns the name of the current measurement.

DISPlay Subsystem

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

Adjacent Channel Power - View Selection

`:DISPlay:ACP:VIEW BGRaph|SPECtrum`

`:DISPlay:ACP:VIEW?`

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

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

Factory Preset and *RST:	Bar Graph (BGRaph)
Remarks:	You must be in the Basic, cdmaOne, cdma2000, W-CDMA (3GPP), W-CDMA (Trial & ARIB), NADC or PDC mode to use this command. Use INSTrument:SELect to set the mode.
Front Panel Access:	**ACP, View/Trace**

Error Vector Magnitude - View Selection

`:DISPlay:EVMagnitude:VIEW POLar|CONStln|QUAD`

`:DISPlay:EVMagnitude:VIEW?`

Select the view of EVM measurement

Factory Preset and *RST:	POLar
Remarks:	You must be in the NADC or PDC mode to use this command. Use INSTrument:SELect to set the mode.

Turn the Display On/Off

`:DISPlay:ENABle OFF|ON|0|1`

`:DISPlay:ENABle?`

Controls the display. If enable is set to off, the display is blanked though the measurement continues to run. Measurements may run faster since the instrument doesn't have to update the display after every data acquisition. There is often no need to update the display information when using remote operation. An instrument preset will turn the display back on.

Factory Preset and *RST:	On
Remarks:	The following key presses will turn display enable back on: 1. If in local, press any key 2. If in remote, press the local (system) key 3. If in local lockout, no key
Front Panel Access:	**System**, **Disp Updates** for VSA

Select Display Format

`:DISPlay:FORMat:TILE`

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

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

Select Display Format

`:DISPlay:FORMat:ZOOM`

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

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

Spectrum - Y-Axis Scale/Div

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

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

Sets the amplitude reference level for the y-axis.

n – selects the view, the default is Spectrum.

— n=1, m=1 Spectrum

— n=1, m=2 I/Q Waveform

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

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

— n=1, m=4 RF envelope (Service mode)

— n=2, m=1 I Waveform (Option B7C)

— n=2, m=2 Q Waveform (Option B7C)

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

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

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

Factory Preset:	10 dB per division, for Spectrum
Range:	.1 dB to 20 dB per division, for Spectrum
Default Unit:	10 dB per division, for Spectrum
Remarks:	May affect input attenuator setting. To use this command, the appropriate mode should be selected with INSTrument:SELect.
Front Panel Access:	When in Spectrum measurement: **Amplitude Y Scale, Scale/Div.**
History:	Modified revision A.05.00

Spectrum - Y-Axis Reference Level

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

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

Sets the amplitude reference level for the y-axis.

n – selects the view, the default is Spectrum.

— n=1, m=1 Spectrum

— n=1, m=2 I/Q Waveform

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

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

— n=1, m=4 RF envelope (Service mode)

— n=2, m=1 I Waveform (Option B7C)

— n=2, m=2 Q Waveform (Option B7C)

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

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

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

Factory Preset:	0 dBm, for Spectrum
Range:	–250 to 250 dBm, for Spectrum
Default Unit:	dBm, for Spectrum
Remarks:	May affect input attenuator setting. 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 352 for more information about sub-opcodes.

Factory Preset:	On
Range:	The valid traces and their sub-opcodes are dependent upon the selected measurement. See the following table. The trace name assignment is independent of the window number.
Remarks:	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 (3GPP), 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 (cdma2000, W-CDMA (3GPP) modes)	CDPower (*n*=2)[a] EVM (*n*=5)[a] MERRor (*n*=6)[a] PERRor (*n*=7)[a] SPOWer (*n*=9)[a] CPOWer (*n*=10)[a]	yes
CHPower - channel power (Basic, cdmaOne, cdma2000, W-CDMA (3GPP) modes)	SPECtrum (*n*=2)[a]	no markers
CSPur - spurs close (cdmaOne mode)	SPECtrum (*n*=2)[a] ULIMit (*n*=3)[a]	yes
EEVM - EDGE error vector magnitude (EDGE mode)	EVMerror (*n*=2)[a] MERRor (*n*=3)[a] PERRor (*n*=4)[a]	yes
EORFspectr - EDGE output RF spectrum (EDGE mode)	RFEMod (*n*=2)[a] RFESwitching (*n*=3)[a] SPEMod (*n*=4)[a] LIMMod (*n*=5)[a]	yes, only for a single offset yes, only for multiple offsets

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

Measurement	**Available Traces**	**Markers Available?**
PVTime - power versus time (GSM, EDGE, Service modes)	RFENvelope (n=2)[a] UMASk (n=3)[a] LMASk (n=4)[a]	yes
RHO - modulation quality (cdmaOne, cdma2000, W-CDMA (3GPP) modes)	EVM (n=2)[a] MERRor (n=3)[a] PERRor (n=4)[a]	yes
SEMask - spectrum emissions mask (cdma2000, W-CDMA (3GPP) modes)	SPECtrum (n=2)[a]	yes
TSPur - transmit band spurs (GSM, EDGE mode)	SPECtrum (n=2)[a] ULIMit (n=3)[a]	yes
TXPower - transmit power (GSM, EDGE 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.

Waveform - Y-Axis Scale/Div

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

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

Sets the scale per division for the y-axis.

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

- n=1, m=1 RF envelope
- n=2, m=1 I/Q Waveform
- n=2, m=1 I and Q Waveform (Option B7C)
- n=4, m=1 I/Q Polar (Basic, W-CDMA, cdma2000)
- n=5, m=1 Linear Envelope (Option B7C)

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

Factory Preset:	10 dBm, for RF envelope
Range:	.1 dB to 20 dB, for RF envelope
Default Unit:	dBm, for RF envelope
Remarks:	May affect input attenuator setting. To use this command, the appropriate mode should be selected with INSTrument:SELect.
Front Panel Access:	When in Waveform measurement: **Amplitude Y Scale, Scale/Div.**
History:	Modified revision A.05.00

Waveform - Y-Axis Reference Level

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

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

Sets the amplitude reference level for the y-axis.

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

- n=1, m=1 RF envelope
- n=2, m=1 I/Q Waveform
- n=2, m=1 I and Q Waveform (Option B7C)
- n=4, m=1 I/Q Polar (Basic, W-CDMA, cdma2000)

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

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

Factory Preset:	0 dBm, for RF envelope
Range:	–250 to 250 dBm, for RF envelope
Default Unit:	dBm, for RF envelope
Remarks:	May affect input attenuator setting. 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

The FETCh? commands are used with several other commands to control the measurement process. These commands are described in the section on the "MEASure Group of Commands" on page 352.

Fetch the Current Measurement Results

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

A FETCh? command must specify the desired measurement. It will return the valid results that are currently available, but will not initiate the taking of any new data. You can only fetch results from the measurement that is currently selected. The code number n selects the kind of results that will be returned. The available measurements and data results are described in the "MEASure Group of Commands" on page 352.

INSTrument Subsystem

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

Catalog Query

`:INSTrument:CATalog?`

Returns a comma separated list of strings which contains the names of all the installed applications. These names can only be used with the **`INST:SELECT`** command. If the optional keyword **`FULL`** is specified, each name is immediately followed by its associated instrument number. These instrument numbers can only be used with the **`INST:NSELect`** command.

Example:	INST:CAT?
	Query response: ”CDMA”4,”PNOISE”14

Select Application by Number

`:INSTrument:NSELect <integer>`

`:INSTrument:NSELect?`

Select the measurement mode by its instrument number. The actual available choices depends upon which applications are installed in the instrument. These instrument numbers can be obtained with **`INST:CATalog:FULL?`**

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

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

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

Example:	INST:NSEL 3
Factory Preset:	Persistent state with factory default of 1
Range:	1 to x, where x depends upon which applications are installed.
Front Panel Access:	**Mode**

Select Application

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

```
:INSTrument[:SELect]?
```

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

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

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

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

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

Example: INST:SEL GSM

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

Front Panel Access: **Mode**

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

CONFigure, FETCh, MEASure, READ Interactions

Measure Commands

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

This is a fast single-command way to make a measurement using the factory default instrument settings. These are the settings and units that conform to the Radio Standard that you have currently selected.

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

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

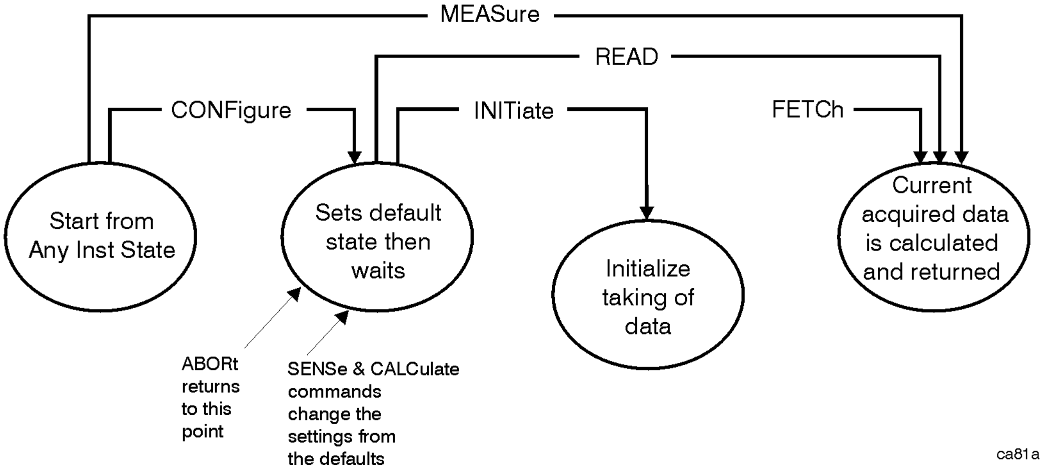
  ASCII is the default format for the data output. The binary data formats should be used for handling large blocks of data since they are smaller and faster then the ASCII format. Refer to the FORMat:DATA command for more information.

If you need to change some of the measurement parameters from the factory default settings you can set up the measurement with the CONFigure command. Use the commands in the SENSe:<measurement> and CALCulate:<measurement> subsystems to change the settings. Then you can use the READ? command to initiate the measurement and query the results. See Figure 2.

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

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

Figure 2 **Measurement Group of Commands**


MEASure
READ
CONFigure
INITiate
FETCh
Start from Any Inst State
Sets default state then waits
Initialize taking of data
Current acquired data is calculated and returned
ABORt returns to this point
SENSe & CALCulate commands change the settings from the defaults
ca81a

Configure Commands

`:CONFigure:<measurement>`

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

NOTE In instruments with firmware older then A.05.00 CONFigure initiates the taking of data. The data should be ignored. Other SCPI commands can be processed immediately after sending CONFigure. You do not need to wait for the CONF command to complete this ’false’ data acquisition.

The CONFigure? query returns the current measurement name.

Fetch Commands

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

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

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

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

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

Read Commands

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

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

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

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

Adjacent Channel Power Ratio (ACP) Measurement

This measures the total rms power in the specified channel and in 5 offset channels. You must be in Basic, cdmaOne, cdma2000, W-CDMA (3GPP), W-CDMA (Trial & Arib), 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**, **ACP** or **ACPR** After the measurement is selected, press **Restore Meas Defaults** to restore factory defaults.

Measurement Results Available

Measurement Type	n	Results Returned
	0	Returns unprocessed I/Q trace data, as a series of 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 NADC and PDC mode	Returns 22 comma-separated scalar results, in the following order: 1. Center frequency – absolute power (dBm) 2. Center frequency – absolute power (W) 3. Negative offset frequency (1) – relative power (dB) 4. Negative offset frequency (1) – absolute power (dBm) 5. Positive offset frequency (1) – relative power (dB) 6. Positive offset frequency (1) – absolute power (dBm) . . . 21. Positive offset frequency (5) – relative power (dB) 22. Positive offset frequency (5) – absolute power (dBm)

Measurement Type	n	Results Returned
	not specified or n=1 iDEN mode	Returns 13 comma-separated scalar results, in the following order: 1. Center frequency – relative power (dB) 2. Center frequency – absolute power (dBm) 3. Lower offset frequency – relative power (dB) 4. Lower offset freq– absolute power (dBm) 5. Upper offset frequency – relative power (dB) 6. Upper offset frequency – absolute power (dBm) 7. Total power (dBm) 8. Offset frequency (Hz) 9. Reference BW (Hz) 10. Offset BW (Hz) 11. Carrier/center frequency (Hz) 12. Frequency span (Hz) 13. Average count
Total power reference	not specified or n=1 Basic, cdmaOne, cdma2000, W-CDMA (3GPP), or W-CDMA (Trial & Arib) mode	Returns 24 comma-separated scalar results, in the following order: 1. Upper adjacent chan center frequency - relative power (dB) 2. Upper adjacent chan center frequency - absolute power (dBm) 3. Lower adjacent chan center frequency - relative power (dB) (same as upper) 4. Lower adjacent chan center frequency - absolute power (dBm) (same as upper) 5. Negative offset frequency (1) - relative power (dB), 6. Negative offset frequency (1) - absolute power (dBm) 7. Positive offset frequency (1) - relative power (dB) 8. Positive offset frequency (1) - absolute power (dBm) . . . 23. Positive offset frequency (5) - relative power (dB) 24. Positive offset frequency (5) - absolute power (dBm)

Measurement Type	n	Results Returned
Power spectral density reference	not specified or n=1 Basic, cdmaOne, cdma2000, W-CDMA (3GPP), or W-CDMA (Trial & Arib) mode	Returns 24 comma-separated scalar results, in the following order: 1. Upper adjacent chan center frequency - relative power (dB) 2. Upper adjacent chan center frequency - absolute power (dBm/Hz) 3. Lower adjacent chan center frequency - relative power (dB) (same as upper) 4. Lower adjacent chan center frequency - absolute power (dBm/Hz) (same as upper) 5. Negative offset frequency (1) - relative power (dB) 6. Negative offset frequency (1) - absolute power (dBm/Hz) 7. Positive offset frequency (1) - relative power (dB) 8. Positive offset frequency (1) - absolute power (dBm/Hz) . . . 23. Positive offset frequency (5) - relative power (dB) 24. Positive offset frequency (5) - absolute power (dBm/Hz)
	2 NADC and PDC mode	Returns 10 comma-separated scalar values of the pass/fail (0=passed, or 1=failed) results determined by testing the absolute power of the offset frequencies: 1. Negative offset frequency (1) absolute power 2. Positive offset frequency (1) absolute power . . . 9. Negative offset frequency (5) absolute power 10. Positive offset frequency (5) absolute power
	2 iDEN mode	Returns 3 comma-separated scalar values of the histogram absolute power trace: 1. Lower offset frequency – absolute power 2. Reference frequency – absolute power 3. Upper offset frequency – absolute power
Total power reference	2 Basic, cdmaOne, cdma2000, W-CDMA (3GPP), or W-CDMA (Trial & Arib) mode	Returns 11 comma-separated scalar values (in dBm) corresponding to the total power histogram display. The values are returned in ascending frequency order: 1. Negative offset frequency (5) 2. Negative offset frequency (4) . . . 6. Center frequency 7. Positive offset frequency (1) . . . 11. Positive offset frequency (5)

Measurement Type	n	Results Returned
	3 NADC and PDC mode	Returns 10 comma-separated scalar values of the pass/fail (0=passed, or 1=failed) results determined by testing the relative power of the offset frequencies: 1. Negative offset frequency (1) relative power 2. Positive offset frequency (1) relative power . . . 9. Negative offset frequency (5) relative power 10. Positive offset frequency (5) relative power
	3 iDEN mode	Returns 3 comma-separated scalar values of the histogram relative power trace: 1. Lower offset frequency – relative power 2. Reference frequency – relative power 3. Upper offset frequency – relative power
Power spectral density reference	3 Basic, cdmaOne, cdma2000, W-CDMA (3GPP), or W-CDMA (Trial & Arib) mode	Returns 11 comma-separated scalar values (in dBm/Hz) corresponding to the power spectral density histogram display. The values are returned in ascending frequency order: 1. Negative offset frequency (5) 2. Negative offset frequency (4) . . . 6. Center frequency 7. Positive offset frequency (1) . . . 11. Positive offset frequency (5)
	4 NADC and PDC mode	Returns the frequency-domain spectrum trace (data array) for the entire frequency range being measured. In order to return spectrum data, the ACP display must be in the spectrum view and you must not turn off the spectrum trace.
	4 iDEN mode	Returns 4 comma-separated absolute power results for the reference and offset channels. 1. Reference channel – absolute power 2. Reference channel – absolute power (duplicate of above) 3. Lower offset channel – absolute power 4. Upper offset channel – absolute power

Measurement Type	n	Results Returned
(For cdma2000 and W-CDMA the data is only available with spectrum display selected)	4 Basic, cdmaOne, cdma2000, W-CDMA (3GPP), or W-CDMA (Trial & Arib) mode	Returns the frequency-domain spectrum trace data for the entire frequency range being measured. With the spectrum view selected (DISPlay:ACP:VIEW SPECtrum) and the spectrum trace on (SENSe:ACP:SPECtrum:ENABle): • In FFT mode (SENSe:ACP:SWEep:TYPE FFT) the number of trace points returned are 343 (cdma2000) or 1715 (W-CDMA). This is with the default span of 5 MHz (cdma2000) or 25 MHz (W-CDMA). The number of points also varies if another offset frequency is set. • In sweep mode (SENSe:ACP:SWEep:TYPE SWEep), the number of trace points returned is 601 (for cdma2000 or W-CDMA) for any span. With bar graph display selected, one point of –999.0 will be returned.
	5 iDEN mode	Returns 4 comma-separated relative power values for the reference and offset channels: 1. Reference channel – relative power 2. Reference channel – relative power (duplicate of above) 3. Lower offset channel – relative power 4. Upper offset channel – relative power
Total power reference	5 Basic, cdmaOne, cdma2000, W-CDMA (3GPP), or W-CDMA (Trial & Arib) mode	Returns 12 comma-separated scalar values (in dBm) of the absolute power of the center and the offset frequencies: 1. Upper adjacent chan center frequency 2. Lower adjacent chan center frequency 3. Negative offset frequency (1) 4. Positive offset frequency (1) . . . 11. Negative offset frequency (5) 12. Positive offset frequency (5)
Power spectral density reference	5 Basic, cdmaOne, cdma2000, W-CDMA (3GPP), or W-CDMA (Trial & Arib) mode	Returns 12 comma-separated scalar values (in dBm/Hz) of the absolute power of the center and the offset frequencies: 1. Upper adjacent chan center frequency 2. Lower adjacent chan center frequency 3. Negative offset frequency (1) 4. Positive offset frequency (1) . . . 11. Negative offset frequency (5) 12. Positive offset frequency (5)

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: 1. Reference channel absolute power pass/fail 2. Reference channel absolute power pass/fail (duplicate of above) 3. Lower offset channel absolute power pass/fail 4. Upper offset channel absolute power pass/fail
Total power reference	6 Basic, cdmaOne, cdma2000, W-CDMA (3GPP), or W-CDMA (Trial & Arib) mode	Returns 12 comma-separated scalar values (total power in dB) of the power relative to the carrier at the center and the offset frequencies: 1. Upper adjacent chan center frequency 2. Lower adjacent chan center frequency 3. Negative offset frequency (1) 4. Positive offset frequency (1) 5. Negative offset frequency (5) . . . 11. Negative offset frequency (5) 12. Positive offset frequency (5)
Power spectral density reference	6 Basic, cdmaOne, cdma2000, W-CDMA (3GPP), or W-CDMA (Trial & Arib) mode	Returns 12 comma-separated scalar values (power spectral density in dB) of the power relative to the carrier at the center and offset frequencies: 1. Upper adjacent chan center frequency 2. Lower adjacent chan center frequency 3. Negative offset frequency (1) 4. Positive offset frequency (1) . . . 11. Negative offset frequency (5) 12. Positive offset frequency (5)
	7 iDEN mode	Returns 4 comma-separated pass/fail test results for the relative power of the reference and offset channels: 1. Reference channel relative power pass/fail 2. Reference channel relative power pass/fail (duplicate of above) 3. Lower offset channel relative power pass/fail 4. Upper offset channel relative power pass/fail

Measurement Type	**n**	**Results Returned**
Total power reference	7 Basic, cdmaOne, cdma2000, W-CDMA (3GPP), or W-CDMA (Trial & Arib) mode	Returns 12 comma-separated scalar values of the pass/fail (0=passed, or 1=failed) results determined by testing the absolute power limit of the center and offset frequencies (measured as total power in dB): 1. Upper adjacent chan center frequency 2. Lower adjacent chan center frequency 3. Negative offset frequency (1) 4. Positive offset frequency (1) . . . 11. Negative offset frequency (5) 12. Positive offset frequency (5)
Power spectral density reference	7 Basic, cdmaOne, cdma2000, W-CDMA (3GPP), or W-CDMA (Trial & Arib) mode	Returns 12 comma-separated scalar values of the pass/fail (0=passed, or 1=failed) results determined by testing the absolute power limit of the center and offset frequencies (measured as power spectral density in dB): 1. Upper adjacent chan center frequency 2. Lower adjacent chan center frequency 3. Negative offset frequency (1) 4. Positive offset frequency (1) . . . 11. Negative offset frequency (5) 12. Positive offset frequency (5)
Total power reference	8 Basic, cdmaOne, cdma2000, W-CDMA (3GPP), or W-CDMA (Trial & Arib) mode	Returns 12 comma-separated scalar values of the pass/fail (0=passed, or 1=failed) results determined by testing the power limit relative to the center frequency (measured as total power spectral in dB): 1. Upper adjacent chan center frequency 2. Lower adjacent chan center frequency 3. Negative offset frequency (1) 4. Positive offset frequency (1) . . . 11. Negative offset frequency (5) 12. Positive offset frequency (5)

Measurement Type	**n**	**Results Returned**
Power spectral density reference	8 Basic, cdmaOne, cdma2000, W-CDMA (3GPP), or W-CDMA (Trial & Arib) mode	Returns 12 comma-separated scalar values of the pass/fail (0=passed, or 1=failed) results determined by testing the power limit relative to the center frequency (measured as power spectral density in dB): 1. Upper adjacent chan center frequency 2. Lower adjacent chan center frequency 3. Negative offset frequency (1) 4. Positive offset frequency (1) . . . 11. Negative offset frequency (5) 12. Positive offset frequency (5)

Error Vector Magnitude Measurement

This measures the vector error of the magnitude of each symbol. You must be in the 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:EVM commands for more measurement related commands.

:CONFigure:EVM

:FETCh:EVM[n]?

:READ:EVM[n]?

:MEASure:EVM[n]?

History:	Version A.02.00 or later
Front Panel Access:	**Measure, EVM** 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.

n	Results Returned
1 (default) EDGE GSM mode	Returns the following 8 comma-separated scalar results, in order. 1. RMS EVM – a floating point number (in percent) of EVM over the entire measurement area. 2. Peak EVM error – a floating point number (in percent) of the peak EVM in the measurement area. 3. Symbol position of the peak EVM error – an integer number of the symbol position where the peak EVM error is detected. 4. First 10 symbols EVM error – a floating point number (in percent) of EVM over the first 10 symbols. 5. Magnitude error – a floating point number (in percent) of average magnitude error over the entire measurement area. 6. Phase error – a floating point number (in degree) of average phase error over the entire measurement area. 7. Frequency error – a floating point number (in Hz) of the frequency error in the measured signal. 8. I/Q origin offset – a floating point number (in dB) of the I and Q error (magnitude squared) offset from the origin.
1 (default) NADC mode	Returns the following 8 comma-separated scalar results, in order. 1. RMS EVM – a floating point number (in percent) of EVM over the entire measurement area. 2. Peak EVM error – a floating point number (in percent) of the peak EVM in the measurement area. 3. Symbol position of the peak EVM error – an integer number of the symbol position where the peak EVM error is detected. 4. First 10 symbols EVM error – a floating point number (in percent) of EVM over the first 10 symbols. 5. Magnitude error – a floating point number (in percent) of average magnitude error over the entire measurement area. 6. Phase error – a floating point number (in degree) of average phase error over the entire measurement area. 7. Frequency error – a floating point number (in Hz) of the frequency error in the measured signal. 8. I/Q origin offset – a floating point number (in dB) of the I and Q error (magnitude squared) offset from the origin.

n	Results Returned
1 (default) PDC mode	Returns the following 7 comma-separated scalar results, in order. 1. RMS EVM – a floating point number (in percent) of EVM over the entire measurement area. 2. Peak EVM error – a floating point number (in percent) of peak EVM in the measurement area. 3. Symbol position of the peak EVM error – an integer number of the symbol position where the peak EVM error is detected. 4. Magnitude error – a floating point number (in percent) of average magnitude error over the entire measurement area. 5. Phase error – a floating point number (in degree) of average phase error over the entire measurement area. 6. Frequency error – a floating point number (in Hz) of the frequency error in the measured signal. 7. I/Q origin offset – a floating point number (in dB) of the I and Q error (magnitude squared) offset from the origin.
2	Returns series of floating point numbers (in percent) that represent each sample in the EVM trace. The first number is the symbol 0 decision point and there are 5 points per symbol. Therefore, the decision points are at 0, 5, 10, 15. . . .
3	Returns series of floating point numbers (in percent) that represent each sample in the magnitude error trace. The first number is the symbol 0 decision point and there are 5 points per symbol. Therefore, the decision points are at 0, 5, 10, 15. . . .
4	Returns series of floating point numbers (in degree) that represent each sample in the phase error trace. The first number is the symbol 0 decision point and there are 5 points per symbol. Therefore, the decision points are at 0, 5, 10, 15. . . .
5	Returns series of floating point numbers that alternately represent I and Q pairs of the corrected measured trace. The magnitude of each I and Q pair are normalized to 1.0. The first number is the in-phase (I) sample of symbol 0 decision point and the second is the quadrature-phase (Q) sample of symbol 0 decision point. As in the EVM, there are 5 points per symbol, so the series of numbers is: 1st number = I of the symbol 0 decision point 2nd number = Q of the symbol 0 decision point . . . (2 × 5) + 1 (or 11th) number = I of the symbol 1 decision point (2 × 5) + 2 (or 12th) number = Q of the symbol 1 decision point . . . (2 × 5) × N + 1 number = I of the symbol N decision point (2 × 5) × N + 2 number = Q of the symbol N decision point

n	Results Returned
6 NADC mode	Returns the following 4 comma-separated scalar values of 1 or 0, in the order given. The pass/fail results (0=passed, or 1=failed) are determined by testing the EVM, peak EVM, first 10 symbols EVM and IQ origin offsets. Test result of EVM Test result of peak EVM Test result of first 10 symbols EVM Test result of IQ origin offset
6 PDC mode	Returns the following 3 comma-separated scalar values of 1 or 0, in the order given. The pass/fail results (0=passed, or 1=failed) are determined by testing the EVM, peak EVM, and IQ origin offsets. Test result of EVM Test result of peak EVM Test result of IQ origin offset

Occupied Bandwidth Measurement

This measures the bandwidth of the carrier signal in the occupied part of the channel. You must be in the PDC, iDEN, cdma2000, or W-CDMA (3GPP) 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) PDC, cdma2000, or W-CDMA (3GPP) mode	Returns 2 comma-separated scalar results, in the following order: 1. Occupied bandwidth - Hz 2. Absolute Carrier Power - dBm
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 PDC, cdma2000, W-CDMA (3GPP) mode	Returns the frequency-domain spectrum trace (data array) for the entire frequency range being measured

n	Results Returned
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.
History:	Modified A.05.20

Measurement Results Available

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

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

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

Waveform (Time Domain) Measurement

This measures the 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.
History:	Modified A.05.20

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**.
3, Option B7C with cdma2000, W-CDMA, Basic modes only	Returns comma-separated magnitude values of the time data in Volts peak.
4, Option B7C with cdma2000, W-CDMA, Basic modes only	Returns comma-separated values of phase in degrees.
5, cdma2000, W-CDMA, Basic modes only	In input modes other than Ionly and Qonly returns comma-separated values of I and Q trace data in Volts. The values are in pairs with the I value first. In Ionly and Qonly the data retured is comma-separated values of the I data or the Q data.

READ Subsystem

The READ? commands are used with several other commands and are documented in the section on the “MEASure Group of Commands” on page 352.

Initiate and Read Measurement Data

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

A READ? query must specify the desired measurement. It will cause a measurement to occur without changing any of the current settings and will return any valid results. The code number n selects the kind of results that will be returned. The available measurements and data results are described in the “MEASure Group of Commands” on page 352.

SENSe Subsystem

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

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

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 352. The equivalent front panel keys for the parameters described in the following commands, are found under the **Meas Setup** key, after the **ACP** or **ACPR** measurement has been selected from the **MEASURE** key menu.

Adjacent Channel Power—Average Count

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

```
[:SENSe]:ACP:AVERage:COUNt?
```

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

Factory Preset and *RST:	10 for cdma2000, W-CDMA (3GPP), W-CDMA (Trial & Arib)
	20 for Basic, cdmaOne, iDEN
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 (3GPP), W-CDMA (Trial & Arib)
	EXPonential for NADC, PDC, iDEN
Remarks:	Use INSTrument:SELect to set the mode.

Adjacent Channel Power—Type of Carrier Averaging

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

```
[:SENSe]:ACP:AVERage:TYPE?
```

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

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

Adjacent Channel Power—Carrier Channel BW

Basic, cdmaOne, iDEN mode

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

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

cdma2000, W-CMDA (3GPP) mode

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

cdmaOne, W-CMDA (Trial & Arib) mode

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

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

BANDwidth[n]|BWIDth[n]:

m=1 is base station and 2 is mobiles. The default is base station (1).

INTegration[n]:

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

W-CDMA (Trial & Arib) 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	1.23 MHz		
W-CDMA (3GPP)	3.84 MHz		
W-CDMA (Trial & Arib)	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 (3GPP), W-CDMA (Trial & Arib) 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 (3GPP), W-CDMA (Trial & Arib), iDEN mode to use this command. Use INSTrument:SELect to set the mode.

Adjacent Channel Power—Reference Channel FFT Segments

`[:SENSe]:ACP:FFTSegment <integer>`

`[:SENSe]:ACP:FFTSegment?`

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

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

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

Adjacent Channel Power—Reference Channel FFT Segments State

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

`[:SENSe]:ACP:FFTSegment:AUTO?`

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

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

Adjacent Channel Power—Frequency Span Query

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

Returns the span of the spectrum view.

Remarks:	You must be in Basic, cdmaOne mode to use this command. Use INSTrument:SELect to set the mode. MEAS|READ|FETC:ACP4? returns the frequency-domain spectrum trace data for the entire frequency range being measured..
History:	Revision A.05.00 or later

Adjacent Channel Power—Offset Frequency Absolute Limit

`[:SENSe]:ACP:LIST:ALIMit <abs_powr>,<abs_powr>,<abs_powr>,<abs_powr>,<abs_powr>`

`[:SENSe]:ACP:LIST:ALIMit?`

Set the absolute limit on offset frequencies relative to the carrier. You can turn off (not use) specific offsets with the [:SENSe]:ACP:LIST:STATe command.

Factory Preset
and *RST:

Mode	Offset A	Offset B	Offset C	Offset D	Offset E
NADC	0 dBm	0 dBm	–13 dBm	0 dBm	0 dBm
PDC	0 dBm	0 dBm	0 dBm	0 dBm	0 dBm

Range:	–200 to 50 dBm
Remarks:	You must be in the NADC, cdmaOne, or PDC mode to use this command. Use INSTrument:SELect to set the mode.

Adjacent Channel Power—Offset Frequency

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

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

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

Factory Preset
and *RST:

Mode	Offset A	Offset B	Offset C	Offset D	Offset E
NADC	30 kHz	60 kHz	90 kHz	120 kHz	0 Hz
PDC	50 kHz	100 kHz	0 kHz	0 kHz	0 kHz

Range:	10 Hz to 45 MHz
	0 to 200 kHz
Default Unit:	Hz
Remarks:	You must be in the NADC, cdmaOne, or PDC mode to use this command. Use INSTrument:SELect to set the mode.

Adjacent Channel Power—Offset Frequency Power Mode

```
[:SENSe]:ACP:LIST:POWer
INTeg|PEAK,INTeg|PEAK,INTeg|PEAK,INTeg|PEAK,INTeg|PEAK
```

```
[:SENSe]:ACP:LIST:POWer?
```

Define the power measurement mode for each of the offset frequencies. You can turn off (not use) specific offsets with the SENS:ACP:LIST:STATe command.

Factory Preset and *RST:	INTeg, INTeg, INTeg, INTeg, INTeg
Remarks:	You must be in the NADC mode to use this command. Use INSTrument:SELect to set the mode.

Adjacent Channel Power—Offset Frequency Relative Limit

```
[:SENSe]:ACP:LIST:RLIMit
<rel_powr>,<rel_powr>,<rel_powr>,<rel_powr>,<rel_powr>
```

```
[:SENSe]:ACP:LIST:RLIMit?
```

Set the relative limit on offset frequencies. You can turn off (not use) specific offsets with the SENS:ACP:LIST:STATe command.

Factory Preset
and *RST: –45 dB

Mode	**Offset A**	**Offset B**	**Offset C**	**Offset D**	**Offset E**
NADC	–26 dB	–45 dB	–45 dB	0 dB	0 dB
PDC	–45 dB	–60 dB	0 dB	0 dB	0 dB

Range: –200 to 50 dB

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

Adjacent Channel Power—Offset Frequency Control

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

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

Turn measurement on or off for the custom offset frequencies.

Factory Preset
and *RST:

Mode	**Offset A**	**Offset B**	**Offset C**	**Offset D**	**Offset E**
NADC	ON	ON	ON	OFF	OFF
PDC	ON	ON	OFF	OFF	OFF

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

Adjacent Channel Power—Offset Frequency Test Mode

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

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

Define the type of testing to be done for the five custom offset frequencies. You can turn off (not use) specific offsets with the SENS:ACP:LIST:STATe command.

Factory Preset

and *RST:	RELative, RELative, OR, AND, AND for NADC, PDC mode
Remarks:	You must be in the NADC, cdmaOne, or PDC 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, cdmaOne

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

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

cdma2000, W-CDMA (3GPP) mode

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

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

W-CDMA (Trial & Arib) mode

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

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

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

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

The query returns 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[m]	
cdmaOne mode	m=1 is cellular bands and 2 is pcs bands. The default is cellular.
W-CDMA (Trial	

& Arib) mode m=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 (3GPP)		50 dBm	50 dBm	50 dBm	50 dBm	50 dBm
W-CDMA (Trial & Arib)		50 dBm	50 dBm	50 dBm	50 dBm	50 dBm
iDEN		0 dBm	n/a	n/a	n/a	n/a

Range: –200.0 dBm to 50.0 dBm

Default Unit: dBm

Remarks: You must be in Basic, cdmaOne, cdma2000, W-CDMA (3GPP), W-CDMA (Trial & Arib), or iDEN mode to use this command. Use INSTrument:SELect to set the mode.

Adjacent Channel Power—Type of Offset Averaging

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

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

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

Factory Preset and *RST:

Mode	Offset A	Offset B	Offset C	Offset D	Offset E
Basic & cdmaOne	RMS	RMS	RMS	RMS	RMS

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

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?`

cdma2000, W-CDMA (3GPP) mode

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

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

cdmaOne, W-CDMA (Trial & Arib) mode

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

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

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

Offset[n]	n=1 is base station and 2 is mobiles. The default is base station (1).
List[n]	
cdmaOne mode	n=1 is cellular bands and 2 is pcs bands. The default is cellular.
W-CDMA (Trial & Arib) 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 (3GPP)		3.84 MHz	3.84 MHz	3.84 MHz	3.84 MHz	3.84 MHz
W-CDMA (Trial & Arib)	3GPP	3.84 MHz	3.84 MHz	3.84 MHz	3.84 MHz	3.84 MHz
	Trial, ARIB	4.096 MHz	4.096 MHz	4.096 MHz	4.096 MHz	4.096 MHz

Range:	300 Hz to 20 MHz for cdmaOne, Basic, cdma2000, W-CDMA (3GPP), or W-CDMA (Trial & Arib) mode 1 kHz to 5 MHz for iDEN mode
Default Unit:	Hz
Remarks:	You must be in Basic, cdmaOne, cdma2000, W-CDMA (3GPP), W-CDMA (Trial & Arib), or iDEN mode to use this command. Use INSTrument:SELect to set the mode.

Adjacent Channel Power—FFT Segments

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

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

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

Factory Preset
and *RST:

Mode	**Offset A**	**Offset B**	**Offset C**	**Offset D**	**Offset E**
Basic & cdmaOne	1	1	1	1	1

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

Adjacent Channel Power—Automatic FFT Segments

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

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

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

Factory Preset
and *RST:

Mode	**Offset A**	**Offset B**	**Offset C**	**Offset D**	**Offset E**
Basic & cdmaOne	ON	ON	ON	ON	ON

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

Adjacent Channel Power—Define Offset Frequency List

iDEN mode

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

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

Basic mode, cdmaOne

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

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

cdma2000, W-CDMA (3GPP) mode

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

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

cdmaOne, W-CDMA (Trial & Arib) mode

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

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

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

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

Offset[n]	n=1 is base station and 2 is mobiles. The default is base station (1).
List[n]	
cdmaOne mode	n=1 is cellular bands and 2 is pcs bands. The default is cellular.
W-CDMA (Trial & Arib) 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	750 kHz	1.98 MHz	0 Hz	0 Hz	0 Hz
	MS	885 kHz	1.98 MHz	0 Hz	0 Hz	0 Hz
W-CDMA (3GPP)		5 MHz	10 MHz	15 MHz	20 MHz	25 MHz

Mode	Variant	Offset A	Offset B	Offset C	Offset D	Offset E
W-CDMA (Trial & Arib)		5 MHz	10 MHz	15 MHz	20 MHz	25 MHz

Range:	0 Hz to 20 MHz for iDEN, Basic 0 Hz to 45 MHz for cdmaOne 0 Hz to 100 MHz for cdma2000, W-CDMA (3GPP), W-CDMA (Trial & Arib)
Default Unit:	Hz
Remarks:	You must be in Basic, cdmaOne, cdma2000, W-CDMA (3GPP), W-CDMA (Trial & Arib), or iDEN mode to use this command. Use INSTrument:SELect to set the mode.

Adjacent Channel Power—Number of Measured Points

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

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

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

Factory Preset
and *RST:

Mode	Offset A	Offset B	Offset C	Offset D	Offset E
Basic & cdmaOne	1024	1024	1024	1024	1024

Range:	64 to 65536
Remarks:	The fastest measurement times are obtained when the number of points measured is 2^n. You must be in Basic, cdmaOne mode to use this command. Use INSTrument:SELect to set the mode.

Adjacent Channel Power—Automatic Measurement Points

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

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

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

Factory Preset
and *RST:

Mode	Offset A	Offset B	Offset C	Offset D	Offset E
Basic & cdmaOne	ON	ON	ON	ON	ON

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

Adjacent Channel Power—Relative Attenuation

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

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

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

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

Factory Preset
and *RST:

Mode	Offset A	Offset B	Offset C	Offset D	Offset E
Basic & cdmaOne	0 dB	0 dB	0 dB	0 dB	0 dB

Range:	–40 to 0 dB, but this relative attenuation cannot exceed the absolute attenuation range of 0 to 40 dB.
Default Unit:	dB
Remarks:	Remember that the attenuation that you specify is always relative to the amount of attenuation used for

the carrier channel. Selecting negative attenuation means that you want less attenuation used. For example, if the measurement must use 20 dB of attenuation for the carrier measurement and you want to use 12 dB less attenuation for the first offset, you would send the value –12 dB.

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

Adjacent Channel Power—Relative Attenuation Control

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

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

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

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

Factory Preset and *RST:	ON
Remarks:	You must be in Basic or cdmaOne 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, cdmaOne

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

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

cdma2000, W-CDMA (3GPP) mode

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

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

cdmaOne, W-CDMA (Trial & Arib) mode

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

`<rel_power>,<rel_power>,<rel_power>,<rel_power>,<rel_power>`

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

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

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

The query returns 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.

W-CDMA (Trial & Arib) 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
cdma2000		0 dBc	0 dBc	0 dBc	0 dBc	0 dBc
W-CDMA (3GPP)	BTS	–44.2 dBc	–49.2 dBc	–49.2 dBc	–49.2 dBc	–44.2 dBc
	MS	–32.2 dBc	–42.2 dBc	–42.2 dBc	–42.2 dBc	–42.2 dBc
W-CDMA (Trial & Arib)		0 dBc	0 dBc	0 dBc	0 dBc	0 dBc

Range:	–150.0 dB to 50.0 dB for cdmaOne, cdma2000, W-CDMA (3GPP), W-CDMA (Trial & Arib), Basic –200.0 dB to 50.0 dB for iDEN
Default Unit:	dB
Remarks:	You must be in Basic, cdmaOne, cdma2000, W-CDMA (3GPP), W-CDMA (Trial & Arib), or iDEN mode to use this command. Use INSTrument:SELect to set the mode.

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

iDEN mode

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

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

Basic mode, cdmaOne

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

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

cdma2000, W-CDMA (3GPP) mode

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

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

cdmaOne, W-CDMA (Trial & Arib) mode

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

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

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

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

The query returns 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.

W-CDMA (Trial & Arib) 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 (3GPP)	BTS	–44.2 dBc	–49.2 dBc	–49.2 dBc	–49.2 dBc	–44.2 dBc
	MS	–32.2 dBc	–42.2 dBc	–42.2 dBc	–42.2 dBc	–42.2 dBc
W-CDMA (Trial & Arib)		0 dB	0 dB	0 dB	0 dB	0 dB

Range: –150.0 dB to 50.0 dB for cdmaOne, Basic, cdma2000, W-CDMA (3GPP), W-CDMA (Trial & Arib)

–200.0 dB to 50.0 dB for iDEN

Default Unit: dB

Remarks: You must be in Basic, cdmaOne, cdma2000, W-CDMA (3GPP), W-CDMA (Trial & Arib), or iDEN mode to use this command. Use INSTrument:SELect to set the mode.

Adjacent Channel Power—Select Sideband

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

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

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

Factory Preset
and *RST:

Mode	**Offset A**	**Offset B**	**Offset C**	**Offset D**	**Offset E**
Basic & cdmaOne	BOTH	BOTH	BOTH	BOTH	BOTH

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

Adjacent Channel Power—Control Offset Frequency List

Basic mode, cdmaOne

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

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

cdma2000, W-CDMA (3GPP) mode

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

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

cdmaOne, W-CDMA (Trial & Arib) mode

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

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

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

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.

W-CDMA (Trial & Arib) 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		On	On	On	On	On
cdmaOne	BS cellular	On	On	On	On	On
	BS pcs	On	On	On	On	On
	MS cellular	On	On	On	On	On
	MS pcs	On	On	On	On	On
cdma2000		On	On	Off	Off	Off
W-CDMA (3GPP)		On	On	Off	Off	Off
W-CDMA (Trial & Arib)		On	On	Off	Off	Off

Remarks: You must be in Basic, cdmaOne, cdma2000, W-CDMA (3GPP), or W-CDMA (Trial & Arib) mode to use this command. Use INSTrument:SELect to set the mode.

Adjacent Channel Power—Sweep Time

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

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

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

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

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

Factory Preset
and *RST:

Mode	Offset A	Offset B	Offset C	Offset D	Offset E
Basic & cdmaOne	11.20 ms	11.20 ms	11.20 ms	11.20 ms	11.20 ms

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

Adjacent Channel Power—Automatic Sweep Time

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

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

Sets the sweep time to be automatically coupled for the fastest measurement time. You can turn off (not use) specific offsets with the SENS:ACP:OFFSet:LIST:STATe command.

Factory Preset
and *RST:

Mode	Offset A	Offset B	Offset C	Offset D	Offset E
Basic & cdmaOne	On	On	On	On	On

Remarks:	You must be in Basic, cdmaOne mode to use this command. Use INSTrument:SELect to set the mode.
History:	Revision A.03.00 or later, in cdmaOne revision A.04.00

Adjacent Channel Power—Define Type of Offset Frequency List

iDEN mode

```
[:SENSe]:ACP:OFFSet:TEST ABSolute|AND|OR|RELative
```

```
[:SENSe]:ACP:OFFSet:TEST?
```

Basic mode, cdmaOne

```
[:SENSe]:ACP:OFFSet:LIST:TEST ABSolute|AND|OR|RELative,
ABSolute|AND|OR|RELative,ABSolute|AND|OR|RELative,
```

ABSolute|AND|OR|RELative,ABSolute|AND|OR|RELative

[:SENSe]:ACP:OFFSet:LIST:TEST?

cdma2000, W-CDMA (3GPP) mode

[:SENSe]:ACP:OFFSet[n]:LIST:TEST ABSolute|AND|OR|RELative, ABSolute|AND|OR|RELative,ABSolute|AND|OR|RELative, ABSolute|AND|OR|RELative,ABSolute|AND|OR|RELative

[:SENSe]:ACP:OFFSet[n]:LIST:TEST?

cdmaOne, W-CDMA (Trial & Arib) mode

[:SENSe]:ACP:OFFSet[n]:LIST[n]:TEST BSolute|AND|OR|RELative,ABSolute|AND|OR|RELative, ABSolute|AND|OR|RELative,ABSolute|AND|OR|RELative, ABSolute|AND|OR|RELative

[:SENSe]:ACP:OFFSet[n]:LIST[n]:TEST?

Defines the type of testing to be done at any custom offset frequencies. The measured powers are tested against the absolute values defined with [:SENSe]:ACP:OFFSet[n]:LIST[n]:ABSolute, or the relative values defined with [:SENSe]:ACP:OFFSet[n]:LIST[n]:RPSDensity and [:SENSe]:ACP:OFFSet[n]:LIST[n]:RCARrier.

You can turn off (not use) specific offsets with the [:SENS]:ACP:OFFSet[n]:LIST[n]:STATe command.

Offset[n]	n=1 is base station and 2 is mobiles. The default is base station (1).
List[n]	
cdmaOne mode	n=1 is cellular bands and 2 is pcs bands. The default is cellular.
W-CDMA (Trial & Arib) 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:

- Absolute - Test the absolute power measurement. If it fails, then return a failure for the measurement at this offset.
- And - Test both the absolute power measurement and the power relative to the carrier. If they both fail, then return a failure for the measurement at this offset.
- Or - Test both the absolute power measurement and the power relative to the carrier. If either one fails, then return a failure for the measurement at this offset.
- Relative - Test the power relative to the carrier. If it fails, then return a failure for the measurement at this offset.

- OFF - Turns the power test off.

Factory Preset
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 (3GPP)		REL	REL	REL	REL	REL
W-CDMA (Trial & Arib)		REL	REL	REL	REL	REL

Remarks: You must be in Basic, cdmaOne, cdma2000, W-CDMA (3GPP), W-CDMA (Trial & Arib), or iDEN mode to use this command. Use INSTrument:SELect to set the mode.

Adjacent Channel Power—Number of Measured Points

`[:SENSe]:ACP:POINts <integer>`

`[:SENSe]:ACP:POINts?`

Selects the number of data points used to measure the reference (carrier) channel. The automatic mode chooses the optimum number of points for the fastest measurement time with acceptable repeatability. The minimum number of points that could be used is determined by the sweep time and the sampling rate.

You can increase the length of the measured time record (capture more of the burst) by increasing the number of points, but the measurement will take longer. Use `[:SENSe]:ACP:OFFSet:LIST:POINts` to set the number of points used for measuring the offset channels.

Factory Preset and *RST:	1024
Remarks:	The fastest measurement times are obtained when the number of points measured is 2^n. You must be in Basic, cdmaOne mode to use this command. Use INSTrument:SELect to set the mode.
Range:	64 to 65536

Adjacent Channel Power—Automatic Measurement Points

`[:SENSe]:ACP:POINts:AUTO OFF|ON|0|1`

`[:SENSe]:ACP:POINts:AUTO?`

Automatically selects the number of points for the optimum measurement speed.

Factory Preset and *RST:	ON
Remarks:	You must be in Basic, cdmaOne 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, iDEN mode to use this command. Use INSTrument:SELect to set the mode.
History:	Revision A.03.27 or later, in cdmaOne revision A.04.00

Adjacent Channel Power—Sweep Time

`[:SENSe]:ACP:SWEep:TIME <seconds>`

`[:SENSe]:ACP:SWEep:TIME?`

Selects a specific sweep time used to measure the reference (carrier) channel. If you increase the sweep time, you increase the length of the time data captured and the number of points measured. You might need to specify a specific sweep speed to accommodate a specific condition in your transmitter. For example, you may have a burst signal and need to measure an exact portion of the burst.

Selecting a specific sweep time may result in a long measurement time since the resulting number of data points may not be the optimum 2^n. Use `[:SENSe]:ACP:OFFSet:LIST:SWEep:TIME` to set the number of points used for measuring the offset channels for Basic and cdmaOne.

For cdma2000 and W-CDMA, this command sets the sweep time when using the sweep mode. See `[:SENSe]:ACP:SWEep:TYPE`.

Factory Preset and *RST:	625 µs (1 slot) for W-CDMA (3GPP), W-CDMA (Trial & Arib) 1.25 ms for cdma2000 11.20 ms for Basic, cdmaOne
Range:	500 µs to 10 ms 1 µs to 50 ms for Basic, cdmaOne
Default Unit:	seconds
Remarks:	You must be in the Basic, cdmaOne, cdma2000, W-CDMA (3GPP), or W-CDMA (Trial & Arib) mode to use this command. Use INSTrument:SELect to set the mode.
History:	Added to Basic revision A.03.00, to cdmaOne revision A.04.00

Adjacent Channel Power—Automatic Sweep Time

`[:SENSe]:ACP:SWEep:TIME:AUTO OFF|ON|0|1`

`[:SENSe]:ACP:SWEep:TIME:AUTO?`

Sets the sweep time to be automatically coupled for the fastest measurement time.

Factory Preset and *RST:	ON

Remarks:	You must be in Basic, cdmaOne mode to use this command. Use INSTrument:SELect to set the mode.
History:	Revision A.03.00 or later, in cdmaOne revision A.04.00

Adjacent Channel Power—Trigger Source

```
[:SENSe]:ACP:TRIGger:SOURce
EXTernal[1]|EXTernal2|FRAMe|IF|IMMediate|RFBurst
```

```
[:SENSe]:ACP:TRIGger:SOURce?
```

Select the trigger source used to control the data acquisitions.

EXTernal 1 – front panel external trigger input

EXTernal 2 – rear panel external trigger input

FRAMe – internal frame trigger from front panel input

IF – internal IF envelope (video) trigger

IMMediate – the next data acquisition is immediately taken, capturing the signal asynchronously (also called free run).

RFBurst – wideband RF burst envelope trigger that has automatic level control for periodic burst signals.

Factory Preset and *RST:	IMMediate for BS RFBurst for MS
Remarks:	You must be in Basic, cdmaOne, iDEN, NADC, or PDC mode to use this command. Use INSTrument:SELect to set the mode. In Basic mode, for offset frequencies >12.5 MHz, the external triggers will be a more reliable trigger source than RF burst. Also, you can use the Waveform measurement to set up trigger delay.

Adjacent Channel Power—Power Reference

```
[:SENSe]:ACP:TYPE PSDRef|TPRef
```

```
[:SENSe]:ACP:TYPE?
```

Selects the measurement type. This allows you to make absolute and relative power measurements of either total power or the power normalized to the measurement bandwidth.

Power Spectral Density Reference (PSDRef) - the power spectral density is used as the power reference

Total Power Reference (TPRef) - the total power is used as the power reference

Factory Preset and *RST:	Total power reference (TPRef)
Remarks:	You must be in the Basic, cdmaOne, cdma2000, W-CDMA (3GPP), W-CDMA (Trial & Arib), NADC, or PDC mode to use this command. Use INSTrument:SELect to set the mode.

Channel Commands

Select the ARFCN—Absolute RF Channel Number

`[:SENSe]:CHANnel:ARFCn|RFCHannel <integer>`

`[:SENSe]:CHANnel:ARFCn|RFCHannel?`

Set the analyzer to a frequency that corresponds to the ARFCN (Absolute RF Channel Number).

Factory Preset and *RST:	38
Range:	0 to 124, and 975 to 1023 for E-GSM
	1 to 124 for P-GSM
	0 to 124, and 955 to 1023 for R-GSM
	512 to 885 for DCS1800
	512 to 810 for PCS1900
	259 to 293 for GSM450
	306 to 340 for GSM480
	438 to 511 for GSM700
	128 to 251 for GSM850
Remarks:	You must be in the EDGE(w/GSM), GSM mode to use this command. Use INSTrument:SELect to set the mode.
	Global to the current mode.
History:	Version A.03.00 or later
Front Panel Access:	**FREQUENCY Channel, ARFCN**

Select the Lowest ARFCN

`[:SENSe]:CHANnel:ARFCn|RFCHannel:BOTTom`

Set the analyzer to the frequency of the lowest ARFCN (Absolute RF Channel Number) of the selected radio band.

Factory Preset and *RST:	975 for E-GSM
	1 for P-GSM
	955 for R-GSM
	512 for DCS1800

	512 PCS1900
	259 GSM450
	306 GSM480
	438 GSM700
	128 GSM850
Remarks:	You must be in the EDGE(w/GSM), GSM mode to use this command. Use INSTrument:SELect to set the mode.
	Global to the current mode.
History:	Version A.03.00 or later
Front Panel Access:	**FREQUENCY Channel, BMT Freq**

Select the Middle ARFCN

`[:SENSe]:CHANnel:ARFCn|RFCHannel:MIDDle`

Set the analyzer to the frequency of the middle ARFCN (Absolute RF Channel Number) of the selected radio band.

Factory Preset and *RST:	38 for E-GSM
	63 for P-GSM
	28 for R-GSM
	699 for DCS1800
	661 for PCS1900
	276 for GSM450
	323 for GSM480
	474 for GSM 700
	189 for GSM850
Remarks:	You must be in the EDGE(w/GSM), GSM mode to use this command. Use INSTrument:SELect to set the mode.
	Global to the current mode.
History:	Version A.03.00 or later
Front Panel Access:	**FREQUENCY Channel, BMT Freq**

Select the Highest ARFCN

`[:SENSe]:CHANnel:ARFCn|RFCHannel:TOP`

Set the analyzer to the frequency of the highest ARFCN (Absolute RF Channel Number) of the selected radio band.

Factory Preset and *RST:	124 for E-GSM 124 for P-GSM 124 for R-GSM 885 for DCS1800 810 for PCS1900 293 for GSM450 340 for GSM480 511 for GSM700 251 for GSM850
Remarks:	You must be in the EDGE(w/GSM), GSM mode to use this command. Use INSTrument:SELect to set the mode. Global to the current mode.
History:	Version A.03.00 or later
Front Panel Access:	**FREQUENCY Channel, BMT Freq**

Burst Type

`[:SENSe]:CHANnel:BURSt TCH|CCH`

`[:SENSe]:CHANnel:BURSt?`

Set the burst type for mobile station testing.

Traffic Channel (TCH) – burst for traffic channel

Control Channel (CCH) – burst for control channel

Factory Preset and *RST:	TCH
Remarks:	The command is only applicable for mobile station testing, device = MS. You must be in the NADC or PDC mode to use this command. Use INSTrument:SELect to set the mode.

Channel Burst Type

`[:SENSe]:CHANnel:BURSt NORMal|SYNC|ACCess`

`[:SENSe]:CHANnel:BURSt?`

Set the burst type that the analyzer will search for and to which it will sync. This only applies with normal burst selected.

NORMal: Traffic Channel (TCH) and Control Channel (CCH)

SYNC: Synchronization Channel (SCH)

ACCess: Random Access Channel (RACH)

Remarks:	Global to the current mode. You must be in the EDGE(w/GSM), GSM mode to use this command. Use INSTrument:SELect to set the mode.
Front Panel Access:	**FREQUENCY Channel, Burst Type**

Digital Demod PN Offset

`[:SENSe]:CHANnel:PNOFfset <integer>`

`[:SENSe]:CHANnel:PNOFfset?`

Set the PN offset number for the base station being tested.

Factory Preset and *RST:	0
Range:	0 to 511
Default Unit:	None
Remarks:	Global to the current mode. You must be in the cdmaOne mode to use this command. Use INSTrument:SELect to set the mode.
Front Panel Access:	**FREQUENCY Channel**, **PN Offset** or **Mode Setup**, **Demod**, *PN Offset*

Time Slot number

```
[:SENSe]:CHANnel:SLOT <integer>
```

```
[:SENSe]:CHANnel:SLOT?
```

Select the slot number that you want to measure.

In GSM mode the measurement frame is divided into the eight expected measurement timeslots.

Factory Preset and *RST:	0 for GSM, PDC mode
	1 for NADC mode
Range:	0 to 5 for PDC mode
	1 to 6 for NADC mode
	0 to 7 for GSM mode
Remarks:	You must be in EDGE(w/GSM), GSM, NADC, PDC mode to use this command. Use INSTrument:SELect to set the mode.
Front Panel Access:	**Mode Setup, Radio, Frequency Hopping Repetition Factor**

Time Slot Auto

```
[:SENSe]:CHANnel:SLOT:AUTO OFF|ON|0|1
```

```
[:SENSe]:CHANnel:SLOT:AUTO?
```

Select auto or manual control for slot searching. The feature is only supported in external and frame trigger source modes. In external trigger mode when timeslot is set on, the demodulation measurement is made on the nth timeslot specified by the external trigger point + n timeslots, where n is the selected timeslot value 0 to 7. In frame trigger mode when timeslot is set on, then demodulation measurement is only made on the nth timeslot specified by bit 0 of frame reference burst + n timeslots, where n is the selected timeslot value 0 to 7 and where the frame reference burst is specified by Ref Burst and Ref TSC (Std) combination.

Factory Preset and *RST:	ON, for NADC, PDC mode
	OFF, for GSM mode
Remarks:	The command is only applicable for mobile station testing, device = MS.

	You must be in EDGE(w/GSM), GSM, NADC, PDC mode to use this command.Use INSTrument:SELect to set the mode.
History:	Added GSM mode, version A.03.00 or later

Training Sequence Code (TSC)

`[:SENSe]:CHANnel:TSCode <integer>`

`[:SENSe]:CHANnel:TSCode?`

Set the training sequence code to search for, with normal burst selected and TSC auto set to off.

Factory Preset and *RST:	0
Range:	0 to 7
Remarks:	Global to the current mode. You must be in the EDGE(w/GSM), GSM mode to use this command. Use INSTrument:SELect to set the mode.
History:	Version A.03.00 or later
Front Panel Access:	**FREQUENCY Channel, TSC (Std)**

Training Sequence Code (TSC) Auto

`[:SENSe]:CHANnel:TSCode:AUTO OFF|ON|0|1`

`[:SENSe]:CHANnel:TSCode:AUTO?`

Select auto or manual control for training sequence code (TSC) search. With auto on, the measurement is made on the first burst found to have one of the valid TSCs in the range 0 to 7 (i.e. normal bursts only). With auto off, the measurement is made on the 1st burst found to have the selected TSC.

Factory Preset and *RST:	AUTO
Remarks:	Global to the current mode. You must be in the EDGE(w/GSM), GSM mode to use this command. Use INSTrument:SELect to set the mode.
Front Panel Access:	**FREQUENCY Channel, TSC (Std)**

Signal Corrections Commands

Correction for Base Station RF Port External Attenuation

```
[:SENSe]:CORRection:BS[:RF]:LOSS <rel_power>
```

```
[:SENSe]:CORRection:BS[:RF]:LOSS?
```

Set the correction equal to the external attenuation used when measuring base stations.

Factory Preset and *RST:	0 dB
Range:	–50 to 100 dB for cdmaOne, iDEN –50 to 50 dB for NADC or PDC
Default Unit:	dB
Remarks:	You must be in the 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:	0.0 dB
Range:	–50 to 100.0 dB for cdmaOne, GSM, EDGE, iDEN –100.0 to 100.0 dB for cdma2000, W-CDMA (3GPP) –50.0 to 50.0 dB for W-CDMA (Trial/Arib), NADC, PDC
Default Unit:	dB
Remarks:	You must be in the cdmaOne, GSM, EDGE (w/GSM), cdma2000, W-CDMA (3GPP), W-CDMA (Trial & Arib), iDEN, NADC or PDC mode to use this command. Use INSTrument:SELect to set the mode. Value is global to the current mode.

Correction for RF Port External Attenuation

```
[:SENSe]:CORRection[:RF]:LOSS <rel_power>
```

```
[:SENSe]:CORRection[:RF]:LOSS?
```

Set the correction equal to the external attenuation used when measuring the device under test.

Factory Preset and *RST:	0 dB
Range:	-50 to +50 dB
Default Unit:	dB
Remarks:	You must be in the Basic mode to use this command. Use INSTrument:SELect to set the mode. Value is global to Basic mode.
Front Panel Access:	**Input**, **Ext Atten**

Error Vector Magnitude Measurement

Commands for querying the error vector magnitude measurement results and for setting to the default values are found in the "MEASure Group of Commands" on page 352. The equivalent front panel keys for the parameters described in the following commands, are found under the **Meas Setup** key, after the **EVM** measurement has been selected from the **MEASURE** key menu.

Error Vector Magnitude—Average Count

`[:SENSe]:EVM:AVERage:COUNt <integer>`

`[:SENSe]:EVM: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
Range:	1 to 10,000
Remarks:	You must be in the NADC or PDC mode to use this command. Use INSTrument:SELect to set the mode.

Error Vector Magnitude—Averaging State

`[:SENSe]:EVM:AVERage[:STATe] OFF|ON|0|1`

`[:SENSe]:EVM:AVERage[:STATe]?`

Turn average on or off.

Factory Preset and *RST:	ON
Remarks:	You must be in the NADC or PDC mode to use this command. Use INSTrument:SELect to set the mode.

Error Vector Magnitude—Averaging Termination Control

`[:SENSe]:EVM:AVERage:TCONtrol EXPonential|REPeat`

`[:SENSe]:EVM:AVERage:TCONtrol?`

Select the type of termination control used to 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:	EXPonential
Remarks:	You must be in the NADC or PDC mode to use this command. Use INSTrument:SELect to set the mode.

Error Vector Magnitude—Burst Synchronization Source

```
[:SENSe]:EVM:BSYNc:SOURce RFBurst|TSEQuence|NONE
```

```
[:SENSe]:EVM:BSYNc:SOURce?
```

Select the method of synchronizing the measurement to the bursts.

RFBurst – The burst sync approximates the start and stop of the useful part of the burst without demodulation of the burst.

Training Sequence (TSEQuence)– The burst sync performs a demodulation of the burst and determines the start and stop of the useful part of the burst based on the midamble training sync sequence.

NONE – The measurement is performed without searching burst.

Factory Preset and *RST:	NONE for BS TSEQuence for MS
Remarks:	You must be in the NADC or PDC mode to use this command. Use INSTrument:SELect to set the mode.

Error Vector Magnitude—Points/Symbol

```
[:SENSe]:EVM:TRACe:PPSYmbol <integer>
```

```
[:SENSe]:EVM:TRACe:PPSYmbol?
```

Select the points/symbol for EVM measurement. Only 1 or 5 are valid entries.

Factory Preset and *RST:	5
Range:	1, 5

Remarks:	You must be in the NADC or PDC mode to use this command. Use INSTrument:SELect to set the mode.

Error Vector Magnitude—Trigger Source

`[:SENSe]:EVM:TRIGger:SOURce EXTernal[1]|EXTernal2|FRAMe|IF|IMMediate|RFBurst`

`[:SENSe]:EVM: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

IF – internal IF envelope (video) trigger

IMMediate – the next data acquisition is immediately taken, capturing the signal asynchronously (also called free run)

FRAMe – internal frame trigger from front panel input

RFBurst – wideband RF burst envelope trigger that has automatic level control for periodic burst signals

Factory Preset and *RST:	IMMediate for BS RFBurst for MS
Remarks:	You must be in the NADC or PDC mode to use this command. Use INSTrument:SELect to set the mode.

Select the Input Signal [VSA, PSA]

`[:SENSe]:FEED RF|IQ|IONLy|QONLy|AREFerence|IFALign`

`[:SENSe]:FEED?`

Selects the input signal. The default input signal is taken from the front panel RF input port. For calibration and testing purposes the input signal can be taken from an internal 321.4 MHz IF alignment signal or an internal 50 MHz amplitude reference source.

If the baseband IQ option (Option B7C) is installed, I and Q input ports are added to the front panel. The I and Q ports accept the in-phase and quadrature components of the IQ signal, respectively. The input signal can be taken from either or both ports.

RF selects the signal from the front panel RF INPUT port.

IQ selects the combined signals from the front panel optional I and Q input ports.

IONLy selects the signal from the front panel optional I input port.

QONLy selects the signal from the front panel optional Q input port.

IFALign selects the internal, 321.4 MHz, IF alignment signal.

AREFerence selects the internal 50 MHz amplitude reference signal.

Factory Preset and *RST:	RF
Front Panel Access:	**Input, Input Port**
History:	VSA modified in A.05.00 version

Frequency Commands

Center Frequency

`[:SENSe]:FREQuency:CENTer <freq>`

`[:SENSe]:FREQuency:CENTer?`

Set the center frequency.

Factory Preset and *RST:	1.0 GHz 942.6 MHz for GSM, EDGE 806.0 MHz for iDEN
Range:	1.0 kHz to 4.3214 GHz

Default Unit: Hz

Front Panel Access: **FREQUENCY/Channel, Center Freq**

Center Frequency Step Size Automatic

`[:SENSe]:FREQuency:CENTer:STEP:AUTO OFF|ON|0|1`

`[:SENSe]:FREQuency:CENTer:STEP:AUTO?`

Specifies whether the step size is set automatically based on the span.

Factory Preset and *RST: ON

History: Version A.03.00 or later

Front Panel Access: **FREQUENCY/Channel, CF Step**

Center Frequency Step Size

`[:SENSe]:FREQuency:CENTer:STEP[:INCRement] <freq>`

`[:SENSe]:FREQuency:CENTer:STEP[:INCRement]?`

Specifies the center frequency step size.

Factory Preset and *RST:

5.0 MHz

1.25 MHz for cdma2000

Range: 1.0 kHz to 1.0 GHz, in 10 kHz steps

Default Unit: Hz

History: Version A.03.00 or later

Front Panel Access: **FREQUENCY/Channel, CF Stepl**

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 352. 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—Average Count

`[:SENSe]:OBW:AVERage:COUNt <integer>`

`[:SENSe]:OBW: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
Range:	1 to 10,000
Remarks:	You must be in the PDC, cdma2000, or W-CDMA (3GPP) mode to use this command. Use INSTrument:SELect to set the mode.
History:	Version A.02.00 or later
Front Panel Access:	**Meas Setup, Avg Number**

Occupied Bandwidth—Averaging State

`[:SENSe]:OBW:AVERage[:STATe] OFF|ON|0|1`

`[:SENSe]:OBW:AVERage[:STATe]?`

Turn averaging on or off.

Factory Preset and *RST:	ON
Remarks:	You must be in the PDC, cdma2000, or W-CDMA (3GPP) mode to use this command. Use INSTrument:SELect to set the mode.
History:	Version A.02.00 or later

Front Panel Access:	**Meas Setup, Avg Number**

Occupied Bandwidth—Averaging Termination Control

`[:SENSe]:OBW:AVERage:TCONtrol EXPonential|REPeat`

`[:SENSe]:OBW:AVERage:TCONtrol?`

Select the type of termination control used for the averaging function. This determines the averaging action after the specified number of data acquisitions (average count) is reached.

EXPonential - After the average count is reached, each successive data acquisition 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 for PDC REPeat for cdma2000, W-CDMA (3GPP)
Remarks:	You must be in the PDC, cdma2000, or W-CDMA (3GPP) mode to use this command. Use INSTrument:SELect to set the mode.
History:	Version A.02.00 or later
Front Panel Access:	**Meas Setup**, **Avg Mode**

Occupied Bandwidth—Trigger Source

iDEN mode

```
[:SENSe]:OBWidth:TRIGger:SOURce
EXTernal[1]|EXTernal2|IF|IMMediate|RFBurst
```

`[:SENSe]:OBWidth:TRIGger:SOURce?`

PDC mode

```
[:SENSe]:OBW:TRIGger:SOURce
EXTernal[1]|EXTernal2|IF|IMMediate|RFBurst
```

`[:SENSe]:OBW:TRIGger:SOURce?`

cdma2000, W-CDMA (3GPP) mode

```
[:SENSe]:OBW:TRIGger:SOURce
EXTernal[1]|EXTernal2|FRAMe|IF|IMMediate|LINE|RFBurst
```

`[:SENSe]:OBW:TRIGger:SOURce?`

Select the trigger source used to control the data acquisitions for the occupied bandwidth measurement.

EXTernal1 – rear panel external trigger input

EXTernal2 – front panel external trigger input

FRAMe – internal frame trigger (cdma2000, W-CDMA (3GPP) mode only)

IF – internal IF envelope (video) trigger

IMMediate – the next data acquisition is immediately taken, capturing the signal asynchronously (also called free run)

LINE – power line (cdma2000, W-CDMA (3GPP) mode only)

RFBurst – wideband RF burst envelope trigger that has automatic level control for periodic burst signals

Factory Preset and *RST:	IMMediate for BS of PDC, cdma2000, W-CDMA (3GPP) RFBurst for MS of PDC, iDEN RFBurst for iDEN
Remarks:	You must be in the PDC, iDEN, cdma2000, or W-CDMA (3GPP) mode to use this command. Use INSTrument:SELect to set the mode.
History:	Version A.02.00 or later

RF Power Commands

RF Port Input Attenuation

`[:SENSe]:POWer[:RF]:ATTenuation <rel_power>`

`[:SENSe]:POWer[:RF]:ATTenuation?`

Set the RF input attenuator. This value is set at its auto value if input attenuation is set to auto.

Factory Preset and *RST:	0 dB 12 dB for iDEN
Range:	0 to 40 dB
Default Unit:	dB
Front Panel Access:	**Input, Input Atten**

RF Port Power Range Auto

`[:SENSe]:POWer[:RF]:RANGe:AUTO OFF|ON|0|1`

`[:SENSe]:POWer[:RF]:RANGe:AUTO?`

Select the RF port power range to be set either automatically or manually.

> ON - power range is automatically set as determined by the actual measured power level at the start of a measurement.
>
> OFF - power range is manually set

Factory Preset and *RST:	ON
Remarks:	You must be in the cdmaOne, EDGE(w/GSM), GSM, NADC, PDC, cdma2000, W-CDMA (3GPP), or W-CDMA (Trial & Arib) mode to use this command. Use INSTrument:SELect to set the mode.
Front Panel Access:	**Input, Max Total Pwr (at UUT)**

RF Port Power Range Maximum Total Power

`[:SENSe]:POWer[:RF]:RANGe[:UPPer] <power>`

`[:SENSe]:POWer[:RF]:RANGe[:UPPer]?`

Set the maximum expected total power level at the radio unit under test. This value is ignored if RF port power range is set to auto.

External attenuation required above 30 dBm.

Factory Preset and *RST:	–15.0 dBm
Range:	–100.0 to 80.0 dBm for EDGE, GSM –100.0 to 27.7 dBm for cdmaOne, iDEN –200.0 to 50.0 dBm for NADC, PDC –200.0 to 100.0 dBm for cdma2000, W-CDMA (3GPP), W-CDMA (Trial & Arib)
Default Unit:	dBm
Remarks:	Global to the current mode. This is coupled to the RF input attenuation You must be in the Service, cdmaOne, EDGE(w/GSM), GSM, NADC, PDC, cdma2000, W-CDMA (3GPP), or W-CDMA (Trial & Arib) mode to use this command. Use INSTrument:SELect to set the mode.
Front Panel Access:	**Input, Max Total Pwr (at UUT)**

Radio Standards Commands

Radio Device Under Test

`[:SENSe]:RADio:DEVice BS|MS`

`[:SENSe]:RADio:DEVice?`

Select the type of radio device to be tested.

BS – Base station transmitter test.

MS – Mobile station transmitter test.

Factory Preset and *RST:	BS
Remarks:	You must be in the NADC, or PDC mode to use this command. Use INSTrument:SELect to set the mode. Global to current mode.
Front Panel Access:	**Mode Setup, Radio, Device**

Radio Traffic Rate

`[:SENSe]:RADio:TRATe FULL|HALF`

`[:SENSe]:RADio:TRATe?`

Select the traffic rate.

FULL – full traffic rate (a slot is every 20 ms)

HALF – half traffic rate (a slot is every 40 ms)

Factory Preset and *RST:	FULL
Remarks:	You must be in the NADC or PDC mode to use this command. Use INSTrument:SELect to set the mode.

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 352. 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.

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 (APEak) - automatically peak the range

  For CW signals, the default of auto-peak ranging can be used, but a better FFT measurement of the signal can be made by selecting one of the manual ranges that are available: M6, P0 - P24.
  Auto peaking can cause the ADC range gain to move monotonically down during the data capture. This movement should have negligible effect on the FFT spectrum, but selecting a manual range removes this possibility. Note that if the CW signal being measured is close to the auto-ranging threshold, the noise floor may shift as much as 6 dB from sweep to sweep.

- Auto Peak Lock (APLock) - automatically peak lock the range

  For CW signals, auto-peak lock ranging may be used. It will find the best ADC measurement range for this particular signal and will not move the range as auto-peak can. Note that if the CW signal being measured is close to the auto-ranging threshold, the noise floor may shift as much as 6 dB from sweep to sweep.
  For “bursty” signals, auto-peak lock ranging should not be used. The measurement will fail to operate, since the wrong (locked) ADC range will be chosen often and overloads will occur in the ADC.

- 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:	APEak
Remarks:	To use this command, the appropriate mode should be selected with INSTrument:SELect.

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.

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— Select Pre-FFT Bandwidth

`[:SENSe]:SPECtrum:BANDwidth|BWIDth:IF:AUTO OFF|ON|0|1`

`[:SENSe]:SPECtrum:BANDwidth|BWIDth:IF:AUTO?`

Select auto or manual control of the pre-FFT BW.

Factory Preset and *RST: AUTO, 1.55 MHz

Front Panel Access: **Measure**, **Spectrum**, **Meas Setup**, **More**, **Advanced**, **Pre-FFT BW**.

Spectrum — IF Flatness Corrections

`[:SENSe]:SPECtrum:BANDwidth|BWIDth:IF:FLATness OFF|ON|0|1`

`[:SENSe]:SPECtrum:BANDwidth|BWIDth:IF:FLATness?`

Turns IF flatness corrections on and off.

Factory Preset and *RST: ON

Front Panel Access: **Measure**, **Spectrum**, **Meas Setup**, **More**, **Advanced**, **Pre-FFT BW**

Spectrum—Pre-ADC Bandpass Filter

`[:SENSe]:SPECtrum:BANDwidth|BWIDth:PADC OFF|ON|0|1`

`[:SENSe]:SPECtrum:BANDwidth|BWIDth:PADC?`

Turn the pre-ADC bandpass filter on or off. This is an advanced control that normally does not need to be changed.

Remarks:	To use this command, 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
	155.0 kHz, for iDEN mode
Range:	1 Hz to 10.0 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 (FLAT)- a filter with a flat amplitude response, which provides the best amplitude accuracy.

GAUSsian - a filter with Gaussian characteristics, which provides the best pulse response.

Factory Preset and *RST:	FLAT

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:	20.0 kHz
	250.0 Hz, for iDEN mode
Range:	0.10 Hz to 3.0 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]?`

Sets the amount of data decimation done by the hardware and/or the software. Decimation by n keeps every nth sample, throwing away each of the remaining samples in the group of n. For example, decimation by 3 keeps every third sample, throwing away the two in between. Similarly, decimation by 5 keeps every fifth sample, throwing away the four in between.

Using zero (0) decimation selects the automatic mode. The measurement will then automatically choose decimation by “1” or “2” as is appropriate for the bandwidth being used.

This is an advanced control that normally does not need to be changed.

Factory Preset and *RST:	0
Range:	0 to 1,000, where 0 sets the function to automatic
Remarks:	
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:	706
Range:	min, depends on the current setting of the spectrum window length max, 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]:SPECtrum:FFT:LENGth:AUTO?
```

Select auto or manual control of the FFT and window lengths.

This is an advanced control that normally does not need to be changed.

> On - the window lengths are coupled to resolution bandwidth, window type (FFT), pre-FFT bandwidth (sample rate) and SENSe:SPECtrum:FFT:RBWPoints.
>
> Off - lets you set `SENSe:SPECtrum:FFT:LENGth` and `SENSe:SPECtrum:FFT:WINDow:LENGth`.

Factory Preset and *RST:	ON
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]:SPECtrum:FFT:RBWPoints?
```

Set the minimum number of data points that will be used inside the resolution bandwidth. The value is ignored if length control is set to manual. This is an advanced control that normally does not need to be changed.

Factory Preset 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 Delay

```
[:SENSe]:SPECtrum:FFT:WINDow:DELay <real>
```

```
[:SENSe]:SPECtrum:FFT:WINDow:DELay?
```

Set the FFT window delay to move the FFT window from its nominal position of being centered within the time capture. This function is not available from the front panel. It is an advanced control that normally does not need to be changed.

Factory Preset and *RST:	0
Range:	–10.0 to +10.0s
Default Unit:	seconds
Remarks:	To use this command, the Service mode must be selected with INSTrument:SELect. In Service mode, it is possible to get an acquisition time that is longer than the window time so that this function can be used.

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
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

FLATtop - flat top, the default (for high amplitude accuracy)

GAUSsian - Gaussian with alpha of 3.5

HAMMing - Hamming

HANNing - Hanning

KB70, 90, and 110 - Kaiser Bessel with sidelobes at –70, –90, or –110 dBc

UNIForm - no window is used. (This is the unity response.)

Factory Preset and *RST:	FLATtop
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:	1.0 MHz 100.0 kHz for iDEN mode
Range:	10 Hz to 10.0 MHz (15 MHz when Service mode is selected)
Default Unit:	Hz
Remarks:	The actual measured span will generally be slightly wider due to the finite resolution of the FFT. To use this command, the appropriate mode should be selected with INSTrument:SELect.

Spectrum—Sweep (Acquisition) Time

`[:SENSe]:SPECtrum:SWEep:TIME[:VALue] <time>`

`[:SENSe]:SPECtrum:SWEep:TIME?`

Set the sweep (measurement acquisition) time. It is used to specify the length of the time capture record. If the specified value is less than the capture time required for the specified span and resolution bandwidth, the value is ignored. The value is set at its auto value when auto is selected. This is an advanced control that normally does not need to be changed.

Factory Preset and *RST:	188.0 µs 15.059 ms, for iDEN mode

Range:	100 ns to 10 s
Default Unit:	seconds
Remarks:	You must be in the Service mode to use this command. Use INSTrument:SELect to set the mode. This command only effects the RF envelope trace.

Spectrum—Sweep (Acquisition) Time Auto

```
[:SENSe]:SPECtrum:SWEep:TIME:AUTO OFF|ON|0|1
```

```
[:SENSe]:SPECtrum:SWEep:TIME:AUTO
```

Select auto or manual control of the sweep (acquisition) time. This is an advanced control that normally does not need to be changed.

AUTO - couples the Sweep Time to the Frequency Span and Resolution BW

Manual - the Sweep Time is uncoupled from the Frequency Span and Resolution BW.

Factory Preset and *RST:	AUTO
Remarks:	To use this command, the appropriate mode should be selected with INSTrument:SELect.

Spectrum—Trigger Source

```
[:SENSe]:SPECtrum:TRIGger:SOURceEXTernal[1]
|EXTernal2|FRAMe|IF|LINE|IMMediate|RFBurst
```

```
[:SENSe]:SPECtrum:TRIGger:SOURce?
```

Select the trigger source used to control the data acquisitions.

EXTernal1 - front panel external trigger input

EXTernal2 - rear panel external trigger input

FRAMe - internal frame timer from front panel input

IF - internal IF envelope (video) trigger

LINE - internal line trigger

IMMediate - the next data acquisition is immediately taken (also called free run)

RFBurst - wideband RF burst envelope trigger that has automatic level control for periodic burst signals

Factory Preset and *RST:	IMMediate (free run)
	RFBurst, for GSM, iDEN mode
Remarks:	To use this command, the appropriate mode should be selected with INSTrument:SELect.

Synchronization Commands

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 352. The equivalent front panel keys for the parameters described in the following commands, are found under the **Meas Setup** key, after the **Waveform (Time Domain)** measurement has been selected from the **MEASURE** key menu.

Waveform—Data Acquisition Packing

`[:SENSe]:WAVeform:ACQuistion:PACKing AUTO|LONG|MEDium|SHORt`

`[:SENSe]:WAVeform:ACQuistion:PACKing?`

This is an advanced control that normally does not need to be changed.

Factory Preset and *RST:	AUTO
Remarks:	You must be in the Service mode to use this command. Use INSTrument:SELect to set the mode.

Waveform—ADC Dither State

`[:SENSe]:WAVeform:ADC:DITHer[:STATe] |OFF|ON|0|1`

`[:SENSe]:WAVeform:ADC:DITHer[:STATe]?`

This is an Advanced control that normally does not need to be changed.

Factory Preset and *RST:	OFF
Remarks:	You must be in the Service mode to use this command. Use INSTrument:SELect to set the mode.

Waveform—Pre-ADC Bandpass Filter

`[:SENSe]:WAVeform:ADC:FILTer[:STATe] OFF|ON|0|1`

`[:SENSe]:WAVeform:ADC:FILTer[:STATe]?`

Turn the pre-ADC bandpass filter on or off. This is an Advanced control that normally does not need to be changed.

Preset:	OFF
Remarks:	To use this command, 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 (APEak) - automatically peak the range

Auto Peak Lock (APLock)- 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 - Query Aperture Setting

[:SENSe]:WAVeform:APERture?

Returns the waveform sample period (aperture) based on current resolution bandwidth, filter type, and decimation factor. Sample rate is the reciprocal of period.

Remarks:	To use this command the appropriate mode should be selected with INSTrument:SELect.
History:	Version A.05.00 or later

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.

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:	100.0 kHz for NADC, PDC, cdma2000, W-CDMA (3GPP), W-CDMA (Trial & Arib), basic, service 500.0 kHz for GSM 2.0 MHz for cdmaOne
Range:	1.0 kHz to 5.0 MHz
Remarks:	To use this command, the appropriate mode should be selected with INSTrument:SELect.

Waveform - Query Actual Resolution Bandwidth

[:SENSe]:WAVeform:BANDwidth:RESolution]:ACTual?

Due to memory constraints the actual resolution bandwidth value may vary from the value entered by the user. For most applications the resulting difference in value is inconsequential but for some it is necessary to know the actual value; this query retrieves the actual resolution bandwidth value.

Remarks:	Implemented for users of Glacier and other applications that require precise resolution bandwidth readings. To use this command the appropriate mode should be selected with INSTrument:SELect.
History:	Version A.05.00 or later

Waveform—Resolution BW Filter Type

`[:SENSe]:WAVeform:BANDwidth|BWIDth[:RESolution]:TYPE FLATtop|GAUSsian`

`[:SENSe]:WAVeform:BANDwidth|BWIDth[:RESolution]:TYPE?`

Select the type of Resolution BW filter that is used. This is an Advanced control that normally does not need to be changed.

> FLATtop - a filter with a flat amplitude response, which provides the best amplitude accuracy.
>
> GAUSsian - a filter with Gaussian characteristics, which provides the best pulse response.

Factory Preset and *RST:	GAUSsian
Remarks:	To use this command, the appropriate mode should be selected with INSTrument:SELect.

Waveform—Decimation of Waveform Display

`[:SENSe]:WAVeform:DECimate[:FACTor] <integer>`

`[:SENSe]:WAVeform:DECimate[:FACTor]?`

Set the amount of data decimation done on the IQ data stream. For example, if 4 is selected, three out of every four data points will be thrown away so every 4th data point will be kept.

Factory Preset and *RST:	1
Range:	1 to 4
Remarks:	To use this command, the appropriate mode should be selected with INSTrument:SELect.

Waveform—Control Decimation of Waveform Display

`[:SENSe]:WAVeform:DECimate:STATe OFF|ON|0|1`

`[:SENSe]:WAVeform:DECimate:STATe?`

Set the amount of data decimation done by the hardware in order to decrease the number of acquired points in a long capture time. This is the amount of data that the measurement ignores.

Factory Preset 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

RFBurst - 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 RFBurst, for GSM, iDEN mode
Remarks:	To use this command, the appropriate mode should be selected with INSTrument:SELect.

TRIGger Subsystem

The Trigger Subsystem is used to set the controls and parameters associated with triggering the data acquisitions. Other trigger-related commands are found in the INITiate and ABORt subsystems.

The trigger parameters are global within the selected Mode. The commands in the TRIGger subsystem set up the way the triggers function, but selection of the trigger source is made from each measurement. There is a separate trigger source command in the SENSe:<meas> subsystem for each measurement. The equivalent front panel keys for the parameters described in the following commands, can be found under the **Mode Setup, Trigger** key.

Automatic Trigger Control

`:TRIGger[:SEQuence]:AUTO:STATe OFF|ON|0|1`

`:TRIGger[:SEQuence]:AUTO:STATe?`

Turns the automatic trigger function on and off. This function causes a trigger to occur if the designated time has elapsed and no trigger occurred. It can be used with unpredictable trigger sources, like external or burst, to make sure a measurement is initiated even if a trigger doesn't occur. Use TRIGger[:SEQuence]:AUTO[:TIME] to set the time limit.

Factory Preset and *RST	Off for cdma2000, W-CDMA (3GPP) , W-CDMA (Trial & ARIB), NADC, and PDC
Front Panel Access	**Mode Setup, Trigger, Auto Trig**

Automatic Trigger Time

`:TRIGger[:SEQuence]:AUTO[:TIME] <time>`

`:TRIGger[:SEQuence]:AUTO[:TIME]?`

After the measurement is activated the instrument will take a data acquisition immediately upon receiving a signal from the selected trigger source. If no trigger signal is received by the end of the time specified in this command, a data acquisition is taken anyway. TRIGger[:SEQuence]:AUTO:STATE must be on.

Factory Preset and *RST:	100.0 ms
Range:	1.0 ms to 1000.0 s

	0.0 to 1000.0 s for cdma2000, W-CDMA (3GPP), W-CDMA (Trial & ARIB)
Default Unit:	seconds

External Trigger Delay

`:TRIGger[:SEQuence]:EXTernal[1]|2:DELay <time>`

`:TRIGger[:SEQuence]:EXTernal[1]|2:DELay?`

Set the trigger delay when using an external trigger. Set the trigger value to zero (0) seconds to turn off the delay.

EXT or EXT1is the front panel trigger input

EXT2 is the rear panel trigger input

Factory Preset and *RST:	0.0 s
Range:	–500.0 ms to 500.0 ms
	–100.0 ms to 500.0 ms for cdma2000, W-CDMA (3GPP), W-CDMA (Trial & ARIB)
Default Unit:	seconds
Front Panel Access:	**Mode Setup, Trigger, Ext Rear (or Ext Front), Delay**

External Trigger Level

`:TRIGger[:SEQuence]:EXTernal[1]|2:LEVel <voltage>`

`:TRIGger[:SEQuence]:EXTernal[1]|2:LEVel?`

Set the trigger level when using an external trigger input.

EXT or EXT1is the front panel trigger input

EXT2 is the rear panel trigger input

Factory Preset and *RST:	2.0 V
Range:	–5.0 to +5.0 V
Default Unit:	volts
Front Panel Access:	**Mode Setup, Trigger, Ext Rear, Level**
	Mode Setup, Trigger, Ext Front, Level

External Trigger Slope

```
:TRIGger[:SEQuence]:EXTernal[1]|2:SLOPe NEGative|POSitive
```

```
:TRIGger[:SEQuence]:EXTernal[1]|2:SLOPe?
```

Sets the trigger slope when using an external trigger input.

EXT or EXT1is the front panel trigger input

EXT2 is the rear panel trigger input

Factory Preset and *RST:	Positive
Front Panel Access:	**Mode Setup, Trigger, Ext Rear (or Ext Front), Slope**

Frame Trigger Adjust

```
:TRIGger[:SEQuence]:FRAMe:ADJust <time>
```

Lets you advance the phase of the frame trigger by the specified amount. It does not change the period of the trigger waveform. If the command is sent multiple times, it advances the phase of the frame trigger more each time it is sent.

Factory Preset and *RST:	0.0 s
Range:	0.0 to 10.0 s
Default Unit:	seconds
Front Panel Access:	*None*

Frame Trigger Period

```
:TRIGger[:SEQuence]:FRAMe:PERiod <time>
```

```
:TRIGger[:SEQuence]:FRAMe:PERiod?
```

Set the frame period that you want when using the external frame timer trigger. If the traffic rate is changed, the value of the frame period is initialized to the preset value.

Factory Preset and *RST:	250.0 μs for Basic, cdmaOne 4.615383 ms, for GSM 26.666667 ms for cdma2000

	10.0 ms (1 radio frame) for W-CDMA (3GPP), W-CDMA (Trial & ARIB)
	90.0 ms for iDEN
	20.0 ms with rate=full for NADC, PDC
	40.0 ms with rate=half for NADC, PDC
Range:	0.0 ms to 559.0 ms for Basic, cdmaOne, GSM, cdma2000, W-CDMA (3GPP), W-CDMA (Trial & ARIB)
	1.0 ms to 559.0 ms for iDEN, NADC, PDC
Default Unit:	seconds
Front Panel Access:	**Mode Setup, Trigger, Frame Timer, Period**

Frame Trigger Sync Source

```
:TRIGger[:SEQuence]:FRAMe:SYNC EXTFront|EXTRear|OFF|RFBurst
```

```
:TRIGger[:SEQuence]:FRAMe:SYNC?
```

Selects the input port location for the external frame trigger that you are using.

Factory Preset and *RST:	Off
Remarks:	You must be in the Basic, cdmaOne, EDGE (w/GSM), GSM, iDEN, NADC, PDC, Service mode to use this command. Use INSTrument:SELect to set the mode.
Front Panel Access:	**Mode Setup, Trigger, Frame Timer, Sync Source**

Frame Trigger Synchronization Offset

```
:TRIGger[:SEQuence]:FRAMe:SYNC:OFFSet <time>
```

```
:TRIGger[:SEQuence]:FRAMe:SYNC:OFFSet?
```

Lets you adjust the frame triggering with respect to the external trigger input that you are using.

Factory Preset and *RST:	0.0 s
Range:	0.0 to 10.0 s
Default Unit:	seconds

Remarks:	You must be in the Basic, cdmaOne, EDGE (w/GSM), GSM, iDEN, NADC, PDC, Service mode to use this command. Use INSTrument:SELect to set the mode.
History:	Revision A.03.27 or later
Front Panel Access:	**Mode Setup, Trigger, Frame Timer, Offset**

Trigger Holdoff

`:TRIGger[:SEQuence]:HOLDoff <time>`

`:TRIGger[:SEQuence]:HOLDoff?`

Set the holdoff time between triggers. After a trigger, another trigger will not be allowed until the holdoff time expires. This parameter affects all trigger sources.

Factory Preset and *RST:	0.0 s
	20.0 ms for iDEN
	10.0 ms for NADC or PDC
Range:	0.0 to 500.0 ms
Default Unit:	seconds
Front Panel Access:	**Mode Setup, Trigger, Trig Holdoff**

Video (IF) Trigger Delay

`:TRIGger[:SEQuence]:IF:DELay <time>`

`:TRIGger[:SEQuence]:IF:DELay?`

Set the trigger delay when using the IF (video) trigger (after the Resolution BW filter).

Factory Preset and *RST:	0.0 s
Range:	–500.0 ms to 500.0 ms
	–100.0 ms to 500.0 ms for cdma2000, W-CDMA (3GPP), W-CDMA (Trial & ARIB)
Default Unit:	seconds
Front Panel Access:	**Mode Setup, Trigger, Video (IF Envlp), Delay**

Video (IF) Trigger Level

`:TRIGger[:SEQuence]:IF:LEVel <power>`

`:TRIGger[:SEQuence]:IF:LEVel?`

Set the trigger level when using the IF (video) trigger.

Factory Preset and *RST:	–6.0 dBm for cdmaOne, GSM, Basic, Service, cdma2000, W-CDMA (3GPP), W-CDMA (Trial & ARIB) –20.0 dBm for iDEN –30.0 dBm for NADC, PDC
Range:	–200.0 to 50.0 dBm
Default Unit:	dBm
Front Panel Access:	**Mode Setup, Trigger, Video (IF Envlp), Level**

Video (IF) Trigger Slope

`:TRIGger[:SEQuence]:IF:SLOPe NEGative|POSitive`

`:TRIGger[:SEQuence]:IF:SLOPe?`

Sets the trigger slope when using the IF (video) trigger.

Factory Preset and *RST:	Positive
Front Panel Access:	**Mode Setup, Trigger, Video (IF Envlp), Slope**

RF Burst Trigger Delay

`:TRIGger[:SEQuence]:RFBurst:DELay <time>`

`:TRIGger[:SEQuence]:RFBurst:DELay?`

Set the trigger delay when using the RF burst (wideband) trigger.

Factory Preset and *RST:	0.0 s
Range:	–500.0 ms to 500.0 ms –100.0 ms to 500.0 ms for cdma2000, W-CDMA (3GPP), or W-CDMA (Trial & ARIB)

Default Unit:	seconds
Front Panel Access:	**Mode Setup, Trigger, RF Burst, Delay**

RF Burst Trigger Level

```
:TRIGger[:SEQuence]:RFBurst:LEVel <rel_power>
```

```
:TRIGger[:SEQuence]:RFBurst:LEVel?
```

Set the trigger level when using the RF Burst (wideband) Trigger. The value is relative to the peak of the signal. RF Burst is also known as RF Envelope.

Factory Preset and *RST:	–6.0 dB
Range:	–25.0 to 0.0 dB
	–200.0 to 0.0 dB for NADC, PDC
Default Unit:	dB
Front Panel Access:	**Mode Setup, Trigger, RF Burst, Peak Level**

RF Burst Trigger Slope

```
:TRIGger[:SEQuence]:RFBurst:SLOPe NEGative|POSitive
```

```
:TRIGger[:SEQuence]:RFBurst:SLOPe?
```

Set the trigger slope when using the RF Burst (wideband) Trigger.

Factory Preset and *RST:	Positive
Remarks:	You must be in the cdmaOne, cdma2000, W-CDMA (3GPP), or W-CDMA (Trial & ARIB) mode to use this command. Use :INSTrument:SELect to set the mode.
Front Panel Access:	**Mode Setup, Trigger, RF Burst, Slope**

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