

User's Guide

Agilent Technologies E4406A VSA Series Transmitter Tester



Agilent Technologies

**Manufacturing Part Number: E4406-90304
Supersedes E4406-90177**

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Safety Information

The following safety symbols are used throughout this manual. Familiarize yourself with the symbols and their meaning before operating this instrument.

WARNING ***Warning* denotes a hazard. It calls attention to a procedure which, if not correctly performed or adhered to, could result in injury or loss of life. Do not proceed beyond a warning note until the indicated conditions are fully understood and met.**

CAUTION *Caution* denotes a hazard. It calls attention to a procedure that, if not correctly performed or adhered to, could result in damage to or destruction of the instrument. Do not proceed beyond a caution sign until the indicated conditions are fully understood and met.

NOTE *Note* calls out special information for the user's attention. It provides operational information or additional instructions of which the user should be aware.

WARNING **This is a Safety Class 1 Product (provided with a protective earth ground incorporated in the power cord). The mains plug shall be inserted only in a socket outlet provided with a protected earth contact. Any interruption of the protective conductor inside or outside of the product is likely to make the product dangerous. Intentional interruption is prohibited.**

WARNING **No operator serviceable parts inside. Refer servicing to qualified personnel. To prevent electrical shock do not remove covers.**

CAUTION Always use the three-prong AC power cord supplied with this product. Failure to ensure adequate grounding may cause product damage.

Where to Find the Latest Information

Documentation is updated periodically. For the latest information about Agilent Technologies E4406 VSA Series Transmitter Tester, including firmware upgrades and application information, please visit the following Internet URL:

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

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1 Getting Started

This chapter introduces you to basic features of the instrument, including front panel keys, rear panel connections, and display annotation. You will also find out how to make a basic measurement and install applications.

Topics include:

- “What Documentation Comes with the E4406A VSA Series Transmitter Tester” on page 17
- “The 3 Steps to Set Up and Make Measurements” on page 21
- “Front Panel Keys Context Dependency” on page 22
- “Front Panel Description” on page 26
- “Rear Panel Description” on page 32
- “Display Annotation” on page 35
- “Installing Optional Measurement Personalities” on page 38
- “Cables for Connecting to the Serial Port (RS-232)” on page 45
- “Safety Considerations” on page 51

What Documentation Comes with the E4406A VSA Series Transmitter Tester

With your purchase of the instrument you receive the following materials:

Table 1-1 **Standard Documentation**

Part Description	Notes
User's Guide	Does not include operational information on the optional measurement personalities.
Specifications	Includes specifications for the transmitter tester and all optional measurement personalities. (Special options will be documented elsewhere.)
Programmer's Guide	Does not include commands for the optional measurement personalities
Error Messages and Functional Tests	Includes all error messages and some simple tests for checking the instrument is functioning properly. (It does not test all specifications.)
Documentation CD-ROM	Includes programming examples. Does not include service documentation or software

A standard instrument contains the Basic and Service modes, which are described here in the User's Guide.

If you have purchased an optional measurement personality, your instrument comes loaded with the personality you have selected plus the Basic and Service modes. You also receive the related guide, containing measurement and programming information, for the personality you have ordered.

Table 1-2 Personality Documentation

Measurement Option	Part Description
Option BAC	cdmaOne Guide
Option BAH	GSM Guide
Option 202	EDGE and GSM Guide
Option BAE	NADC, PDC Guide
Option BAF	W-CDMA Guide
Option B78	cdma2000 Guide
Option 204	1xEV-DO Guide

Service documentation is also available from Agilent Technologies.

NOTE

If the shipping container is damaged, or any part is missing, notify Agilent Technologies (see [page 239](#) for locations). When transporting the instrument use the original packaging or comparable packaging.

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

Many measurement personality options are available for use with this instrument. If the option is loaded in the instrument, you must also have a license key entered, to use it.

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

URL for the Latest VSA Transmitter Tester Update

For the latest information about this instrument, including firmware upgrades, application information, and product information, please visit the following URL: <http://www.agilent.com/find/vsa/>.

Understanding Digital Communications Measurements

Additional measurement application information is available through your local Agilent Technologies sales and service office. See the “If You Have a Problem” chapter for office location information. Some available application notes are listed below.

Description	Agilent Part Number
Digital Modulation in Communications Systems - An Introduction, Application Note 1298	5965-7160E
Understanding CDMA Measurements for Base Stations and Their Components, Application Note 1311	5968-0953E
Understanding GSM Transmitter Measurements, Application Note 1312	5968-2320E
HPSK Spreading for 3G	5968-8438E
Agilent E4406A VSA Series Transmitter Tester Self-Guided Tour	5968-7617E
Designing and Testing 3GPP W-CDMA Base Stations, Application Note 1355	5980-1239E
Designing and Testing 3GPP W-CDMA User Equipment, Application Note 1356	5980-1238E
Designing and Testing IS-2000 Base Stations, Application Note 1357	5980-1303E
Designing and Testing IS-2000 Mobile Stations, Application Note 1358	5980-1237E
Understanding PDC and NADC Transmitter Measurements for Base Transceiver Stations and Mobile Stations, Application Note 1324	5968-5537E

Updating the Firmware

Updated versions of the E4406A VSA Transmitter Tester firmware will be available from several sources. Information on the latest firmware revision can be accessed through the following URL.

URL to Contact to Obtain Firmware Update Information
http://www.agilent.com/find/vsa/

The 3 Steps to Set Up and Make Measurements

All measurements need to be set up in 3 steps: first at the Mode level, second at the Measurement level, then finally the result display may be adjusted.

1. Select and Set Up the Mode

Press **MODE** - All licensed, installed Modes available are shown. Press **Basic** mode to make measurements of signals with non-standard formats.

Press **Mode Setup** - Make any required adjustments to the mode settings. These settings apply to all measurement in the mode.

2. Select and Set Up the Measurement

Press **MEASURE** - Select a specific measurement to be performed (e.g.). The measurement begins as soon as any required trigger conditions are met. The resulting data is shown on the display or is available for export.

Press **Meas Setup** - Make any adjustments as required to the selected measurement settings. The settings only apply to this measurement.

3. Select and Set Up a View of the Results

Press **Trace/View** - Select a display format for the current measurement data. Depending on the mode and measurement selected, other graphical and tabular data presentations may be available. **X-Scale** and **Y-Scale** adjustments may also be made now.

NOTE

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

Step	Primary Key	Setup Keys	Related Keys
1. Select & set up a Mode	MODE	Mode Setup, Input (E4406), FREQUENCY Channel	System
2. Select & set up a Measurement	MEASURE	Meas Setup	Meas Control, Restart
3. Select & set up a View of the Results	View/Trace (E4406),	SPAN X Scale, AMPLITUDE Y Scale, Display, Next Window, Zoom	File, Save, Print, Print Setup, Marker, Search (E4406),

Front Panel Keys Context Dependency

Many of the instrument features are context dependent. The functions that are available will change based on your selections of mode, mode setup, measurement, and measurement setup. The following figures represent the dependency relationships of the front panel keys.

Figure 1-1 System and Navigation Keys are not Context Dependent

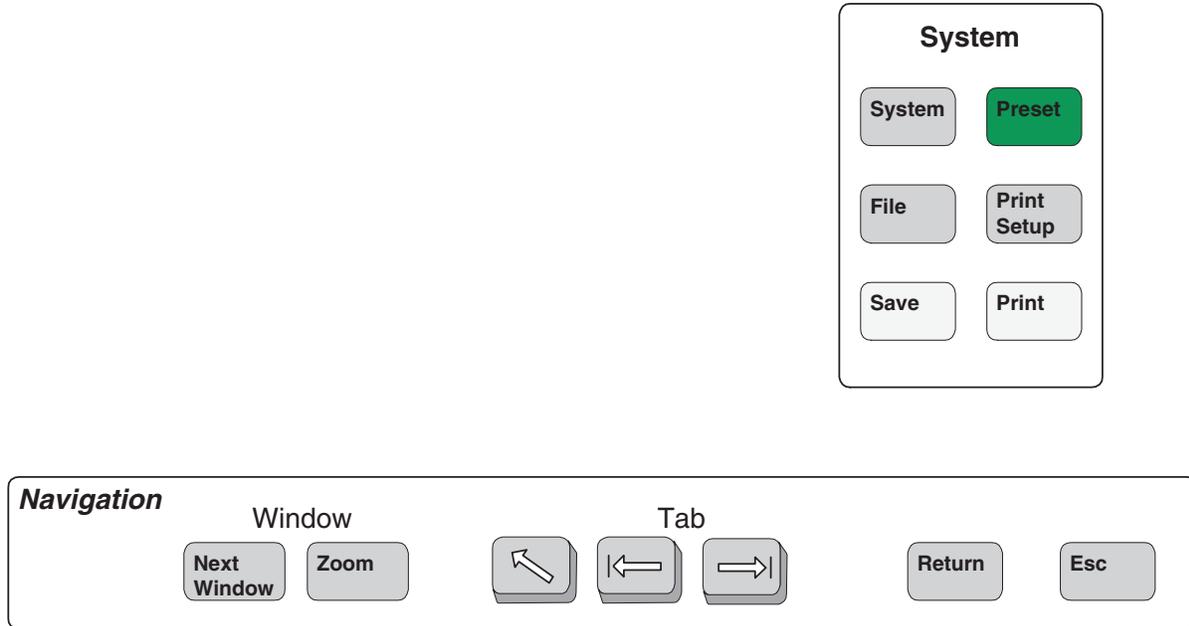
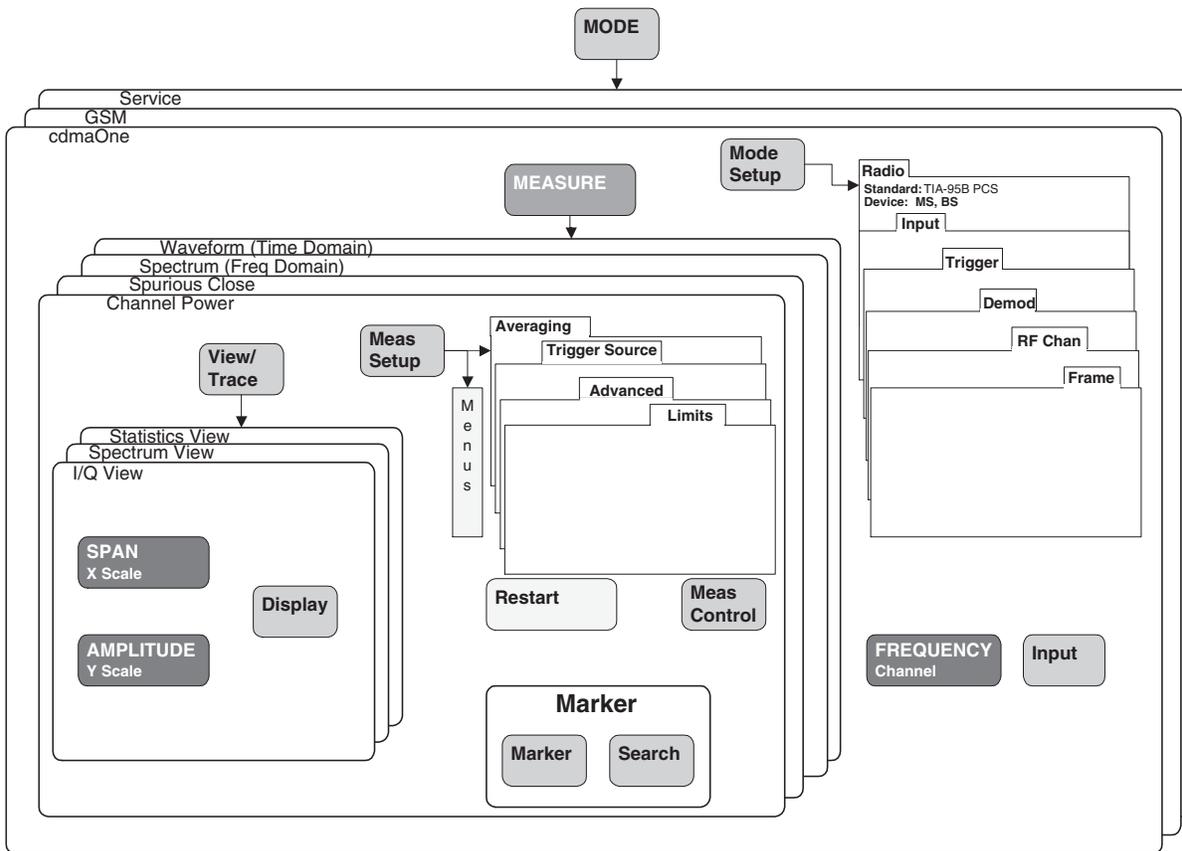
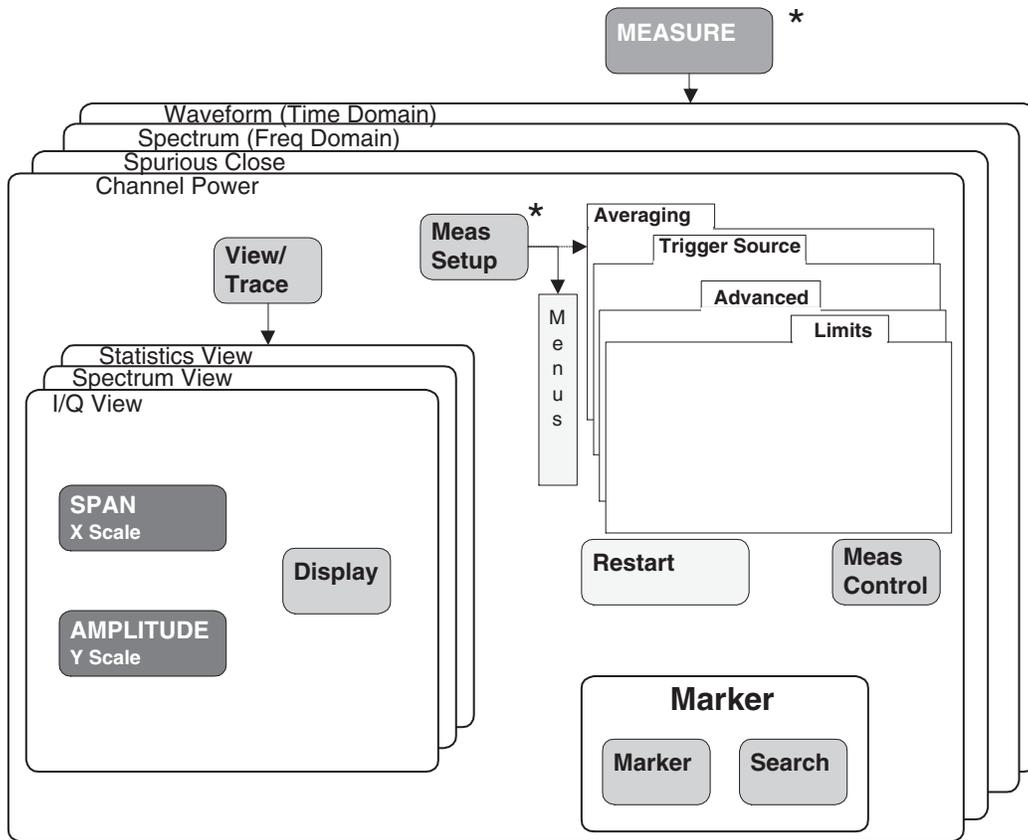


Figure 1-2 These Features are Dependent on the Selected Mode and the Mode Setup



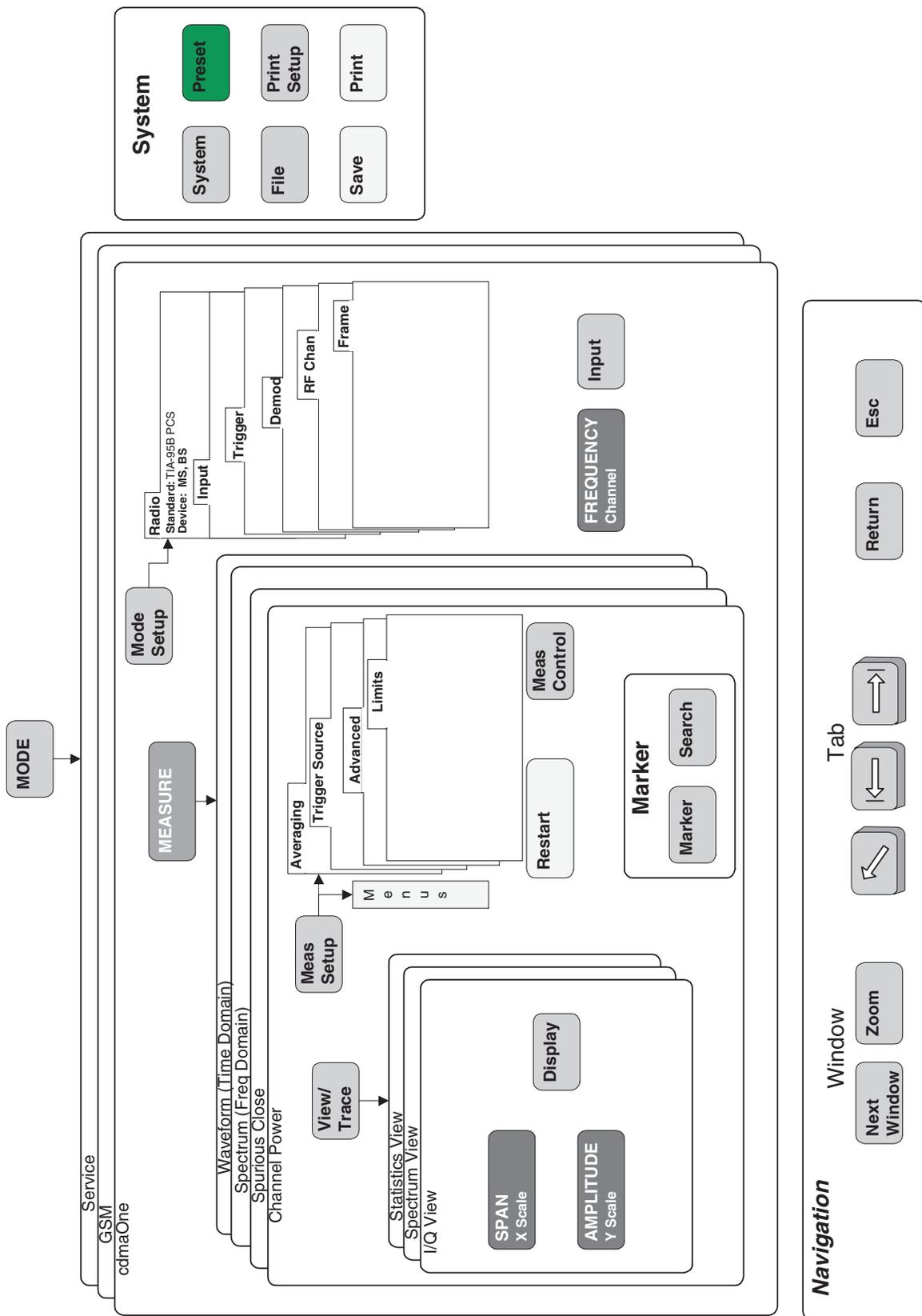
Getting Started

Figure 1-3 These Features are Dependent on the Selected Measurement and the Measurement Setup



* Some **Measure** and **Meas Setup** parameters are context dependent upon the Radio variant and Device selected in the **Mode Setup**

Figure 1-4 Front Panel Keys Context Dependent Relationships



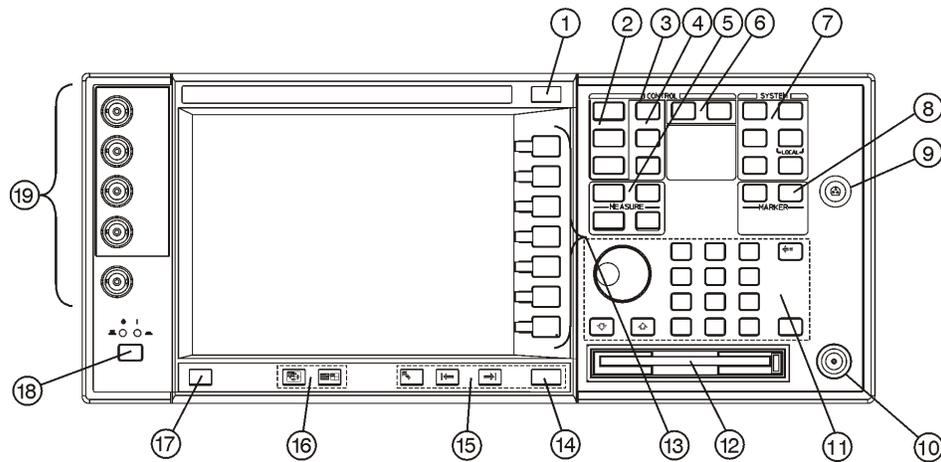
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Front Panel Description

Key menus may vary depending on the currently selected mode or measurement. menu keys which are not available for use are greyed-out. Keys may be greyed-out keys as a result of:

- the current setting of other inter-related functions,
- not having a required password or license key, or
- not having some piece of optional hardware that is required.

Paths to access any feature will be found in the key access table, [Table 2-1 on page 57](#). Display annotation is explained in [“Display Annotation” on page 35](#). Operation of the 3.5 inch floppy-drive is covered in [“Using Print and Print Setup Functions” on page 67](#).



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1. ESC key Use the escape key to exit any function without modifying current parameters. Pressing the **ESC** key will:

- Clear any numeric entry that you have begun to enter but decided you want to cancel.
- Remove any entries that are visible in the active function area of the display (see [“Display Annotation” on page 35](#) for a description of the active function area and other display features).
- Cancels an alignment, if one is in progress.

2. Control keys

set parameters that are used by the measurement in

the current measurement mode.

- **FREQUENCY/Channel** accesses menu keys that control the center frequency or channel number. These parameters apply to all measurements in the current mode.
- **SPAN/X Scale** accesses menu keys that control the horizontal scale in units of frequency, time, symbols or bits. The parameters in this menu apply only to the active window in the current measurement. See “[Span / X Scale Keys](#)” on page 97 for more detail.
- **AMPLITUDE/Y Scale** accesses menu keys that control vertical scale functions in units of dBm, dB, volts, degrees, or radians. The parameters in this menu apply only to the active window in the current measurement. See “[Amplitude / Y Scale Keys](#)” on page 98 for more detail.

3. Input key The **Input** key accesses menu keys that control the input of the transmitter tester. These affect all measurements within the current mode. Note that the internal 50 MHz reference signal and the IF align signal are used as internal inputs that do not require external connections. See “[Using Input/Output Configuration Keys](#)” on page 73 for more detail.

4. View keys **View** keys modify the format of the trace and numeric data on the display. See “[View/Trace Key](#)” on page 96 for more detail.

- **View/Trace** accesses menu keys that control the way results are viewed.
- **Display** accesses menu keys that change the display. Functions such as limit mask on/off and dots on/off are available for some measurements.

5. Measure keys

The Measure keys are used to select and set up a specific measurement within the selected application. See “[Preparing for Measurements](#)” on page 94 for more detail.

- **MEASURE** accesses menu keys that select and initiate the various measurements that are specific to the current mode.
- **Meas Setup** accesses the setup parameters that are specific to the current measurement.
- **Restart** causes the measurement that is currently in process to stop, then start again at the beginning

according to the current measurement setup parameters.

- **Meas Control** accesses menu keys that affect the measurement after it has been setup, for example selecting a single or continuous measurement.

6. Mode keys select the measurement mode and mode parameters. See [“Mode Setup” on page 87](#) for more detail.

- **MODE** accesses menu keys to select the instrument mode. Each mode is independent of all other modes.
- **Mode Setup** accesses menu keys that affect parameters that are specific to the current mode and affect all measurements within that mode.

7. System keys access system features, that are used with all instrument modes. See [“Using System Keys” on page 56](#) for further explanation of system features.

- **System** accesses features that control instrument configuration at the system level, like I/O configuration and alignment, which affect all instrument modes. Pressing **System** also returns the instrument to local control, if it has been in remote mode.
- **Preset** resets all parameters of the current mode back to the factory defaults.
- **Print** immediately prints what is on the screen to the printer, or saves a file to a floppy disc, according to the parameters that are currently set in the **Print Setup** menu. See [“Using Print and Print Setup Functions” on page 67](#) for more detail.
- **Print Setup** configures the transmitter tester for printing to a printer, or saving an image file to the floppy disc drive, and also allows you to select the printer type.
- **File** accesses menu keys that control the file system of the transmitter tester for saving and loading instrument states. See [“Using File and Save Keys” on page 71](#) for more detail.
- **Save** saves the current instrument state in the **File** menu. See [“Using File and Save Keys” on page 71](#) for more detail.

8. Marker keys are used to obtain specific information about parts of the displayed measurement (for example, to identify the exact frequency of an offset). See [“Using Markers”](#)

on page 98 for more detail.

- **Marker** accesses menu keys that allow manual positioning of markers.
- **Search** automatically performs a peak search, and accesses menu keys that automatically position markers at preset locations on the trace (for example, to determine the difference between the amplitude of one peak and another).

9. Probe Power The probe power input supplies power for external probes; the three connectors are a ground, and a +15 V, and a –12.6 V connector. The probe power supplies power to high frequency probes and accessories, such as preamplifiers, that are used as accessories to the transmitter tester. The probe power provides a maximum of 150 mA.

10. RF Input The 50 Ω RF input allows for input of an external RF signal. The connector is a type N female, and is rated for a maximum input of +35 dBm for measuring a CW signal, and a maximum of 26 volts for a DC signal.

11. Data Entry keys are used to enter numeric values. Entries made using data entry keys will be visible in the active function area (see “[Display Annotation](#)” on page 35 to locate the active function area).

- The **Enter** key is used to terminate numeric data where no units of measurement are being entered, or where you want to terminate with the default unit of measurement. For operations involving selection of a unit of measurement (for example, dB, dBm, Hz, s, degrees, radians), the **Units** menu key menu (explained below) is used to terminate numeric entries.
- **Units** menu keys are used to enter units of measurement. If the value you are entering is in units of measurement, the units menu key menu will automatically appear once you enter a digit. After entering the desired numeric value, you terminate the entry by pressing the appropriate units of measurement menu key.
- **Numeric** keys enter numeric values as indicated on the keys. In addition, decimal and positive and negative sign keys are available for your use.
- The **Step** keys (these are the up and down arrow keys) change numeric values in increments of the

current step size.

- The **Backspace** key moves the cursor backwards one space and erases the character in that space. You can use the **Backspace** key to backspace characters in the active function area.
- The RPG Knob changes numeric values in increments of the current knob resolution.

12. Floppy Disk Drive. The floppy disk drive accepts 1.44 megabyte disks. For an explanation of the operation of the floppy disc drive see [“Using Print and Print Setup Functions” on page 67.](#)

13. Menu keys Menu keys either activate a feature or access a further menu key menu. An arrow on the right side of a menu key label indicates that the key accesses a further menu. The menu key which is currently active is highlighted. Keys unavailable for use are greyed-out. If a menu key menu has multiple pages, further pages will be accessed by pressing the **More** key which is the bottom key on any multi-page menu.

14. Return key The **Return** key exits the current menu and returns you to the previous menu. If you are on page one of a multi-page menu (a menu with a “More” key) the **Return** key will exit the multi-page menu. When you activate a different measurement, the return list is cleared. The **Return** key will not return you to the previously activated mode, nor will it alter any values you have entered on previous menus.

15. Navigation keys are used to move around in the display, and to return to the previous menu.

- The **Tab Left** feature is not implemented. This feature will be implemented with a future firmware update.
- The **Tab Right** feature is not implemented. This feature will be implemented with a future firmware update.
- The **Home** feature is not implemented. This feature will be implemented with a future firmware update.

16. Window keys are used to move to a different window in the display or to zoom the windows being displayed.

- The **Next Window** key switches between windows. When a single window is being viewed it switches to display the next window which is contained in the

current multi-window display which, however, is not initially visible on the display. When viewing multiple windows, it activates the next window on the display. The active window is indicated by a green border.

- The **Zoom** key allows you to switch between a multiple-window screen and a full-size display of the window that is active.

17. Help key The **Help** feature is not implemented. This feature will be implemented with a future firmware update.

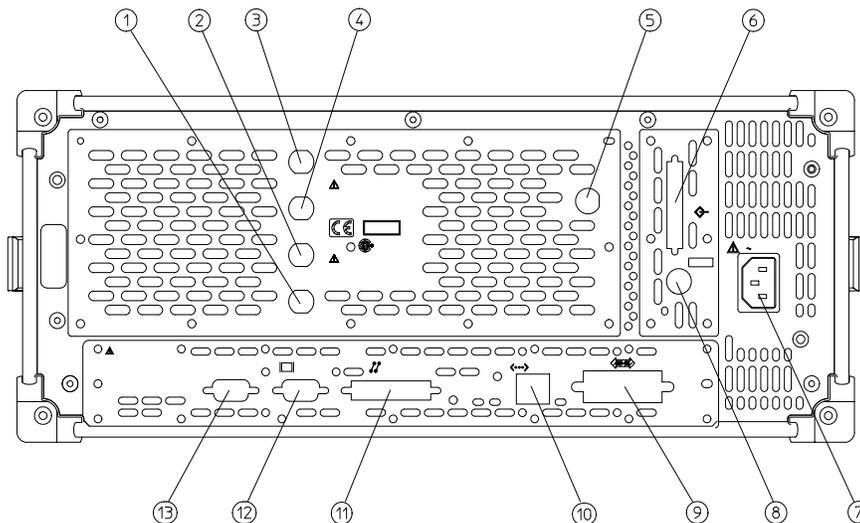
18. On/Off switch turns on the transmitter tester. A green LED will light below the **Power** switch when the instrument has been turned on. When in standby mode a yellow LED is visible above the **On/Off** switch.

19. Inputs enable you to input one or more of the two following external signals.

- **I input and Q inputs.** There are two I and two Q inputs (I and \bar{I} ; Q and \bar{Q}). This functionality is available if the BbIQ measurement personality (Option B7C) is installed in your instrument.
- **External Trigger input.** The external trigger allows external triggering of measurements. The external trigger accepts an external trigger signal between -5 and $+5$ V, and has a nominal impedance of > 10 k Ω . For more information on triggering, see [“Trigger Keys” on page 89](#).

Rear Panel Description

The diagram below illustrates all rear panel connections. For further explanation of labels found on the rear panel see the section on safety considerations on [page 53](#).



pa82a

- 1. TRIGGER 2 OUT** provides a transmitter tester trigger output. This is used to synchronize other test equipment with the transmitter tester.
- 2. TRIGGER 1 OUT** provides a transmitter tester trigger output. This is used to synchronize other test equipment with the transmitter tester.
- 3. EXT REF IN** allows the input of a 1 to 30 MHz external frequency reference signal. The external reference frequency must be entered by the user.
- 4. 10 MHz OUT** provides an output of the transmitter tester's internal 10 MHz frequency reference signal. This is used to lock the frequency reference of other test equipment with the transmitter tester. This is a switched output.
- 5. TRIGGER IN** The external trigger allows external triggering of measurements. The external trigger accepts an external trigger signal between -5 and $+5$ V, and has a nominal impedance of $10\text{ k}\Omega$. For more information on triggering, see [page 89](#).
- 6. SCSI** Currently the **SCSI** connection can only be used to connect an external SCSI drive for firmware upgrades.

SCSI functionality will be fully implemented with a future firmware update.

7. Line Power Input AC power line connection. The line voltage operates at nominally 115 V (47 to 66 Hz) or at nominally 230 V (47 H to 66 Hz). The input power ranges for the power supply are 90 to 132 V or 195 to 250 Vrms. The power supply automatically senses the input power and switches between these two ranges. There is no customer replaceable power fuse. When on, the instrument consumes less than 350 W; when in standby less than 20 W.

8. KYBD This feature is not implemented. This feature will be implemented with a future firmware update. The **KYBD** enables connection of an external PS-2 keyboard using a 6-pin mini-DIN connector. If no keyboard is available you can use the numeric keyboard and the **Alpha Editor** menu key feature to make the entries. The keyboard must be plugged into the instrument prior to powering the instrument on or the keyboard will not work.

9. GPIB The **GPIB** allows the connection of a General Purpose Interface Bus (GPIB) cable, which enables remote instrument operation.

10. LAN-TP The **LAN-TP** connector can be used:

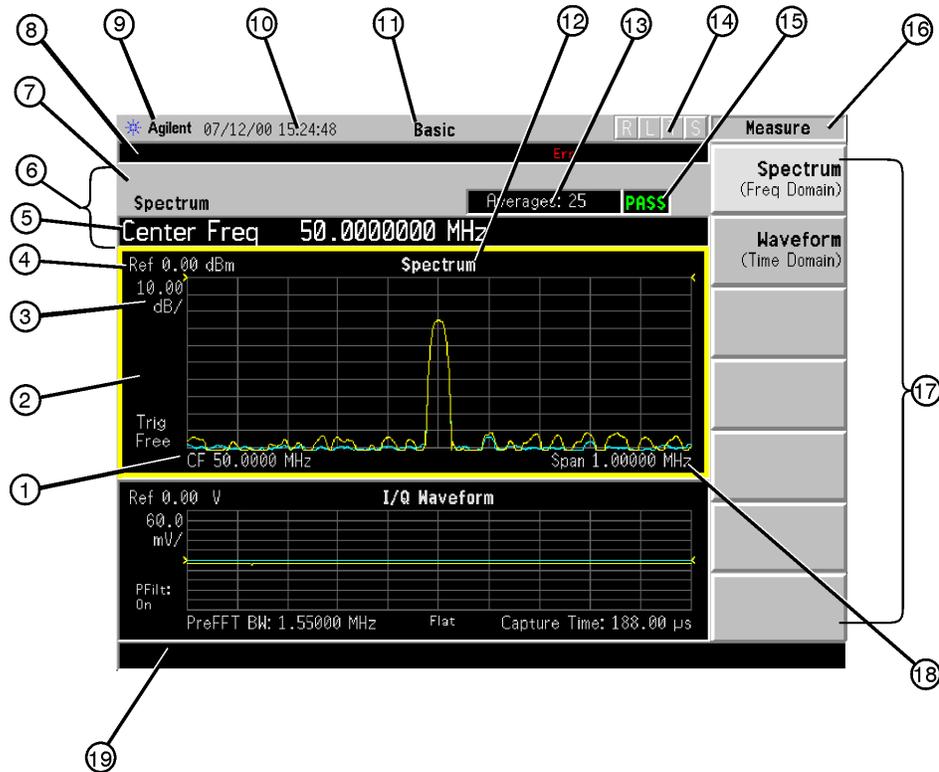
- as a SICL server emulating IEEE 488.2 protocol over LAN.
- for a telnet programming port that can be sent SCPI commands.
- for a TCP/IP socket programming port that can be sent SCPI commands.
- for anonymous FTP operations to retrieve a screen “gif” or screen “xwd” file from the ftp/pub.

NOTE

For more information on remote programming with your transmitter tester, refer to the programmer’s guide.

11. **PARALLEL** The **PARALLEL** connection supports remote printing.
12. **MONITOR** The **MONITOR** allows connection of an external VGA monitor, using a 15– pin mini D–SUB connector.
13. **RS-232** The serial port **RS-232** is not implemented. This feature will be implemented with a future firmware update.

Display Annotation



pa83a

The annotation features explained below refers to the display that is visible when your transmitter tester is in basic measurement mode; this is the default state of the transmitter tester when it is turned on. For explanations relating to unique measurement options such as GSM or cdmaOne see the documentation that accompanies each mode.

1. Center Frequency annotation.
2. Trigger Source Indicator.
3. Vertical Scale dB/Division Indicator.
4. Reference Level Indicator (in dBm).
5. Active Function Area. The active function area displays numeric entries. If you press a measurement key that activates a function, its value will appear in the active function area.
6. Measurement Bar. Displays information about measurements including some mode setup parameters.
7. Current Measurement Annotation.
8. The Annunciators bar displays annunciators that

indicate that hardware errors, other errors, or specific instrument states, are detected in the instrument, as explained below. Error indicators are shown in red text. Where applicable, some states will appear in green, indicating that the feature is active and performing correctly. Informational annunciators are shown in white text. To view error messages fully you will use keys in the **Show Errors** menu (see [page 56](#)). The current error message with the highest priority will also appear in the Status/Info Bar that appears at the bottom of the display. The following annunciators are available:

Unlock - This annunciator indicates that one or more of the internal phase-locked loops are unable to maintain a phase-locked state.

Corr Off (corrections off) - This annunciator appears when the **Corrections** menu key is set to off.

Err (error) - This annunciator appears when an error message is placed in the history error queue. It will persist until you use the **Clear Error Queue(s)** key to clear the history error queue.

Ext Ref (external reference) - The green Ext Ref annunciator indicates that the external reference has been selected and the instrument is locked to it. The red Ext Ref annunciator indicates that the external reference has been selected, but the instrument is not locked to that reference. Note that the external reference on this instrument can be set at any frequency between 1 and 30 MHz; if the entered value does not correspond to the external reference that is in use, a red Ext Ref annunciator will appear.

NOTE

Be aware that the value entered for the external reference frequency will persist, even after the instrument has been powered off. The user must manually enter a new value for the external reference if a different value is required, even if it corresponds with the default value. An Ext Ref annunciator will appear only if the external reference has been activated by the user.

E_{Sec} (even second clock) - The green E_{Sec} annunciator indicates that the external even second clock has been selected as the sync type and a sync signal is present at the even second input (rear panel Trigger In), and the measurement is using it as the demodulation sync type. The red E_{Sec} annunciator indicates that an external even second clock has been selected as the sync type but a sync signal is not present at the even second input (rear panel Trigger In). In this case, the error message Even Second Clock Missing will appear in the Status/Info bar at the bottom of the display. The even second clock detection is updated every 2 seconds.

Klock (keyboard lock) - The keyboard can be locked remotely using SYSTem:KLOck. The Klock annunciator will appear in white text when the keyboard has been locked.

9. System Bar.
10. Time and Date.
11. Personality Mode Indicator.
12. Graph (Window) Title.
13. Averaging Indicator.
14. Remote Status Indicator. The remote status indicator contains four letters: “R”, “L”, “T”, and “S”. The current status is indicated by the letters that are highlighted. “R” indicates that the instrument is in remote mode. “L” indicates a listen state. “T” indicates a talk state. “S” indicates a service request.
15. Pass/Fail Status Indicator.
16. Menu Title.
17. Menu keys. A menu key that is currently active is highlighted. Greyed-out menu keys are unavailable and may require a password for use.
18. Span annotation.
19. Status/Info Bar. The current error message which has the highest priority will appear in the Status/Info Bar. A programmer can also send a message to the Status/Info bar using a SCPI command.

Installing Optional Measurement Personalities

When you install a measurement personality, you need to follow a three step process:

1. Determine whether your memory capacity is sufficient to contain all the options you want to load. If not, decide which options you want to install now, and consider upgrading your memory. Details follow in [“Do You Have Enough Memory to Load All Your Personality Options?”](#) on page 38.
2. Install the measurement personality firmware into the instrument memory. Details follow in [“Loading an Optional Measurement Personality”](#) on page 41.
3. Enter a license key that activates the measurement personality. Details follow in [“Obtaining and Installing a License Key”](#) on page 42.

Adding measurement personalities requires the purchase of an upgrade kit for the desired option. The upgrade kit contains the measurement personality firmware and an entitlement certificate that is used to generate a license key from the internet website. A separate license key is required for each option on a specific instrument serial number and host ID.

For the latest information on Agilent Spectrum Analyzer options and upgrade kits, visit the following web location:

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

Do You Have Enough Memory to Load All Your Personality Options?

If you do not have memory limitations then you can skip ahead to the next section [“Loading an Optional Measurement Personality”](#) on page 41. If after installing your options you get error messages relating to memory issues, you can return to this section to learn more about how to optimize your configuration.

If you have 64 MBytes of memory installed in your instrument, you should have enough memory to install at least four optional personalities, with plenty of memory for data and states.

The optional measurement personalities require different amounts of memory. So the number of personalities that you can load varies. This is also impacted by how much data you need to save. If you are having memory errors you must swap the applications in or out of memory as needed. If you only have 48 MBytes of memory, you can upgrade your

hardware to 64 MBytes.

To see the size of your installed memory for E4406A Transmitter Testers:

1. Press the **System** key, **MORE (1 of 3)**, and **MORE (2 of 3)** keys.
2. Read the **File System Key** - The total of the entries for Used and Free memory will total the installed flash memory, either 48 or 64 MBytes.

If you have 48 MBytes of memory, and you want to install more than 3 optional personalities, you may need to manage your memory resources. The following section, [“How to Predict Your Memory Requirements” on page 40](#), will help you decide how to configure your installed options to provide optimal operation.

How to Predict Your Memory Requirements

If you plan to install many optional personalities, you should review your memory requirements, so you can determine whether you have enough memory. There is an Agilent “Memory Calculator” available online that can help you do this, or you can make a calculated approximation using the information that follows. You will need to know your instrument’s installed memory size as determined in the previous section and then select your desired applications.

To calculate the available memory on your E4406, see:
http://www.agilent.com/find/e4406a_firmware

Select the “Memory Calculator” link. You can try any combination of available personalities to see if your desired configuration is compatible with your installed memory.

You can manually estimate your total memory requirements by adding up the memory allocations described in the following steps. Compare the desired total with the available memory that you identified in the previous section.

1. Program memory - Select option requirements from the table “Measurement Personality Options and Memory Required” on page 40.
2. Screens - .gif files need 20-25 kB each
3. State memory - State file sizes range from 21 kB for SA mode to 40 kB for W-CDMA. The state of every mode accessed since power-on will be saved in the state file. File sizes can exceed 150 kB each when several modes are accessed, for each state file saved.

TIP

State memory retains settings for all states accessed before the **Save State** command. To reduce this usage to a minimum, reduce the modes accessed before the **Save State** is executed. You can set the PSA to boot into a selected mode by accessing the desired mode, then pressing the **System, Power On/Preset, Power On** keys and toggle the setting to **Last**.

Measurement Personality Options and Memory Required

Personality Options for E4406A Transmitter Tester ^a	Option	File Size (E4406A Rev: A.10)
cdmaOne measurement personality	BAC	1.82 Mbytes
NADC measurement personality	BAE	1.10 Mbytes
PDC measurement personality	BAE	1.23 Mbytes
W-CDMA or W-CDMA, HSDPA, HSUPA measurement personality	BAF, 210	5.00 Mbytes

Personality Options for E4406A Transmitter Tester ^a	Option	File Size (E4406A Rev: A.10)
cdma2000 or cdma2000 w/ 1xEV-DV measurement personality	B78, 214	3.88 Mbytes
1xEV-DO measurement personality	204	4.84 Mbytes
GSM (with EDGE) measurement personality	202	3.56 Mbytes
GSM measurement personality	BAH	2.51 Mbytes
EDGE upgrade from BAH measurement personality	252 (202)	3.56 Mbytes
iDEN measurement personality	HN1	2.10 Mbytes
WiDEN measurement personality	HN1	1.58 Mbytes
Baseband I/Q Inputs	B7C	n/a (hardware only)

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

Memory Upgrade Kits

The VSA 64 MByte Memory Upgrade kit part number is E4406AU-ANE.

For more information about memory upgrade kits contact your local sales office, service office, or see:

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

Loading an Optional Measurement Personality

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

You can check the Agilent internet website for the latest E4406 firmware versions available for downloading:

http://www.agilent.com/find/e4406a_firmware

NOTE

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

Depending on your installed hardware memory, you may not be able to fit all of the available measurement personalities in instrument memory at the same time. You may need to delete an existing option file from memory and load the one you want. Use the automatic update

program that is provided with the files. Refer to the table showing “[Measurement Personality Options and Memory Required](#)” on page 40. The approximate memory requirements for the options are listed in this table. These numbers are worst case examples. Some options share components and libraries, therefore the total memory usage of multiple options may not be exactly equal to the combined total.

Obtaining and Installing a License Key

If you purchase an optional personality that requires installation, you will receive an “Entitlement Certificate” which may be redeemed for a license key specific to one instrument. Follow the instructions that accompany the certificate to obtain your license key.

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

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

For E4406:

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

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

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

Viewing a License Key

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

Use the following procedure to display the license key unique to your personality option that is already installed in your E4406:

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

NOTE

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

Using the Uninstall Key on E4406A

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

NOTE

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

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

Ordering Optional Measurement Personalities

When you order a personality option, you will receive an entitlement certificate. Then you will need to go to the Web site to redeem your entitlement certificate for a license key. You will need to provide your instrument serial number and host ID, and the entitlement certificate number.

Required Information:	Front Panel Key Path:
Model #: (Ex. E4440A)	
Host ID: _____	System, Show System
Instrument Serial Number: _____	System, Show System

Cables for Connecting to the Serial Port (RS-232)

There are a variety of cables and adapters available for connecting to PCs, and printers. Several of these are documented in the following wiring diagrams. You need to find out what connections your equipment uses to identify the cables and/or adapters that you will need.

HP 34398A
 RS-232
 Cable Kit

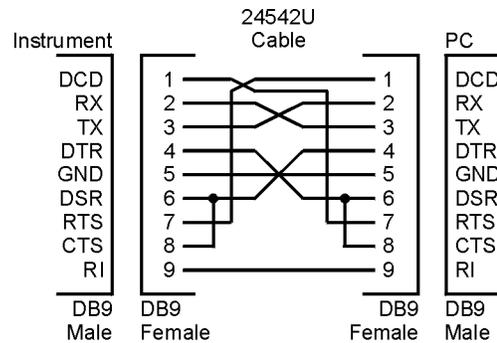
This kit comes with an RS-232, 9-pin female to 9-pin female null modem/printer cable and one adapter 9-pin male to 25-pin female (HP part number 5181-6641). The adapter is also included in HP 34399A RS-232 Adapter Kit.

HP 34399A
 RS-232
 Adapter Kit

This kit includes four adapters to go from DB9 female cable (HP 34398A) to PC/printer DB25 male or female, or to modem DB9 female or DB25 female.

Figure 1-5

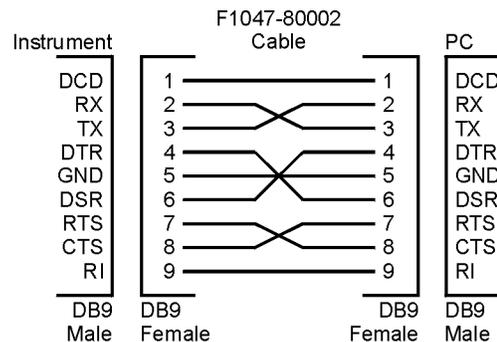
HP 24542U Cable



ca85a

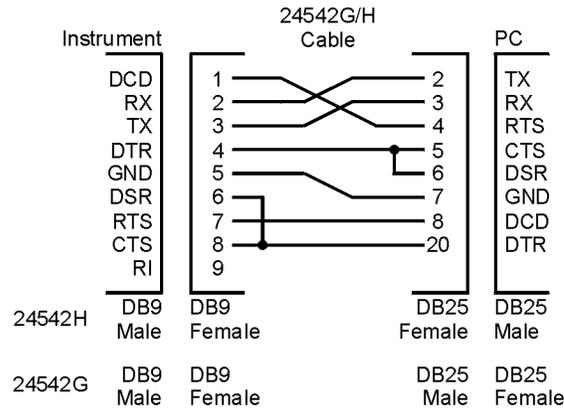
Figure 1-6

HP F1047-80002 Cable



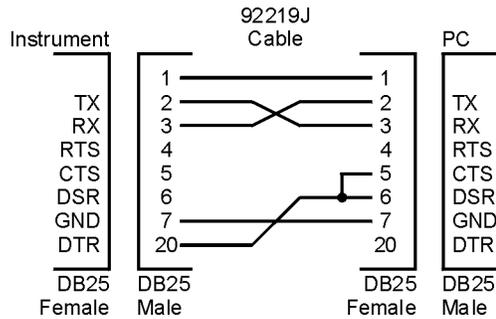
ca86a

Figure 1-7 HP 24542G/H Cable



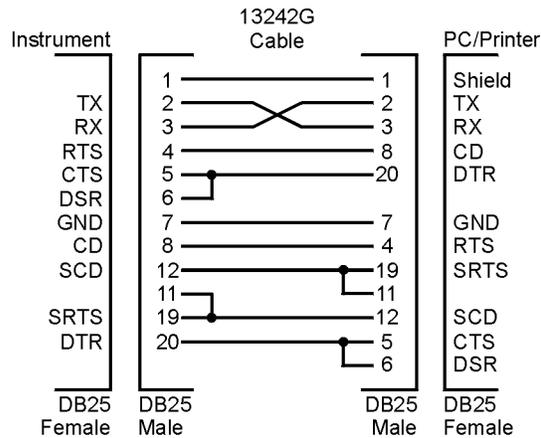
ca87a

Figure 1-8 HP 92219J Cable



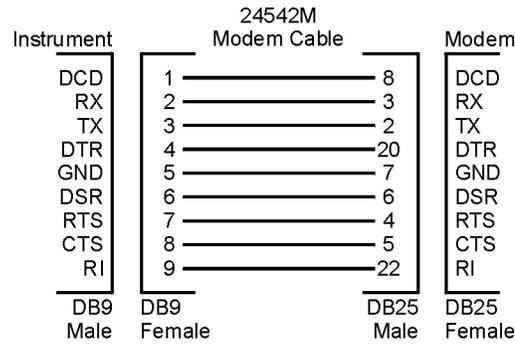
ca83a

Figure 1-9 HP 13242G Cable



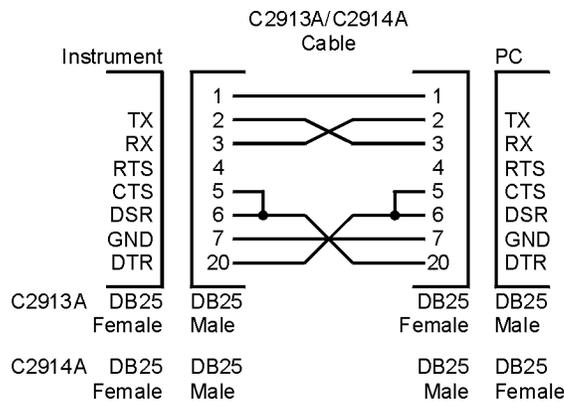
ca84a

Figure 1-10 HP 24542M Modem Cable



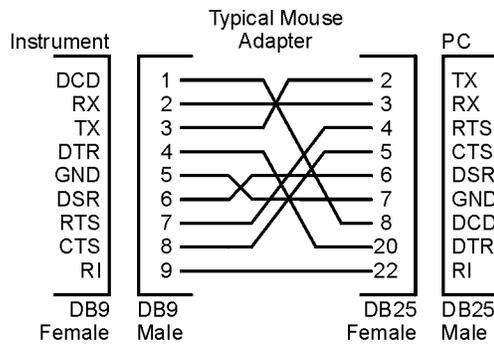
ca88a

Figure 1-11 HP C2913A/C2914A Cable



ca89a

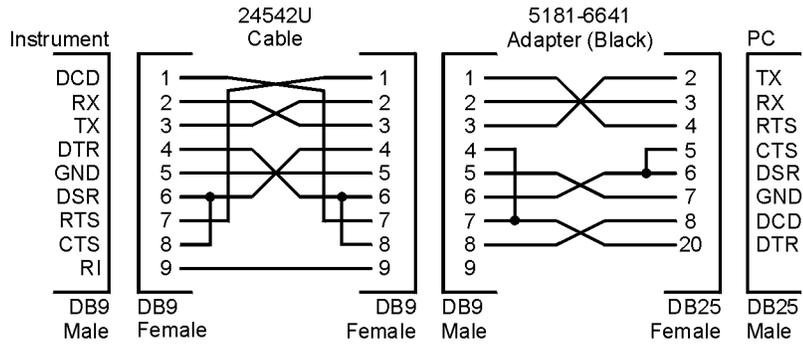
Figure 1-12 Mouse Adapter (typical)



A mouse adapter works well as a 9 pin to 25 pin adapter with a PC.

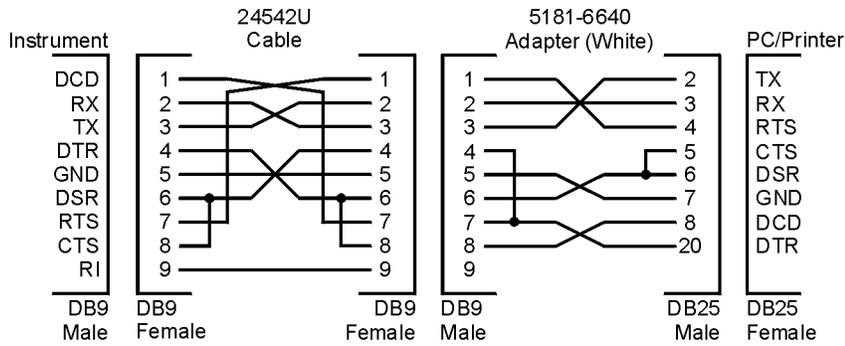
ca810a

Figure 1-13 HP 24542U Cable with 5181-6641 Adapter



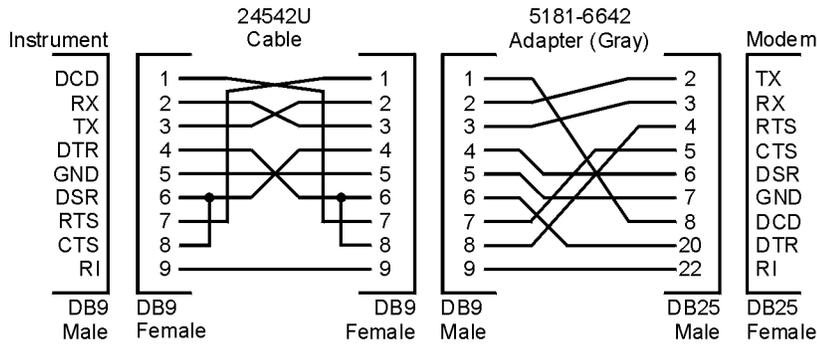
ca811a

Figure 1-14 HP 24542U Cable with 5181-6640 Adapter



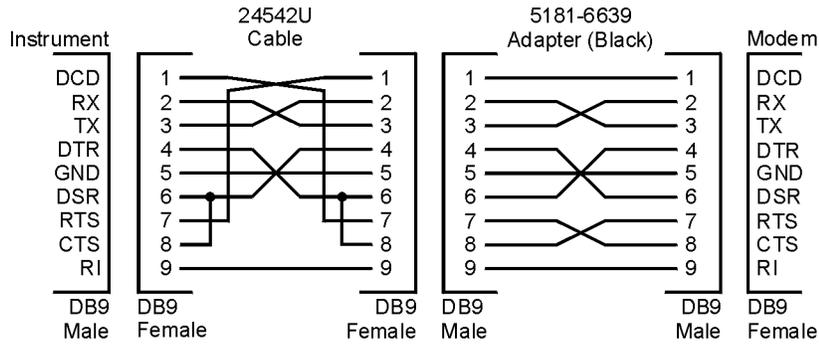
ca812a

Figure 1-15 HP 24542U Cable with 5181-6642 Adapter



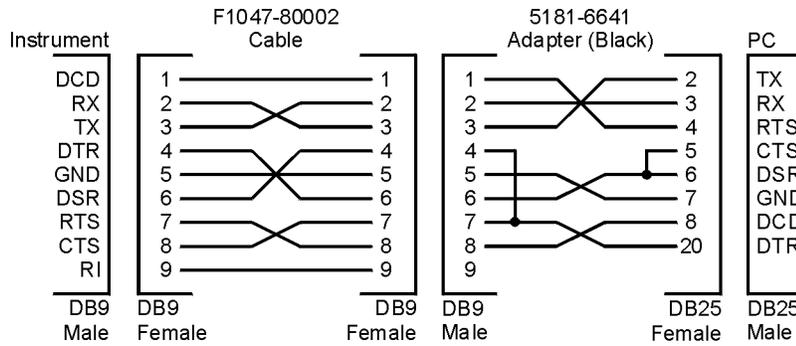
ca813a

Figure 1-16 HP 24542U Cable with 5181-6639 Adapter



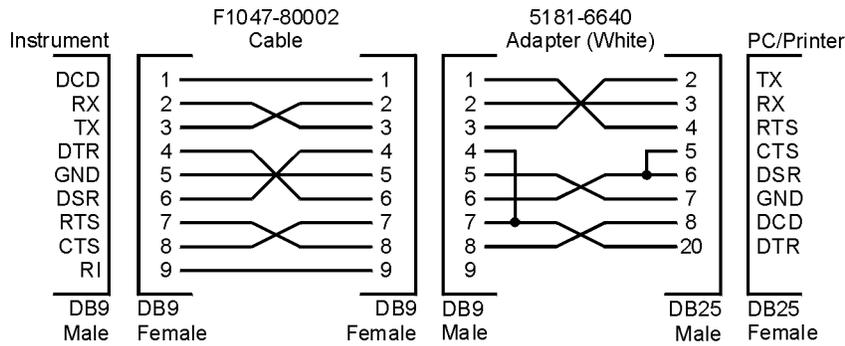
ca814a

Figure 1-17 HP F1047-80002 Cable with 5181-6641 Adapter



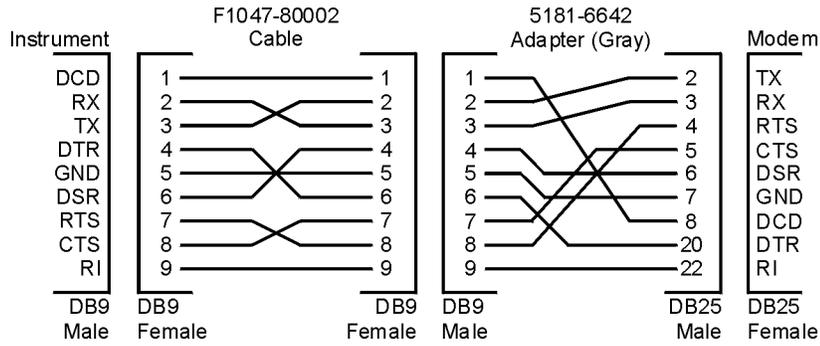
ca815a

Figure 1-18 HP F1047-80002 Cable with 5181-6640 Adapter



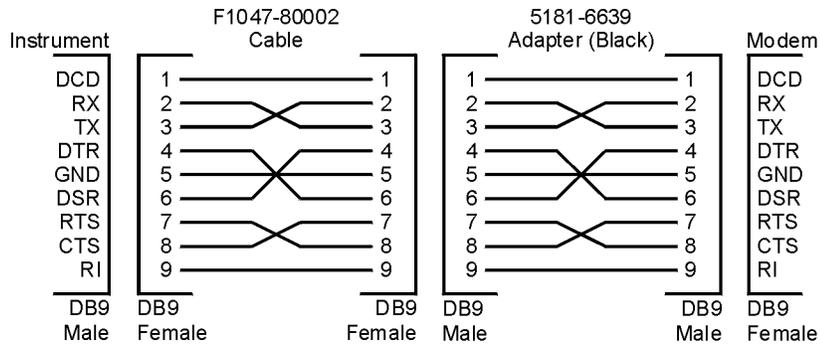
ca816a

Figure 1-19 HP F1047-80002 Cable with 5181-6642 Adapter



ca817a

Figure 1-20 HP F1047-80002 Cable with 5181-6639 Adapter



ca818a

Safety Considerations

This section covers safety considerations relating to the installation and use of the instrument.

Instrument Installation

Install the instrument so that the detachable power cord is readily identifiable and is easily reached by the operator. The detachable power cord is used to completely disconnect the instrument. The front panel switch is only a standby switch which maintains standby power to some parts of the instrument. It does not disconnect the instrument from the power source. Alternatively, an externally installed switch or circuit breaker (which is readily identifiable and is easily reached by the operator) may be used as a disconnecting device.

The input power ranges for the power supply are 90 to 132 V, or 195 to 250 Vrms. The power supply automatically senses the input power and switches between these two ranges. There is no customer replaceable power fuse.

WARNING	The power cord is connected to internal capacitors that may remain live for 5 seconds after the plug is disconnected from its power supply.
----------------	--

WARNING	If this product is to be energized via an external autotransformer for voltage reduction, make sure that its common terminal is connected to a neutral (earthed pole) of the power supply.
----------------	---

CAUTION	This instrument has autoranging line voltage input, be sure the supply voltage is within the specified range.
----------------	---

CAUTION	VENTILATION REQUIREMENTS: When installing the product in a cabinet, the convection into and out of the product must not be restricted. The ambient temperature (outside the cabinet) must be less than the maximum operating temperature of the product by 4° C for every 100 watts dissipated in the cabinet. If the total power dissipated in the cabinet is greater than 800 watts, then forced convection must be used.
----------------	--

Instrument Operation and Maintenance

The following warnings explain conditions which affect the safe operation of the instrument.

WARNING	If this instrument is not used as specified, the protection provided by the equipment could be impaired. This product must be used in a normal condition (in which all means for protection are in tact) only.
----------------	---

WARNING	To prevent electrical shock, disconnect the E4406A from mains before cleaning. Use a dry cloth or one slightly dampened with water to clean the external case parts. Do not attempt to clean internally.
----------------	---

Explanation of Safety Symbols that are on the Instrument

The following list describes all safety symbols that are on the front and rear panels of the transmitter tester.



The instruction documentation symbol. The product is marked with this symbol when it is necessary for the user to refer to the instructions in the documentation.



This symbol is used to mark the ON position of the power line switch.



This symbol is used to mark the OFF position of the power line switch.



This symbol is used to mark the STANDBY position of the power line switch.



This symbol indicates that the input power required is AC.



This symbol is used to mark the STANDBY/OFF position of the power line switch.



This symbol is used to mark the On position of the power line switch.

Safety Considerations for Service Personnel

NOTE

No one other than qualified service personnel are allowed to remove the cover of the instrument. The following warnings apply to service personnel. These warnings are found on the rear panel of the instrument.



To Remove Outer Cover, Remove Strap Handle, 4 Bottom Feet, and 4 Rear Feet.



To Remove CPU Assembly Unplug All Boards Connected to CPU. When Removing CPU Keep Perpendicular with Rear Panel

2

Using System Features

System keys access features that are used with all modes, including alignment, configuring I/O, and file management.

Using System Keys

System features are accessed through the **System** front panel key. These are features that are not dependent on the currently selected application mode or the particular measurement being made. They apply to all modes and measurements.

The **System** key also performs the LOCAL function. If the instrument was previously being controlled remotely by a computer, pressing the **System** key will reactivate the front panel keys.

Print feature keys are accessed through the front panel **Print Setup** and **Print** keys, which are explained on [page 67](#).

File feature keys are accessed through the **File** and **Save** menu keys, which are explained on [page 71](#).

Each description of a system feature begins with a table that shows the key path for all keys related to that feature.

NOTE

Most of the system features are not affected by pressing the **Preset** key or by cycling the instrument power. These features will retain the last value set by the user. Press **System, More, Restore Sys Defaults, Yes** to reset the System parameters back to the factory defaults.

Install and Uninstall

The **Install** and **Uninstall** keys, which enable you to install and remove measurement personalities, are described separately on [page 38](#) of the Getting Started chapter.

Key Locations

All system, service, and basic features can be located by using the key access table below. The key access path describes the key sequence you enter to access the particular key.

Some features can only be used when specific measurements are active. If a feature is not currently valid the key label for that feature will appear as lighter colored text, will be greyed-out, or will not be displayed at all.

Table 2-1 Key Access Locations

Key	Key Access Path
10 MHz Out	System/Reference/
50 MHz Amptd	MODE/Service/
50 MHz Ref	Input/Input Port/
ADC Dither	Meas Setup/More(1 of 2)/Advanced/ More(1 of 2)/
ADC Range	Meas Setup/More(1 of 2) / Advanced / Note: This feature is used when measure is set to either spectrum or waveform.
Adjust Now	System/Alignments/Align Subsystem/Align 50 MHz Reference/ Note: Requires Password
Advanced	Meas Setup/More(1 of 2)
Align 50 MHz Reference	System/Alignments/Align Subsystem/ Note: Requires Password
Align ADC	System/Alignments/Align Subsystem/
Align All Now	System/Alignments/
Align IF	System/Alignments/Align Subsystem/
Align RF	System/Alignments/Align Subsystem/
Alignments	System/
Align Subsystems	System/Alignments/
All	View/Trace/Trace Display/
Alpha Editor	The Alpha Editor is accessed by following the Menu Access Paths that accompany the following key entries: Choose Option, License Key, and Host Name.
AMPLITUDE/ Y Scale	Front Panel
Auto	Meas Setup/More(1 of 2)/Advanced/ More (1 of 2)/Data Packing/

Table 2-1 Key Access Locations

Key	Key Access Path
Auto	Meas Setup/More(1 of 2)/ Advanced /ADC Range / Note: This feature is used when measurement is set to either spectrum or waveform.
Auto Align	System/Alignments/
AutoPeak	Meas Setup/More(1 of 2)/ Advanced /ADC Range / Note: This feature is used when measurement is set to either spectrum or waveform.
AutoPeakLock	Meas Setup/More(1 of 2)/ Advanced /ADC Range / Note: This feature is used when measurement is set to either spectrum or waveform.
Auto Trig	Mode Setup/ Trigger/ Note: This feature is used when measurement is set to either spectrum or waveform.
Average	View/Traces/ Display Traces/
Average	Meas Setup/ Note: This feature is used when measurement is set to either spectrum or waveform.
Avg Mode	Meas Setup/ Average/ Note: This feature is used when measurement is set to either spectrum or waveform.
Avg Number	Meas Setup/Average/ Note: This feature is used when measurement is set to either spectrum or waveform.
Avg Trace	Marker/More(1 of 2)/ Marker Trace/
Avg Type	Meas Setup/ Average/ Note: This feature is used when measurement is set to either spectrum or waveform.
Band Power	Marker/ Function/
Basic	MODE/
Blackman	Meas Setup/More(1 of 2)/ Advanced/ FFT Window/
Blackman- Harris	Meas Setup/More(1 of 2) /Advanced / FFT Window/ More(1 of 2)/
BMP	Print Setup/Print To: File/File Type
cdmaOne	MODE/
Center Freq	FREQUENCY/Channel/
Choose Option	System/More(1 of 3)/More(2 of 3) /Install/
Choose Option	System/More(1 of 3)/More(2 of 3) /Uninstall/

Table 2-1 Key Access Locations

Key	Key Access Path
Clear Error Queue(s)	System/Show Errors/
Color Print	Print Setup/Print To: Printer/Printer Type: Custom/Define Custom/Color Printer: Yes
Color Printer	Print Setup/Print To: Printer/Printer Type: Custom/Define Custom
Comb	Input/IF Align Signal/Signal Type/
Config I/O	System/
Corrections	System/Alignments/
Counts	MODE/Basic, Meas Setup
Current	View/Trace/ Trace Display/
Current Trace	Marker/ More(1 of 2)/Marker Trace/
Custom	Print Setup/Print To: Printer/Printer Type
CW	Input/IF Align Signal/Signal Type/
Data Packing	Meas Setup/More(1 of 2)/
Decimation	Meas Setup/More(1 of 2)/ Advanced/More (1 of 2)/
Define Custom	Print Setup/Print To: Printer
Delay	Mode Setup/Trigger/Ext Front/
Delay	Mode Setup/Trigger/Ext Rear/
Delay	Mode Setup/Trigger/RF Burst/
Delay	Mode Setup/Trigger/Video/
Delta	Marker/
Diagnostics	System/More (1 of 3)/ Note: Requires Password
Display	Front Panel
Emulated GPIB Name	System/Config I/O/ SICL Server
Emulated GPIB Logical Unit	System/Config I/O/ SICL Server
Emulated GPIB Address	System/Config I/O/ SICL Server
Enter	Front Panel
ESC	Front Panel

Table 2-1 Key Access Locations

Key	Key Access Path
Exit Main Firmware	System/ More (1 of 3)/More (2 of 3)/ Install/
Ext Front	Mode Setup/ Trigger/
Ext Rear	Mode Setup/ Trigger/
Fast ACP	Mode/ACP/Meas Setup/More(1 of 2)/
FFT Length	Meas Setup/More(1 of 2)/ Advanced/FFT Size/ Note: This feature is used when measurement is set to spectrum.
FFT Size	Meas Setup/ More(1 of 2)/ Advanced/ Note: This feature is used when measurement is set to spectrum.
FFT Window	Meas Setup/ More(1 of 2)/ Advanced/ Note: This feature is used when measurement is set to spectrum.
File	Front Panel
File System	System/More(1 of 3)/ More(2 of 3)/
File Location	Print Setup/Print to File
File Type	Print Setup/Print to File
Flat Top	Meas Setup/More(1 of 2)/ Advanced/ FFT Window/
Frame	MODE/Basic, Meas Setup/Trig Source
Free Run	Meas Setup//Trig Source/
FREQUENCY/ Channel	Front Panel
Freq Ref	System/ Reference/
Front Panel Test	MODE/Service/More(1 of 2)/
Function	Marker/ More(1 of 2)/
Gaussian	Meas Setup/More(1 of 2) /Advanced / FFT Window/
GIF	Print Setup/Print To: File/File Type
GPIB Address	System/Config I/O/
GSM	MODE/
Hamming	Meas Setup/More(1 of 2) /Advanced / FFT Window/
Hanning	Meas Setup/More(1 of 2) Advanced / FFT Window/
Help	Front Panel
Host Name	System/Config I/O/
IF Align	Input/ Input Port/

Table 2-1 Key Access Locations

Key	Key Access Path
IF Align Signal	Input/
Image	Print Setup/Print to File
Instrument Name	System/Config I/O/ SICL Server
Instrument Logical Unit	System/Config I/O/ SICL Server
Input	Front Panel
Input Atten	Input/
Input Port	Input/
Install	System/More(1 of 3)/ More(2 of 3)/
Install Now	System/ More (1 of 3)/ More (2 of 3)/ Install/
IP Address	System/Config I/O/
I/Q Input Z	Input/
I/Q Waveform	Marker/Trace/ Note: This feature is used when measurement is set to either spectrum or waveform.
K-B 70 dB	Meas Setup/More(1 of 2)/ Advanced / FFT Window/More(1 of 2)/
K-B 90 dB	Meas Setup/More(1 of 2)/ Advanced / FFT Window/More(1 of 2)/
K-B 110 dB	Meas Setup/More(1 of 2)/ Advanced / FFT Window/More(1 of 2)/
Landscape	Print Setup/Print To: Printer/Printer Type: Custom/Orientation
Language	Print Setup/Print To: Printer/Printer Type: Custom/Define Custom
Length Ctrl	Meas Setup/More(1 of 2)/ Advanced/FFT Size/ Note: This feature is used when measurement is set to spectrum.
Level	Mode Setup/Trigger/Ext Front/
Level	Mode Setup/Trigger/Ext Rear/
License Key	System/ More (1 of 3)/ More (2 of 3)/ Install/
Line	Meas Setup/ Trig Source/
Load State	File/
Local (System)	Note: Press the front panel System key to change from remote to local control of the instrument
Log-Pwr Avg	Meas Setup/Average/Avg Type/

Table 2-1 Key Access Locations

Key	Key Access Path
Long	Meas Setup/More(1 of 2)/ Advanced/ More (1 of 2)/ Data Packing/
Manual	Meas Setup/More(1 of 2)/ Advanced /ADC Range/ Note: This feature is used when measurement is set to either spectrum or waveform.
Marker	Front Panel
Maximum Connections	System/Config I/O/ SICL Server
Mrkr All Off	Marker/More(1 of 2)/
Maximum	Meas Setup/ Average/ Avg Type/
Max Total Pwr	Input/
Measure	Front Panel
Meas BW	MODE/Basic, Meas Setup
Meas Control	Front Panel
Meas Interval	MODE/Basic, Meas Setup
Meas Setup	Front Panel
Medium	Meas Setup/More(1 of 2)/Advanced/ More (1 of 2)/Data Packing/
Minimum	Meas Setup/Average/ Avg Type/
Min Pnts/ RBW	Meas Setup/More(1 of 2)/ Advanced/FFT Size/ Note: This feature is used when measurement is set to spectrum.
MODE	Front Panel
Mode Setup	Front Panel
Next Window	Front Panel
Noise	Marker/ Function/
Normal	Marker/
Off	Marker/
Orientation	Print Setup/Print To: Printer
Pause	Meas Control
PCL3	Print Setup/Print To: File/File Type
PCL5	Print Setup/Print To: File/File Type
Peak Level	Mode Setup/ Trigger/ RF Burst/

Table 2-1 Key Access Locations

Key	Key Access Path
Power Stat CCDF	MODE/Basic, Meas Setup
Portrait	Print Setup/Print To: Printer/Printer Type: Custom/Orientation
Pre-ADC BPF	Meas Setup/ More(1 of 2)/ Advanced/ Note: This feature is used when measurement is set to either spectrum or waveform.
Pre-FFT BW	Meas Setup/ More(1 of 2)/ Advanced/ Note: This feature is used when measurement is set to spectrum.
Pre-FFT Filtr	Meas Setup/ More(1 of 2)/ Advanced/ Note: This feature is used when measurement is set to spectrum.
Print	Front Panel
Printer	Print Setup/
Printer Type	Print Setup/Print To: Printer
Print Setup	Front Panel
Prints/Page	Print Setup/ Print To: Printer
Print To	Print Setup/
Pulse	Input/IF Align Signal/Signal Type/
Pwr Avg (RMS)	Meas Setup/Average/Avg Type/
Pwr vs Time	MODE/Service/
RBW Filter	Meas Setup/ More(1 of 2)/ Advanced Note: This feature is used when measurement is set to spectrum.
Reference	System/
Ref Position	AMPLITUDE/Y Scale/ for spectrum or waveform - or - SPAN/XScale/ for waveform.
Ref Values	AMPLITUDE/Y Scale/ for spectrum or waveform - or - SPAN/XScale/ for waveform.
Res BW	Meas Setup/ Note: This feature is used when measurement is set to either spectrum or waveform.
Restart	Front Panel
Restore Align Defaults	System/Alignments/
Restore Meas Defaults	Meas Setup/ More(1 of 2)

Table 2-1 Key Access Locations

Key	Key Access Path
Restore Sys Defaults	System/ More(1 of 3)/ More (2 of 3) /
Return	Front Panel
RF	Input/Input Port/
Align RF	System/Alignments/Align Subsystem/
RF Burst	Mode Setup/ Trigger/
RF Envelope	View/Trace/ Note: This feature is used when measurement is set to waveform.
RF Envelope	Marker/Trace/ Note: This feature is used when measurement is set to waveform.
RF Inp Level	System/Alignments/Align Subsystem/ Align 50 MHz Reference/
Save	Front Panel
Save State	File/ or Save/
Scale Coupling	AMPLITUDE/Y Scale/ for spectrum or waveform - or - SPAN/XScale/ for waveform.
Scale/Div	AMPLITUDE/Y Scale/ for spectrum or waveform - or - SPAN/XScale/ for waveform.
SCPI LAN	System/Config I/O/
Search	Front Panel
Select	Marker/
Sensors	MODE/Service/
Server	System/Config I/O/ SICL Server
Service	MODE/
Service Password	System/More(1 of 3)/Show System/
Shape	Marker/More (1 of 2)/
Short	Meas Setup/More(1 of 2)/ Advanced/More (1 of 2)/Data Packing/
Show Errors	System/
Show System	System/More(1 of 3)/
SICL Server	System/Config I/O/
Signal Amptd	Input/IF Align Signal/
Signal Rate	Input/IF Align Signal/

Table 2-1 Key Access Locations

Key	Key Access Path
Signal Type	Input/IF Align Signal/
Slope	Mode Setup/Trigger/Ext Front
Slope	Mode Setup/Trigger/Ext Rear/
Slope	Mode Setup/Trigger/RF Burst/
Slope	Mode Setup/Trigger/Video/
Socket Port	System/Config I/O/ SCPI Lan
Span	Meas Setup/
SPAN/ X Scale	Front Panel
Spectrum	View/Trace/ Note: This feature is used when measurement is set to spectrum.
Spectrum	Marker/Trace/ Note: This feature is used when measurement is set to spectrum.
Spectrum Avg	Marker/Trace/ Note: This feature is used when measurement is set to spectrum.
Spectrum (Freq Domain)	MODE/Service/
Spectrum (Freq Domain)	MODE/Basic/
Store Abs Ampl to EEROM	System/Alignments/Align Subsystem/ Align 50 MHz Reference/
Subnet Mask	System/Config I/O
Sweep Time	Meas Setup/ Can be accessed when measure is set to waveform.
System	Front Panel
Telnet Port	System/Config I/O/ SCPI Lan
Timebase Freq	MODE/Service/
Trace	Marker/
Trace Display	View/Trace/
Trigger	Mode Setup/ Note: This feature is used when measurement is set to either spectrum or waveform.
Trig Holdoff	Mode Setup/ Trigger/ Note: This feature is used when measurement is set to either spectrum or waveform.

Table 2-1 Key Access Locations

Key	Key Access Path
Trig Source	Meas Setup/ Note: This feature is used when measurement is set to either spectrum or waveform.
Uniform	Meas Setup/More(1 of 2)/Advanced / FFT Window/
Uninstall	System/ More (1 of 3)/ More (2 of 3)/
Uninstall Now	System/ More (1 of 3)/ More (2 of 3)/ Uninstall/
Verbose	System/Show Errors/
Video	Mode Setup/ Trigger/
View/Trace	Front Panel
Visible Align	System/Alignments/
Voltage Avg	Meas Setup/Average/ Avg Type/
Waveform (Time Domain)	MODE/Basic/
Waveform (Time Domain)	MODE/Service/
WindowLength	Meas Setup/More(1 of 2)/ Advanced/FFT Size/ Note: This feature is used when measurement is set to spectrum.
WMF	Print Setup/Print To: File/File Type
Zoom	Front Panel

Using Print and Print Setup Functions

Keys in the **Print Setup** menus enable you to print displayed screen images to a variety of printers, as a file in a variety of formats to the C: drive flash memory, or to the built-in floppy disk drive. The **Print** key is used to execute choices made in the **Print Setup** menus.

Printing a Displayed Screen

1. Connect a compatible printer via the parallel port on the rear panel.
2. Press **Print Setup**, then toggle the **Print To** key to select **Printer**.
3. Press **Printer Type**, then select **Custom**.
4. Press **Define Custom**, then select a **Language**, either **PCL3** or **PCL5**. (In general, modern laser printers use PCL5 while inkjet printers use PCL3.)
5. Select **Color Printer Yes / No** depending on the capability of the printer.
6. If your printer uses **PCL5** you can select **Orientation**, then **Portrait** or **Landscape** as appropriate. **Orientation** is unavailable with **PCL3** printers, which always default to portrait orientation.
7. Toggle **Color Print - On/Off** to enable or disable color printing once the **Color Printer** key (see above) is set to **Yes**.
8. Toggle **Prints /Page (1 or 2)** to select to print either one image (in portrait orientation) covering half a page, or two images (in portrait orientation), each covering half the page.
9. Press the **Print** key. A copy of the current display screen will be sent to the printer according to the parameters set above.
10. If you want to reprint the most recently printed page, press **Reprint**.
11. If you want to eject a page from a compatible printer, toggle **More (1 of 2)**, then **Eject Page**.
12. If a printer failure occurs (for example, if the printer hangs up), press **Reset Printer**. It may also be necessary to cycle printer power.

The following table illustrates the **Print Setup** menu. Level 1 shows key choices available when the front panel key is pressed. Level 2 shows key choices available when **Print To** is set to **Printer** and Level 1 keys are pressed.

Front Panel Key	Level 1	Level 2
Print Setup	Print To with Printer selected	
	Printer Type	None
		Custom
	Define Custom	Language PCL3/PCL5
		Color Printer Yes/No
	Orientation (Only active for PCL5 language; printers with PCL3 language default to portrait orientation)	Portrait
		Landscape
	Color Print (Only active when Color Print is set to Yes - see above.)	On/Off
	Prints/Page 1 / 2	
	More (1 of 2)	
	Reprint (Only active after initial printing.)	
	Eject Page	
	Reset Printer	
More (2 of 2)		

Printing a Screen Image to a File on A: or C: Drives

1. Press **Print Setup, Print To**. Toggle the **Print To** key to select **File**.
2. Press the **File Type** key, then select between gif, bmp, and wmf formats.
3. To print a file to the floppy drive, toggle the **File Location** key to **A:** and insert a 3.5" HD floppy disc, formatted for MS-DOS, into the front panel disk drive.

To print a file to the internal flash memory, toggle the **File Location** key to **C:**.

4. Select the **Image** format to be stored on the disk. Use **Normal** to store an image that is identical to the currently displayed image, with a black background. Use **Invert**, which provides a light background with a dark trace, to minimize ink and toner consumption.
5. Press **HCOPY Dest**, then select **Printer**. This enables you to generate up to six files containing screen images.

Note:

if **HCOPY Dest** is set to **FPanel** only one file can be saved to memory or a floppy disk. Any subsequent screen files will overwrite the file currently saved in the A: or C: drives. For these reasons, **Printer** is usually the preferred selection.

6. Press the front panel **PRINT** key. If you have set **HCOPY** to **Printer**, six filenames will appear in the menu keys: screen1.xxx, screen2.xxx, screen3.xxx, screen4.xxx, screen5.xxx, and screen6.xxx (the xxx extension will be gif, bmp, or wmf, depending on the file type selected in **File Type**). The destination drive name will also be displayed.

Press the appropriate screen#.xxx key. Files written to the A: drive will be located at A:screen#.xxx. Files written to the C: drive may be accessed by the following path: /users/ftp/pub/screen#.xxx. Six files may be stored at the same time to either location. Any subsequent files stored to the same filename will overwrite the existing file

7. The disk may be removed from the A: drive once the LED on the disk drive is off. Any files you have saved are now available to be printed through use of an external computer and printer, or to be imported into an electronic document.

Files located on the C: drive may be retrieved over the LAN by ftp with the use of an external computer

The following table illustrates the keys used and key choices available to print a screen image to either the A: internal floppy disk drive or the internal C: drive flash memory. Level 1 shows key choices available when the front panel key is pressed. Level 2 shows key choices available when **Print To** is set to **File** and Level 1 keys are pressed.

Front Panel Key	Level 1	Level 2
Print Setup	Print To with File selected	
	File Type	GIF
		BMP
		WMF
	File Location A:/C:	
	Image Invert/Normal	
HCOPY Dest FPanel/Printer	= Print to Key	
	Printer	
Print	(the six screen files shown below are available only when HCOPY Dest is set to Printer .)	
	screen1.xxx (xxx depends on File Type)	
	screen2.xxx	
	screen3.xxx	
	screen4.xxx	
	screen5.xxx	
	screen6.xxx	

Using File and Save Keys

The **File** and **Save** keys enable you to save instrument states to memory and to load instrument states into the instrument from memory. For instructions on how to save a screen image to a floppy disc, see [Saving a Screen Image to a Floppy Disc on page 67](#).

Front Panel Key	Level 1	Level 2	Level 3
File	Load State	numeric entry	Enter
	Save State	numeric entry	Enter
Save	numeric entry	Enter	

Loading a State

1. Press **File, Load State**. A label in the active function area will read Load State.
2. Use the numeric keypad to enter the number of the register from which you desire to retrieve a state (you can retrieve states from registers 0 to 19), then press the **Enter** key.

Saving a State

1. Press **File, Save State** or press the front panel **Save** key. An active function labeled Save State will appear.
2. Use the numeric keypad to enter the desired state number (you can enter values from 0 to 19), then press the **Enter** key.

Using the Alpha Editor Keys

The alpha editor enables you to enter text. All text entries are displayed in the active function area.

Level 1	Level 2	Level 3	Example
ABCDEFGH	abcdefgh	():,'	V
HIJKLMN	hijklmn	_! ? ~	W
OPQRSTU	opqrstu	+ - * / <> =	X
VWXYZ	vwxyz	!@{} []	Y
Done	Done	@ # \$ % ^ &	Z
Space	Space	Space	
More (1 of 3)	More (2 of 3)	More (3 of 3)	

1. Pressing a key that requires you to enter a string gives you access to the alpha editor. **Choose Option**, **License Key**, and **Host Name** are some of those keys. When one of these keys is pressed, you will see the menu which is shown in level 1 of the table above.
2. To enter an upper case letter, press the key which contains the letter you wish to select. In the example table above, pressing **VWXYZ** lets you select the key labelled upper case **Y**. The **Y** will then appear in the active function area. Press **More (1 of 3)** to access the lower case letters and **More (2 of 3)** to access mathematical symbols and punctuation marks.
3. To enter a digit, 0 through 9, use the numeric keypad.
4. To enter a space, press the **Space** key, which is available on both the letters and the symbols **Alpha Editor** menus.
5. Press the **Return** front panel key to return to the previous menu without entering characters.
6. If you need to correct a character you have entered, you can use the backspace key to move the cursor in the active function area to the character you need to correct.
7. Once you have completed entering all characters, press the **Done** key.
8. Pressing the **ESC** key at any time prior to pressing the **Done** key will clear the new entry and leave the previous entry unchanged.

Using Input/Output Configuration Keys

There are several keys available to help configure the instrument front panel and rear panel inputs/outputs. These include the various buses, external reference, and other types of I/O.

Configuring I/O

Press System, Config I/O to access keys and menus that enable you to identify and change the current GPIB address, to identify and change various LAN settings.

Front Panel Key	Level 1	Level 2	Level 3/Entry
System	Config I/O	GPIB Address	
		IP Address	
		Host Name	Alpha Editor
		Subnet Mask	
		SCPI LAN	Telnet Port
			Socket Port
		SICL Server	Server
			Maximum Connections
			Instrument Name
			Instrument Logical Unit
			Emulated GPIB Name
			Emulated GPIB Logical Unit
			Emulated GPIB Address
		Ethernet Addr	

- **GPIB Address** - Shows the current GPIB address (18 is the default setting) and allows you to change this value. The new value is displayed in the active function area. The GPIB port is always active.
- **IP Address** - Changes the IP (internet protocol) address, domain name and node (host) name for the instrument. The IP address of

the instrument can be changed by entering a numeric address composed of numbers and decimal points.

- **Host Name** - Displays the host name of the instrument. Pressing the key activates the alpha editor, which enables you to change the host name. However, this will not change your LAN system representation of the host name. You must work through your local system administrator to change the host name. Changing it in the instrument only changes the displayed information, it will not enable LAN access with the new name.
- **Subnet Mask** - Changes the subnet mask of the instrument. The subnet mask is a 32-bit address mask used in IP networks to indicate the bits of an IP address that are used for the subnet address. The default address is 255.255.0.0 for a class B network.
- **SCPI LAN** - Accesses the following keys:

Telnet Port - Turns on or off telnet programming over the LAN. This key only affects new connections, not existing connections. Enter the port number that you will use for your telnet connection to the transmitter tester. The default port number is 5023.

Socket Port - Turns on or off socket programming over the LAN. This key only affects new connections, not existing connections. Enter the port number that you will use for your socket connection to the transmitter tester. The default port number is 5025.

- **SICL Server** - Accesses the following keys. These keys are provided for information only. The “value” of the settings cannot be changed.

Server - Indicates the on/off condition of the SICL IEEE 488.2 protocol LAN server.

Maximum Connections - Shows you the maximum number of connections that can be accessed simultaneously. The default is 5.

Instrument Name - Shows you the name (same as the remote SICL address) of your transmitter tester. The default is `inst0`.

Instrument Logical Unit - Shows you the unique integer assigned to your transmitter tester when using SICL LAN. The default is 8.

Emulated GPIB Name - Shows you the name (same as the remote SICL address) of the device used when communicating with your transmitter tester. The default is `gpiib7`.

Emulated GPIB Logical Unit - Shows you the unique integer assigned to your device when it is being controlled using SICL LAN. The default is 8.

Emulated GPIB Address - Shows you the emulated GPIB

address assigned to your transmitter tester when it is a SICL server. This address is set using the **GPIB Address** key.

- **Ethernet Addr** - Shows the Ethernet address. This is an information only feature that can not be modified by the user.

NOTE

For more information about these and other remote programming features, refer to the programmer's guide for your transmitter tester.

File System

Press **System, More (1 of 3), More (2 of 3)** to access the **File System** key. The label of the **File System** key shows the current amount of Used memory and Free memory in units of megabyte (MB).

Reference

Press the **Reference** menu key to activate a menu which allows you to select an external reference, or to deactivate a 10 MHz out signal on the rear panel.

Front Panel Key	Level 1	Level 2	Toggle	Entry
System	Reference	Freq Ref	Int/Ext	When toggled to Ext, enter any value between 1 and 30 MHz
		10 MHz Out	Off/On	

- **Freq Ref** - Allows you to select an external or an internal (the default) reference. When toggled to Ext (external) you will set the external reference frequency by entering a value between 1 and 30 MHz. When the instrument is locked to an external reference a green Ext Ref indicator will appear in the annunciator bar.

NOTE

External reference values are persistent. This means that the external reference frequency you select will remain active until it is changed, even if the instrument is turned off and on, or preset. If the frequency you have input to the rear panel external frequency connector is not the same as the external frequency value you have manually set, a red Ext Ref error indicator and a red Unlock error indicator will appear in the annunciator bar.

- **10 MHz Out** - Activates, or deactivates, the 10 MHz out signal on the rear panel of the instrument. The 10 MHz out can be used to lock

other test equipment to the same frequency reference that is used by the transmitter tester. Once activated, the 10 MHz out feature is persistent, so if it is set to On it will remain on, even if the instrument has been preset, or powered off and then on.

Using System Configuration and Alignment Keys

There are number of different keys that can help you with understanding the current instrument configuration and for hardware alignment.

NOTE

Some features are intended for use only by service personnel and cannot be accessed without a service password. If after pressing a key a message appears requesting entry of a password, you should understand this to indicate that this feature is meant for service use only. The password is not available unless the user has purchased the service guide.

Restore System Defaults

Press **System, More (1 of 3), More (2 of 3)** to access the **Restore Sys Defaults** key. There are some instrument functions that stay set to the last value that you selected even if you press the instrument preset key or turn the power off and on. The **Restore Sys Defaults** key allows you to preset those functions back to the original factory settings.

NOTE

Pressing this key will preset functions like the GPIB/IP address, external reference/trigger settings and auto-alignment selection. You will have to reset these items to return to the your previous setup.

Show Errors

Press **System, Show Errors** to activate a menu with features that enable you to move around in the error history queue, and to clear the error queue.

Front Panel Key	Level 1	Level 2
System	Show Errors	Top Page
		Last Page
		Next Page
		Prev Page
		Clear Error Queue(s)
		Verbose

- **Clear Error Queue(s)** - The error history queue retains and displays all errors once they have been detected, even if they are no

longer detected after a period of time has elapsed. After reviewing the error queue you will likely want to clear it before making another measurement. Note that if an error condition exists continuously, the error will not appear in the queue after the error history queue has been cleared.

- **Verbose** - When an error is made in using the instruments programming commands, the verbose feature displays the command in which an error has been detected. An error indicator will appear in the displayed command line immediately following the entry that caused the error. This feature can help you troubleshoot programming problems.

You can exit the error history queue display to return to a measurement display by pressing the **ESC** or the **Return** key.

Show System

Press **System**, **More (1 of 3)**, **Show System** to access the two-page show system display. The first page shows firmware and option information (see Figure 2-1). Press **More (2 of 3)** to access the second page, which shows option and hardware status information (see Figure 2-2).

Under the **Show System** menu is a key that enables you to enter a password, and four information-only keys, in a lighter font, that show the serial number, model designation, firmware revision, and host ID for your instrument.

NOTE

Diagnostics features require a service password. The password is only available if the service guide has been purchased. All service diagnostic features are described in the service guide.

Front Panel Key	Level 1	Level 2
System	Show System	Service Password
		Model
		Serial Number
		Firmware Rev
		Host ID
		Next Page
	Prev Page	
	Diagnostics	

The display lists all the measurement options/modes available at the time the firmware was installed or upgraded. It shows whether or not the code for each option is currently installed in memory. It may not be

possible to fit all the options into your available memory. Hardware information includes the name of boards along with part, serial number, and revision information.

The display also indicates whether you have the license key installed that gives you access to a particular option/mode. It is possible to have the license key installed but not have the program code, or to have the program code with no license key. Either situation will prevent the option from running.

Show System Displays

Figure 2-1

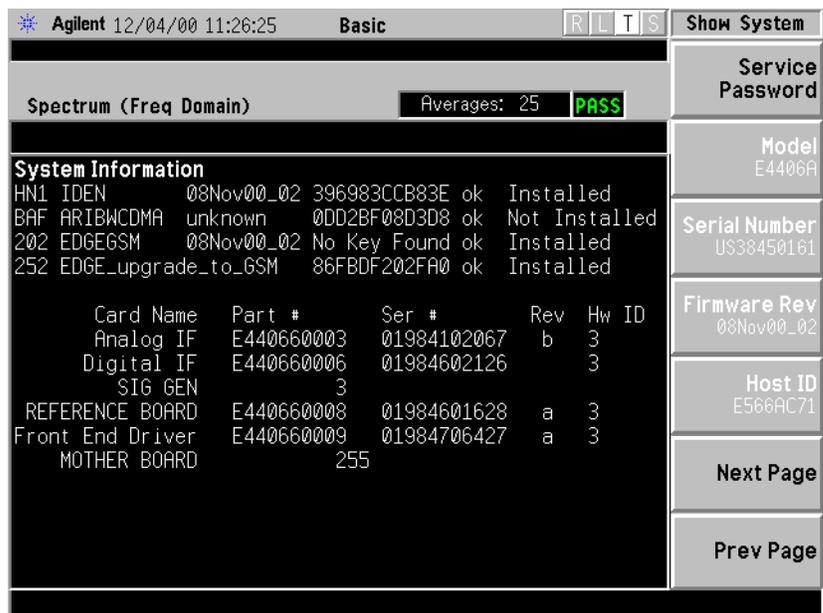
Firmware and Option Information (first page)

The screenshot shows a terminal-style interface for an Agilent device. At the top, it displays 'Agilent 03/14/01 11:59:11' and 'Basic' mode. A 'Show System' button is visible in the top right. Below this, there's a 'Spectrum (Freq Domain)' section with 'Averages: 25' and a green 'PASS' indicator. The main area is titled 'System Information' and lists various system details. On the right side, there are several buttons: 'Service Password', 'Model', 'Serial Number', 'Firmware Rev', 'Host ID', 'Next Page', and 'Prev Page'.

Opt Name	Version	License Key	Firmware
STD SERVICE	A.05.05	Standard	ok Installed
BAH GSM	A.05.05	D3CFB451EAA8	ok Installed
BAC CDMA	A.05.05	B6E9D16EE4AB	ok Installed
BAE NADC	A.05.05	BCDDCB68D8B1	ok Installed
BAE PDC	unknown	BCDDCB68D8B1	ok Not Installed
STD BASIC	A.05.05	Standard	ok Installed
BAF WCDMA	A.05.05	BDDBCA67D6B2	ok Installed
B78 CDMA2K	A.05.05	A84A3ECF80A2	ok Installed
HN1 IDEN	unknown	CF6E8A1FFF14	ok Not Installed

Figure 2-2

Option and Hardware Information (second page)



System (Local)

Pressing the **System** front panel key will return the instrument to local control if the instrument was in remote mode being controlled by an external computer.

Alignment

Press **System, Alignments** to access menus which enable you to align the instrument. Press the **ESC** key to stop any alignment. The table below diagrams the paths through which you will access alignment feature keys. The feature in the cell that is greyed-out requires a password.

Front Panel Key	Level 1	Level 2	Level 3	
System	Alignments	Auto Align	On/Alert/Off	
		Align All Now		
		Align Subsystems	Align RF	
			Align IF	
			Align ADC	
			Align 50 MHz Reference	
			Align Current IF Flatness	
		Align Current Sysgain		
		Corrections	On/Off	
		Time Corr	Auto/On/Off	
Restore AlignDefaults				
Visible Align	Off/Low/High			

Auto Align - Defaults to the alert state. When set to Alert, the auto align feature causes a message to appear 24 hours after the last alignment to tell you that the instrument needs to be aligned. This message will also appear if there is a change of ambient temperature greater than $\pm 3^{\circ}$ C. Use the **Align All Now** key. If the message has appeared and then the Mode is changed, the message will be cleared without running an alignment.

When set to the On state an alignment (which slows down measurements) automatically occurs every 5 minutes or when a change in ambient temperature of greater than $\pm 3^{\circ}$ C has occurred.

- **Align All Now** - Immediately activates an alignment on all of the instrument's standard RF, IF, and ADC alignments. All other operations are stopped and the alignments progress will be visible on the display.

Align Subsystem - Allows you to activate one or a group of the

standard internal instrument alignments. Perform alignments on circuitry relating to the following internal alignments. Press the **ESC** key to cause any alignment to stop.

Align RF - Activates an alignment on the RF circuitry.

Align IF - Activates an alignment on the IF circuitry. The main gain of the Analog IF is used to compensate for prefilter BW gain variations so the gain of the entire IF path before the A/D remains constant.

Align ADC - Activates an alignment on the ADC circuitry.

Align 50 MHz Reference - Enables a service technician to adjust the amplitude of the internal 50 MHz reference signal for absolute amplitude accuracy. The test equipment and the adjustment procedure required are described in the E4406A service guide.

NOTE

The Align 50 MHz reference feature can only be activated if you have a service password. The password is not available unless the user has purchased the service guide.

Align Current IF Flatness - Activates an immediate measurement of the current IF flatness, for FFT spectral amplitude compensation. Normally this alignment occurs in the background when the instrument bandwidth is changed. Given the current BW and Gain DAC settings for a measurement, alignment is done using the comb calibration signal. The relative amplitude of combs within the BW are compared to expected amplitudes to generate the effective shape of the current IF path.

If Time Corrections are active, this alignment generates complex IF responses (magnitude and phase) rather than just the original scalar (magnitude) response. The complex alignment requires reasonable delay estimation, and improved trigger compensation so the phase response of several averaged measurements can be unwrapped properly.

Align Current SysGain - Activates a fine-tuning adjustment of the system gain. This is done by measuring the response of the current system state configuration to the 50 MHz amplitude reference signal. All subsequent measurements are then compensated appropriately for absolute amplitude accuracy. Normally this occurs in the background when the instrument bandwidth is changed.

- **Corrections** - When set to On (the default state), the alignment firmware applies many numerical corrections to improve amplitude accuracy of the measurement. This includes an absolute amplitude adjustment at center frequency, and IF flatness correction for FFT

spans (spectral measurements). When corrections are Off, the background alignments which determine corrections are disabled. Corrections is a background feature which runs automatically, while the instrument is on.

- **Time Corr** - Time corrections are the application of a complex filter directly onto the time capture data. It compensates for the complex (magnitude and phase) response of the analog and digital IF hardware. Time corrections are less efficient (take more CPU cycles) than frequency corrections when only scalar (magnitude) FFT flatness is required, but for demod or other time-based (not FFT) measurements, only time corrections can improve the flatness of imperfect IF hardware. If the time correction functionality is set to Auto (the default), the individual measurements activate the corrections when they are needed.
- **Restore Align Defaults** - Restores the instrument's align defaults. This feature will only be needed if the instrument calibration locks up, which may occur as a result of hardware problems. Once the defaults are restored a message will appear informing you that alignment is needed.
- **Visible Align** - When toggled to Off, the alignment traces which are visible in the display during an alignment will be turned off, and the alignment process will take less time. When set to High, every alignment trace is shown, resulting in the alignment taking more time than when **Visible Align** is set to Low (the default state), where one out of ten traces is shown. Note that text showing alignment results is displayed on screen when any alignment is activated, even when the visible alignment is set to Off.

Using System Features
Using System Configuration and Alignment Keys

3 Setting the Mode

A set of mode parameters such as input and trigger settings applies to each mode. These settings affect all measurements and measurement setup parameters in the current mode.

Selecting a Mode

The Mode menu key is used to select the measurement personality you have purchased with your instrument, or to select the basic or service modes, which are native to the instrument. Upon turn-on the instrument will default to the basic mode.

- **Mode** - Accesses the measurement personality mode. Press the key that corresponds to the mode you want to select, such as **GSM** or **cdmaOne**. For a full explanation of the personality mode you have purchased, see the documentation which comes with that option.
- **Basic** - This mode is useful for making measurements that are not preset to industry standards. They can be used for troubleshooting your devices. Press **Mode**, **Basic** to switch to the basic mode, and bring up the measurements menu. For more information on these measurements go to [“Basic Measurements” on page 92](#).
- **Service** These features will help you check the functionality of your instrument. Press **Mode**, **Service**, to switch to the service mode, and bring up the service measurements menu. Features accessed through this menu include tests which check the timebase frequency, the sensors on the RF board, and the functionality of the front panel keys. For more information on these features go to [“Service Measurements” on page 141](#).

The basic waveform and spectrum measurements are available as well as a power vs time measurement which is used only for self-diagnostic purposes. The measurement setup parameters that you select while in Service mode are only used for service mode. The Basic mode settings are independent. For descriptions of the spectrum and waveform measurements refer to [“Spectrum \(Frequency Domain\) Measurements” on page 101](#) and [“Waveform \(Time Domain\) Measurements” on page 112](#).

Note that spectrum and waveform measurements are available in each personality mode, as well as in the basic and service modes. Each with their own independent mode settings.

Press **Preset** to set the instrument to a known factory default state. This sets all parameters to their factory default values for the selected mode. **Preset** does not switch the modes.

NOTE

Some features are intended for use only by service personnel and cannot be accessed without a password. If after pressing a key, a message appears requesting entry of a password, this means that the feature is meant for service use only. The password is only available through the service guide.

Mode Setup

When you select a mode the instrument automatically presets settings to defaults for that mode. These defaults apply to all measurements in the mode.

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

NOTE

Before making measurements, it is important to set the parameters under the mode setup key for the device to be tested. These parameters are not saved when you preset or power the instrument off and on, so you may want to save them in an instrument state for later use.

The **Mode Setup** key accesses: (1) the **Input** key menu of features including selecting inputs, changing input attenuation, and modifying IF align settings, and (2) the **Trigger** key menu which lets you to choose trigger setup states for the instrument.

Input Keys

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

Activate an Input Port and Adjust Input Power

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

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

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

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

Adjust Input Attenuation and Input Power.

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

NOTE

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

Adjust the IF Align Signal.**NOTE**

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

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

Trigger Keys

The Trigger key accesses the mode setup menu for the following trigger sources. See “[Trigger Source](#)” on page 96 for a description of trigger sources including:

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

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

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

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

- **Trig Holdoff** key. Sets the period of time before the next trigger can occur.
- **Auto Trig** key. Acts as a trigger timeout. If no trigger occurs by the specified time, a trigger is automatically generated. When set to On the instrument will take data when it receives a signal from the current trigger source; if no signal is received in the expected time period, the time period will default to the Free Run trigger default time period. When set to Off (the default setting) data will only be taken if a trigger has been set, and the Free Run trigger will not be automatically activated.

Setting the Mode

Mode Setup

- **Frame Timer** key. The frame timer feature uses the internal frame clock to generate a trigger signal.
 - **Period** key. Sets the period of the frame clock. Values between 33 ns and 559 ms can be entered.
 - **Offset** key. Allows entry of offset values between 33 ns and 10 s.
 - **Reset Offset Display** key. Resets the display of the **Offset** key to 0 s.
 - **Sync Source** menu key. See keys listed below.
- **Sync Source** key menu.
 - **Off** key. Deactivates any sync source trigger that has been selected and returns you to the frame timer menu.
 - **Ext Front** key. Synchronizes the measurement to an external sync source, such as a frame clock signal. The starting point is the point coinciding with the external trigger point plus the external trigger delay.
 - **Ext Rear** key. Synchronizes the measurement to an external sync source, such as a frame clock signal. The starting point is the point coinciding with the external trigger point plus the external trigger delay.

Selecting the Frequency/Channel

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

4 Making Measurements

This chapter describes measurements that are available in the Basic and Service modes. Basic mode measurements are common to many modulation formats. Service mode measurements are used to check the functionality of the instrument.

Basic Measurements

Basic measurements are useful for making measurements that are not specified in measurement standards, and will be useful if you need to troubleshoot a measurement operation. In addition, having spectrum and waveform measurements available independently of personality modes provides extra flexibility.

To access the Basic mode press the **Mode** key and select the **Basic** menu key. The following measurements are then available by pressing the **Measure** key:

- “Spectrum (Frequency Domain) Measurements” on page 101
- “Waveform (Time Domain) Measurements” on page 112
- “Adjacent Channel Power (ACP) Measurements” on page 125
- “Channel Power Measurements” on page 130
- “Making Power Stat CCDF Measurements” on page 133
- “Using Option B7C Baseband I/Q Inputs” on page 136
- “Service Measurements” on page 141

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

The 3 Steps to Set Up and Make Measurements

All measurements need to be set up in 3 steps: first at the Mode level, second at the Measurement level, then finally the result display may be adjusted.

1. Select and Set Up the Mode

Press **MODE** - All licensed, installed Modes available are shown. Press, or select **Basic** mode to make measurements of signals with non-standard formats.

Press **Mode Setup** - Make any required adjustments to the mode settings. These settings apply to all measurement in the mode.

2. Select and Set Up the Measurement

Press **MEASURE** - Select a specific measurement to be performed (e.g.). The measurement begins as soon as any required trigger conditions are met. The resulting data is shown on the display or is available for export.

Press **Meas Setup** - Make any adjustments as required to the selected measurement settings. The settings only apply to this measurement.

3. Select and Set Up a View of the Results

Press **Trace/View** - Select a display format for the current measurement data. Depending on the mode and measurement selected, other graphical and tabular data presentations may be available. **X-Scale** and **Y-Scale** adjustments may also be made now.

NOTE

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

Step	Primary Key	Setup Keys	Related Keys
1. Select & set up a Mode	MODE	Mode Setup, Input (E4406), FREQUENCY Channel	System
2. Select & set up a Measurement	MEASURE	Meas Setup	Meas Control, Restart
3. Select & set up a View of the Results	View/Trace (E4406),	SPAN X Scale, AMPLITUDE Y Scale, Display, Next Window, Zoom	File, Save, Print, Print Setup, Marker, Search (E4406),

Preparing for Measurements

All measurements need to be set up in 3 steps: first at the Mode level, second at the Measurement level, then finally the result display may be adjusted. For details on setting up a measurement using these three steps, refer to [“The 3 Steps to Set Up and Make Measurements” on page 93](#)

Using Measure Keys

The **MEASURE** front panel key allows you to activate one measurement from those available in the current mode. The measurements that are available will vary depending on which mode you have selected. It may be a measurement personality mode, the basic mode, or the service mode.

Measurement Control

Following your selection of the instrument mode and mode setup you will use keys in the **Meas Control** keys to control processes that affect the running of the current measurement.

- **Measure** - Toggles between Single and Cont (for continuous) measurement states. When set to Single the measurement will continue until it has reached the specified number of averages set by the average counter. When set to Cont the measurement will run continuously, and perform averaging according to the current average type (repeat or exponential). The default is continuous. See [“Averaging” on page 95](#) for an explanation of averaging.
- **Pause** - Pauses the current measurement. Once toggled, the label of the **Pause** key changes to read **Resume**. Measurement settings can be change while it is paused. The **Resume** key continues the active measurement from the point at which it was paused.
- **Restart** re-initiates the current measurement from the beginning (including averaging), without changing the current measurement settings. If the measurement is paused, then restart is the same as resuming from the beginning of the measurement instead of from the point at which it was paused.

Measurement Setup

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

The following features can be used with many measurements:

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

Averaging

Features in the **Average** menu allow you to modify the number, average mode, and type of averaging you use for the currently selected measurement. The features available for averaging will vary slightly depending on the measurement that is currently active. On the display averaged trace results are shown in blue, while the instantaneous signal is shown in yellow.

- **Avg Number** - Modifies the number of times the current measurement will be repeated with the results from the repeated measurements averaged. Increased averages usually give more accurate results. There will be an increase in the time taken to make a measurement if the number of averages is increased.
- **Avg Mode** - Selects between an **Exp** (exponential) or a **Repeat** mode of averaging. This selection only affects the averaging after the number of N averages is reached (set using **Avg Number**). Normal (linear) averaging is always used until the specified number of N averages is reached. When **Measure** is set to Single, data acquisitions are stopped when the number of averages is reached. Therefore **Avg Mode** has no effect on single measurements.

Exponential averaging: When **Measure** is set at Cont (continuous) data acquisitions will continue indefinitely. After N averages, exponential averaging is used with a weighting factor of N (the displayed average count stops at N). Exponential averaging weights new data more than old data, which facilitates tracking of slow-changing signals. The value of N is set through use of the **Average** key or the **Avg Bursts** key.

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

- **Avg Type** - Allows you to select type of averaging. Only the types of averaging that are appropriate for the current measurement are available in that measurement. The following average types are available:

Pwr Avg - Averages the power, which is equivalent to the rms of

the voltage. This is the default type of averaging.

Log-Pwr Avg - The log of the power is averaged. This is also known as video averaging.

Voltage Avg - The voltage is averaged.

Maximum - The maximum values are retained.

Minimum - The minimum values are retained.

Trigger Source

Changing the **Trig Source** alters the trigger source for the current measurement only. Not all of the selections are available for all measurements. Note that the **RF Burst**, **Video**, **Ext Front**, and **Ext Rear** menu keys found in the **Trigger** menu enable you to change settings to modify the delay, level, and slope for each of these trigger sources (as described on [page 89](#)). Choose one of the following trigger sources:

- **Free Run** - Triggers at the time the data is requested, completely asynchronous to the RF or IF signals.
- **Video** - Is an internal IF envelope trigger. It triggers on an absolute threshold level of the signal passed by the IF.
- **RF Burst** - Is an internal wideband RF burst trigger that has an automatic level control for burst signals.
- **Ext Front** - Activates the front panel **Ext Trigger Input**. The external trigger must be a signal between -5 and +5 volts.
- **Ext Rear** - Activates the rear panel **Trigger In**. The external trigger must be a signal between -5 and +5 volts.
- **Frame** - Uses the internal frame clock to generate a trigger signal. The clock parameters are controlled under the **Mode Setup** key or the measurement firmware, not both. See the specific measurement for details.
- **Line** - Activates an internal line trigger. Sweep triggers occur at intervals synchronized to the line frequency.

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

Changing the View

The following keys enable you to select the desired view of the measurement and to change scale parameters for the graphic window.

View/Trace Key

View/Trace - Selects a predefined view of the current measurement and

highlights the selected window. Once a window is selected, the X and Y scale keys can be used to modify scale parameters. The types of windows, and X and Y scale parameters that are available will vary, depending on the measurement you have activated.

- **Typical Measurement Windows**

Spectrum window - Select this window if you want to view a signal in parameters of frequency and power. Changes to frequency span or power will sometimes affect data acquisition. For more details see the section on spectrum measurements.

Signal Envelope window - Select this window to view a signal in parameters of time and power. For more detail see the section on waveform measurements. Both RF and BbIQ signals can be viewed in this window.

I/Q Waveform window - Select this window to view the I and Q signal characteristics of the current measurement in parameters of voltage and time. This window is in both the spectrum and waveform measurements.

Press **View/Trace, Spectrum**, to view a spectrum measurement window, or **View/Trace, Waveform** to view a waveform measurement window.

- **Trace Display**

All - Displays both the current and the average trace.

Average - Displays only the average trace. The average trace is shown in blue.

Current - Displays only the trace for the latest data acquisition. The current trace is shown in yellow.

- **Span / X Scale Keys**

Span key. This key allows you to modify the frequency span. Changes in span may affect data acquisition.

Scale/Div key. This key allows you to modify the X scale parameter in units of time.

Sweep Time key. This key allows you to modify sweep time. Changes in sweep time will affect data acquisition.

Ref Value key. This key allows you to set the value of the reference level for X scale display in units of time.

Ref Position key. This key allows you to place the current reference level on the left, the center, or the right of the display. This is used for X scale display either in units of frequency or time.

Scale/Coupling key. This key couples the scale/division to the

sweep time for measurements made in the time domain.

- **Amplitude / Y Scale Keys**

Scale/Div key. This key enables you to set the dB/Division (for the Spectrum and the RF Envelope windows) or V/Division (for the I/Q window).

Ref Value key. This key allows you to set the value of the reference, in units of dB (for the RF Envelope window), or in units of mV (for the I/Q window).

Ref Position key. This key allows you to move the current reference level to the top, center, or bottom of the display.

Using Markers

Markers enable you to make measurements on screen. Keys in the **Marker** menu control the number and types of markers you can access. **Trace** keys allow you to select the trace on which you will activate a marker. The **Search** key enables you to perform an immediate peak search and activate a marker at the peak signal.

Paths to access any of the features listed below will be found next to the specific key listed in the key access table which begins on [page 57](#).

Trace

The **Trace** keys allow you to select the trace that will be used for the other marker keys. You can then use marker features to obtain the results you desire. To access **Trace** keys press **Marker, Trace**.

NOTE

The selections in the **Trace** menu include traces on all windows for the current measurement, including windows that are not currently displayed.

When making waveform measurements you can activate the following trace keys: **RF Envelope** and **I/Q Waveform** keys.

When making spectrum measurements you can activate: **Spectrum**, **Spectrum Avg**, and **I/Q Waveform** keys. The spectrum average trace feature places a marker on the average trace in the spectrum window.

Markers

Up to four markers can appear on the display simultaneously but only one marker can be activated and moved at a time. This marker is called the “active” marker. Press **Marker** to access the keys below, except for the **Shape** and **Marker All Off** keys, which require you to press **Marker, More (1 of 2)**.

- **Normal** - Activates a single marker on the selected trace (as set by the trace key) in units either of frequency or time, depending on the

measurement mode that is currently active. However, if a marker has previously been activated, that marker will persist as the default marker until it is changed. You can change the position of the marker through use of the front panel step keys and RPG knob. Annotation in the active function area and the upper right hand corner of the display indicate the value of the active marker in units of the window which contains that marker. Pressing **Normal** also deactivates any marker delta functions which have been activated previously.

- **Select** - Enables you to select one, or more, of the four available markers. Once selected, a marker can be activated, or deactivated, by using the **Normal**, **Delta**, or **Function** keys. If a marker has previously been turned on and assigned to a specific trace it will become active on that trace when the **Select** key is pressed.
- **Delta** - Places two markers on the selected trace or, if a marker is already active, places a second marker at the position of the active marker. You can activate up to two sets of delta markers. Annotation in the active function area and in the upper-right corner of the display show differences between the two markers in the units of the window which contains that marker.
- **Off** - Turns off the selected marker (as set by the **Select** key).
- **Marker All Off** - Turns off all markers.
- **Shape** - Allows you to select markers in the shapes of diamonds, crosses, squares, and lines. The line markers run vertically, from the bottom to the top of the display, while the diamond, square, and cross shapes simply allow you to distinguish different points on the trace by using different shapes. You may use up to four different shaped markers at a given time, although only one may be active.

Marker Functions

The marker **Function** menu key enables you to use two marker functions: **Band Power** and **Noise**. These functions do not apply to all measurements; if you attempt to press a function key for a function that is not applicable to that measurement a message will appear telling you that the function is not supported under the current measurement. These functions are described below. Press **Marker, Function** to access the following keys.

- **Band Power** - Allows you to place two markers to either side of a band so you can measure the power within that band. You can use the RPG knob to move the band markers; the numerical power reading will be visible in the upper right corner of the display. This feature is particularly useful for measuring channel power.
- **Noise** - Normalizes the equivalent amplitude of the measured noise to a 1 Hz bandwidth, which is centered around the displayed marker. This is done by sampling and displaying the average of 32 data

points.

Search Marker

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

Spectrum (Frequency Domain) Measurements

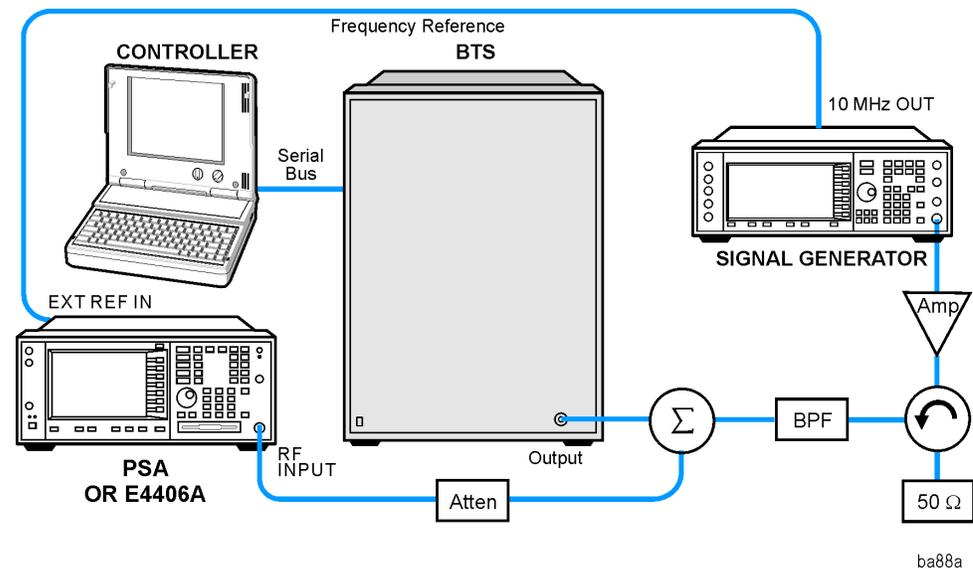
This section explains how to make a frequency domain measurement on a cellular base station. An adjacent or an interfering signal can also be applied, if desired, during spectrum measurements.

Configuring the Measurement System

This example shows a base station (BTS) under test set up to transmit RF power, and being controlled remotely by a system controller. The transmitting signal is connected to the analyzer RF input port. Connect the equipment as shown.

Figure 4-1

Spectrum Measurement System



1. Using the appropriate cables, adapters, and circulator, connect the output signal of the BTS to the RF input of the instrument.
2. Connect the base transmission station simulator or signal generator to the BTS through a circulator to initiate a link constructed with sync and pilot channels, if required.
3. Connect a BNC cable between the 10 MHz OUT port of the signal generator and the EXT REF IN port of the instrument.
4. Connect the system controller to the BTS through the serial bus cable to control the BTS operation.

Setting the BTS

From the base transmission station simulator and the system controller, set up a call using loopback mode to allow the BTS to transmit RF signal.

Measurement Procedure

- Step 1.** Press the **Preset** key to preset the instrument.
- Step 2.** Press the **MODE**, **Basic** keys to enable the Basic Mode measurements.
- Step 3.** To set the measurement center frequency press the **FREQUENCY Channel** key, enter a numerical frequency using the front-panel keypad, and complete the entry by selecting a units key, like **MHz**.
- Step 4.** Press the **SPAN** key, enter a numerical span using the front-panel keypad, and press the **MHz** key to set the measurement span in MHz.
- Step 5.** Press the **MEASURE** to initiate the spectrum measurement, which is the default measurement for Basic.

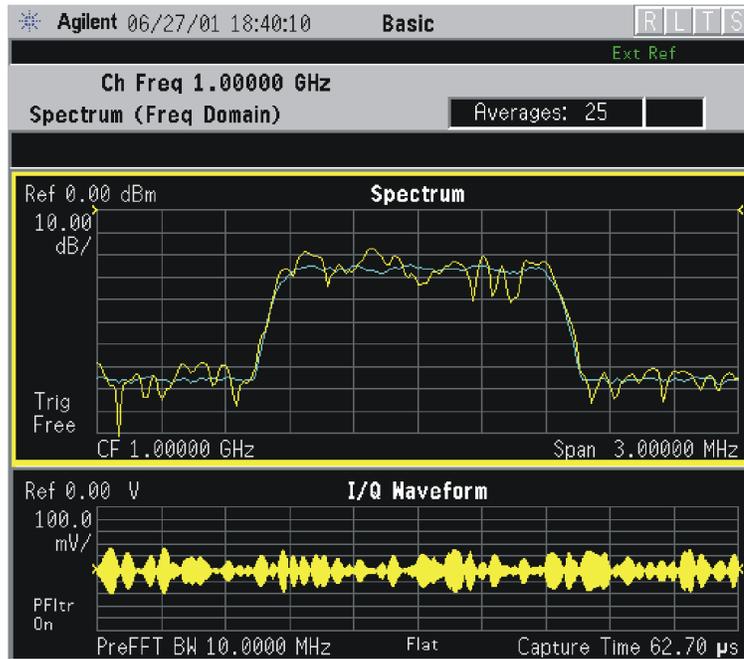
NOTE

A display with both a Spectrum window and an I/Q Waveform window will appear when you activate a Spectrum measurement. The active window is outlined in green. Changes to **FREQUENCY**, **Span**, or **Amplitude** settings will affect only the active window. Use the **Next Window** key to select a different window, and the **Zoom** key to enlarge a window.

The default display shows both **Current** (yellow trace) and **Average** (blue trace) data. To make viewing the display easier, you can view either the **Current** trace or **Average** separately.

- Press **Trace/View**, **Trace Display**, and select the trace(s) desired for display.

Figure 4-2 Spectrum Measurement - Spectrum and I/Q Waveform (Default View)

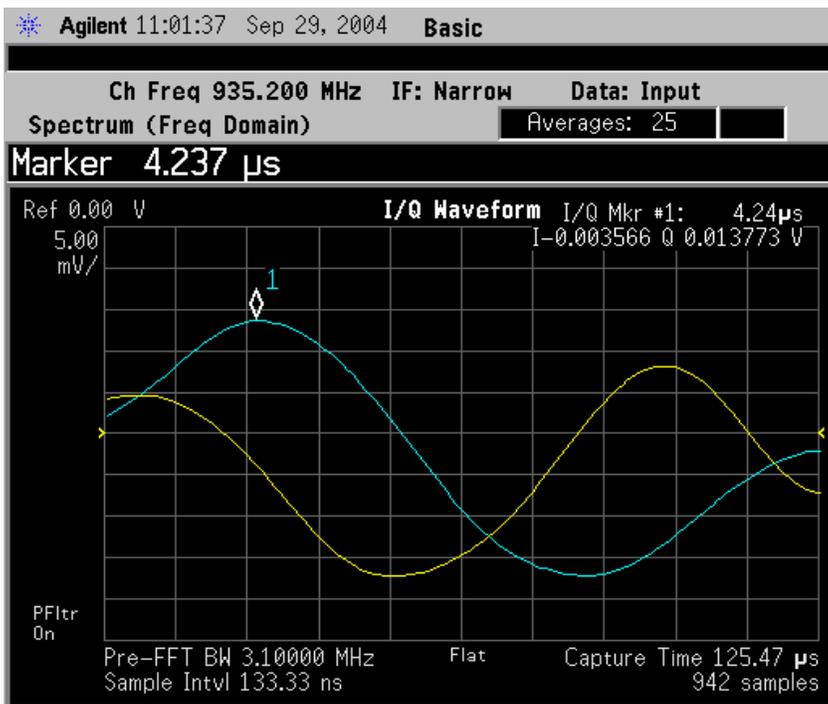


The spectrum measurement result should look like the above figure. The measurement result values are shown in the summary result window.

Step 6. Press the **View/Trace** key to display a menu allowing selection of another measurement result display including the following:

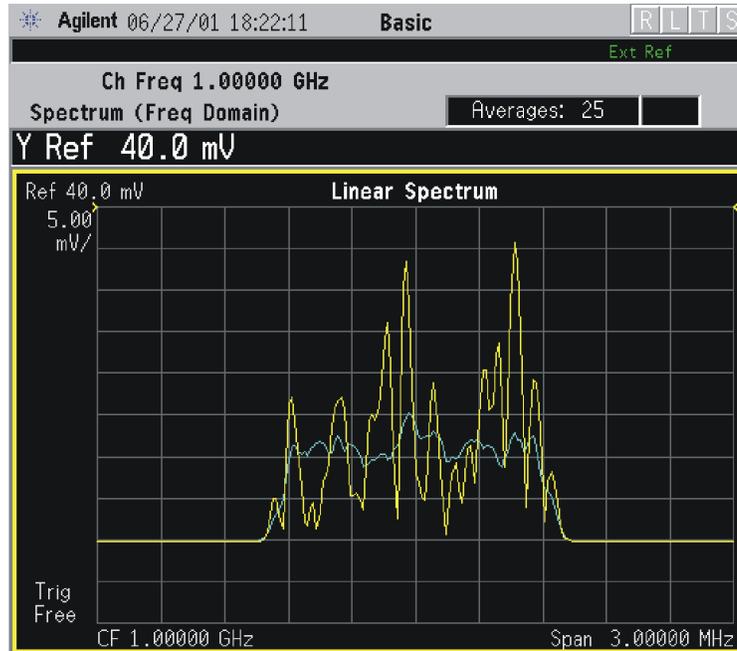
- **Spectrum** - Provides a combination view of the spectrum graph in parameters of power versus frequency with semi-log graticules, and the I/Q waveform graph in parameters of voltage and time. Changes to frequency span or power will sometimes affect data acquisition. This is equivalent to changing the selected window with the **Next** key.
- **Spectrum (Time Domain) I/Q Waveform** - (Key for PSA only) This graph is shown below the Spectrum graph in the default dual-window display. I/Q Waveform provides a view of the I/Q waveform in parameters of voltage versus time in linear scale. Changes to sweep time or resolution bandwidth can affect data acquisition.

Figure 4-3 Spectrum (Time Domain) Measurement - I/Q Waveform Result



- **Spectrum Linear** - (for E4406A) Provides a view of the spectrum graph in parameters of voltage versus frequency in linear scale. Changes to frequency span or voltage can affect data acquisition.

Figure 4-4 Spectrum Measurement - Linear Spectrum View (for E4406A)



*Meas Setup: View/Trace = Spectrum Linear,
Span = 3.000 MHz,
Y Scale/Div = 5.00 mV, Ref Value = 30.0 mV,
Others = Factory default settings

*Input signals: -10.00 dBm, 9 channels of SR1, cdma2000 Rev 8

NOTE

(for E4406A) For the widest spans, the I/Q window becomes just “ADC time domain samples”, because the I/Q down-conversion is no longer in effect. This is not the case for E4406A Option B7C if the **Input Port** is set to either **I/Q**, **I only**, or **Q only** and you have connected baseband I/Q signals to the **I/Q INPUT** connectors.

- **I and Q Waveform** - (for E4406A) Provides individual views of the I and Q signal waveform windows in parameters of voltage versus time.

To select the I or Q trace view, press the **Next** key at the bottom of the display. The selected window will have a green outline. To view the window full size press the **Zoom** key.

Figure 4-5 Spectrum Measurement - I and Q Waveform View (for E4406A)

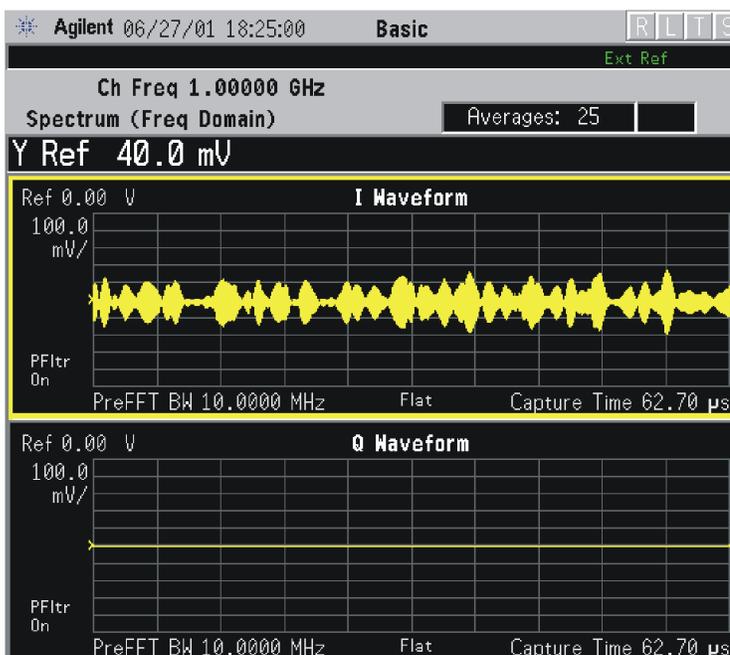
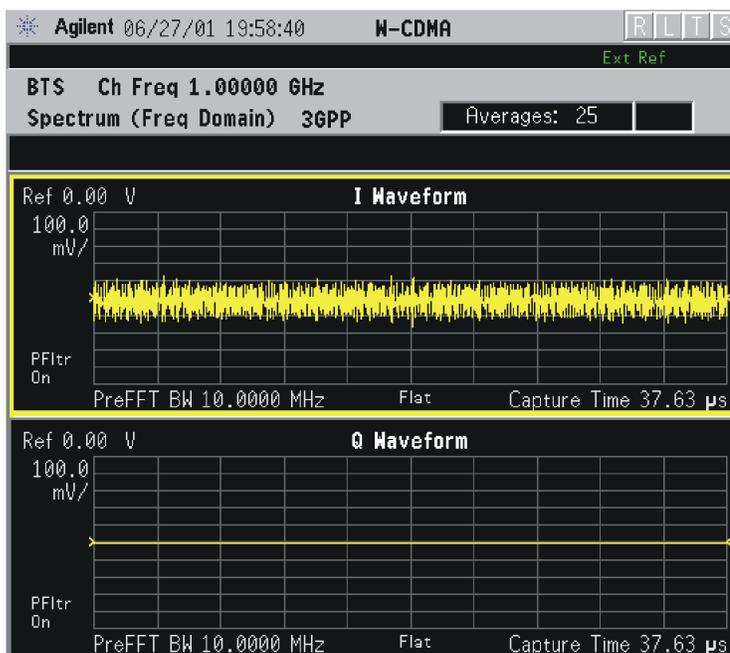


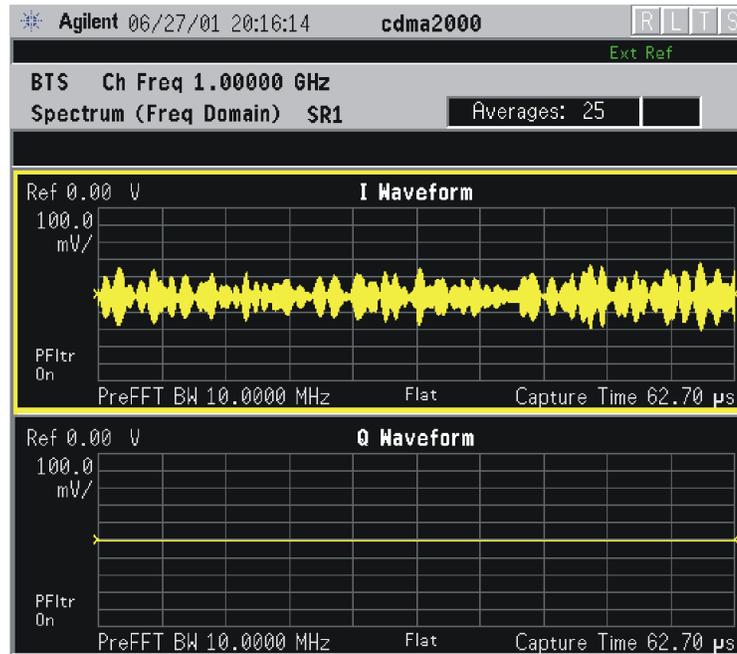
Figure 4-6 Spectrum Measurement - I and Q Waveform View (for E4406A)



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

*Input signals: -10.00 dBm, PCCPCH + SCH

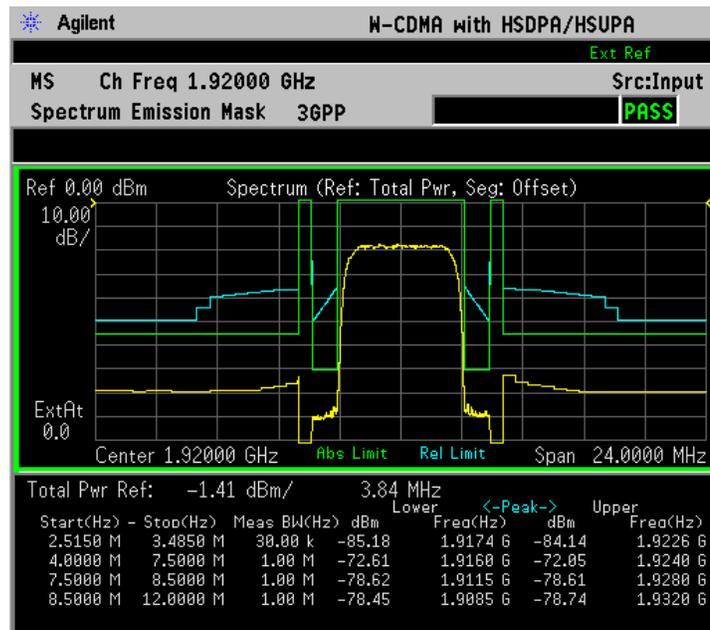
Figure 4-7 Spectrum Measurement - I and Q Waveform View (for E4406A)



*Meas Setup: View/Trace = I and Q Waveform,
AMPLITUDE Y Scale = 5.00 mV,
Others = Factory default settings

*Input signals: -10.00 dBm, 9 channels of SR1, cdma2000 Rev 8

Figure 4-8 Spectrum Measurement - I and Q Waveform View (for E4406A)

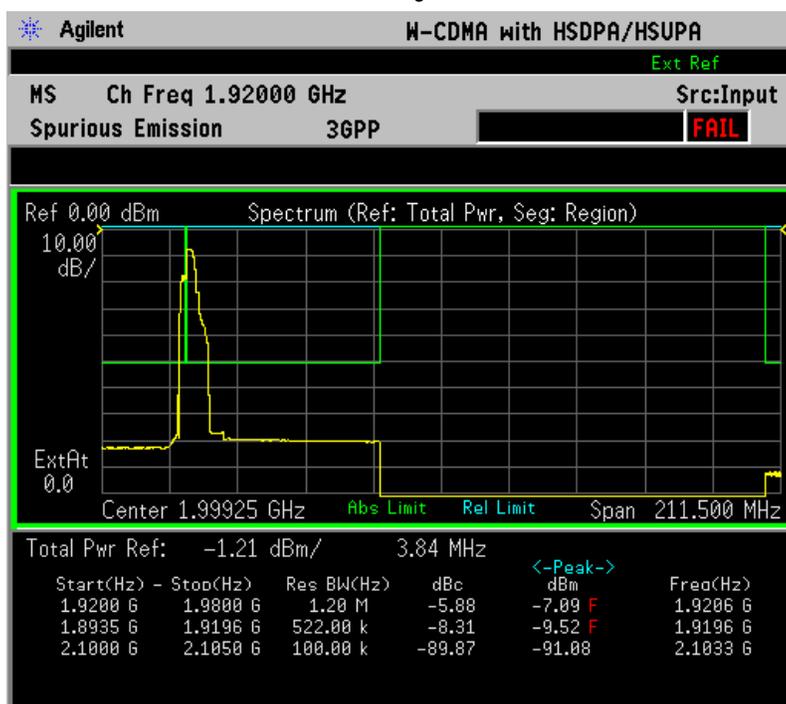


*Meas Setup: View/Trace = I and Q Waveform,
Others = Factory default settings

Making Measurements

*Input signals: -10.00 dBm, Pilot channel, 1xEV-DO

Figure 4-9 Spectrum Measurement - I and Q Waveform View (for E4406A)



*Meas Setup: View/Trace = I and Q Waveform
Span = 500.000 kHz,
Y Scale/Div = 5.0 mV, Ref Value = 0.0 V,
Others = Factory default settings

*Input signals: -20.00 dBm, EDGE pattern data (PN9)

- **I/Q Polar** - (for E4406A) Provides a view of the I/Q signal displayed in a polar vector graph.

Figure 4-10 Spectrum Measurement - I/Q Polar View (for E4406A)

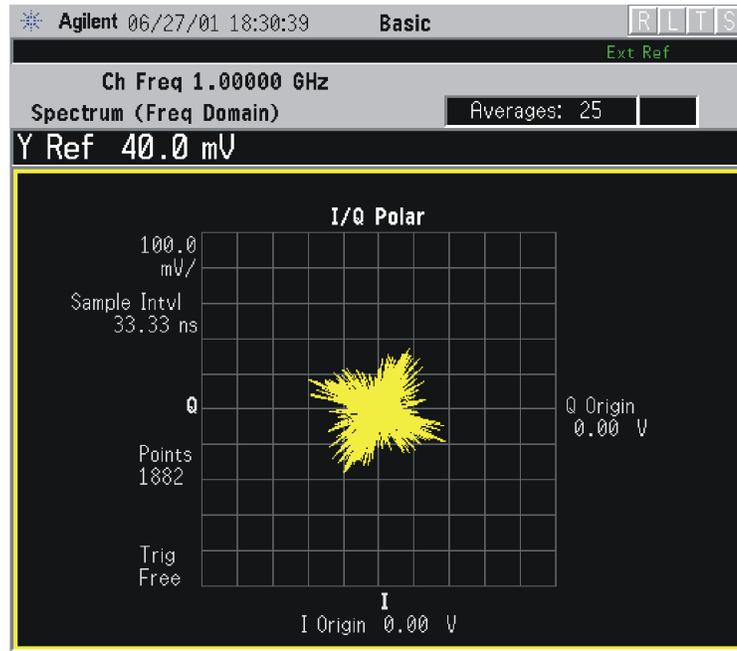
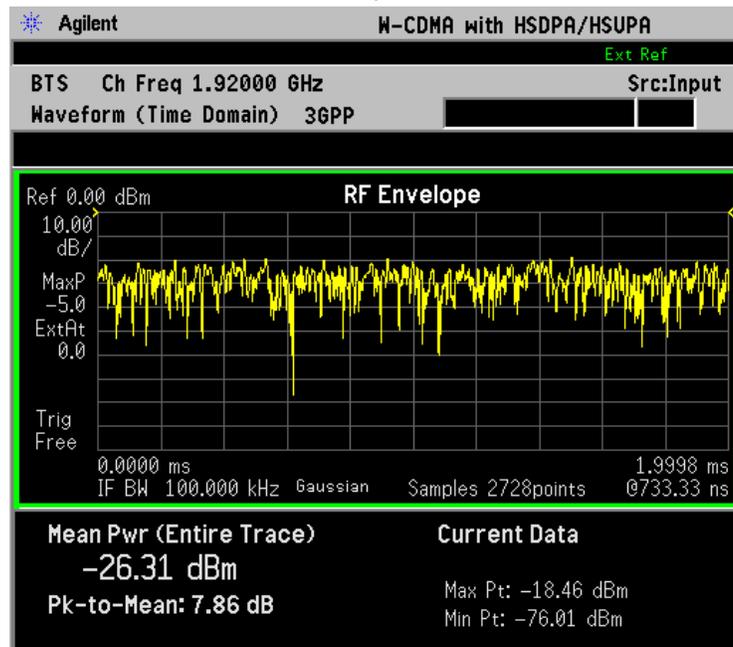


Figure 4-11 Spectrum Measurement - I/Q Polar View (for E4406A)



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

*Input signals: -10.00 dBm, PCCPCH + SCH

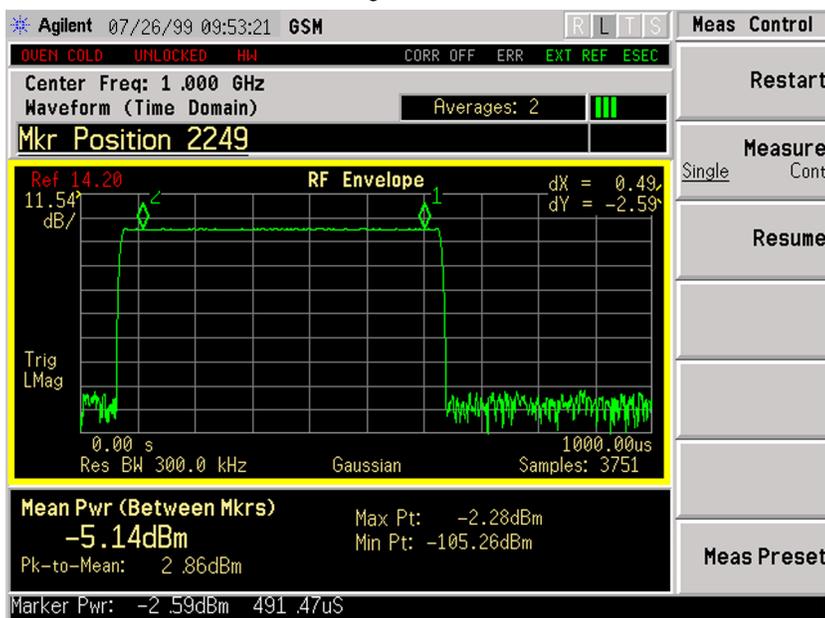
Figure 4-12 Spectrum Measurement - I/Q Polar View (for E4406A)



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

*Input signals: -10.00 dBm, Pilot channel of SR1, cdma2000 Rev 8

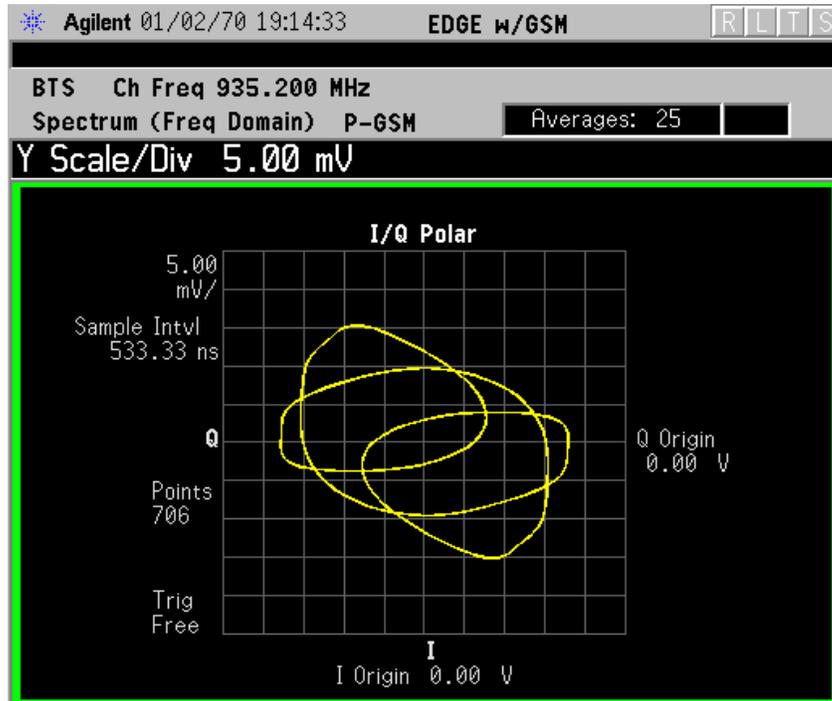
Figure 4-13 Spectrum Measurement - I/Q Polar View (for E4406A)



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

*Input signals: -10.00 dBm, Pilot channel, 1xEV-DO

Figure 4-14 Spectrum Measurement - I/Q Polar View (for E4406A)



*Meas Setup: View/Trace = I/Q Polar
Span = 500.000 kHz,
Y Scale/Div = 5.0 mV, Ref Value = 0.0 V,
Others = Factory default settings

*Input signals: -20.00 dBm, EDGE pattern data (PN9)

Step 7. To make a measurement repeatedly, press **Meas Control**, **Measure** to toggle the setting from **Single** to **Cont**.

Step 8. Press the **Meas Setup**, **More (1 of 2)** keys to check the keys available to change the measurement parameters from the default condition

For more details about changing measurement parameters, see
[“Spectrum \(Frequency Domain\) Measurement Concepts” on page 222](#)

Waveform (Time Domain) Measurements

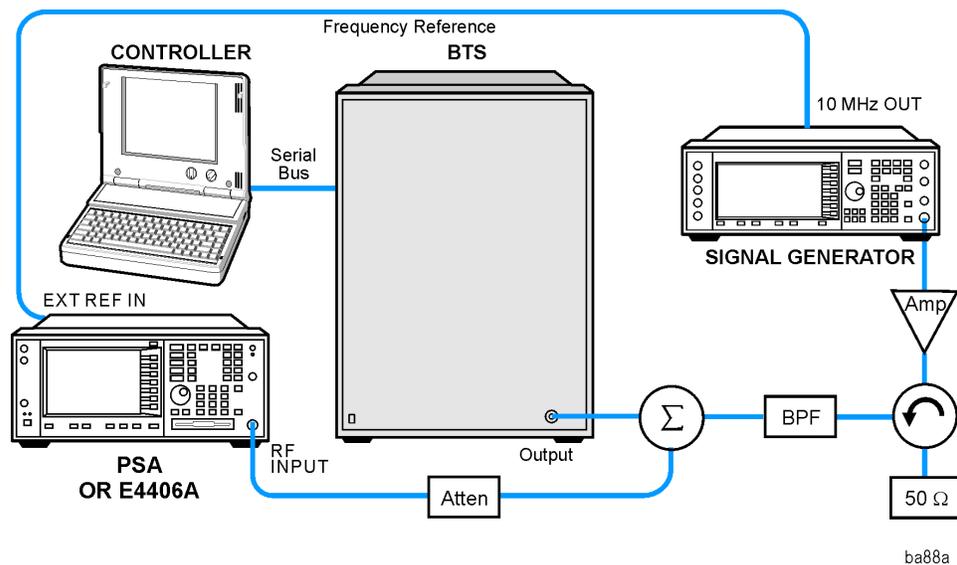
This section explains how to make waveform (time domain) measurement on a cellular base station. Measurement of I and Q modulated waveforms in the time domain disclose the voltages which comprise the complex modulated waveform of a digital signal.

Configuring the Measurement System

The base station (BTS) under test has to be set to transmit the RF power remotely through the system controller. This transmitting signal is connected to the instruments RF input port. Connect the equipment as shown. An interfering or adjacent signal may supplied as shown.

Figure 4-15

Waveform Measurement System



1. Using the appropriate cables, adapters, and circulator, connect the output signal of the BTS to the RF input of the instrument.
2. Connect the base transmission station simulator or signal generator to the BTS through a circulator to initiate a link constructed with sync and pilot channels, if required.
3. Connect a BNC cable between the 10 MHz OUT port of the signal generator and the EXT REF IN port of the instrument.
4. Connect the system controller to the BTS through the serial bus cable to control the BTS operation.
5. Connect an external trigger, if needed. Press **Mode Setup, Trigger** to access a menu to set up inputs and levels for all triggers. You must then select the appropriate trigger under the **Meas Setup, Trigger** menu to direct the measurement to use your trigger settings.

Setting the BTS

From the base transmission station simulator and the system controller, set up a call using loopback mode for the BTS to transmit the RF signal.

Measurement Procedure

- Step 1.** Press the **Preset** key to preset the instrument.
- Step 2.** Press the **MODE**, Basic keys to enable the Basic Mode measurements.
- Step 3.** To set the measurement center frequency press the **FREQUENCY Channel** key, enter a numerical frequency using the front-panel keypad, and complete the entry by selecting a units key, like **MHz**.
- Step 4.** Press the **SPAN** key, enter a numerical span using the front-panel keypad, and press the **MHz** key to set the measurement span in MHz.
- Step 5.** Press the **MEASURE** to initiate the Waveform measurement.

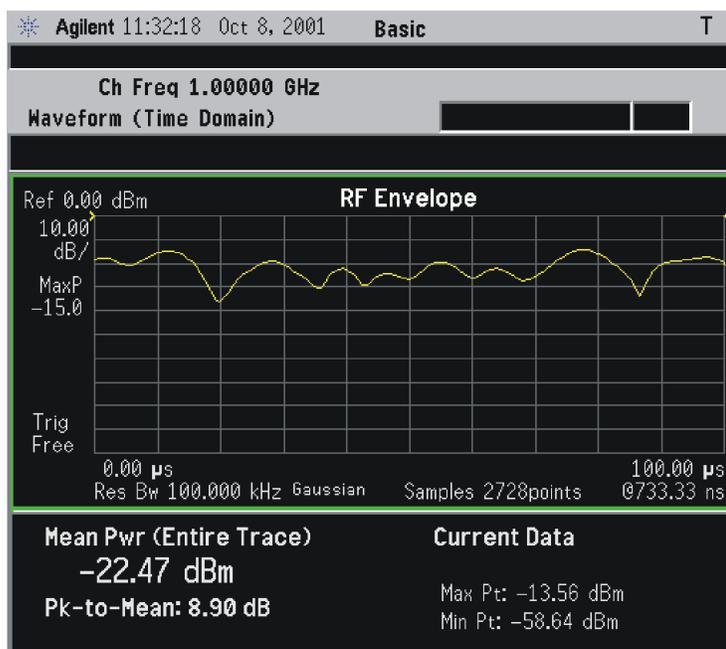
The default display shows both **Current** (yellow trace) and **Average** (blue trace) data. To make viewing the display easier, you can view either the **Current** trace or **Average** separately.

- Press **Trace/View**, **Trace Display**, and select the trace(s) desired for display.

- Step 6.** Press **SPAN X Scale**, and the up or down arrow keys until the waveform is shown at a convenient time scale for viewing.

The next figure shows an example of an **RF Envelope** (key is called **Signal Envelope** on VSA) result for a waveform (time domain) measurement. The measured values for the mean power and peak-to-mean power are shown in the text window.

Figure 4-16 Waveform Measurement - RF Envelope (Default View)

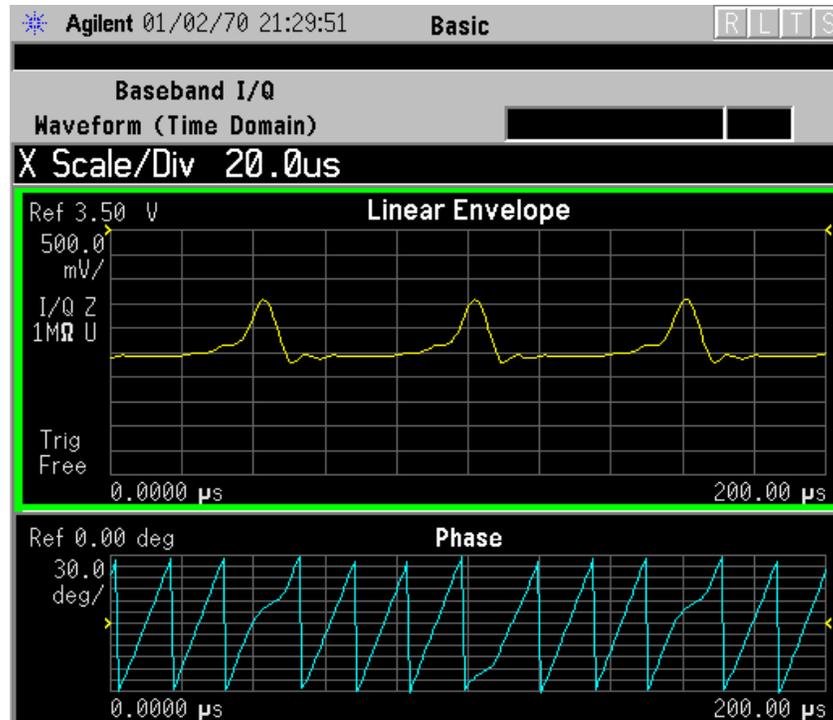


*Meas Setup: Trace/View = RF Envelope,
Others = Factory default settings

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

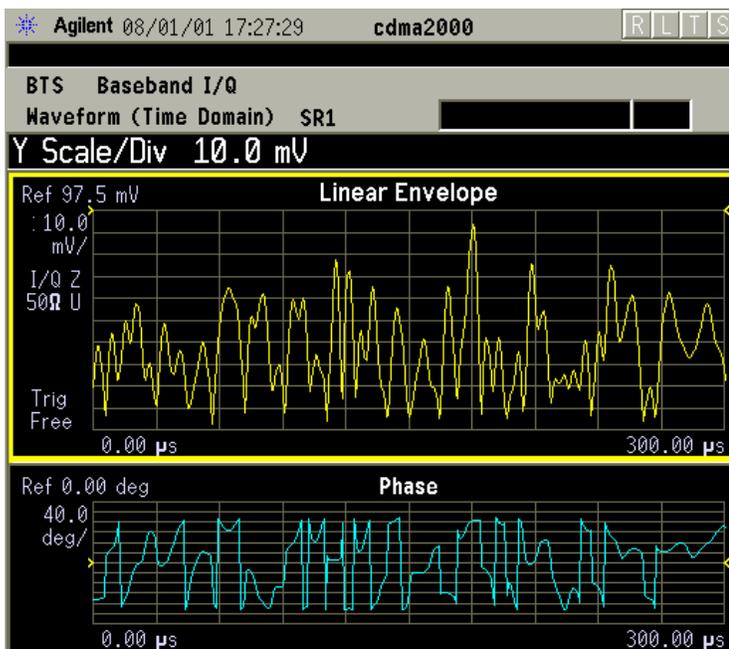
- Step 7.** Press the **Trace/View** (for PSA) or **View/Trace** (for E4406A) key to display the menu allowing selection of the other Waveform views, including the following:
- **Linear Envelope** - (for E4406A Option B7C) Provides a combination view of a linear signal envelope graph and a phase graph with linear graticules. Use the **Next Window** and **Zoom** keys to select and enlarge either graph.

Figure 4-17 Waveform Measurement - Linear Envelope View



*Meas Setup: View/Trace = Linear Envelope View, GSM signal
Others = Factory defaults, except X and Y scales

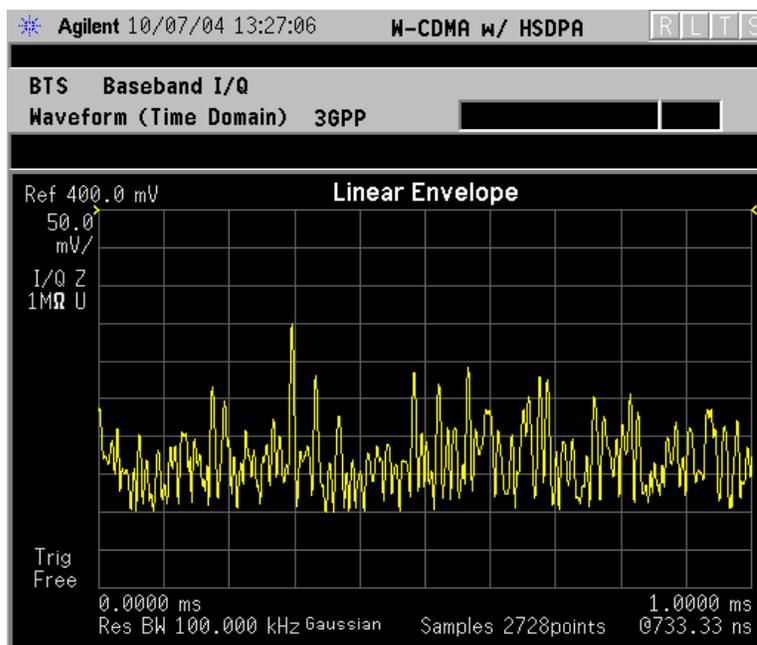
Figure 4-18 Waveform Measurement - Linear Envelope View



*Meas Setup: View/Trace = Linear Envelope View,
Others = Factory defaults, except X and Y scales

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

Figure 4-19 Waveform Measurement - Linear Envelope View

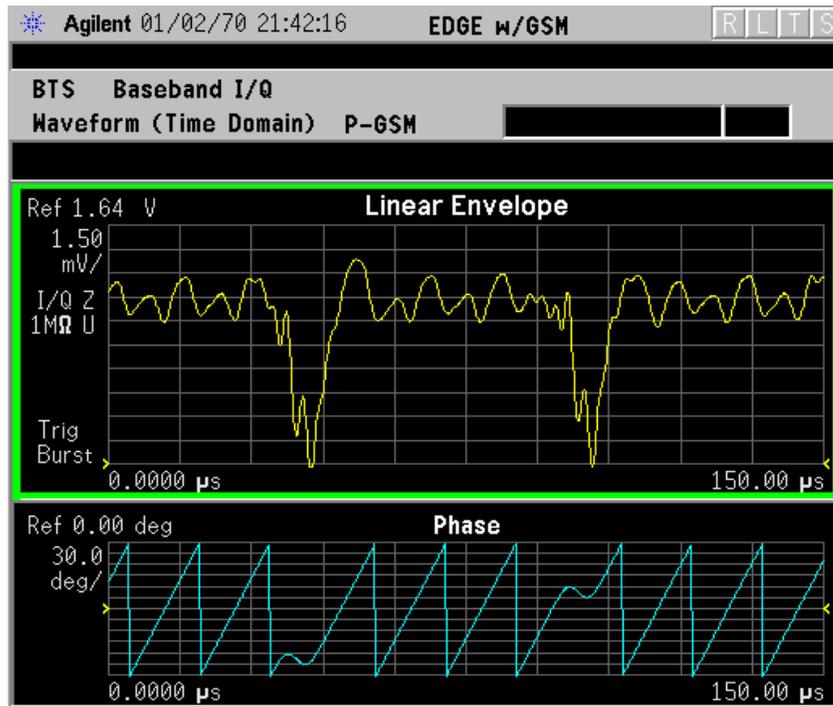


*Meas Setup: View/Trace = Linear Envelope View,
Others = Factory defaults, except X and Y scales

*Input signal: W-CDMA (3GPP 3.4 12-00), 1 DPCH,

Figure 4-20

Waveform Measurement - Linear Envelope View

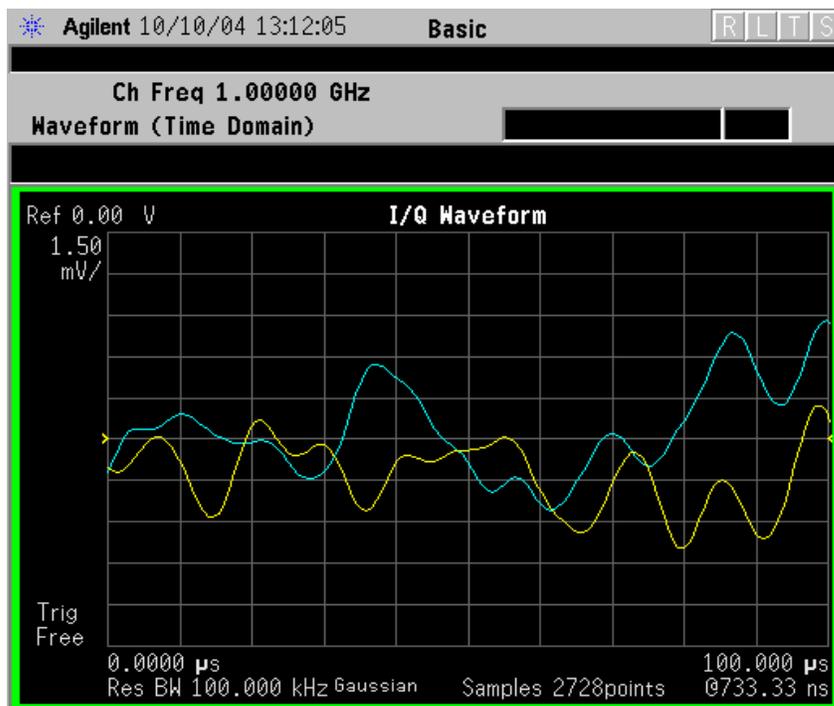


*Meas Setup: View/Trace = Linear Envelope View,
Others = Factory defaults, except X and Y scales

*Input signal: EDGE Standard pattern (4-1s and 4-0s)

- **I/Q Waveform** - Provides a view of the I and Q waveforms together on the same graph in parameters of voltage versus time in linear scale. Changes to sweep time or resolution bandwidth can affect data acquisition.

Figure 4-21 Waveform Measurement - I/Q Waveform View



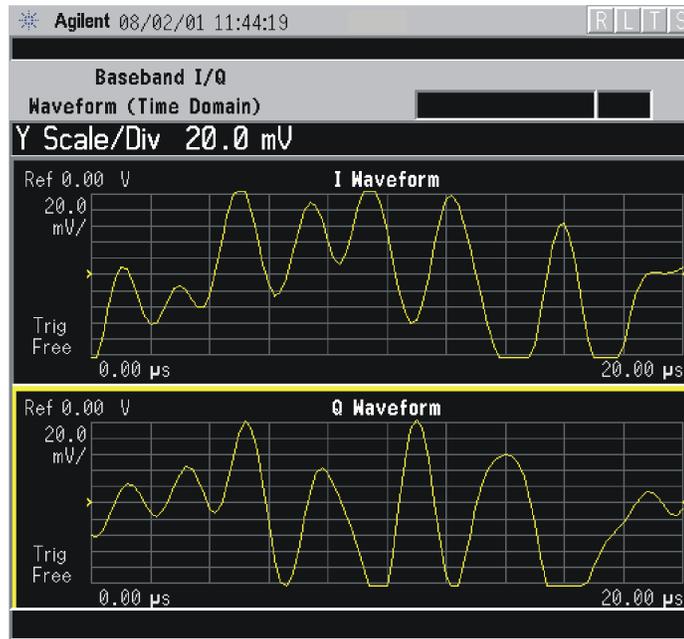
NOTE For the widest spans, the I/Q Waveform window becomes just “ADC time domain samples”, because the I/Q down-conversion is no longer in effect.

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

- **I and Q Waveform** - (for E4406A Option B7C) Provides a combination view of the I and Q signal waveform graphs in the linear scales.

Figure 4-22

Waveform Measurement - I and Q Waveform View



Making Measurements

Figure 4-23

Waveform Measurement - I and Q Waveform View

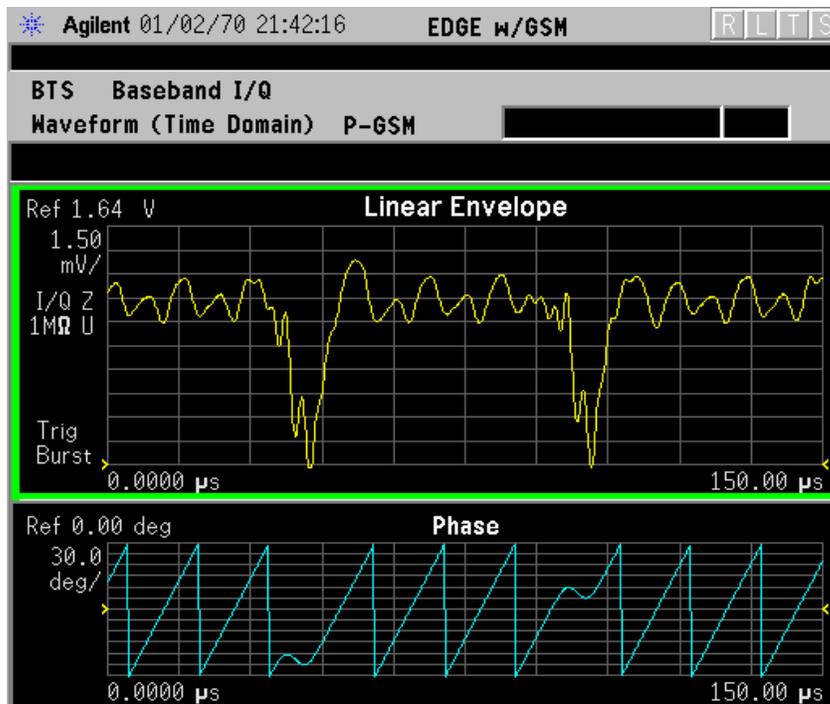
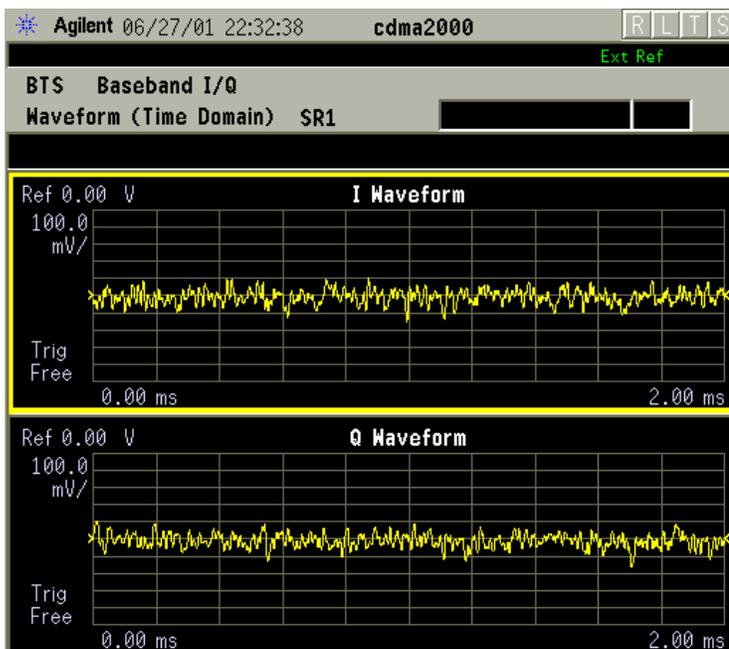


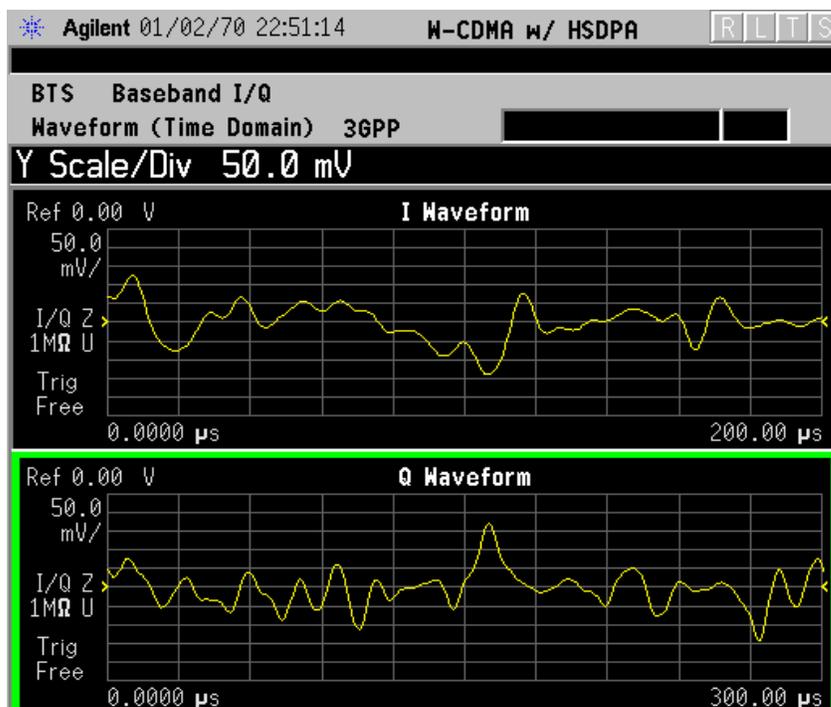
Figure 4-24 Waveform Measurement - I and Q Waveform View



*Meas Setup: View/Trace = I and Q Waveform View,
Others = Factory defaults, except X and Y scales

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

Figure 4-25 Waveform Measurement - I and Q Waveform View

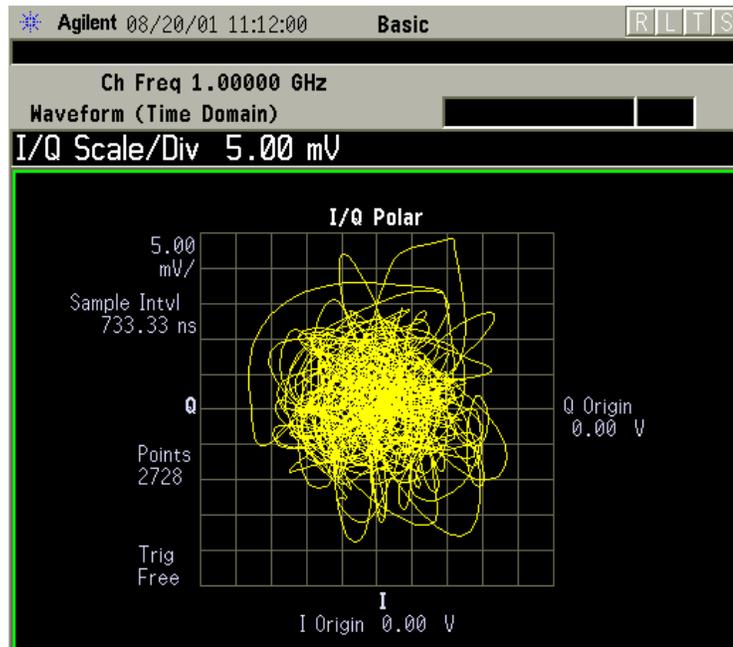


*Meas Setup: View/Trace = I and Q Waveform View,
Others = Factory defaults, except X and Y scales

*Input signal: W-CDMA (3GPP 3.4 12-00), 1 DPCH,

- **I/Q Polar** - (for E4406A) Provides a view of the I/Q signal in a polar vector graph.

Figure 4-26 Waveform Measurement - I/Q Polar View



Making Measurements

Figure 4-27 Waveform Measurement - I/Q Polar View

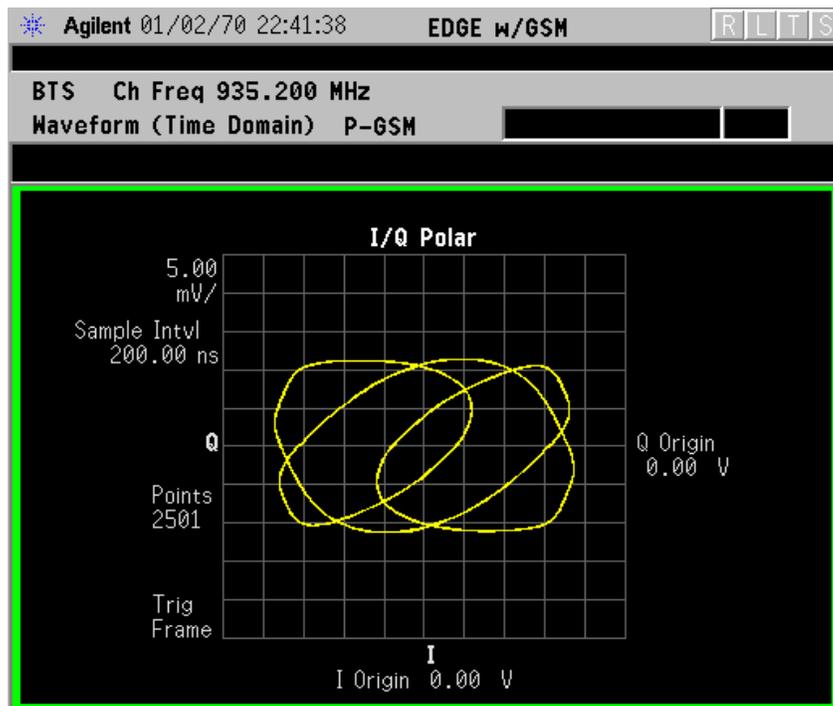
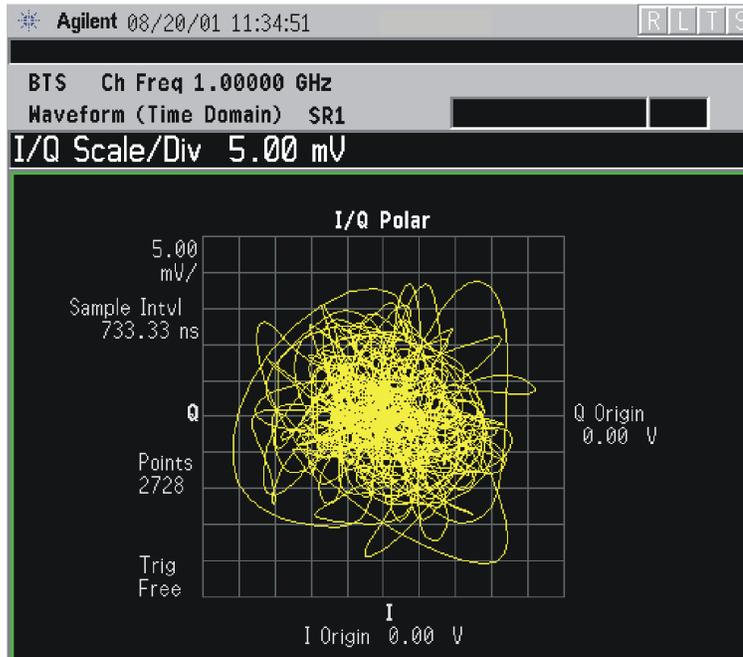


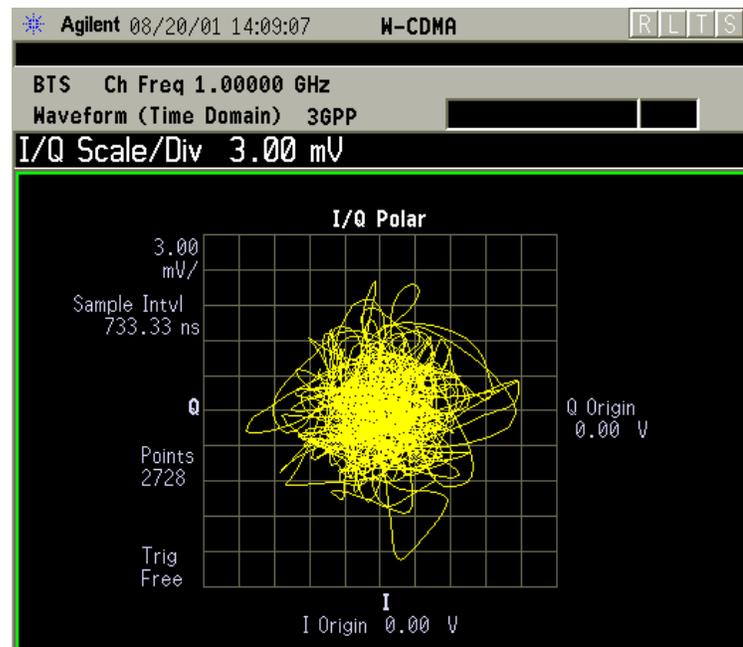
Figure 4-28 Waveform Measurement - I/Q Polar View



*Meas Setup: View/Trace = I/Q Polar View,
Others = Factory defaults, except X and Y scales

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

Figure 4-29 Waveform Measurement - I/Q Polar View



*Meas Setup: View/Trace = I/Q Polar View,
Others = Factory defaults, except X and Y scales

*Input signal: W-CDMA (3GPP 3.4 12-00), 1 DPCH,

Figure 4-30 Waveform Measurement - I/Q Polar View



*Meas Setup: View/Trace = I/Q Polar,
Trigger Source = Ext Rear,
Others = Factory default settings

*Input signal: -10 dBm, Idle slot, 1xEV-DO

- Step 8.** Press the **AMPLITUDE Y Scale**, and down arrow keys until the waveforms are shown at a convenient voltage scale for viewing.
- Step 9.** Press the **SPAN X Scale**, and down arrow keys until the waveforms are shown at a convenient time scale for viewing.
- Step 10.** Press the **Marker, Trace**, and **I/Q Waveform** keys to activate a marker. Rotate the RPG knob until the marker is shown at a desired time in the waveform for viewing the trace values at the time position of the marker.
- Step 11.** To make a measurement repeatedly, press **Meas Control, Measure** to toggle the setting from **Single** to **Cont**.
- Step 12.** Press the Meas Setup, More (1 of 2) keys to check the keys available to change the measurement parameters from the default condition.

Using the Waveform Measurement to Set Up Triggering (for burst signals)

You can use the waveform measurement to view your signal in the time domain and to help select the appropriate trigger to acquire your signal.

- Step 1.** Activate the waveform measurement view:

Press **MEASURE, Waveform (Time Domain)**.

Step 2. Adjust the scale of the x-axis to view the complete signal waveform:

Press **SPAN X Scale, Scale/Div**, then use the front-panel keypad to input the scale/div, then press a units key, like μs , to complete the entry.

Step 3. Select a trigger source (free run is the default setting):

Press **Meas Setup, Trig Source**, then select one of the available trigger sources.

Step 4. Setup the trigger conditions:

Press **Trig** or for E4406A press **Mode Setup, Trigger Setup**, then choose a trigger mode.

In the trigger mode set the delay, peak level and positive or negative edge slope trigger. You can also setup trigger holdoff, auto trigger timing and frame timer settings.

For more details about using PSA Option 122, 80 MHz BW Digitizing Hardware, and PSA Option 140, 40 MHz Digitizing Hardware, including detailed function descriptions, SCPI commands and concepts, see the PSA Basic Mode Guide.

For more details about changing measurement parameters, see [“Waveform \(Time Domain\) Measurement Concepts” on page 223](#)

Adjacent Channel Power (ACP) Measurements

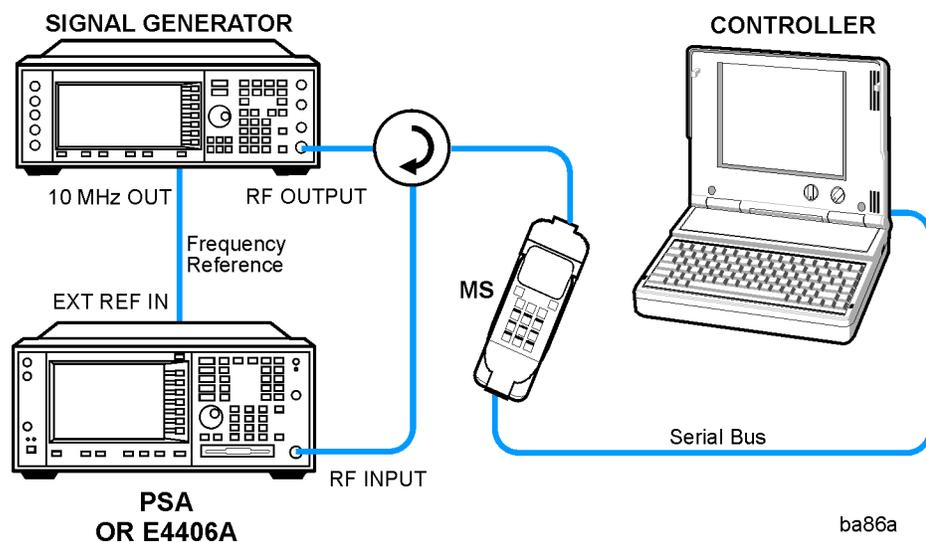
This section explains how to make an adjacent channel power (ACP) measurement on a cellular mobile station. ACP is a measurement of the amount of interference, or power, in an adjacent frequency channel. The results are displayed as a bar graph or as spectrum data, along with measurement data at specified offset.

Configuring the Measurement System

The mobile station (MS) under test has to be set to transmit the RF power remotely through the system controller. This transmitting signal is connected to the instruments RF input port. Connect the equipment as shown.

Figure 4-31

Adjacent Channel Power Ratio Measurement System



1. Using the appropriate cables, adapters, and circulator, connect the output signal from the MS to the RF input port of the instrument.
2. Connect the base transmission station simulator or signal generator to the MS through a circulator to initiate a link constructed with the sync and pilot channels, if required.
3. Connect a BNC cable between the 10 MHz OUT port of the signal generator and the EXT REF IN port of the instrument.
4. Connect the system controller to the MS through the serial bus cable to control the MS operation.

Setting the MS

From the base transmission station simulator and the system

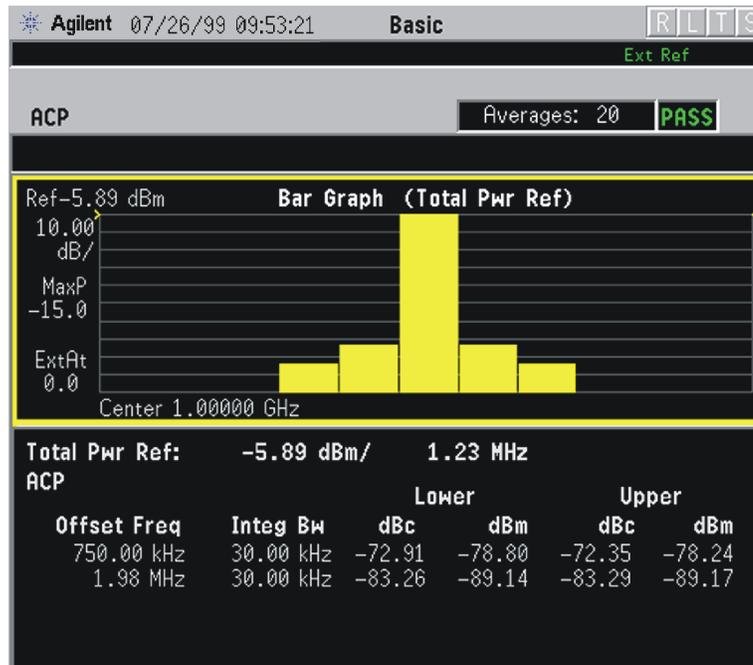
controller, set up a call using loopback mode to transmit the RF power.

Measurement Procedure

- Step 1.** Press the **Preset** key to preset the instrument. The settings will default to IS-95 standards.
- Step 2.** Press the **MODE**, **Basic** keys to enable the Basic Mode measurements.
- Step 3.** Press the **Mode Setup**, **Radio**, **Device** keys and toggle to select **MS** or **BTS**.
- Step 4.** To use settings different than for an IS-95 signal, press the **Meas Setup**, **Offsets and Limits** keys and select settings for your signal of interest. For more information see [“Adjacent Channel Power \(ACP\) Keys”](#) on page 168.
- Step 5.** To set the measurement center frequency press the **FREQUENCY Channel** key, enter a numerical frequency using the front-panel keypad, and complete the entry by selecting a units key, like **MHz**. Depending on the measurement selected, you may have other keys available to select a channel or slot. For more information see “FREQUENCY Channel Key Menu”.
- Step 6.** Press the **MEASURE**, **ACP** keys to initiate the adjacent channel leakage power ratio measurement.

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

Figure 4-32 Basic ACP Measurement - Bar Graph (Default) View



The ACP Bar Graph measurement result should look like the above figure. The bar graph (referenced to the total power) and a text window are displayed. The text window shows the absolute total power reference, while the lower and upper offset channel power levels are displayed in both absolute and relative readings. In this example the test failed because of excessive power in the lower region.

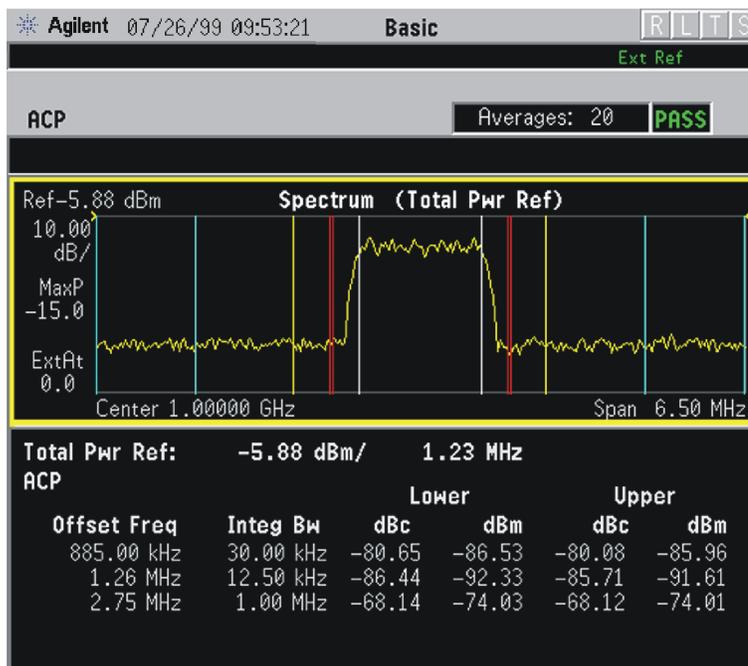
In the factory default condition, 5 of the total integration power levels, centered at the carrier frequency and ± 765.0 kHz and ± 1.995 MHz offset frequencies, are shown in the default result display. The corresponding measured data is shown in the text window. Depending on the **Meas Type** selection, one of the two following displays is obtained:

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

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

Step 7. Press the **View/Trace, Spectrum** keys to see the ACP Spectrum graph view with the bandwidth marker lines in the graph window. In the factory default condition, the frequency spectrum with the FFT sweep type is displayed with the bandwidth marker lines in the graph window. The corresponding measured data in the text window is the total integration power levels, in dBc and dBm, within the defined bandwidth as shown in the figure below.

Figure 4-33 ACP Measurement - Spectrum View



Step 8. If desired, select a **Meas Type** setting. Depending on the **Meas Type** setting, one of the two following displays is obtained:

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

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

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

If **Sweep Type** is set to **Swp**, the swept frequency ACPR is displayed as shown below and only **Spectrum** is available for **View/Trace**.

While in this view, you can change the vertical scale by pressing the **AMPLITUDE Y Scale** key.

Troubleshooting Hints

The adjacent channel power ratio measurement can reveal degraded or

defective parts in the transmitter section of the UUT. The following examples are some areas which can contribute to poor ACPR:

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

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

NOTE

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

For more information on ACP measurements see “[Adjacent Channel Power \(ACP\) Measurement Concepts](#)” on page 218.

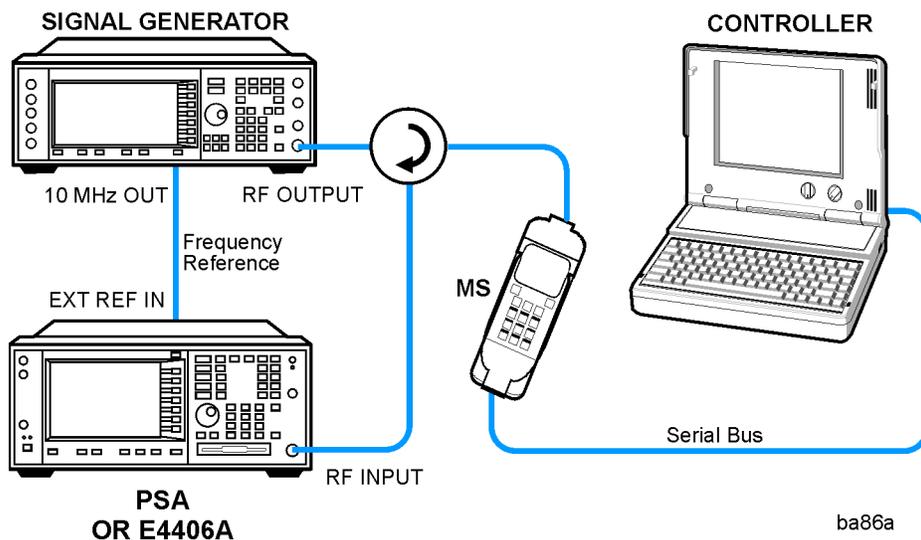
Channel Power Measurements

This section explains how to make a cellular measurement on a cellular mobile station. This test measures the total RF power present in the channel. The results are displayed graphically as well as in total power (dB) and power spectral density (dBm/Hz).

Configuring the Measurement System

The mobile station (MS) under test has to be set to transmit the RF power remotely through the system controller. This transmitting signal is connected to the instrument's RF input port. Connect the equipment as shown.

Figure 4-34 Channel Power Measurement System



1. Using the appropriate cables, adapters, and circulator, connect the output signal from the MS to the RF input port of the instrument.
2. Connect the base transmission station simulator or signal generator to the MS through a circulator to initiate a link constructed with the sync and pilot channels, if required.
3. Connect a BNC cable between the 10 MHz OUT port of the signal generator and the EXT REF IN port of the instrument.
4. Connect the system controller to the MS through the serial bus cable to control the MS operation.

Setting Up the MS

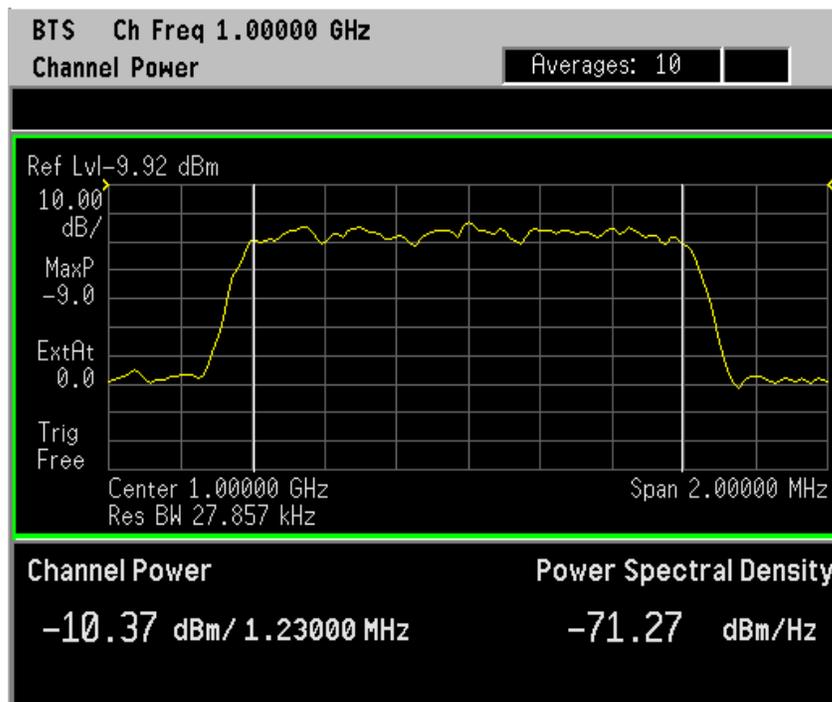
From the base transmission station simulator and the system controller, set up a call using loopback mode for the MS to transmit RF power.

Measurement Procedure

- Step 1.** Press the **Preset** key to preset the instrument.
- Step 2.** Press the **System, Reference, Freq Ref** keys to toggle the frequency reference to EXT, if required. In the annunciator bar you will see EXT REF displayed in green.
- Step 3.** Press the **MODE, More (1 of 2), Basic** keys to enable Basic Mode measurements.
- Step 4.** Press the **Mode Setup, Radio, Device** keys and toggle to select **MS** or **BTS**.
- Step 5.** Press the **MEASURE, Channel Power** keys to initiate the channel power measurement.
- Step 6.** Press the **FREQUENCY Channel** key to set the measurement center frequency. This frequency should be at the exact center of the band for which you want to measure the channel power.
- Step 7.** Press the **Meas Setup, Chan Power Span** keys to set the display span for the channel power measurement. (This does not set the integration bandwidth. See **Integ BW** in Step 8 below.) Enter a number by using the front panel keypad, and selecting a unit of frequency like **1855, MHz**, or by rotating the RPG knob. This setting should be the exact desired span of the channel for which you have set the center frequency in Step 5 above. See [“Channel Power Keys” on page 176](#) for more information.
- Step 8.** Set the power measurement integration bandwidth for the channel power measurement. Press the **Integ BW** key, and enter a number by using the front panel keypad, and selecting a unit of frequency like **1855, MHz**, or by rotating the RPG knob. The adjustment of this value is coupled to the measurement span setting. The setting can be any integer frequency between 10% and 61.5% of the span of the channel which you set in Step 6 above. If desired, once the bandwidth setting is accomplished, the channel power span may be reset to a value greater than that allowed by the Span coupling function. The fastest measurement speed is obtained by using a channel power span that is only slightly greater than the integration bandwidths. Using Channel Power Spans that are much greater than the integration bandwidths slow the measurement and may degrade accuracy.

For more information see [“Channel Power Measurement Concepts” on page 219](#)

Figure 4-35 Channel Power Measurement Result



Your result should look like the screen above. The total RF power in the measurement channel span is shown at the left of the lower text window. The vertical white lines indicate the integration bandwidth setting.

Step 9. Press the **Meas Setup, More (1 of 2)** keys to check the keys available to change the measurement parameters from the default condition.

Troubleshooting Hints

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

The channel power measurement can reveal the effects of degraded or defective parts in the transmitter section of the UUT. The following are areas of concern which can contribute to performance degradation:

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

Making Power Stat CCDF Measurements

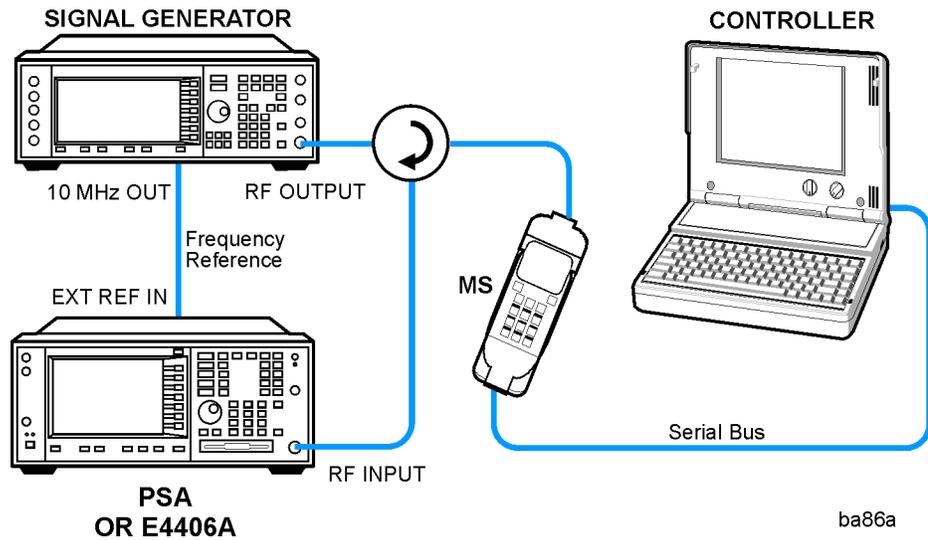
This section explains how to make a power statistics CCDF measurement on a cellular mobile station. Power Complementary Cumulative Distribution Function (CCDF) curves characterize the higher level power statistics of a digitally modulated signal.

Configuring the Measurement System

The mobile station (MS) under test has to be set to transmit the RF power remotely through the system controller. This transmitting signal is connected to the instruments RF input port. Connect the equipment as shown.

Figure 4-36

Power Statistics (CCDF) Measurement System



1. Using the appropriate cables, adapters, and circulator, connect the output signal of the MS to the RF input of the instrument.
2. Connect the base transmission station simulator or signal generator to the MS through a circulator to initiate a link constructed with sync and pilot channels, if required.
3. Connect a BNC cable between the 10 MHz OUT port of the signal generator and the EXT REF IN port of the instrument.
4. Connect the system controller to the MS through the serial bus cable to control the MS operation.

Setting the MS

From the base transmission station simulator and the system controller, set up a call using Rate Set 1 Fundamental Code Channel loopback mode (Service Option 2) with 9600 bps data rate only required for the MS to transmit the RF power as follows:

MS: Band Class 1, Block Designator A, Class III
Frequency: 1855.000 MHz (preferred set channel number 100)
(= $100 \times 0.050 + 1850.000$ MHz)
Output Power: -3 dBW (0.5 W) controlled by '0' power control bits

Measurement Procedure

- Step 1.** Press the **Preset** key to preset the instrument.
- Step 2.** Press the **MODE, Basic** keys to enable the Basic Mode measurements.
- Step 3.** Press the **Mode Setup, Radio, Device** to toggle the device to **MS**.
- Step 4.** Press the **FREQUENCY Channel, 1855, MHz** keys to set the center frequency to 1,855.000 MHz.
- Step 5.** Press the **MEASURE, More (1 of 2), Power Stat CCDF** keys to initiate the power statistics CCDF measurement.

Figure 4-37 Power Statistics CCDF Measurement Results



The CCDF measurement result should look like the above figure. The measurement result values are shown in the summary result window.

- Step 6.** To make a measurement repeatedly, press **Meas Control, Measure** to toggle the setting from **Single** to **Cont**.
- Step 7.** Press the **Meas Setup, More (1 of 2)** keys to check the keys available to change the measurement parameters from the default condition.

Using Option B7C Baseband I/Q Inputs

Baseband I/Q Measurements Available for E4406A VSA Series Transmitter Tester

The following measurements can be made using Baseband I/Q inputs:

- Channel Power
- Power Stat CCDF
- Spectrum (Frequency Domain)
- Waveform (Time Domain)

NOTE

The following measurements can not be made using Baseband I/Q Inputs:

- ACP
-

Baseband I/Q Measurement Overview

Baseband I/Q measurements are similar to RF measurements. To avoid duplication, this section describes only the details unique to using the baseband I/Q inputs. For generic measurement details, refer to the previous “Making Measurements” sections.

To make measurements using baseband I/Q Inputs, make the following selections:

- Select a measurement that supports baseband I/Q inputs. For details see [“Baseband I/Q Measurements Available for E4406A VSA Series Transmitter Tester”](#) on page 136.
- Select the appropriate circuit location and probe(s) for measurements. For details see [“Selecting Input Probes for Baseband Measurements”](#) on page 225.
- Select baseband I/Q input connectors. For details see Input Port Key Menu in the Key Reference chapter.
- Select just I/Q Setup if desired. For details see IQ Setup Key Menu in the Key Reference chapter.
- Select baseband I/Q input impedance. For details see I/Q Input Z Key Menu in the Key Reference chapter.
- Select a baseband I/Q measurement results view. For details see [“Baseband I/Q Measurement Result Examples”](#) on page 137.

Baseband I/Q Measurement Result Examples

The following are examples of new measurement result displays using baseband I/Q Inputs. A notation below each example indicates the nature of the input signal.

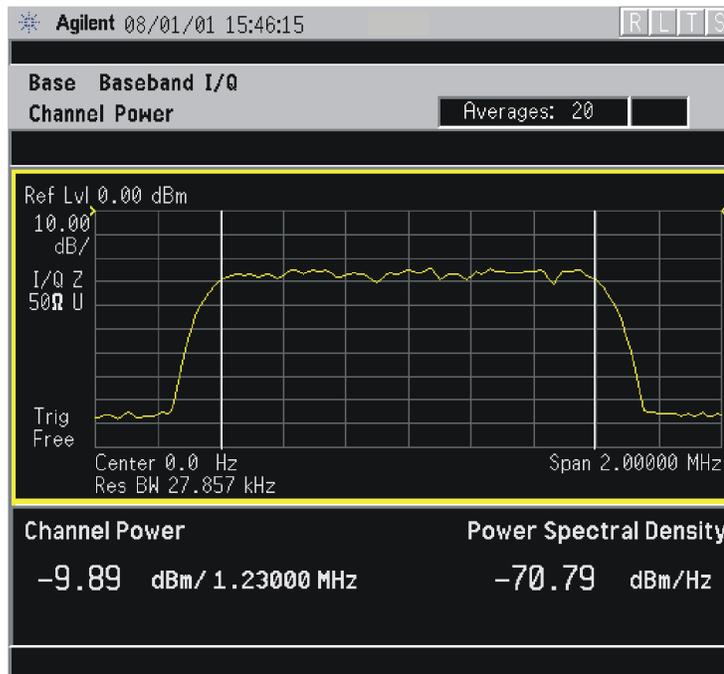
Channel Power Measurement

There is a new view for Channel Power measurements with baseband I/Q Inputs: the Channel Power Spectrum view with 0 Hz center frequency.

This measurement is not available if Input Port menu is set to **I only** or **Q only**, as the total I/Q channel power cannot be measured.

Figure 4-38

Channel Power - Baseband I/Q Inputs



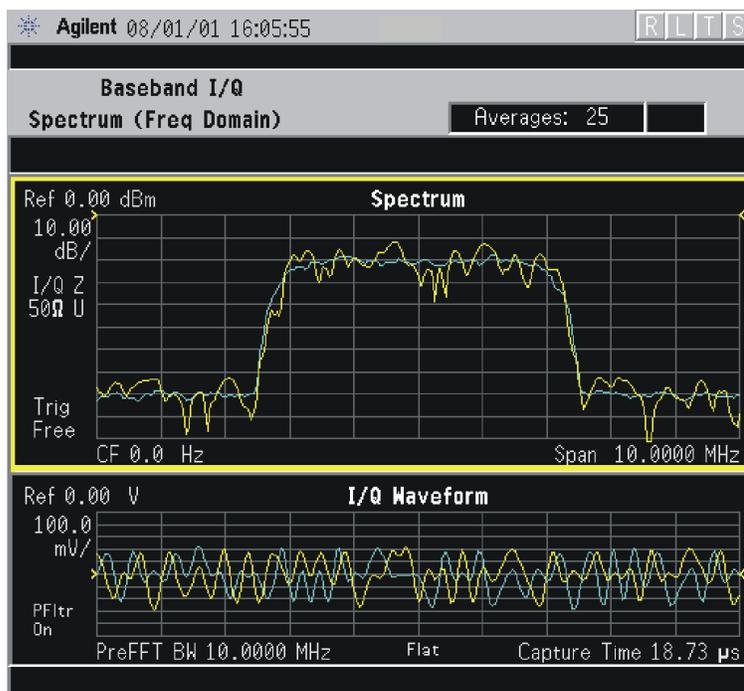
cdma2000 (Rev. 8) Downlink, SR1 9 Channel, Baseband I/Q Inputs

Spectrum (Frequency Domain) Measurement

There are two new views with baseband I/Q input Spectrum measurements: the Spectrum view with 0 Hz center frequency, and the Spectrum Linear view with 0 Hz center frequency and the vertical scale in volts.

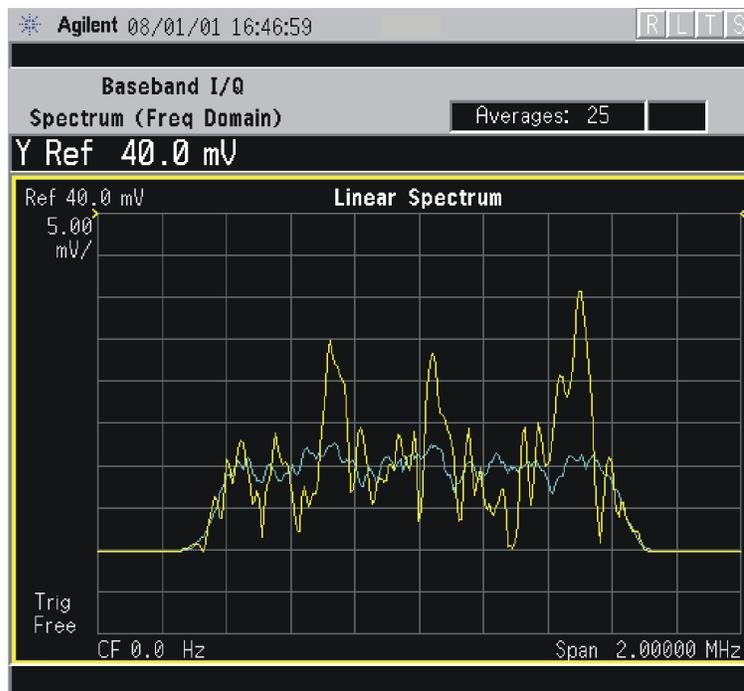
If you have **I only** or **Q only** selected as the **Input Port**, a Spectrum view does not have 0 Hz as the center frequency. It is displayed with 0 Hz at the left margin, similar to a conventional spectrum display, except that the start frequency remains 0 Hz regardless of **Span**, and the center frequency is displayed as half the **Span**.

Figure 4-39 Spectrum View- Baseband I/Q Inputs



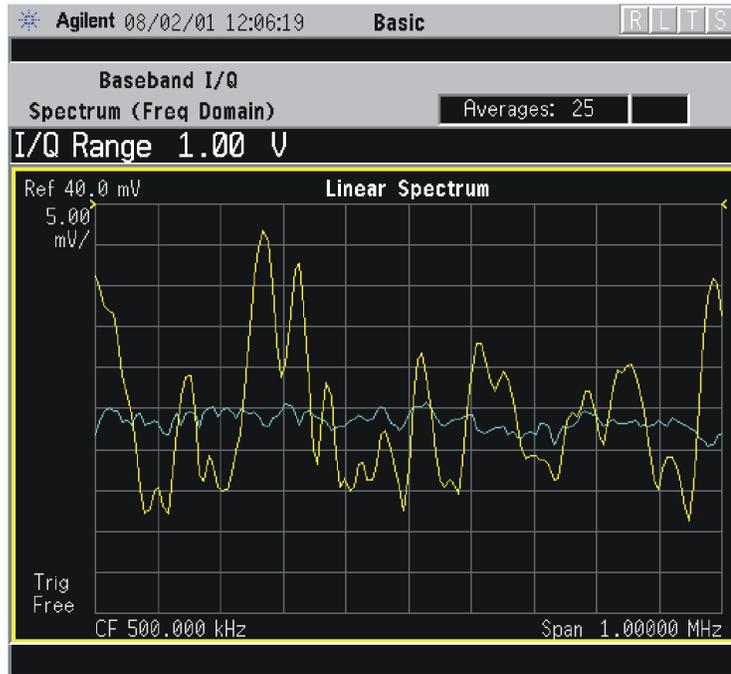
W-CDMA (3GPP 3.4 12-00) Downlink, 1 DCPH, Baseband I/Q Inputs

Figure 4-40 Spectrum Linear View- Baseband I/Q Inputs



W-CDMA (3GPP 3.4 12-00) Downlink, 1 DCPH, Baseband I/Q Inputs

Figure 4-41 Basic Mode Spectrum I only View- Baseband I/Q Inputs

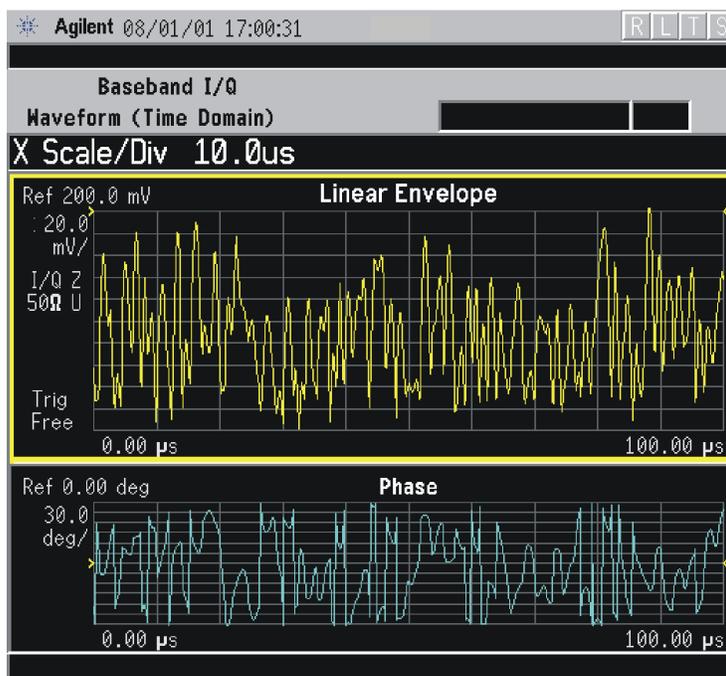


W-CDMA (3GPP 3.4 12-00) Downlink, 1 DCPH, Baseband I/Q Inputs

Waveform (Time Domain) Measurement

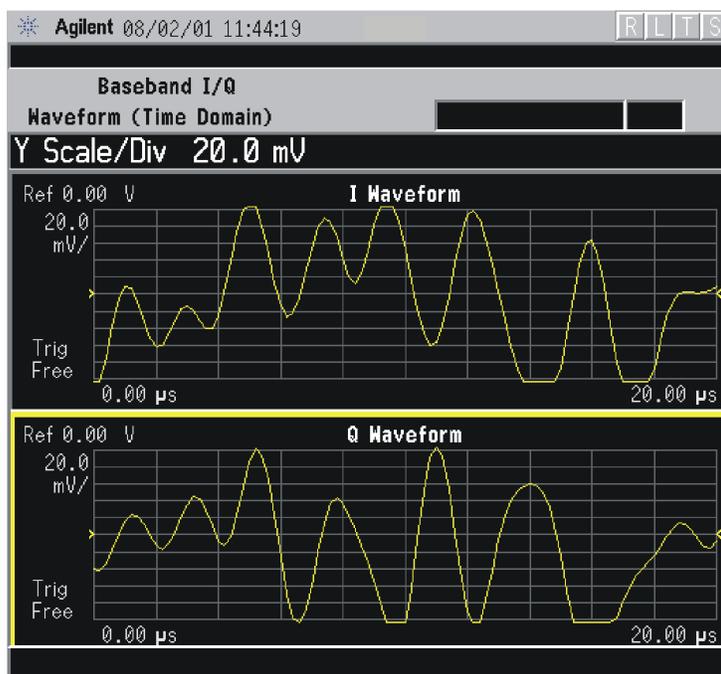
There are two new views with baseband I/Q input Waveform (Time Domain) measurements: the Linear Envelope view with the vertical scale in volts, and the I and Q Waveform view with separate windows for the I and Q traces.

Figure 4-42 Waveform Linear Envelope - Baseband I/Q Inputs



W-CDMA (3GPP 3.4 12-00) Downlink, 1 DCPH, Baseband I/Q Inputs

Figure 4-43 I and Q Waveform View - Baseband I/Q Inputs



W-CDMA (3GPP 3.4 12-00) Downlink, 1 DCPH, Baseband I/Q Inputs

Service Measurements

Service measurements help you check the functionality of your instrument. They include a power vs. time measurement which is intended strictly for diagnostic uses.

The spectrum and waveform measurements that can be accessed through the service menu are explained in the section on basic measurements. Refer to “[Spectrum \(Frequency Domain\) Measurements](#)” on page 101 and “[Waveform \(Time Domain\) Measurements](#)” on page 112.

To access the Service mode press the **Mode** key and select the **Service** menu key. The following service measurements are available:

Pwr vs Time on [page 142](#)

Timebase Frequency on [page 146](#)

50 MHz Amptd on [page 148](#)

Sensors on [page 150](#)

Spectrum on [page 101](#)

Waveform on [page 112](#)

Front Panel Test on [page 152](#)

Making the Power vs. Time Measurement

Purpose

This measurement is provided for instrument internal testing and self diagnostics.

Power vs. Time measures the mean transmit power during the “useful part” of GSM bursts and verifies that the power ramp fits the within the defined mask. Power vs. Time also lets you view the rise, fall, and “useful part” of the GSM burst.

Measurement Method

The instrument acquires a GSM signal in the time domain. The “T0” point and the useful part are computed. If Burst Sync is set to **Training Seq**, a GSM demodulation is performed to find “T0”. If Burst Sync is set to **RF Amptd**, an approximation of “T0” will be used without performing a demodulation. The average power in the useful part is then computed and displayed, and the GSM limit mask is applied. The measurement displays `Pass` when the burst fits within the bounds of the mask.

Making the Measurement

NOTE

The factory default settings provide a good starting point. 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.

Press **Measure, Pwr vs Time** to immediately make Power vs. Time the active measurement.

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

Results

Figure 4-44 Power vs. Time Measurement Result - Burst View

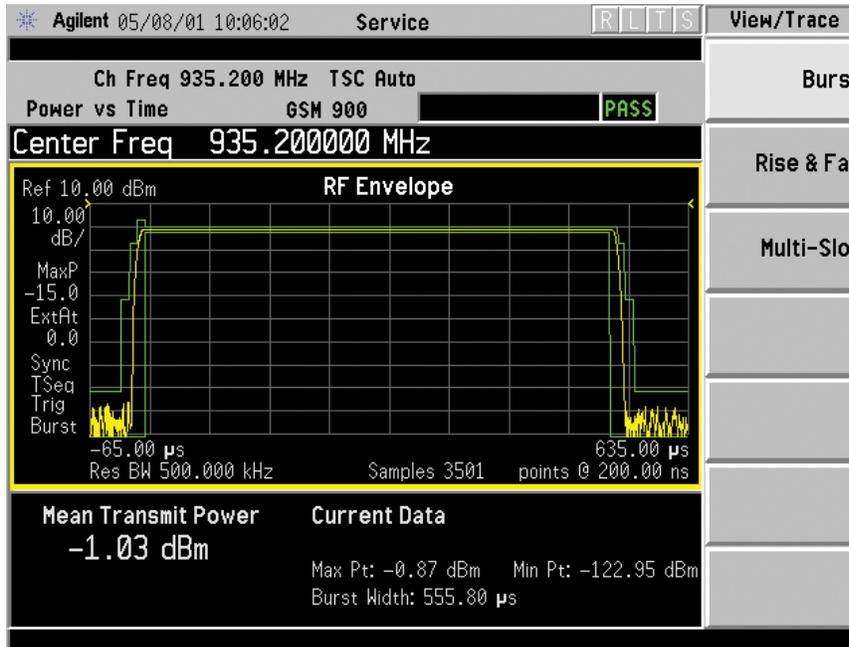
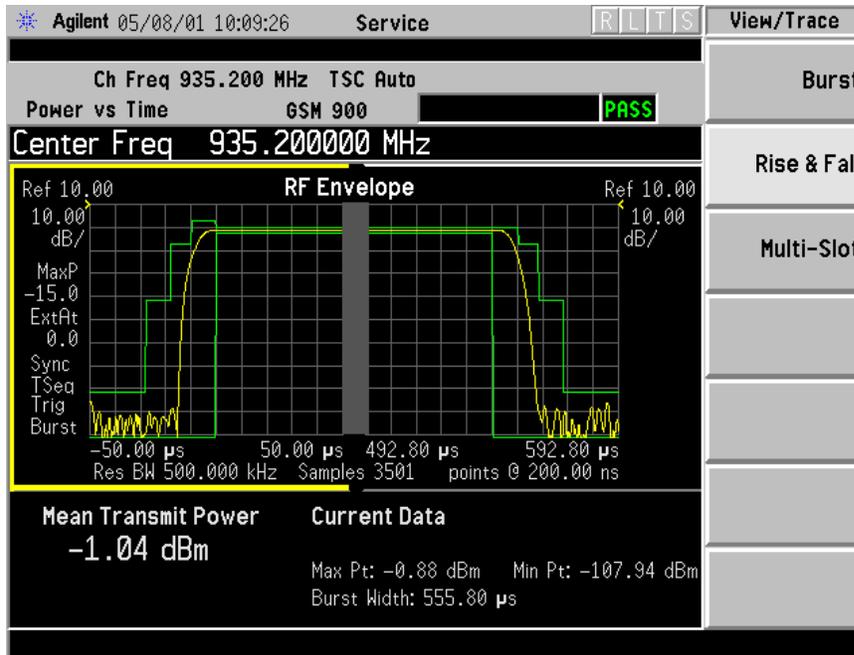


Figure 4-45 Power vs. Time Measurement Result - Rise & Fall View



Making Measurements

Changing the Measurement Setup

Table 4-1 Power vs. Time Measurement Defaults

Measurement Parameter	Factory Default Condition
Avg Bursts	10 Off
Avg Mode	Exp
Avg Type	Pwr Avg (RMS)
Meas Time	1 Slot
Trig Source	RF Burst (Wideband)
Burst Sync	Training Seq
Advanced	
RBW Filter	Gaussian
Res BW	500.000 kHz

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 Power vs. Time measurement is selected under the **Measure** menu. The **Meas Setup** key will access a menu which allows you to modify the averaging, trigger source, and burst sync for this measurement (as described in the “[Measurement Setup](#)” section at the beginning of this chapter). In addition, the following power vs. time measurement parameters can be modified:

- **Meas Time** - allows you to measure more than one timeslot. Enter a value in integer increments of “slots” with a range of 1 to 50. The actual measure time in μs is set somewhat longer than the specified number of slots in order to view the complete burst.
- **Advanced** - accesses a menu to change the following parameters:
 - **RBW Filter** - Choose the type of filter, either **Gaussian** or **Flat** (Flatop). Gaussian is the best choice when looking at the overall burst or the rising and falling edges, as it has excellent pulse response. If you want to precisely examine just the useful part of the burst, choose **Flat**.

Res BW - sets the resolution bandwidth.

Changing the View

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

- **Burst** - views the entire sweep as specified by the meas time. [Figure 4-44 on page 143](#).
- **Rise & Fall** - zooms in on the rising and falling portions of the burst being tested. [Figure 4-45 on page 143](#).

NOTE

The limit test will still be performed on the entire burst, (viewed using the **Burst** menu), when **Rise & Fall** is selected.

Timebase Frequency

Purpose

In the absence of a frequency counter, the measurement quickly determines the frequency difference between the instrument's 10 MHz reference oscillator signal and an accurate, external 10 MHz frequency standard.

NOTE

The timebase frequency check is not as accurate as a measurement of the 10 MHz Out signal (rear panel) using a frequency counter referenced to a frequency standard.

Measurement Method

The internal 10 MHz reference signal is compared with a reliable external 10 MHz signal which the user inputs into the front panel RF connector. The transmitter tester subtracts its 10 MHz reference from the input signal and displays the frequency difference.

Test Setup

An accurate external 10 MHz frequency signal, such as a house standard, is connected to an attenuator, which attenuates the signal to 0 dB. The attenuated 10 MHz signal is connected to the RF input of the transmitter tester. Pressing **Mode**, **Service**, **Measure**, **Timebase Frequency** will result in the display of data described below.

NOTE

When setting up this test ensure that the reference is set to internal. To check this press **System**, **Reference**. The **Freq Ref** menu key allows you to toggle between **Int** (internal) and **Ext** (external). Make sure **Int** is underlined.

Results

Window One (Time Record)

Shows an I/Q display of the frequency difference between the input signal and the internal 10 MHz signal.

Window Two (Magnitude)

Shows a polar representation of window one. This window shows how much the phase error changes during the sampling period.

Window Three (Freq Error)

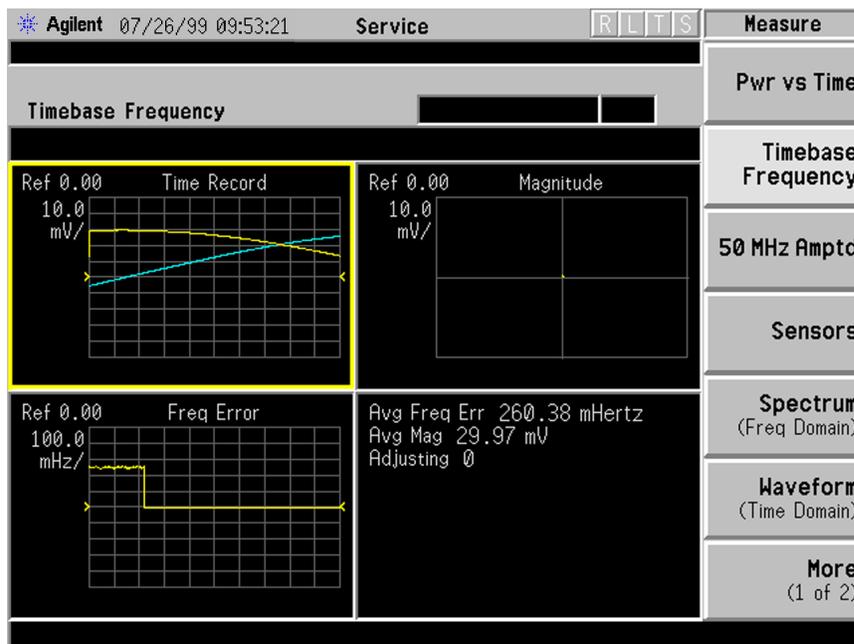
Shows a stripchart of the timebase error in MHz vs. time. Each dot on the horizontal axis is one sampling period.

Window Four (numeric results)

Freq error: The error difference between the 10 MHz input signal and the internal 10 MHz signal.

Magnitude: The magnitude of the external 10 MHz signal. While this is an uncalibrated value, it gives the user an idea of the signal amplitude.

Adjusting: A 0 will appear if the timebase adjustment is not being performed. A 1 will appear if the adjustment is being performed.



50 MHz Amplitude

Purpose

To check the amplitude of the internal 50 MHz amplitude reference signal.

Measurement Method

The amplitude of an internal 50 MHz reference signal is compared with the amplitude of a stable external 50 MHz signal which has been measured with a power meter and then connected to the front panel RF connector.

Test Setup

The 50 MHz amplitude feature enables you to measure the amplitude of the internal 50 MHz reference signal. The amplitude of an internal 50 MHz reference signal is adjusted as close as possible to -25.00 dBm, based on the relative measurement of the reliable external 50 MHz signal, which is input by the user into the front panel RF connector. Follow these steps to measure the amplitude of the 50 MHz amplitude reference signal (a power meter and a reliable external source will be needed to perform this test):

1. Set the external source to a frequency of 50 MHz at a power level of -25 dBm (± 2 dBm).
2. Connect the external source to the power meter through a cable. Adjust the power output of the source until the power meter reads -25.00 dBm, or as close to -25.00 dBm, as possible.
3. Disconnect the power sensor and connect the source to the transmitter tester.
4. Press **Mode, Service, Measure, 50 MHz Amptd** on the transmitter tester. See next page for results.

Results

Window One (RF Magnitude)

Shows the amplitude (unitless) of the external source as measured by the transmitter tester.

Window Two (Cal Magnitude)

Shows the amplitude (unitless) of the 50 MHz input calibrator.

Window Three (Error)

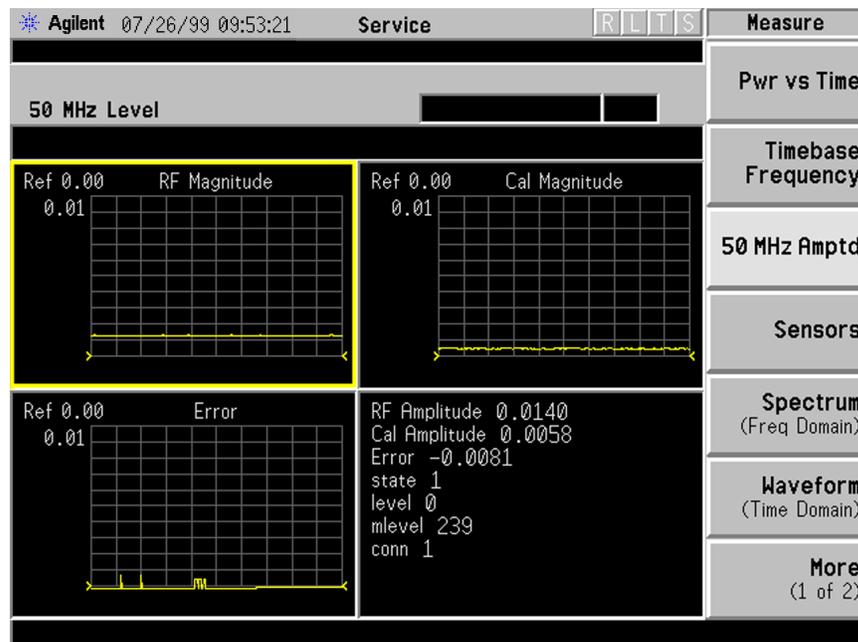
Shows a stripchart of the amplitude error between the 50 MHz internal calibrator and the external source amplitude.

Window Four (numeric results)

Cal Amplitude: The instrument's internal ADC level when measuring the internal 50 MHz calibrator amplitude.

RF Amplitude: The instrument's internal ADC level when measuring the external source amplitude

Error: The difference in ADC level between the 50 MHz internal calibrator amplitude and the source amplitude.



Sensors

Purpose

The temperature of the RF board will vary over time and can adversely affect the IF signal amplitude. Sensors on the RF board monitor changes in temperature.

Measurement Method

The sensor measurements are generated internally and do not require any user interaction.

Test Setup

Press **Mode**, **Service**, **Measure**, **Sensors**.

Results

Window One (IF Signal Level)

Shows a stripchart of the IF signal amplitude in dBm.

Window Two (Cal Osc Level)

The Cal Oscillator window is not implemented.

Window Three (RF Temperature)

Shows a stripchart of the RF assembly temperature in Celsius.

Window Four (numeric results)

IF Signal Level: The ADC number for the detected 21.4 MHz IF signal at the input to the AIF. Typical values with the input attenuator set to 0 dB: 20 (no signal applied); 23(- 10 dBm); 27(- 5 dBm), and 38(0 dBm).

Cal Osc Level: Not implemented.

RF Temp: Shows current temperature in Celsius.

Agilent 07/26/99 09:53:21 Service R L T S Measure

Sensors

Ref 0.00 IF Signal Level 256.0	Ref 10.0 Cal Osc Level 10.0 V/
Ref 10.0 RF Temperature 10.0 Deg/	IF Signal Level 20.00 Cal Osc Level 0.00 dBm RF Temp 30.94

Power Ramp

Timebase Freq

50 MHz Amptd

Sensors

Spectrum (Freq Domain)

Waveform (Time Domain)

More (1 of 2)

Making Measurements

Front Panel Test

Purpose

The front panel test checks the functionality of the instrument front panel keys and the RPG knob.

Test Setup

Press **Measure, More (1 of 2), Front Panel Test**. Once the **Front Panel Test** key is pressed you will see a display with three columns appear on the screen. The entries on the left side of each column describe a key. On the right side of each entry you will see a 0.

The front panel test requires you to press each of the front panel keys (in any order, with the exception of the **ESC** key, which *must* be pressed last), and to turn the RPG knob. The first time you press a key a 1 will replace the 0 that originally appeared to the right of the key column. Each additional instance of pressing a given key will result in an increment to the number listed in the column to the right of the key description. For example if you press the **Zoom** key four times, you will see a 4 to the right of the **Zoom** entry.

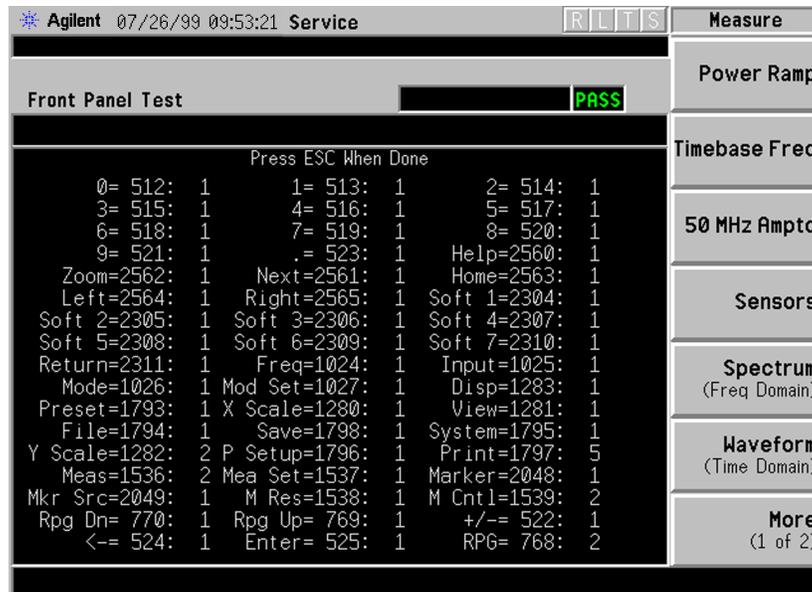
Rotating the RPG knob will result in a rapidly incrementing, or decrementing value appearing in the column to the right of the **RPG Knob** entry. Rotate the RPG knob clockwise and counter-clockwise. You will see negative or positive values appear, in ascending or descending order, depending on the direction you have turned the RPG knob.

Note that the two step keys (the up and down arrow keys) are described as the **Rpg Dn** and **Rpg Up** keys.

The **ESC** key must be pressed only after all other keys have been pressed and the RPG knob has been rotated; pressing the **ESC** key will cause the front panel test to be cancelled.

Results

The front panel test display shows a list of front panel keys and the RPG knob, followed by a “times-pressed” indicator. You will see a count of the number of times you have pressed a key next to that key on the display, except for the knob, next to which you will see positive or negative numbers in increments of 1.



Troubleshooting Hints

If the front panel check fails contact the Agilent Technologies instrument support center. See [page 239](#).

Making Measurements
Front Panel Test

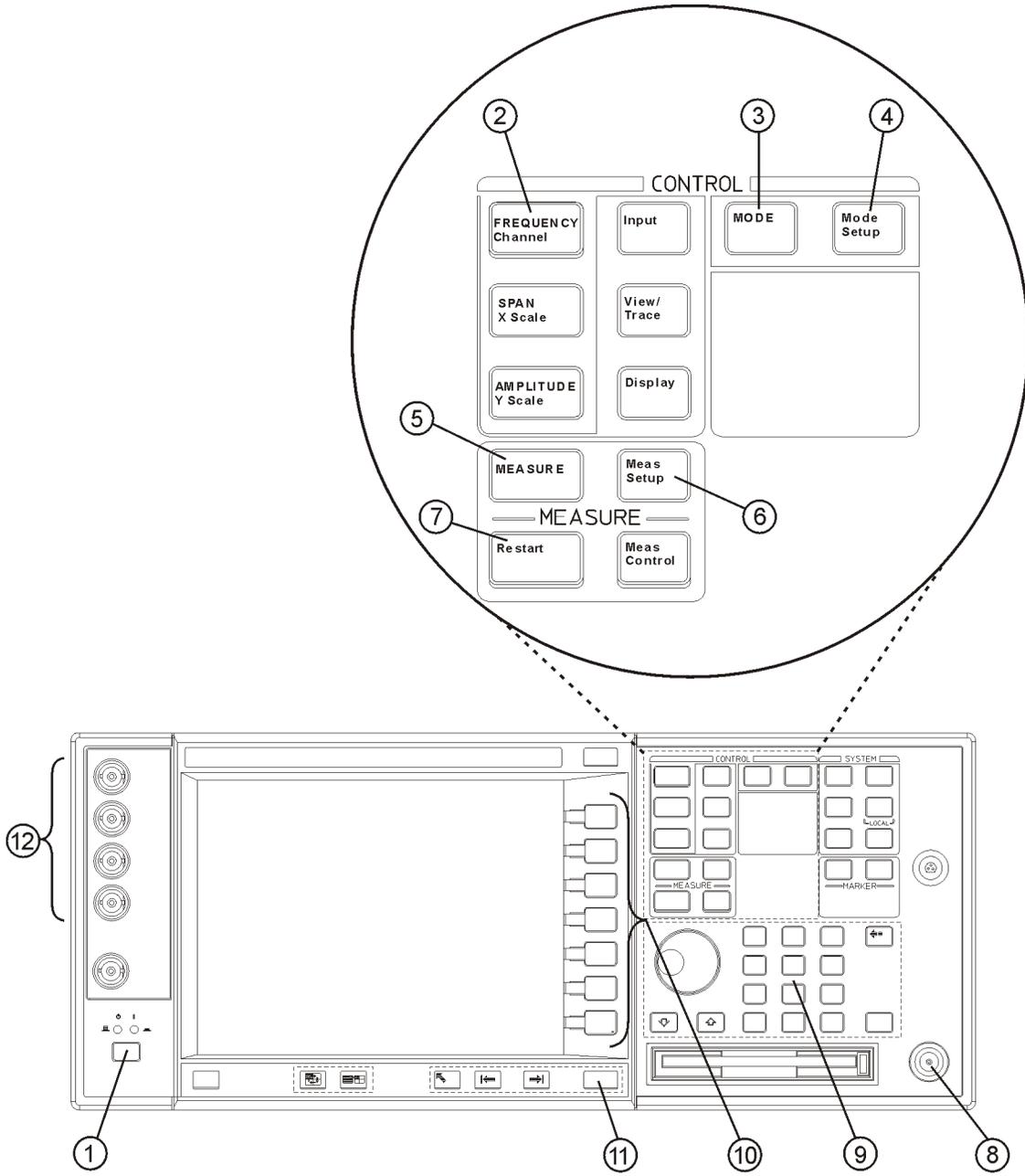
5 Key Reference

This chapter provides detailed descriptions of the keys used to set up and make Basic Mode measurements, including **Mode Setup**, **Meas Setup**, and **MEASURE**. Keys that allow you to see different presentations of the measurement results are also described, including **Trace/View**, and **Display**, showing the associated screens.

Instrument Front Panel Highlights

The most commonly used function keys on the VSA and front panels are located as shown in the illustrations below. The operation of the keys is briefly explained on the following page. Refer to your User's Guide for complete details on all keys.

Figure 5-1 Selected E4406A VSA Series Front Panel Feature Locations



aa81a

Selected E4406A VSA Front-Panel Features

1. The **On/Off** switch toggles the AC Line power between On and Standby. A green LED will light when the instrument is On. When energized in the standby mode, a yellow LED is lit above the switch.
2. **FREQUENCY Channel** accesses a key menu to set the analyzer center frequency in units of Hz, kHz, MHz, or GHz, or by channel number. These parameters apply to all measurements in the current mode.
3. **MODE** accesses a key menu to select one of the measurement personalities installed in the instrument. Each mode is independent from all other modes.
4. **Mode Setup** accesses a key menu that sets parameters specific to the current mode and can affect all measurements within that mode.
5. **MEASURE** accesses a display key menu to initiate one of the various measurements that are specific to the current mode.
6. **Meas Setup** accesses the menus of test parameters that are specific to the current measurement.
7. **Restart** causes a measurement to start again from the initial process according to the current measurement setup parameters.
8. **RF INPUT** port: Type N connector for the E4406A. The maximum input power level is shown next to the port.
9. The **Data Entry** keypad is used to enter numeric values. Keypad entries are displayed in the active function area of the screen and become valid for the current measurement upon pressing the **Enter** key or selecting a unit of measurement, depending on the parameter.
10. The Display Menu keys allow you either to activate a feature or to access a more detailed sub-menu. An arrow on the right side of a menu key label indicates that the key has a further selection menu. The active menu key is highlighted, however, grayed-out keys are currently unavailable for use or only show information. If a menu has multiple pages, successive pages are accessed by pressing the **More** key located at the bottom of the menu.
11. Pressing the **Return** key allows you to exit the current menu and display the previous menu. Often, pressing a menu key will invoke a multi-page sub-menu. Pressing the **Return** key will show the menu “above” it, not a previous page. When you activate another measurement, the return list is cleared. The **Return** key will not return you to a previously activated mode, nor will it alter any values you have entered in previous menus.
12. **Baseband I/Q Inputs** (E4406A Option B7C only) Allow you to analyze signals at baseband frequencies. See [“Using Option B7C Baseband I/Q Inputs” on page 136](#).
13. **BNC Audio Input** (PSA Option 233 Measuring Receiver only) Provides

Key Reference

Instrument Front Panel Highlights

a 100 kohm input for audio measurements. Frequency range is 20 Hz to 250 kHz. Safe input level is 7 Vrms or 20 V DC.

Front Panel Keys

NOTE Only front panel keys affected by selection of Basic mode are described here. These key settings affect all of the measurements available under the **MEASURE** key.

For information about the measurements and their setups, see the individual measurement key descriptions in this chapter.

FREQUENCY Channel Key Menu

Key path: **FREQUENCY Channel**

NOTE **FREQUENCY Channel** settings apply to all measurements in the mode.

- **Center Freq** - Selects a frequency that corresponds to the desired RF channel to be measured. This is the current instrument center frequency.

Span X Scale Key Menu

- **Span** - Modifies 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. The **Span** key is also accessible under the **Meas Setup** menu.
- **Scale/Div** - Only available in the Spectrum measurement with the IQ Waveform display selected. It sets the horizontal scale by changing a time value per division. The range is 1.00 ns to 1.00 s per division. The default setting is 18.8 ms per division. However, since the **Scale Coupling** default is **On**, this value is automatically determined by the measurement results. When you set a value manually, **Scale Coupling** automatically changes to **Off**.
- **Ref Value** - Only available in the Spectrum measurement with the IQ Waveform display selected. It sets the reference value ranging from -1.00 to 10.0 s. The default setting is 0.00 s. However, since the **Scale Coupling** default is **On**, this value is automatically determined by the measurement results. When you set a value manually, **Scale Coupling** automatically changes to **Off**.
- **Ref Position** - Only available in the Spectrum measurement with the IQ Waveform display selected. It sets the reference position to either **Left**, **Ctr** (center) or **Right**. The default setting is **Left**.
- **Scale Coupling** - Only available in the Spectrum measurement with the IQ Waveform display selected. It toggles the scale coupling

function between **On** and **Off**. The default setting is **On**. Upon pressing the **Restart** front-panel key or **Restart** menu key under the **Meas Control** menu, this function automatically determines the scale per division and reference values based on the measurement results. When you set a value to either **Scale/Div** or **Ref Value** manually, **Scale Coupling** automatically changes to **Off**.

AMPLITUDE Y Scale Key Menu

Key Path: **AMPLITUDE Y Scale**

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

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

MEASURE Key Menu

Key path: **MEASURE**

- **Spectrum (Freq Domain)** - Press this key to make frequency domain spectrum measurements. The following windows are available:
 - Spectrum graph with semi-log graticules and I/Q waveform graph with linear graticules
- **Waveform (Time Domain)** - Press this key to make time domain waveform measurements. The following windows are available:
 - Signal Envelope graph with semi-log graticules and summary

data

— I/Q waveform graph and summary data

- **CCDF** - Press this key to make power statistics measurements. The following windows are available:
 - The tested CCDF curve shown on the right-hand side of the display
 - The average power and the power statistics data on the left-hand side of the display

Meas Control Key Menu

Key path: **Meas Control**

- **Restart** - Press this key to repeat the current measurement from the beginning, while retaining the current measurement settings. When pressed, the scale coupling function is activated for an appropriate display to the current input signal level. This is equivalent to the **Restart** front panel key.
- **Measure** - Press this key (not to be confused with the **MEASURE** front panel 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 **Cont**, the measurement will run continuously and execute averaging according to the current average mode, either repeat or exponential. The default setting is **Cont** for most measurements, but the Code Domain and Power Stat CCDF measurements have **Single** as the default.
- **Pause** - Press this key 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.

Mode Setup Key Menu

Key path: **Mode Setup**

Input Key Menu

Key Path: **Mode Setup, Input**

NOTE

You can also access this menu from the **Input/Output** front panel key.

- **Input Port** - Allows you to access the menu to select one of the signal input ports as follows:
 - **RF** - Measures an RF signal supplied to the front panel RF input port.
 - **50 MHz Ref** - Allows you to measure the 50 MHz reference signal to calibrate the instrument.
 - **IF Align** - Allows you to configure the IF alignment signal. The RF path is manually switched to bring in the internal alignment signal.

- **Input Atten** - Controls the internal input attenuator setting. The electronic attenuator range is 0 to 40 dB with 1 dB resolution. The **Input Atten** key reads out the 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 to the **Max Total Pwr** setting.

When you use the internal preamplifier, **Int Preamp**, the electronic attenuator selections using the **Input Atten** key are not available, and the key is grayed out. Use the mechanical attenuator under **Attenuator**, below.

- **Ext RF Atten** - Enters the external attenuation values. The **Ext RF Atten** settings is coupled to the **RF Input Range** setting. This will allow the instrument to display the measurement results referenced to the output of the UUT.
- **Int Preamp** - (For PSA Option 1DS or Option 110) Controls the internal RF input preamplifier. The internal preamplifier provides +30 dB of gain and is useful for lower power measurements. The **Int Preamp** setting default is **Off**. RF power values displayed for these measurements are adjusted to compensate for the internal preamplifier gain, and indicate power levels at the input port. The preamplifier is only available for Modulation Accuracy (EVM and Peak Code Domain Error) measurements, QPSK EVM, and Code Domain measurements. If the **Int Preamp** is not available for a particular measurement, the key is grayed out.

To avoid damaging the internal preamplifier, limit the total power

applied to the RF input to $\leq +25$ dBm.

When using the internal preamplifier, the electronic attenuator selections using the **Input Atten** key are not available, and the key is grayed out. Use the mechanical attenuator under **More, Attenuator**, below.

- **Attenuator** - (For PSA Option 1DS or Option 110) When **Int Preamp** is set to **On**, this key controls an internal mechanical input attenuator setting. The choices are 0 dB, 10 dB, and 20 dB. The **Attenuator** key shows the actual hardware value that is used for the current measurement. The **Attenuator** setting is not coupled to the **Max Total Pwr** setting.

The **Attenuator** is only available for measurements which can use the **Int Preamp**: Modulation Accuracy (EVM and Peak Code Domain Error) measurements, QPSK EVM, and Code Domain measurements. If the **Int Preamp** is not available for a particular measurement, the key is grayed out.

- **IF Align Signal** - Accesses the following menu to select one of the signals to be used for IF alignment:
 - Signal Rate** - Sets a value to be used for dividing the fundamental frequency of 468.75 kHz. The value ranges from 0 to 12 as the power of 2.
 - Signal Amptd** - Sets an amplitude value to be applied to the digital analog converter, for the IF alignment signal. The value ranges from 0 to 4095. This functionality is not available if the PSA Option 122 or 140 wideband IF path is selected.
 - Signal Type** - Accesses the following menu to select one of the signal types:
 - CW** - Sets the IF alignment signal to CW.
 - Comb** - Sets the IF alignment signal to comb wave.
 - Pulse** - Sets the IF alignment signal to pulse wave.

Input Default Settings	
Input Port	RF
Input Atten	0.00 dB
Ext RF Atten: MS BTS	0.00 dB 0.00 dB
Int Preamp	OFF
Attenuator	0 dB

Key Reference
Front Panel Keys

Input Default Settings	
IF Align Signal: Signal Rate Signal Amptd Signal Type	0; = 468.75 kHz DAC 500 CW

Trigger Key Menu

Key Path: **Mode Setup, Trigger, <trigger type>**

NOTE

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

- **RF Burst, Video (Envlp), Ext Front, Ext Rear**- Pressing any one of these trigger keys accesses the following triggering condition setup menu. This menu is used to specify the **Delay, Level** and **Slope** settings for each trigger source as follows:
 - **Delay** - Enters a numerical value to modify the trigger delay time. The range is -100.0 to $+500.0$ ms with $1\ \mu\text{s}$ resolution. For trigger delay use a positive value, and for pre-trigger use a negative value.
 - **Level** - Enters a numerical value to adjust the trigger level depending on the trigger source selected.
 - For **RF Burst**, the key label reads as **Peak Level**. The RF level range is -25.00 to 0.00 dB with 0.01 dB resolution, relative to the peak RF signal level. The realistic range can be down to -20 dB.
 - For **Video (Envlp)**, the video level range is -200.00 to $+50.00$ dBm with 0.01 dB resolution at the RF input. The realistic range can be down to around -50 dBm depending on the noise floor level of the input signal.
 - For **Ext Front** or **Ext Rear**, the level range is -5.00 to $+5.00$ V with 1 or 10 mV resolution.
 - **Slope** - Toggles the trigger slope between **Pos** at the positive-going edge and **Neg** at the negative-going edge of the burst signal.
- **Trig Holdoff** - Sets the period of time before the next trigger can occur. The range is $0.000\ \mu\text{s}$ to 500.0 ms with $1\ \mu\text{s}$ resolution.

For Option 122 or 140: When the wideband path is selected, the trigger holdoff is the minimum time that must occur between trigger events before a trigger is accepted. For example, a rising edge external trigger with a 10 ms holdoff will not trigger until at least 10 ms has passed during which no rising edges have occurred.

This Option 123 definition changes slightly for negative slope video triggers. For this case the instrument waits until it sees a time interval *following* the trigger event that is free of additional trigger events. This lets you trigger on the falling edge of a burst that may contain trigger events.

- **Auto Trig** - Specifies a time for a trigger timeout and toggle the auto trigger function between **On** and **Off**. The range is 1.000 ms to 1.000

ks with 1 μ s resolution. If no trigger occurs by the specified time, a trigger is automatically generated.

- **Frame Timer** - Accesses the menu to manually control the frame timer:
 - **Period** - Sets the period of the frame clock. The range is 0.000 ns to 559.0000 ms with 1 ns resolution.
 - **Offset** - Sets the offset of the frame clock. The range is 0.000 to 10.00 s with 100 ns resolution over 1.000 μ s range.
 - **Reset Offset Display** - Displays the measurement without any offset of the frame clock.
 - **Sync Source** - Accesses the menu to select one of the sources to be synchronized with.

For Option 122 or 140: The frame trigger will wait for, and sync with, the first external trigger that is received after sync is turned off. After the sync is received the frame trigger stays locked to that event, ignoring any later triggers. The instrument will only resync if the measurement settings are changed or if an alignment occurs.

- Off** - Turns the synchronizing source off for asynchronous tests.
- RF Burst (Wideband)** - Selects the RF burst signal as the synchronizing source. (Not available with Option 122 or 140 when using the wideband IF path.)
- Ext Front** - Selects the external input signal from the front panel input port as the synchronizing source. With Option 122 or 140, you can use the external front trigger setup menu to change the trigger level or delay.
- Ext Rear** - Selects the external input signal from the rear panel input port as the synchronizing source. With Option 122 or 140, you can use the external rear trigger setup menu to change the trigger level or delay.

Trigger Default Settings	
RF Burst: Delay Peak Level Slope	0.000 μ s -6.00 dB Pos
Video (Envlp): Delay Level Slope	0.000 μ s -6.00 dBm Pos

Trigger Default Settings	
Ext Front: Delay Level Slope	0.000 μ s 2.00 V Pos
Ext Rear: Delay Level Slope	0.000 μ s 2.00 V Pos
Trig Holdoff	0.000 ms
Auto Trig Frame Timer: Period Offset Sync Source	100.0 ms; Off 26.666667 ms 0.000 ms Off

Adjacent Channel Power (ACP) Keys

NOTE You must have selected ACP at Key Path: **MEASURE** to access these menus.

Measurement Setup Key Menu

Key Path: **Meas Setup**

- **Avg Number** - Allows you to change the number of N averages.
- **Avg Mode** - Allows you to toggle the averaging mode between **Exp** (exponential) and **Repeat**. This selection only effects on 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 the 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 average count displayed is set back to 1. This is equivalent to being in **Measure Single** and pressing the **Restart** key each time the single measurement finishes.
- **Ref Channel** - Allows you to access the following parameters for the reference channel settings:
 - **Chan Integ BW** - Allows you to specify the channel integration bandwidth in which the carrier power is measured. The range is 1.000 kHz to 20.0000 MHz with the best resolution of 1 Hz.
 - **Avg Type** - Allows you to set to power averaging type to either **Pwr Avg (RMS)** or **Maximum**.
 - **Ref Chan Adv** - Allows you to access the menu to change the following advanced parameters for the reference channel:
 - Sweep Time** - Allows you to toggle the sweep time function

between **Auto** and **Man** (manual), and to set a value for the sweep time ranging from 1.0 ms to 50.000 ms if set to **Man**. If set to **Auto**, the reference channel measurement sweep time is derived from the data points and the number of FFT segments.

- ❑ **Data Points** - Allows you to toggle the control function of the number of data points between **Auto** and **Man** (manual), and to set the number of data points ranging from 64 to 65536. The automatic mode chooses the optimum number of points ($= 2^{n+6}$ where $n = 0$ to 11) for the fastest measurement time with acceptable repeatability. The minimum number of points that could be used is determined by the sweep time and the sampling rate. You can increase the length of the measured time record (capture more of the burst) by increasing the number of points, but the measurement will take longer.
- ❑ **Res BW** - This key is always grayed out. However, it allows you to see the resolution bandwidth that is derived from the combination of sweep time, data points, and FFT segments.
- ❑ **Num FFT Seg** - Allows you to select the number of FFT segments used in making the measurement of the reference channel (carrier). In the automatic mode the measurement optimizes the number of FFT segments required for the shortest measurement time. The minimum number of segments required to make a measurement is set by your desired measurement bandwidth. Selecting more than the minimum number of segments will give you more dynamic range for making the measurement, but the measurement will take longer to execute.
- **Offset/Limits** - Allows you to access the menu to change the following parameters for offset frequency settings and pass/fail tests:
 - **Offset** - Allows you to select one of five offsets (**A** through **E**). Only one selection at a time (**A**, **B**, **C**, **D**, or **E**) is shown on this key label. The remaining menu keys on the **Offset/Limits** menu then apply to the selected offset.
 - **Offset Freq** - Allows you to enter an offset frequency value and toggle the offset function between **On** and **Off**. The range is 0.0 Hz to 45.000 MHz. While this key is activated, enter an offset value from the numeric keypad by terminating with one of the frequency unit keys shown. Offsets **A** and **B** are defaulted as follows for BS tests, while others are defaulted to 0.0 Hz and **Off**:
 - Offset A: 750.00 kHz, **On**
 - Offset B: 1.9800 MHz, **On**One offset frequency center value corresponding to the **Offset** menu selection is shown on this key label.
 - **Offset Side** - Choose **Neg** (negative) or **Pos** (positive) to have

single-sided offsets relative to the carrier, or **Both** (the default) to have offset frequency pairs.

- **Ref BW** - Allows you to enter a reference bandwidth ranging from 300 Hz to 20.0000 MHz with the best resolution of 1 Hz. When this parameter is changed, the integration bandwidth **Integ BW** in the summary data window changes to that value.
- **Avg Type** - Choose the type of averaging between **Pwr Avg (RMS)** or **Maximum**.
- **Limit Setup** - Allows you to access the menu to setup the limit values and conditions.
 - Abs Limit** - Allows you to enter an absolute limit value ranging from -200.00 to +50.00 dBm with 0.01 dB resolution.
 - Fail** - Allows you to access the following menu to select one of the logic keys for fail conditions between the measurement results and the test limits:
 - AND** - Fail is shown if one of the relative ACP measurement results is larger than **Rel Lim (Car)** or **Rel Lim (PSD)** AND one of the absolute ACP measurement results is larger than **Abs Limit**.
 - OR** - Fail is shown if one of the relative ACP measurement results is larger than **Rel Lim (Car)** or **Rel Lim (PSD)** OR one of the absolute ACP measurement results is larger than **Abs Limit**.
 - Absolute** - Fail is shown if one of the absolute ACP measurement results is larger than **Abs Limit**.
 - Relative** - Fail is shown if one of the relative ACP measurement results is larger than **Rel Lim (Car)** or **Rel (PSD)**.
 - Rel Lim (Car)**- Allows you to enter a relative limit value of the carrier level ranging from -150.00 to +50.00 dBc with 0.01 dB resolution. The default is -45.00 dBc for **Offset A** and -60.00 dBc for **Offset B**.
 - Rel Lim (PSD)**- Allows you to enter a relative limit value of the power spectral density level ranging from -150.00 to +50.00 dB with 0.01 dB resolution. The default is -28.87 dB for **Offset A** and -43.87 dB for **Offset B**.
- **Offset Adv** - Allows you to access the menu to change the following advanced offset parameters:
 - Sweep Time** - Allows you to toggle the sweep time function between **Auto** and **Man** (manual), and to set a value for the sweep time ranging from 1.0 ms to 50.000 ms if set to **Man**. If set to **Auto**, the offset channel measurement sweep time is

derived from the data points and the number of FFT segments.

- ❑ **Data Points** - Allows you to toggle the control function of the number of data points between **Auto** and **Man** (manual), and to set the number of data points ranging from 64 to 65536. If set to **Auto**, the optimum number of points ($= 2^{n+6}$ where $n = 0$ to 11) for the fastest measurement time with acceptable repeatability is automatically determined. The minimum number of points that could be used is determined by the sweep time and the sampling rate. You can increase the length of the measured time record (capture more of the burst) by increasing the number of points, but the measurement will take longer.
- ❑ **Res BW** - This key is always grayed out. However, it allows you to see the resolution bandwidth that is derived from the combination of sweep time, data points, and FFT segments.
- ❑ **Num FFT Seg** - The automatic mode selects the optimum number of FFT segments to measure the offset, while making the fastest possible measurement.
- ❑ **Relative Atten** - Allows you to set a relative amount of attenuation for the measurements made at your offsets. The amount of attenuation is always specified relative to the attenuation that is required to measure the carrier channel. Since the offset channel power is lower than the carrier channel power, less attenuation is required to measure the offset channel and you get wider dynamic range for the measurement.
- **Meas Type** - Allows you to access the menu to select one of the measurement reference types.
 - **Total Pwr Ref** - Select this to set the total carrier power to the measurement reference level and the measured data is shown in dBc and dBm.
 - **PSD Ref** - Select this to set the mean power spectral density of the carrier to the measurement reference level and the measured data is shown in dB and dBm/Hz.
- **Fast ACP** - Allows you to increase the speed of the measurement. A time domain computation method is used rather than an FFT transformation. When this faster measurement method is selected, repeatability is slightly reduced.
- **Spectrum Trace** - Turns off the spectrum trace data calculations. This is only applicable when using the Spectrum View. It speeds up the display of the other measured data values by not calculating the spectrum trace.
- **Limit Test** - Turns on or off the limit test function.

- **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.

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

Table 5-1 Adjacent Channel Power Measurement Defaults

Measurement Parameter	Factory Default Condition
View/Trace	Bar Graph (Total Pwr Ref)
Spectrum Trace	On
Avg Number	20; On
Avg Mode	Repeat
Ref Channel:	
Chan Integ BW	1.23000 MHz
Avg Type	Pwr Avg (RMS)
Ref Chan Adv.:	
Sweep Time	546.1 μ s; Auto
Data Points	2048; Auto
Res BW	1.620 kHz (grayed out)
Num FFT Seg	1; Auto
Offset/Limits:	
Offset	A
Offset Freq	A: 750.000 kHz; On B: 1.98000 MHz; On
Offset Side	Both
Ref BW	30.000 kHz
Avg Type	Pwr Avg (RMS)
Limit Setup:	
Abs Limit	0.00 dBm
Fail	Relative
Rel Lim (Car)	A: -45.00 dBc B: -60.00 dBc
Rel Lim (PSD)	A: -28.87 dB B: -43.87 dB
Offset Adv.:	
Sweep Time	11.20 ms; Auto
Data Points	1024; Auto
Res BW	79.0 Hz (grayed out)
Num FFT Seg	1; Auto
Relative Atten	0.00 dB
Meas Type	Total Pwr Ref
Trig Source	Free Run (Immediate)
Fast ACP	Off

Table 5-1 **Adjacent Channel Power Measurement Defaults**

Measurement Parameter	Factory Default Condition
Limit Test	On

View/Trace Key Menu

Key Path: **View/Trace**

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

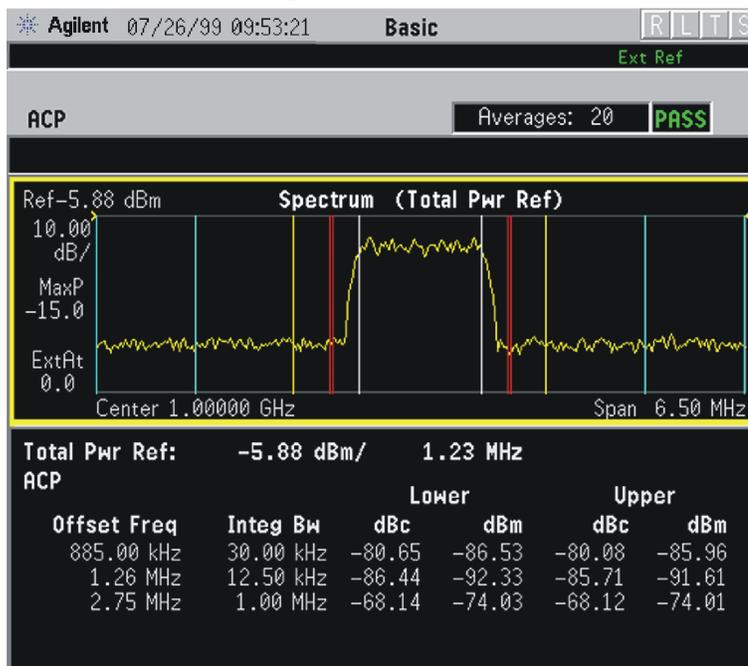
- **Bar Graph** - In the factory default condition 5 of the total integration power levels, centered at the carrier frequency and ± 765.0 kHz and ± 1.995 MHz offset frequencies, are shown in the figure for the “Results” section. The corresponding measured data is shown in the text window. Depending on the **Meas Type** selection, one of the two following displays is obtained:

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

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

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

Figure 5-2 ACP Measurement - Spectrum View



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

Spectrum (Total Pwr Ref) - A spectrum display referenced to

the total power

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

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

Channel Power Keys

NOTE You must have selected Channel Power at Key Path: **MEASURE** to use these menus.

Measurement Setup Key Menu

Key Path: **Meas Setup**

- **Avg Number** - Allows you to change the number of N averages.
- **Avg Mode** - Allows you to toggle the averaging mode between **Exp** (exponential) and **Repeat**. This selection only effects on 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 the 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 average count displayed is set back to 1. This is equivalent to being in **Measure Single** and pressing the **Restart** key each time the single measurement finishes.
- **Integ BW** - Allows you to specify the integration bandwidth in which the power is measured. The range is 1.000 kHz to 10.0000 MHz with 1 Hz resolution. Since **Integ BW** is coupled to **Chan Power Span** in the factory default condition, if you change the integration bandwidth setting, the channel power span setting changes by a proportional amount, 1.2 times the integration bandwidth, until a limit value is reached.
- **Chan Power Span** - Allows you to set the frequency span for the channel power measurement. The range is 1.000 kHz to 10.0000 MHz with 1 Hz resolution. This span is used for the current integration bandwidth setting. Since **Chan Power Span** is coupled to **Integ BW** in the factory default condition, if you change the

integration bandwidth setting, the channel power span setting changes by a proportional amount, 1.2 times the integration bandwidth, until a limit value is reached. However, the channel power span can be individually set.

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

NOTE

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

- **Sweep Time** - Allows you to manually change the sweep time and also to toggle the sweep time control between **Auto** and **Man** (manual). The range is 1.0 μ s to 50.00 ms with 1 μ s resolution. If set to **Auto**, the sweep time derived from the data point setting is shown on this key regardless of the manual entry range.
- **Data Points** - Allows you to select the number of data points and also to toggle the data point control between **Auto** and **Man** (manual). The range is 64 to 65536 with the acceptable entry in powers of 2 (for example: 64, 128, 512). If set to **Auto**, the optimum number of points is determined for the fastest measurement time with acceptable repeatability. The minimum number of points that could be used is determined by the sweep time and the sampling rate. You can increase the length of the measured time record (capture more of the burst) by increasing the number of points, but the measurement will take longer.
- **Res BW** - Shows information on the resolution bandwidth derived from the sweep time. This key is always grayed out.
- **Trig Source** - Allows you to choose a trigger source from **Free Run (Immediate)**, **Video (Envlp)**, **RF Burst (Wideband)**, **Ext Front**, **Ext Rear**, **Frame**, **I/Q Input**, or **Line**.

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

Table 5-2

Channel Power Measurement Defaults

Measurement Parameter	Factory Default Condition
Meas Setup: Avg Number	200; On

Table 5-2

Channel Power Measurement Defaults

Measurement Parameter	Factory Default Condition
Avg Mode	Repeat
Integ BW ^a	5.00000 MHz
Chan Power Span ^a	6.00000 MHz
Advanced	
Sweep Time	68.27 μ s; Auto
Data Points	2048; Auto
Res BW (grayed out)	27.857 kHz (grayed out)
Trig Source	Free Run (Immediate)

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

AMPLITUDE Y Scale Key Menu

Key Path: **AMPLITUDE Y Scale**

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

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

Marker Key Menu

The Marker key is not available for this measurement function.

Spectrum (Frequency Domain) Keys

NOTE You must have selected **Spectrum** under the **MEASURE** menu to access these menus

Meas Setup Key Menu

Key Path: **Meas Setup**

- **Span** - Modifies the frequency span. The range is 10 Hz to 10 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. For PSA Option 122 wideband operation, the maximum span is 80 MHz. For PSA Option 140 wideband operation, the maximum span is 40 MHz.
- **Res BW** - Sets 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.
- **Average**
 - **Avg Number** - Changes the number of N averages.
 - **Avg Mode** - Toggles the averaging mode between **Exp** (exponential) and **Repeat**. This selection only effects on 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 the 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 average count displayed 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** - Accesses the menu of the following average types only for making spectrum (frequency domain) and waveform (time domain) measurements:
 - ❑ **Pwr Avg (RMS)** - Executes the true power averaging which is calculated by averaging the rms 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. This type of averaging will underestimate the power when the signal is noise-like.
 - ❑ **Voltage Avg** - Executes voltage averaging.
 - ❑ **Maximum** - Captures peak voltage data. Simulates the traditional spectrum analyzer peak hold function.
 - ❑ **Minimum** - Captures the minimum voltage data, similar to the maximum function.

- **Trig Source**

Key path: **Meas Setup, Trig Source**

NOTE

Changing the selection in the **Trig Source** menu alters the trigger source for the selected measurement only.

- **Free Run (Immediate)** - A trigger occurs at the time the data is requested, completely asynchronous with the RF or IF signal.
- **Video (Envlp)** - An internal IF envelope trigger that occurs at the absolute threshold level of the IF signal level.
- **RF Burst (Wideband)** - An internal wideband RF burst trigger that has the automatic level control for burst signals. It triggers at the level that is set relative to the peak RF signal (12 MHz bandwidth) input level.
- **Ext Front** - Activates the front panel external trigger input (**EXT TRIGGER INPUT**) port. The external signal must be between -5.00 and $+5.00$ V with 1 or 10 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 or 10 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. Refer to the specific measurement section for details.

- **Line** - Sets the trigger to the internal line mode. Sweep triggers occur at intervals synchronous to the line frequency. See the specific measurement section for details.
- **Restore Meas Defaults** - Presets 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.
- **(Narrowband) Advanced** Accesses the menu to change the following parameters.

NOTE

The advanced features should be used only if you are familiar with their operation. Changes from the default values may result in invalid data.

The **Narrowband** key word is only present if you have Option B7J and either Option 122 or 140 installed. Parameters that are under the **(Narrowband) Advanced** key only affect the standard narrow band IF path. The wideband IF advanced functions are found under the **Wideband Advanced** key.

- **Pre-ADC BPF** - Toggles 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 Filtr** - Toggles 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** - Toggles 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** - Accesses 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 Blackman filter.
 - Blackman Harris** - Press this key to activate the Blackman Harris filter.
 - K-B 70dB/90dB/110dB (Kaiser-Bessel)** - Select one of the Kaiser-Bessel filters with sidelobes at -70 , -90 , or -110 dBc.
- **FFT Size** - Accesses the menu to change the following parameters:
- Length Ctrl** - Toggles the FFT and window length setting function between **Auto** and **Man** (manual).
 - Min Pts in RBW** - Sets 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** - Enters 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** - Enters 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** - Accesses the menu to define one of the following ADC ranging functions:
- Auto** - Sets 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** - Sets the ADC range automatically to the peak signal level. Auto peak is a compromise that works well for both CW and burst signals.
 - Auto Peak Lock** - Select this to hold the ADC range automatically at the peak signal level. Auto peak lock is more stable than auto peak for CW signals, but should not be used for “bursty” signals.
 - Manual** - Accesses the selection menu of values, -6 to $+24$ dB for E4406A or None to $+18$ dB for PSA, to set the ADC range level. Also note that manual ranging is best for CW signals.

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

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

Table 5-3

Spectrum (Frequency Domain) Measurement Defaults

Measurement Parameter	Factory Default Condition
Trace Display	All
Res BW	20.0000 kHz; Auto

Table 5-3 Spectrum (Frequency Domain) Measurement Defaults

Measurement Parameter	Factory Default Condition
Averaging: Avg Number Avg Mode Avg Type Time Avg Num (Opt. 122 or 140) Trig Source Region/Limits: Region Upper Mask Lower Mask Offset Start Offset Stop Interval IF Path (requires Option B7J and Option 122 or 140) Wideband IF Gain (Opt. 122 or 140) Wideband Filtering (Opt. 122 or 140) Filter Type Filter Alpha Filter BW Spectrum View: SPAN AMPLITUDE Y Scale - Scale/Div I/Q Waveform View: Capture Time AMPLITUDE Y Scale - Scale/Div Spectrum Linear View: SPAN AMPLITUDE Y Scale - Scale/Div I and Q Waveform View: Capture Time AMPLITUDE Y Scale - Scale/Div I/Q Polar View: I/Q Scale/Div I or Q Origin	25; On Exp Log-Pwr Avg (Video) 1 Free Run (Immediate) A A: -40.00 dB; On A: -100.00 dB; Off A: -667.0 μs A: -25.0 μs A: 642.0 μs Narrow 0.00 dB None 0.30 0.50 1.000 MHz (VSA), 10.000 MHz (PSA) 10.00 dB 188.00 μs 100.0 mV (for E4406A) 1.00000 MHz 100.0 mV (for E4406A) 188.00μs 100.0 mV (for E4406A) 100.0 mV 0.00 V
(Narrowband) Advanced	
Pre-ADC BPF	On

Key Reference

Table 5-3 Spectrum (Frequency Domain) Measurement Defaults

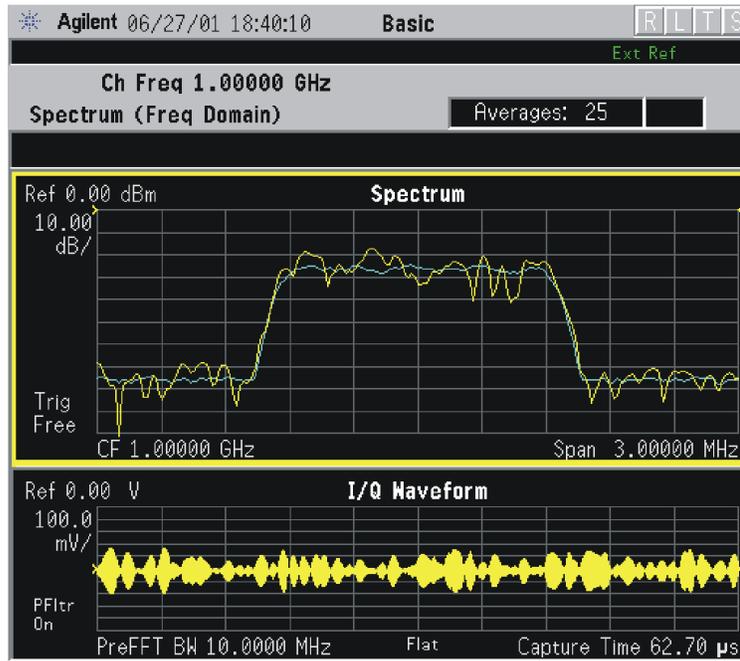
Measurement Parameter	Factory Default Condition
Pre-FFT Filter	Flat
Pre-FFT BW	1.55000 MHz; Auto
FFT Window	Flat Top (High Amptd Acc)
FFT Size:	
Length Control	Auto
Min Points/RBW	3.100000
Window Length	706 (VSA), 566 (PSA)
FFT Length	1024
ADC Range	Auto Peak
Data Packing	Auto
ADC Dither	Auto
Decimation	0; Auto
IF Flatness	On
Wideband Advanced (Option 122 or 140 PSA only)	
ADC Correction	On
IF Flatness Corrections	On
Analog Filter	Auto, 80 MHz (Opt 122), 40 MHz (Opt 140)
WB ADC Dither	On
FFT Window	Flat Top (High Amptd Acc)
FFT Size:	
Length Control	Auto
Min Points/RBW	3.100
Window Length	236 (Opt. 122), 118 (Opt. 140)
FFT Length	256 (Opt. 122), 128 (Opt. 140)

View/Trace Key Menu

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

- **Spectrum** - Provides a combination view of the spectrum graph in parameters of power versus frequency with semi-log graticules, and the I/Q waveform graph in parameters of voltage and time. Changes to frequency span or power will sometimes affect data acquisition. This is equivalent to changing the selected window with the **Next** key.

Figure 5-3 Spectrum Measurement - Spectrum and I/Q Waveform (Default View)

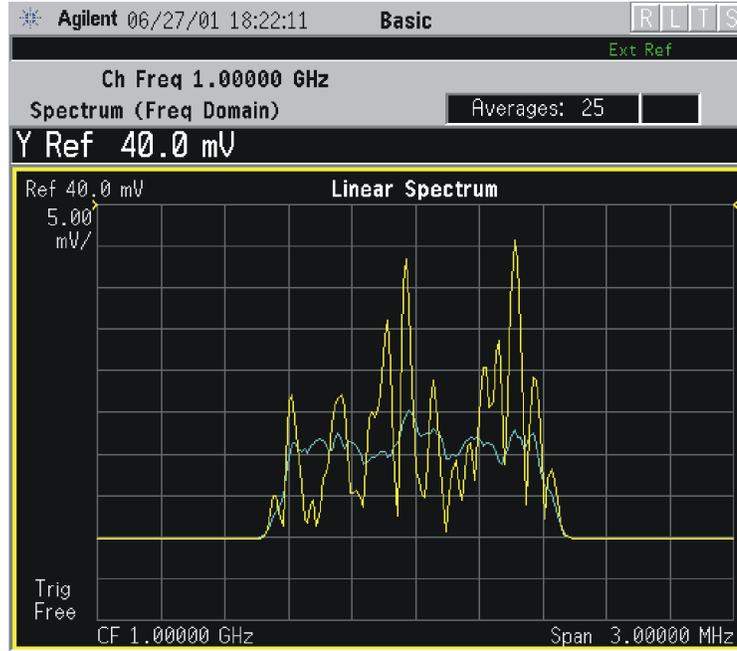


The spectrum measurement result should look like the above figure. The measurement result values are shown in the summary result window.

- **Spectrum (Time Domain) I/Q Waveform** - (Key for PSA only) This graph is shown below the **Spectrum** graph in the default dual-window display. **I/Q Waveform** provides a view of the I/Q waveform in parameters of voltage versus time in linear scale. Changes to sweep time or resolution bandwidth can affect data acquisition. Pressing this button is equivalent to pressing the **Next Window** button on the front panel. Press the **Zoom** key to view this display full-screen.

- **Spectrum Linear** - (for E4406A) Provides a view of the spectrum graph in parameters of voltage versus frequency in linear scale. Changes to frequency span or voltage can affect data acquisition.

Figure 5-4 Spectrum Measurement - Linear Spectrum View (for E4406A)



*Meas Setup: View/Trace = Spectrum Linear,
Span = 3.000 MHz,
Y Scale/Div = 5.00 mV, Ref Value = 30.0 mV,
Others = Factory default settings

*Input signals: -10.00 dBm, 9 channels of SR1, cdma2000 Rev 8

NOTE

(for E4406A) For the widest spans, the I/Q window becomes just “ADC time domain samples”, because the I/Q down-conversion is no longer in effect. This is not the case for E4406A Option B7C if the **Input Port** is set to either **I/Q**, **I only**, or **Q only** and you have connected baseband I/Q signals to the **I/Q INPUT** connectors.

- **I and Q Waveform** - (for E4406A) Provides individual views of the I and Q signal waveform windows in parameters of voltage versus time.

To select the I or Q trace view, press the **Next** key at the bottom of the display. The selected window will have a green outline. To view the window full size press the **Zoom** key.

Figure 5-5 Spectrum Measurement - I and Q Waveform View (for E4406A)

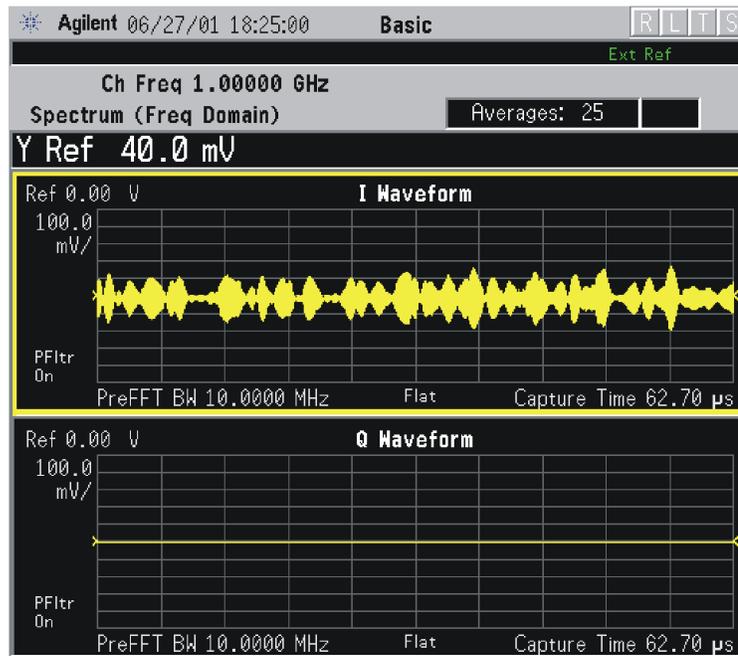
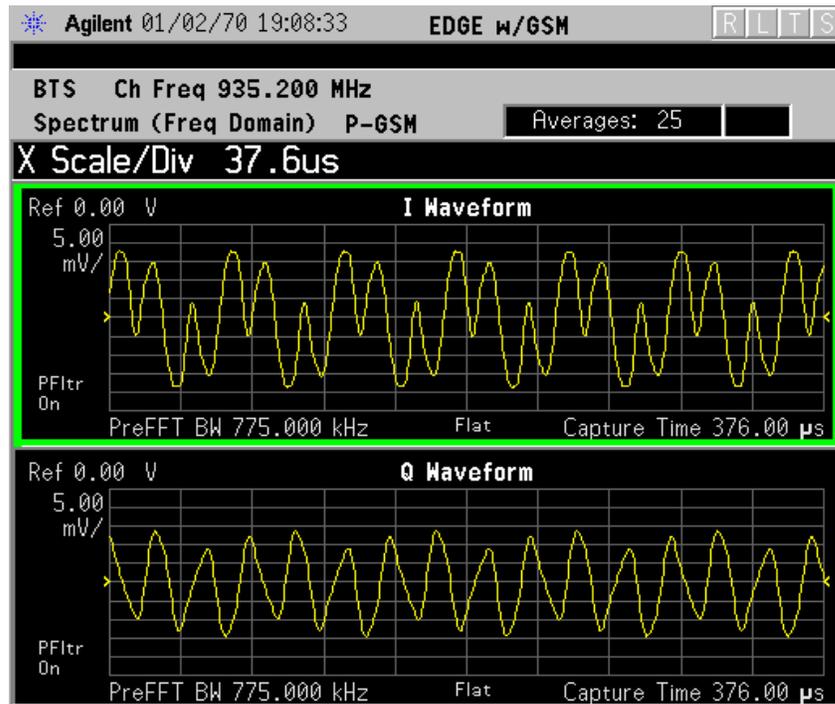
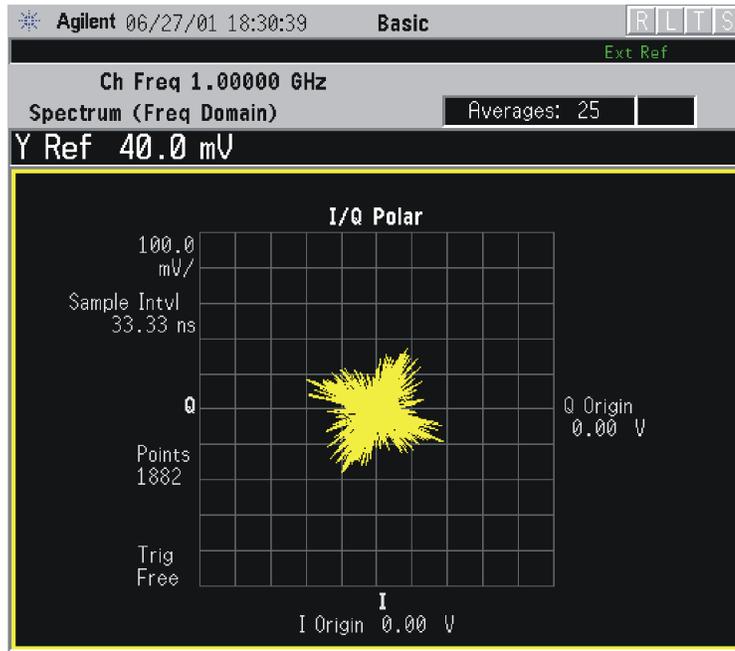


Figure 5-6 Spectrum Measurement - I and Q Waveform View (for E4406A)



- **I/Q Polar** - (for E4406A) Provides a view of the I/Q signal displayed in a polar vector graph.

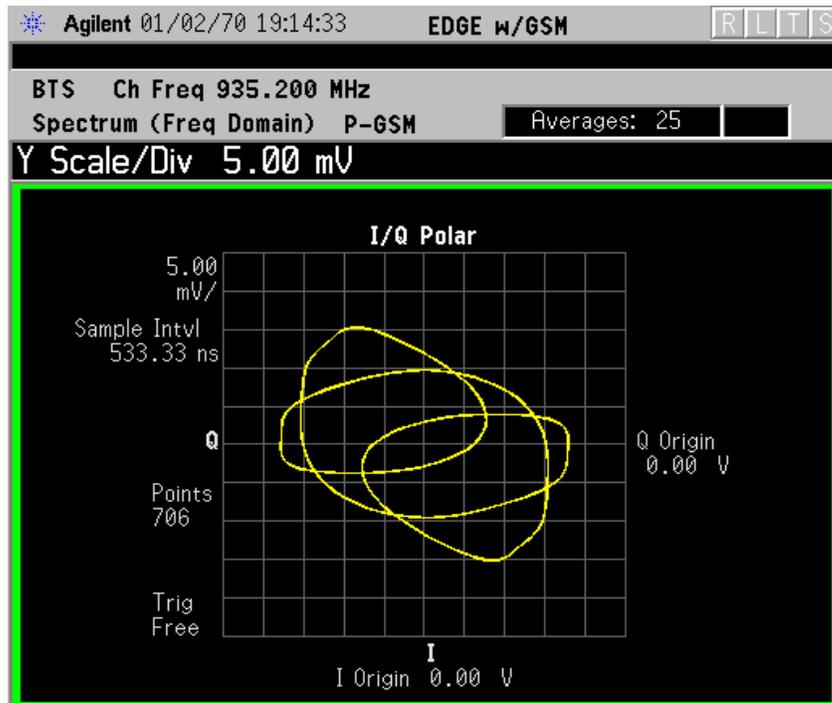
Figure 5-7 Spectrum Measurement - I/Q Polar View (for E4406A)



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

*Input signals: -10.00 dBm, Pilot channel, 1xEV-DO

Figure 5-8 Spectrum Measurement - I/Q Polar View (for E4406A)



- **Trace Display** - Press this key to reveal the trace selection menu. The

currently selected trace type is shown on the **Trace Display** key.

- **All** - Views both the current trace and the average trace.
- **Average** - Views only the average trace (in blue color). See the **Meas Setup, Average** keys to select different types of averaging.
- **Current** - Views only the trace (in yellow color) for the latest data acquisition.
- **I Trace** - (for E4406A) Views only the I signal trace.
- **Q Trace** - (for E4406A) Views only the Q signal trace.

SPAN X Scale Key Menu

NOTE The Spectrum or Linear Spectrum (for E4406A) window must be active in the **Spectrum** or **Spectrum Linear** (for E4406A) view to access the following **Span X Scale** key menu:

- **Span** - Modifies 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. The **Span** key is also accessible under the **Meas Setup** menu.

NOTE The I/Q Waveform (for E4406A) window must be active in the **Spectrum** or **Spectrum Linear** (for E4406A) view to access the following **Span X Scale** key menu:

- **Scale/Div** - Sets the horizontal scale by changing a time value per division. The range is 1.00 ns to 1.00 s per division. The default setting is 18.8 ms per division. However, since the **Scale Coupling** default is **On**, this value is automatically determined by the measurement results. When you set a value manually, **Scale Coupling** automatically changes to **Off**.
- **Ref Value** - Sets the reference value ranging from -1.00 to 10.0 s. The default setting is 0.00 s. However, since the **Scale Coupling** default is **On**, this value is automatically determined by the measurement results. When you set a value manually, **Scale Coupling** automatically changes to **Off**.
- **Ref Position** - Sets the reference position to either **Left, Ctr** (center) or **Right**. The default setting is **Left**.
- **Scale Coupling** - Toggles the scale coupling function between **On** and **Off**. The default setting is **On**. Upon pressing the **Restart** front-panel key or **Restart** menu key under the **Meas Control** menu, this function automatically determines the scale per division and reference values based on the measurement results. When you set a value to either **Scale/Div** or **Ref Value** manually, **Scale Coupling** automatically

changes to **Off**.

NOTE

The **I/Q Polar** window must be active in the **I/Q Polar** view (for E4406A), for the **SPAN X Scale** key to access the following menu:

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

AMPLITUDE Y Scale Key Menu

NOTE

The **Spectrum** or **Linear Spectrum** (for E4406A) window must be active in the **Spectrum** or **Spectrum Linear** (for E4406A) view to access the following **AMPLITUDE Y Scale** key menu:

- **Scale/Div** - Sets the vertical scale by changing an amplitude value per division. The range is 0.10 dB to 20.00 dB per division or 1.00 nV to 20.00 V per division, respectively. The default setting is 10.00 dB or 100.0 mV. However, since the **Scale Coupling** default is **On**, this value is automatically determined by the measurement results. When you set a value manually, **Scale Coupling** automatically changes to **Off**.
- **Ref Value** - Sets the reference value ranging from -250.00 to 250.00 dBm or -250.00 to 250.00 V. The default setting is 0.00 dBm or 0.00 V. However, since the **Scale Coupling** default is **On**, this value is automatically determined by the measurement results. When you set a value manually, **Scale Coupling** automatically changes to **Off**.
- **Ref Position** - Sets the reference position to either **Top**, **Ctr** (center) or **Bot** (bottom). The default setting is **Ctr**.
- **Scale Coupling** - Toggles the scale coupling function between **On** and **Off**. The default setting is **On**. Upon pressing the **Restart** front-panel key or **Restart** menu key under the **Meas Control** menu, this function automatically determines the scale per division and reference values based on the measurement results. When you set a value to either **Scale/Div** or **Ref Value** manually, **Scale Coupling** automatically changes to **Off**.

NOTE

The **I** or **Q** **Waveform** window must be active in the **I and Q Waveform** view (for E4406A) for the **AMPLITUDE Y Scale** key to access the following menu:

- **Scale/Div** - Sets the vertical scale by changing the amplitude value per division. The range is 1.00 nV to 20.00 V per division. The default setting is 100.0 mV. However, since the **Scale Coupling** default is **On**, this value is automatically determined by the

measurement results. When you set a value manually, **Scale Coupling** automatically changes to **Off**.

- **Ref Value** - Sets the reference value ranging from -250.00 to 250.00 V. The default setting is 0.00 V. However, since the **Scale Coupling** default is **On**, this value is automatically determined by the measurement results. When you set a value manually, **Scale Coupling** automatically changes to **Off**.
- **Ref Position** - Sets the reference position to either **Top**, **Ctr** (center) or **Bot** (bottom). The default setting is **Ctr**.
- **Scale Coupling** - Toggles the scale coupling function between **On** and **Off**. The default setting is **On**. The **Restart** front-panel key or **Restart** menu key under the **Meas Control** menu, this function automatically determines the scale per division and reference values by the measurement results. When you set a value to either **Scale/Div** or **Ref Value** manually, **Scale Coupling** automatically changes to **Off**.

NOTE

The I/Q Polar window must be active in the **I/Q Polar** view (for E4406A), for the **AMPLITUDE Y Scale** key to access the following menu:

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

Display Key Menu

The Display Key is not active for this measurement.

Marker Key Menu

- **Select 1 2 3 4** - Activates 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** - Activates the selected marker to read the frequency and amplitude of the marker position on the spectrum trace. Marker position is controlled by the **RPG** knob.
- **Delta** - Reads the differences in frequency and amplitude between the selected marker and the next marker.
- **Function Off** - Selects 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** - Places the selected marker on the **Spectrum**, **Spectrum Avg**, **Spectrum Linear** (for E4406A), **Spectrum Avg Linear** (for E4406A), **I/Q Waveform**, **I Waveform** (for E4406A), or **Q Waveform** (for

E4406A) trace. The default is **Spectrum**.

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

Peak Search Key

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

Waveform (Time Domain) Keys

NOTE You must have selected **Waveform** under the Key Path: **MEASURE** menu to access these menus.

Measurement Setup Key Menu

Key Path: **Meas Setup**

- **Sweep Time** - Specifies the measurement acquisition time which is used as the length of the time capture record. The range is 1.0 μ s and 100.0 s, depending upon the resolution bandwidth setting and the available internal memory size for acquisition points.
- **Res BW** - Sets the measurement bandwidth. The range is 10 Hz to 8 MHz using the Gaussian filter selected from RBW Filter under the Advanced menu, or 10 Hz to 10 MHz using the Flat top filter selected from RBW Filter. A larger bandwidth results in a larger number of acquisition points and reduces the maximum value allowed for the sweep time.
- **Average**
 - **Avg Number** - Changes the number of N averages.
 - **Avg Mode** - Toggles the averaging mode between **Exp** (exponential) and **Repeat**. This selection only effects on 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 the 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 average count displayed 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** - Accesses the menu of the following average types only for making spectrum (frequency domain) and waveform (time domain) measurements:
 - ❑ **Pwr Avg (RMS)** - Executes the true power averaging which is calculated by averaging the rms 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. This type of averaging will underestimate the power when the signal is noise-like.
 - ❑ **Voltage Avg** - Executes voltage averaging.
 - ❑ **Maximum** - Captures peak voltage data. Simulates the traditional spectrum analyzer peak hold function.
 - ❑ **Minimum** - Captures the minimum voltage data, similar to the maximum function.

CAUTION If triggering is set incorrectly, averaged signal results can approach nil. “HW Average” is displayed when averaging is ON.

TIP If your measurement results vary or provide unexpected values, try turning Averaging OFF and execute single, non-averaged measurements to check your triggering setup. Press **Meas Control, Measure, Single** to make non-continuous measurements.

- **Trig Source**
Key path: **Meas Setup, Trig Source**

NOTE Changing the selection in the **Trig Source** menu alters the trigger source for the selected measurement only.

- **Free Run (Immediate)** - A trigger occurs at the time the data is requested, completely asynchronous with the RF or IF signal.
- **Video (Envlp)** - An internal IF envelope trigger that occurs at the absolute threshold level of the IF signal level.
- **RF Burst (Wideband)** - An internal wideband RF burst trigger that has the automatic level control for burst signals. It triggers at the level that is set relative to the peak RF signal (12 MHz bandwidth) input level.
- **Ext Front** - Activates the front panel external trigger input (**EXT TRIGGER INPUT**) port. The external signal must be between -5.00 and $+5.00$ V with 1 or 10 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 or 10 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. Refer to the specific measurement section for details.
- **Line** - Sets the trigger to the internal line mode. Sweep triggers occur at intervals synchronous to the line frequency. See the specific measurement section for details.
- **Restore Meas Defaults** - Presets 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.
- **(Narrowband) Advanced** - Accesses the menu to change the following parameters.

CAUTION

The advanced features should be used only if you are familiar with their operation. Changes from the default values may result in invalid data.

The **Narrowband** key label word is only present if you have Option B7J and either Option 122 or 140 installed. Parameters that are under the **(Narrowband) Advanced** key only affect the standard narrow band IF path. The wideband IF advanced functions are found under the **Wideband Advanced** key.

- **Pre-ADC BPF** - Toggles 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** - Toggles the resolution bandwidth filter selection between **Flat** and **Gaussian**. If set to **Gaussian**, the filter provides more even time-domain response, particularly for “bursts”. If set to **Flat**, the filter provides a flatter bandwidth but is less accurate for “pulse responses”. A flat top filter also requires less memory and allows longer data acquisition times. For most waveform applications, the Gaussian filter is recommended. The resolution bandwidth range is 10 Hz to 8 MHz using the Gaussian filter or 10 Hz to 10 MHz using the Flat top filter.
- **ADC Range** - Accesses the menu to select one of the ADC ranging functions:
 - Auto** - Automatically adjusts the signal range for optimal measurement results.
 - AutoPeak** - Continuously searches for the highest peak signal.

- ❑ **AutoPeakLock** - Adjusts the range for the highest peak signal it identifies. It retains the range settings determined by that peak signal, even when the peak signal is no longer present.
- ❑ **Manual** - Accesses the selection menu of values, -6 to +24 dB for E4406A or None to +18 dB for PSA, to set the ADC range level. Also note that manual ranging is best for CW signals.
- **Data Packing** - Selects **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** - Toggles 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** - Toggles 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.

Table 5-4

Waveform (Time Domain) Measurement Defaults

Measurement Parameter	Factory Default Condition
Sweep Time	2.000 ms
Res BW	100.000 kHz
Averaging: Avg Number Avg Mode Avg Type	10; Off Exp Pwr Avg (RMS)
Trig Source	Free Run (Immediate)
IF Path (requires Option B7J and Option 122 or 140)	Narrow

Table 5-4

Waveform (Time Domain) Measurement Defaults

Measurement Parameter	Factory Default Condition
Wideband IF Gain (Option 122 or 140)	0.00 dB
Wideband Filtering (Option 122 or 140) Filter Type Filter Alpha Filter BW	None 0.30 0.50
Signal Envelope View SPAN X Scale - Scale/Div AMPLITUDE Y Scale - Scale/Div	(for E4406A) 200.0 μ s 10.00 dB
RF Envelope View SPAN X Scale - Scale/Div AMPLITUDE Y Scale - Scale/Div	(for PSA) 200.0 μ s 10.00 dB
Linear Envelope View SPAN X Scale - Scale/Div Linear Envelope window: AMPLITUDE Y Scale - Scale/Div Phase window: AMPLITUDE Y Scale - Scale/Div	(for E4406A Option B7C) 200.0 μ s 100.0 mV 30.0 deg
I/Q Waveform View: SPAN X Scale -Scale/Div AMPLITUDE Y Scale - Scale/Div	200.0 μ s 100.0 mV
I and Q Waveform View: SPAN X Scale -Scale/Div AMPLITUDE Y Scale - Scale/Div	(for E4406A Option B7C) 200.0 μ s 100.0 mV
I/Q Polar View: I/Q Scale/Div I or Q Origin	(for E4406A) 100.0 mV 0.00 V
(Narrowband) Advanced	
Pre-ADC BPF	Off
RBW Filter	Gaussian
ADC Range	Auto
Data Packing	Auto
ADC Dither	Off
Decimation	Off
Wideband Advanced (Option 122 or 140)	
ADC Correction	On

Table 5-4

Waveform (Time Domain) Measurement Defaults

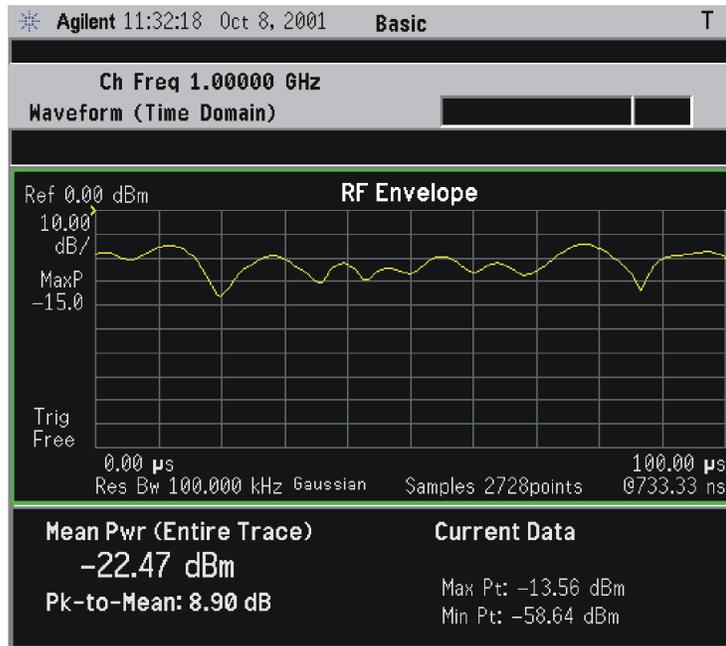
Measurement Parameter	Factory Default Condition
IF Flatness Corrections	On
Analog Filter	Auto, 80 MHz (Opt 122), 40 MHz (Opt 140)
WB ADC Dither	On
Trigger Interpolation	On

View/Trace Key Menu

Key Path: **View/Trace**

- **RF Envelope** (for E4406A) or **Signal Envelope** (for PSA) - Displays a time domain graph of the signal. The measured values for the mean power and peak-to-mean power are shown in the text window.

Figure 5-9 Waveform Measurement - RF Envelope (Default View)



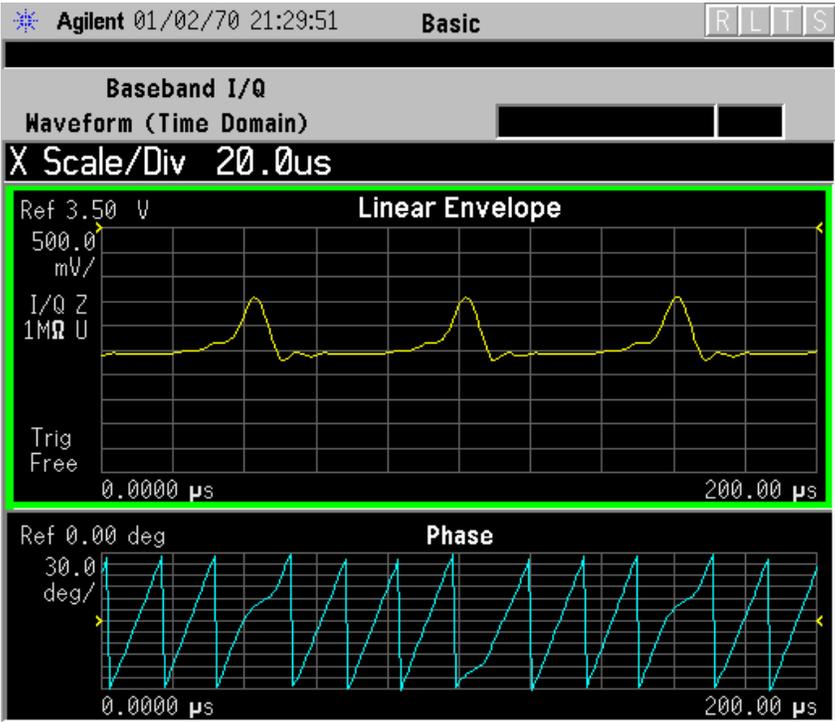
*Meas Setup: Trace/View = RF Envelope,
Others = Factory default settings

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

- **Linear Envelope** - (for E4406A Option B7C) Provides a combination view of a linear signal envelope graph and a phase graph with linear graticules. Use the **Next Window** and **Zoom** keys to select and enlarge either graph.

Figure 5-10

Waveform Measurement - Linear Envelope View



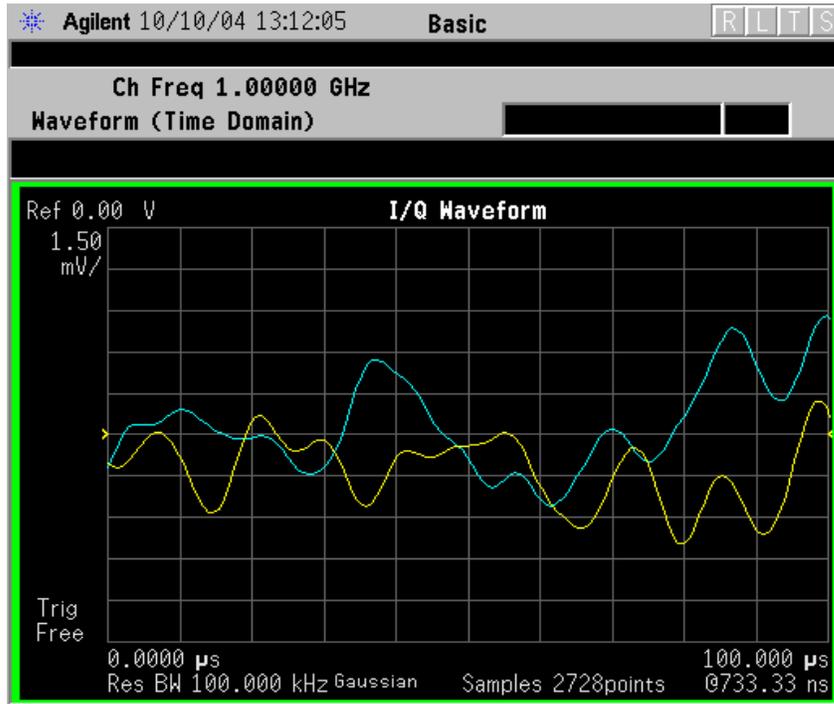
*Meas Setup: View/Trace = Linear Envelope View, GSM signal
Others = Factory defaults, except X and Y scales

Key Reference

- **I/Q Waveform** - Provides a view of the I and Q waveforms together on the same graph in parameters of voltage versus time in linear scale. Changes to sweep time or resolution bandwidth can affect data acquisition.

Figure 5-11

Waveform Measurement - I/Q Waveform View

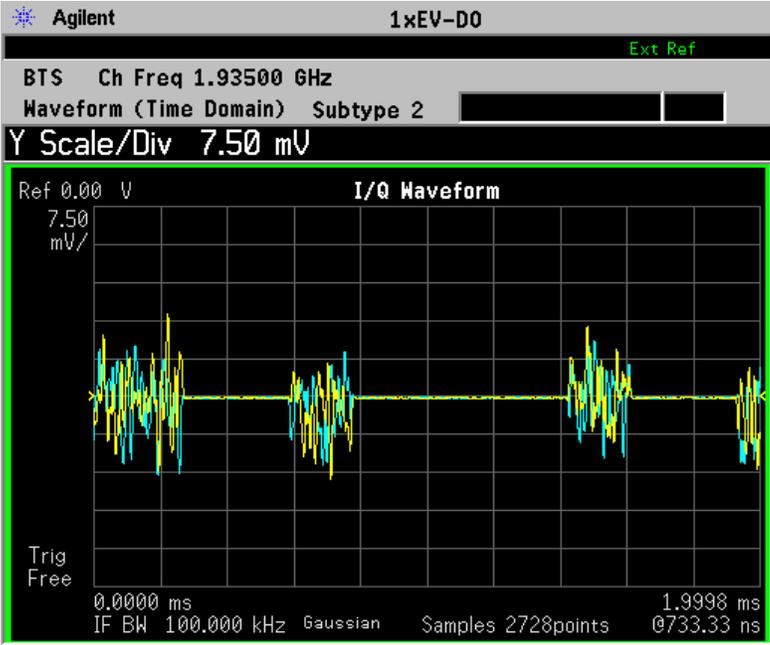


NOTE For the widest spans, the I/Q Waveform window becomes just “ADC time domain samples”, because the I/Q down-conversion is no longer in effect.

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

- **I and Q Waveform** - (for E4406A Option B7C) Provides a combination view of the I and Q signal waveform graphs in the linear scales.

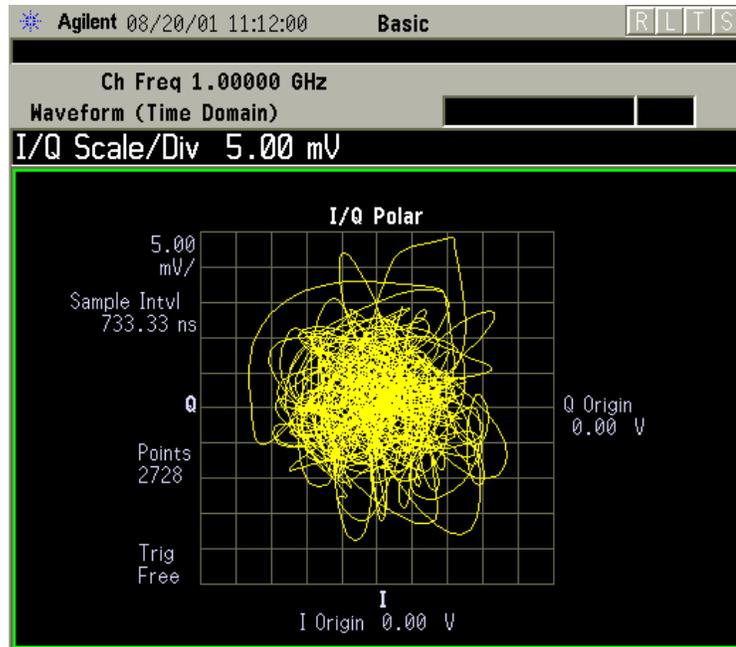
Figure 5-12 Waveform Measurement - I and Q Waveform View



Key Reference

- **I/Q Polar** - (for E4406A) Provides a view of the I/Q signal in a polar vector graph.

Figure 5-13 Waveform Measurement - I/Q Polar View



*Meas Setup: View/Trace = I/Q Polar View,
Others = Factory defaults, except X and Y scales

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

- **Trace Display** - Press this key to access the trace selection menu. The currently selected trace type is shown on the **Trace Display** key.
 - **All** - Views both the current trace and the average trace.
 - **Average** - Views only the average trace (in blue color). See the **Meas Setup**, **Average** keys to select different types of averaging.
 - **Current** - Views only the trace (in yellow color) for the latest data acquisition.
 - **I Trace** - (for E4406A) Views only the I signal trace.
 - **Q Trace** - (for E4406A) Views only the Q signal trace.

SPAN X Scale Key Menu

Key Path: **Span X Scale**

NOTE

The **SPAN X Scale** key accesses the menu to modify the horizontal parameters common to the scaled windows for this measurement. Use the **Sweep Time** key under the **Meas Setup** menu to control the

horizontal time span for this measurement:

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

NOTE

For E4406A, if the I/Q Polar window is active in the I/Q Polar view, the **SPAN X Scale** key accesses the following menu:

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

AMPLITUDE Y Scale Key Menu

Key Path: **AMPLITUDE Y Scale**

NOTE

If the RF Envelope (for PSA) or Signal Envelope (for E4406A) window is active in the **RF Envelope** (for PSA) or **Signal Envelope** (for E4406A) view, the **AMPLITUDE Y Scale** key accesses the following menu:

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

NOTE

For E4406A with Option B7C, if the Linear Envelope window is active in the **Linear Envelope** view, the **AMPLITUDE Y Scale** key accesses the following menu:

- **Scale/Div** - Sets 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 the **Scale Coupling** default is **On**, this value is automatically determined by the measurement result. When you set a value manually, **Scale Coupling** automatically changes to **Off**.
- **Ref Value** - Sets the reference value ranging from -250.00 to 250.00 V. The default setting is 0.00 V. However, since the **Scale Coupling** default is **On**, this value is automatically determined by the measurement result. When you set a value manually, **Scale Coupling** automatically changes to **Off**.
- **Ref Position** - Sets the reference position to either **Top**, **Ctr** (center) or **Bot** (bottom). The default setting is **Top**.

- **Scale Coupling** - Toggles the scale coupling function between **On** and **Off**. The default setting is **On**. Upon pressing the **Restart** front-panel key or **Restart** menu key under the **Meas Control** menu, this function automatically determines the scale per division and reference values based on the measurement results. When you set a value to either **Scale/Div** or **Ref Value** manually, **Scale Coupling** automatically changes to **Off**.

NOTE

For E4406A with Option B7C, 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** - Sets 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 the **Scale Coupling** default is **On**, this value is automatically determined by the measurement result. When you set a value manually, **Scale Coupling** automatically changes to **Off**.
- **Ref Value** - Sets the reference value ranging from -36000.0 to 36000.0 deg. The default setting is 0.00 deg. However, since the **Scale Coupling** default is **On**, this value is automatically determined by the measurement result. When you set a value manually, **Scale Coupling** automatically changes to **Off**.
- **Ref Position** - Sets the reference position to either **Top**, **Ctr** (center) or **Bot** (bottom). The default setting is **Ctr**.
- **Scale Coupling** - Toggles the scale coupling function between **On** and **Off**. The default setting is **On**. Upon pressing the **Restart** front-panel key or **Restart** menu key under the **Meas Control** menu, this function automatically determines the scale per division and reference values based on the measurement results. When you set a value to either **Scale/Div** or **Ref Value** manually, **Scale Coupling** automatically changes to **Off**.

NOTE

If the I/Q Waveform window is active in the **I/Q Waveform** view (or the I Waveform, or Q Waveform window is active in the **I and Q Waveform** view for E4406A with Option B7C), the **AMPLITUDE Y Scale** key accesses the menu to modify the following parameters:

- **Scale/Div** - Sets the vertical scale by changing an amplitude value per division. The range is 1.00 nV to 20.00 V per division. The default setting is 100.0 mV. However, since the **Scale Coupling** default is **On**, this value is automatically determined by the measurement result. When you set a value manually, **Scale Coupling** automatically changes to **Off**.
- **Ref Value** - Sets the reference value ranging from -250.00 to 250.00 V. The default setting is 0.00 V. However, since the **Scale Coupling**

default is **On**, this value is automatically determined by the measurement result. When you set a value manually, **Scale Coupling** automatically changes to **Off**.

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

NOTE

For E4406A, if the I/Q Polar window is active in the **I/Q Polar** view, the **SPAN X Scale** or **AMPLITUDE Y Scale** key accesses the menu to modify the following parameters:

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

Display Key Menu

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

Marker Key Menu

Key Path: **Marker**

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

- **Select 1 2 3 4** - Activates 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** - Activates the selected marker to read the time position and amplitude of the marker on the RF envelope or Signal Envelope trace. Marker position is controlled by the **RPG** knob.
- **Delta** - Reads the differences in frequency and either time position or amplitude, between the selected marker and the next marker.
- **Function Off** - Selects the marker function to be **Band Power**, **Noise**, or **Off**. The default is **Off**. If set to **Band Power**, you need to select **Delta**.
- **Trace** - Places the selected marker on **RF Envelope** (for PSA), **Signal Envelope** (for E4406A), or **I/Q Waveform**. Also, for E4406A with Option

B7C, you can place the marker on **Linear Envelope**, **Linear Phase**, **I Waveform**, or **Q Waveform**.

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

Peak Search Key

Key Path: **Search**

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

NOTE

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

Power Stat CCDF Keys

NOTE You must have selected **Power Stat CCDF** under the **MEASURE** menu to access these menus.

Meas Setup Key Menu

Key Path: **Meas Setup**

- **Meas BW** - Allows you to set the measurement bandwidth according to the channel bandwidth.
- **Counts** - Allows you to set the accumulated number of sampling points for data acquisition. The range is 1.000 kpt (killo points) to 2.00000 Gpt (Giga points) with 1 kpt resolution. While this key is activated, enter a value from the numeric keypad and terminate with one of the unit keys shown.
- **Meas Interval** - Sets the number of data points that will be used as the measurement interval.
- **Wideband Setup** - Allows you to configure the wideband hardware path.
 - **Wideband IF Gain** - Sets the gain for the wideband IF path in 2 dB steps from -12 to +12 dB. Increasing the gain can increase the amplitude of small signals as long as you don't overdrive the hardware. Wideband gain should usually be adjusted after setting the input attenuation.
 - **Wideband Filtering** - Accesses the keys to configure the optional channel filter. The default is no filtering.
 - Filter Type** - Selects **None** for no filtering, or **Raised Cosine**, **RRC** (root-raised cosine), **Nyquist**, **Root Nyquist**, or **Gaussian**.
 - Filter Alpha** - Specifies the channel filter alpha for cosine and Nyquist filters applied within the wideband digital IF. This filter alpha is the ratio of transition bandwidth divided by 2, to filter bandwidth. Pressing Filter Alpha allows you to enter this numeric value.
 - Filter BW** - Specifies the bandwidth of the filter with respect to the sample rate (i.e. BW/sample rate) of channel filter.
 - **Sample Rate** - Sets the sampling rate. This parameter is coupled with the **Meas BW**. Changes to either **Sample Rate** or **Meas BW** will affect both parameters.
 - **Block Size** - Shows the number of samples within one Meas Interval. This key is for information only. It is always grayed out.

- **Wideband Advanced** - Accesses the advanced settings for the wideband IF hardware path.

NOTE

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

- ADC Corr** - Turning corrections on performs an ADC calibration to reduce the spectral image and applies the corrections.
- IF Flat Corr** - Turns IF flatness corrections on and off in all wideband IF measurements.
- WB ADC Dither** Toggles the wideband dither signal on or off. The “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 the dynamic range by approximately 3 dB. It should only be turned off when measuring a noise-like signal and the 1 to 2 dB extra dynamic range is needed. The wideband dither control does not affect the ADC dither in the narrowband IF path.
- Trig Interp** - This key toggles the Trigger interpolation function on or off.

- **Trigger**

Key path: **Meas Setup, Trig Source**

NOTE

Changing the selection in the **Trig Source** menu alters the trigger source for the selected measurement only.

- **RF Burst** -
- **Video (Envlp)** - An internal IF envelope trigger that occurs at the absolute threshold level of the signal passed by the IF signal level.
- **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 or 10 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 or 10 mV resolution.
- **Trig Holdoff** - Sets the period of time before the next trigger can occur. The range is 0.000 μ s to 500.0 ms with 1 μ s resolution.

For Option 122 or 140: When the wideband path is selected, the trigger holdoff is the minimum time that must occur between trigger events before a trigger is accepted. For example, a rising

edge external trigger with a 10 ms holdoff will not trigger until at least 10 ms has passed during which no rising edges have occurred.

This Option 123 definition changes slightly for negative slope video triggers. For this case the instrument waits until it sees a time interval *following* the trigger event that is free of additional trigger events. This lets you trigger on the falling edge of a burst that may contain trigger events.

- **Auto Trig** - Specifies a time for a trigger timeout and toggle the auto trigger function between **On** and **Off**. The range is 1.000 ms to 1.000 ks with 1 μ s resolution. If no trigger occurs by the specified time, a trigger is automatically generated.
- **Frame Timer** - Accesses the menu to manually control the frame timer:
 - **Period** - Sets the period of the frame clock. The range is 0.000 ns to 559.0000 ms with 1 ns resolution.
 - **Offset** - Sets the offset of the frame clock. The range is 0.000 to 10.00 s with 100 ns resolution over 1.000 μ s range.
 - **Reset Offset Display** - Displays the measurement without any offset of the frame clock.
 - **Sync Source** - Accesses the menu to select one of the sources to be synchronized with.

For Option 122 or 140: The frame trigger will wait for, and sync with, the first external trigger that is received after sync is turned off. After the sync is received the frame trigger stays locked to that event, ignoring any later triggers. The instrument will only resync if the measurement settings are changed or if an alignment occurs.

- Off** - Turns the synchronizing source off for asynchronous tests.
- Ext Front** - Selects the external input signal from the front panel input port as the synchronizing source. With Option 122 or 140, you can use the external front trigger setup menu to change the trigger level or delay.
 - **Ext Rear** - Selects the external input signal from the rear panel input port as the synchronizing source. With Option 122 or 140, you can use the external rear trigger setup

menu to change the trigger level or delay.

Trigger Default Settings	
RF Burst: Delay Peak Level Slope	0.000 μ s -6.00 dB Pos
Video (Envlp): Delay Level Slope	0.000 μ s -6.00 dBm Pos
Ext Front: Delay Level Slope	0.000 μ s 2.00 V Pos
Ext Rear: Delay Level Slope	0.000 μ s 2.00 V Pos
Trig Holdoff	0.000 ms
Auto Trig	100.0 ms; Off
Frame Timer: Period Offset Sync Source	26.666667 ms 0.000 ms Off

6 **Concepts**

This chapter provides details about how the various measurements are performed by the instrument.

Adjacent Channel Power (ACP) Measurement Concepts

Purpose

Adjacent Channel Power (ACP) is the power contained in a specified frequency channel bandwidth relative to the total carrier power. It may also be expressed as a ratio of power spectral densities between the carrier and the specified offset frequency band.

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

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

Measurement Method

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

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

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

Channel Power Measurement Concepts

Purpose

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

Measurement Method

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

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

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

For E4406A Option B7C, this measurement is available for use with either the RF input or baseband I/Q inputs. For detailed operation, see the "Using Option B7C Baseband I/Q Inputs" section.

Power Stat CCDF Measurement Concepts

Purpose

Many of the digitally modulated signals now look noise-like in the time and frequency domain. This means that statistical measurements of the signals can be a useful characterization. Power Complementary Cumulative Distribution Function (CCDF) curves characterize the higher level power statistics of a digitally modulated signal. The curves can be useful in determining design parameters for digital communications systems.

The power statistics CCDF measurement can be affected by many factors. For example, modulation filtering, modulation format, combining the multiple signals at different frequencies, number of active codes, and correlation between symbols on different codes with spread spectrum systems will all affect measurement results. These factors are all related to modulation and signal parameters. External factors such as signal compression and expansion by nonlinear components, group delay distortion from filtering, and power control within the observation interval also affect the measurement.

Both the amplifier designer and the system integrator must make sure that the PA (and other components) can handle the PAR that the signal exhibits for the different data rates, while maintaining a good ACL performance. You can use the complementary cumulative distribution function to help you with this job.

The complementary cumulative distribution function (CCDF) fully characterizes the power statistics of a signal [15].

CCDF curves can help you in several situations:

- To determine the headroom required when designing a component [15].
- To confirm the power statistics of a given signal or stimulus. CCDF curves allow you to verify if the stimulus signal provided by another design team is adequate. For example, RF designers can use CCDF curves to verify that the signal provided by the digital signal processing (DSP) section is realistic.
- To confirm that a component design is adequate or to troubleshoot your subsystem or system design, you can make CCDF measurements at several points of a system. For example, if the ACLR of a transmitter is too high, you can make CCDF measurements at the input and output of the PA. If the PA design is

correct, the curves will coincide. If the PA compresses the signal, the PAR of the signal is lower at the output of the PA.

Measurement Method

The power measured in power statistics CCDF curves is actually instantaneous envelope power defined by the equation:

$$P = (I^2 + Q^2)/Z_0$$

(where I and Q are the quadrature voltage components of the waveform and Z_0 is the characteristic impedance).

A CCDF curve is defined by how much time the waveform spends at or above a given power level. The percent of time the signal spends at or above the level defines the probability for that particular power level. For capturing a lower probability down to 0.0001%, this measurement is made in the single mode by setting **Measure** under **Meas Control** to **Single**. To make the power statistics CCDF measurement, the instrument uses digital signal processing (DSP) to sample the input signal in the channel bandwidth.

The Gaussian distribution line as the band-limited Gaussian noise CCDF reference line, the user-definable reference trace, and the currently measured trace can be displayed on a semi-log graph. If the currently measured trace is above the user reference trace, it means that the higher peak power levels against the average power are included in the input signal.

For E4406A, Option B7C, in addition to RF input signals, baseband I/Q input signals can be measured using the Option B7C “Baseband I/Q Inputs”.

Spectrum (Frequency Domain) Measurement Concepts

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.

For E4406A Option B7C, 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 [“Using Option B7C Baseband I/Q Inputs”](#).

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.

Waveform (Time Domain) Measurement Concepts

Purpose

The waveform measurement is a generic measurement for viewing the input signal waveforms in the time domain. This measurement is how the instrument performs the zero span functionality found in traditional spectrum analyzers.

Basic mode waveform measurement data may be displayed using either a Signal Envelope window, or an I/Q window which shows the I and Q signal waveforms in parameters of voltage versus time. The advantage of having an I/Q view available while making a waveform measurement is that it allows you to view complex components of the same signal without changing settings or measurements.

For E4406A, an I/Q Polar display is also available to view the I and Q waveforms in a polar plot. This display shows the instantaneous relationship between the I and Q waveform voltages.

The waveform measurement can be used to perform general purpose power measurements in the time domain with excellent accuracy.

Measurement Method

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

For E4406A with Option B7C, this measurement is available for use with both the RF input and baseband I/Q inputs. For details on Baseband I/Q operation see the section on “Using Option B7C Baseband I/Q Inputs”.

Baseband I/Q Inputs (Option B7C) Measurement Concepts

The E4406A VSA Option B7C Baseband I/Q Inputs provides the ability to analyze baseband I/Q signal characteristics of mobile and base station transmitters. This option may be used only in conjunction with the following personalities:

- Basic mode (available in all VSA Series Transmitter Testers)
- Option BAF W-CDMA Measurement Personality
- Option B78 cdma2000 Measurement Personality
- Option 202 GSM with EDGE
- Option 252 GSM to GSM with EDGE upgrade

What are Baseband I/Q Inputs?

Option B7C consists of a Baseband Input module, four 50 Ω BNC connectors, and internal cabling. The four BNC connectors are grouped into pairs at the upper left corner of the front panel. The upper two connectors labeled “I” and “Q” are the “unbalanced” inputs.

In practice, an unbalanced or “single-ended” baseband measurement of an I or Q signal is made using a probe connected to the I or Q connector. A simultaneous I/Q unbalanced single-ended measurement may be made using two probes connected to the I and Q input connectors.

If “balanced” signals are available, they may be used to make a more accurate measurement. Balanced signals are signals present in two separate conductors, are symmetrical about ground, and are opposite in polarity, or out of phase by 180 degrees.

Measurements using balanced signals can have a higher signal to noise ratio resulting in improving accuracy. Noise coupled into each conductor equally in a “common mode” to both signals may be separated from the signal. The measure of this separation is “common-mode rejection”.

To make a balanced measurement, the lower two connectors labeled “ \bar{I} ” and “ \bar{Q} ” are used in conjunction with the I and Q inputs. The terms “I-bar” and “Q-bar” may be applied to the signals, as well as the inputs themselves. Probes (customer provided) must be used to input balanced baseband I/Q signals. This may be referred to as a balanced measurement.

Balanced baseband measurements are made using the I and \bar{I} connectors for I only signal measurements, while the Q and \bar{Q} connectors are used for a Q only signal measurement. Balanced

measurements of I/Q require differential probe connections to all four input connectors. For details of probe selection and use, refer to “[Selecting Input Probes for Baseband Measurements](#)” on page 225.

What are Baseband I/Q Signals?

In transmitters, the term baseband I/Q refers to signals that are the fundamental products of individual I/Q modulators, before the I and Q component signals are combined, and before up conversion to IF or RF frequencies.

In receivers, baseband I/Q analysis may be used to test the I and Q products of I/Q demodulators, after an RF signal has been down converted and demodulated.

Why Make Measurements at Baseband?

Baseband I/Q measurements are a valuable means of making qualitative analyses of the following operating characteristics:

- I/Q signal layer access for performing format-specific demodulation measurements (e.g. CDMA, GSM, W-CDMA):
- Modulation accuracy – i.e. I/Q plane metrics
 - rho
 - error vector magnitude; rms, peak, or 95%
 - carrier feed-through
 - frequency error
 - magnitude and phase errors
- Code-domain analysis (including code-specific metrics)
- CCDF of $I^2 + Q^2$
- Single sideband (SSB) metrics for assessing output quality
- Basic analysis of I and Q signals in isolation including: DC content, rms and peak to peak levels, CCDF of each channel

Comparisons of measurements made at baseband and RF frequencies produced by the same device are especially revealing. Once signal integrity is verified at baseband, impairments can be traced to specific stages of up conversion, amplification, or filtering by RF analysis. Likewise, impairments to signal quality that are apparent at RF frequencies may be traceable to baseband using baseband analysis.

Selecting Input Probes for Baseband Measurements

The selection of baseband measurement probe(s) and measurement

method is primarily dependent on the location of the measurement point in the circuit. The probe must sample voltages without imposing an inappropriate load on the circuit.

The following measurement methods may be used with baseband I/Q inputs:

- **50 Ω Unbalanced** - This is the measurement method of choice if single-ended or unbalanced baseband I and/or Q signals are available in 50 Ω coaxial transmission lines and are terminated in a coaxial connectors. Adapters necessary to convert to a 50 Ω BNC-type male connector must be of 50 Ω impedance.

The methods are as follows:

- I only measurement using one single-ended probe connected to the I input connector (available in the Basic mode)
- Q only measurement using one single-ended probe connected to the Q input connector (available in the Basic mode)
- I/Q measurement using two single-ended probes connected to the I and Q input connectors
- **600 Ω Balanced** - This is the measurement method of choice if balanced baseband signals having a 600 Ω impedance are available. The methods are as follows:
 - I only measurement using one differential probe or two single-ended probes connected to the I and \bar{I} inputs (available in the Basic mode)
 - Q only measurement using one differential probe or two single-ended probes connected to the Q and \bar{Q} inputs (available in the Basic mode)
 - I/Q measurement using two differential probes or four single-ended probes connected to the I, Q, \bar{I} , and \bar{Q} input connectors
- **1 M Ω Unbalanced** - High input impedance is the measurement method of choice if single-ended or unbalanced baseband signals to be measured lie in a trace on a circuit board and are sensitive to loading by the probe. This is the default input connector setting.

When making 1 M Ω measurements, the reference input impedance may be adjusted. 1 M Ω unbalanced measurements may be made as follows:

- I only measurement using one single-ended probe connected to the I input connector (available in the Basic mode)
- Q only measurement using one single-ended probe connected to the Q input connector (available in the Basic mode)

- I/Q measurement using two single-ended probes connected to the I and Q input connectors
- **1 M Ω Balanced** - High input impedance measurements may also be made if differential or balanced signals are available. 1 M Ω balanced measurements may be made as follows:
 - I only measurement using one differential probe or two single-ended probes connected to the I and \bar{I} inputs (available in the Basic mode)
 - Q only measurement using one differential probe or two single-ended probes connected to the Q and \bar{Q} inputs (available in the Basic mode)
 - I/Q measurement using two differential probes or four single-ended probes connected to the I, Q, \bar{I} , and \bar{Q} input connectors

This is the measurement method of choice if differential or balanced baseband signals to be measured lie in a trace on a circuit board and are sensitive to loading by the probe. When making 1 M Ω measurements, the reference input impedance may be adjusted.

The following table lists the probes currently available from Agilent, which are suitable for use under various measurement conditions:

Table 6-1 Agilent Probes - Balanced and Unbalanced

Probe Type	Description
Unbalanced (single-ended)	1144A 800 MHz Active Probe ^{abc} 54701A 2.5 GHz Active Probe ^{bcd} 1145A 750 MHz 2-Channel Active Probe ^{abc} 85024A High Frequency Probe ^{be} 41800A Active Probe ^{bf} 10020A Resistive Divider Probe ^{bc} 54006A 6 GHz Passive Divider Probe ^g
Balanced (differential)	1141A 200 MHz Active Differential Probe ^{abc} N1025A 1 GHz Active Differential Probe ^{bh}

- a. Not compatible with 3-wire power interface. Needs 1142A power supply. For two channels, you will need either two 1142A power supplies or one 1142A power supply and one 01144-61604 1-input, two-output adapter cable.
- b. Two probes needed to cover both I and Q inputs.
- c. Output connector is BNC-type.
- d. Not compatible with 3-wire power interface. Requires use of 1143A power supply that can power two 54701A probes.
- e. 85024A bandwidth is 300 kHz to 3 GHz. Output connector is N-type. Power is 3-wire connector (+15 V, -12.6 V, ground).
- f. 41800A bandwidth is 5 Hz to 500 MHz. Output connector is N-type. Power is 3-wire connector (+15 V, -12.6 V, ground).
- g. 54006A output connector is 3.5 mm
- h. 3.5 mm output connector, requires ± 15 V supply.

Refer to the current Agilent data sheet for each probe for specific information regarding frequency of operation and power supply requirements.

The E4406A Transmitter Tester provides one “three-wire” probe power connector on the front panel. Typically, it can energize one probe. If you plan on operating more than one probe, make sure you provide sufficient external power sources as required.

Baseband I/Q Measurement Views

Measurement result views made in the Basic mode, or by other compatible optional personalities, are available for baseband signals if they relate to the nature of the signal itself. Many measurements which relate to the characteristics baseband I and Q signals have when mixed and up converted to signals in the RF spectrum can be made as well. However, measurements which relate to the characteristics of an up

converted signal that lie beyond the bandwidth available to the Baseband I/Q Input circuits can not be measured (the limits are up to 5 MHz bandwidth for individual I and Q signals, and up to 10 MHz for composite I/Q signals).

Some measurement views are appropriate for use with both RF and baseband I/Q signals without any modification, while other views must be altered. Some examples of measurements with identical results views are QPSK EVM, Code Domain, and CCDF. For Spectrum measurements, identical views include the I and Q Waveform view and the I/Q Polar view. For Waveform measurements, identical views include the I/Q Waveform view, the Signal Envelope view, and the I/Q Polar view.

At RF frequencies, power measurements are conventionally displayed on a logarithmic vertical scale in dBm units, whereas measurements of baseband signals using Baseband I/Q inputs may be conveniently displayed as voltage using a linear vertical scale as well as a log scale.

Spectrum Views and 0 Hz Center Frequency

Some views must be altered to account for the fundamental difference between RF and baseband I/Q signals. For Spectrum measurements of I/Q signals this includes using a center frequency of 0 Hz for Spectrum views and the Spectrum Linear view. Occupied Bandwidth and Channel Power results are also displayed using a center frequency of 0 Hz.

The center frequency of baseband I/Q Spectrum displays is 0 Hz. Frequencies higher than 0 Hz are displayed as “positive” and those below 0 Hz are “negative”. The “negative” portion of a multi-channel baseband signal below 0 Hz corresponds to the portion of the signal that would lie below the carrier center frequency when it is up converted, if no spectral inversion occurs. As 0 Hz is a fixed center frequency, the **FREQUENCY Channel** front-panel key has no active menu for baseband I/Q Spectrum measurements.

I only and Q only Spectrum views are conventional, displayed with 0 Hz at the left margin of the vertical axis. When up converted or multiplied, an I only or Q only signal could ultimately lie above or below the carrier center frequency, but in either case it will only occupy half the bandwidth. As 0 Hz is a fixed start frequency, the **FREQUENCY Channel** front panel key has no active menu keys. Use **Span** to change horizontal scale. The center frequency is displayed as half the current **Span**.

Waveform Views for Baseband I/Q Inputs

For Waveform measurements, two new displays are available exclusively for baseband I/Q input signals; the I and Q Waveform view, which separates the individual I and Q traces, and the I/Q Polar view. Since the horizontal axis for Waveform measurements is Time, the **FREQUENCY Channel** front-panel key has no active menu for baseband I/Q Waveform measurements. Use **Span** to change horizontal scale. A

Linear Envelope view is also available to display baseband signals that employs linear voltage units on the vertical axis.

Waveform Signal Envelope Views of I only or Q only

The I and Q Waveform of an I/Q signal is very different from the complex signal displayed in the Waveform Signal Envelope view. That is because the Signal Envelope is a product of both the I and Q modulation waveforms.

However, an I and Q Waveform measurement of an I only or Q only signal is exactly the same signal displayed in the Waveform Signal Envelope view. That is because an I only or Q only waveform determines the I only or Q only signal envelope. Thus, the Waveform Signal Envelope view can be used to measure an I only or Q only waveform directly.

Comparing RF and Baseband I/Q Measurement Views

The following table compares the measurement views for RF inputs and baseband I/Q inputs.

Table 6-2 RF vs. Baseband I/Q Input Measurement Views by Measurement

Measurement	Views for RF Input Measurements	Views for Baseband I/Q Inputs Measurements	Mods to RF View for Baseband I/Q Inputs
Channel Power	Channel Power	Channel Power	Center Freq = 0 Hz
ACP	FFT, Fast Bar Graph, Spectrum	Measurement Not Available	n/a
Power Stat CCDF	CCDF	CCDF	none
Spectrum (Freq Domain)	Spectrum Spectrum Linear I and Q Waveform I/Q Polar	Spectrum Spectrum Linear I and Q Waveform I/Q Polar	Center Freq = 0 Hz (Spectrum Views) Y axis = V, dBm (Spectrum Linear)
Waveform (Time Domain)	Signal Envelope I/Q Waveform I/Q Polar	Signal Envelope I/Q Waveform I/Q Polar Linear Envelope I and Q Waveform	Y axis = V, dBm (Linear Envelope)

Results screens for the above measurements unique to baseband I/Q inputs are shown in the section [“Using Option B7C Baseband I/Q Inputs”](#) on page 136.

Other Sources of Measurement Information

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

- Application Note 1298
Digital Modulation in Communications Systems - An Introduction
Agilent part number 5965-7160E
- Application Note
Characterizing Digitally Modulated Signals with CCDF Curves
Agilent part number 5968-5858E

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.

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

7

If You Have a Problem

This chapter will help you identify the causes of some problems you may encounter, offers warranty information, and provides instructions for returning your instrument to Agilent Technologies.

For information about error messages and functional tests, see the *Instrument Messages and Functional Tests* document.

Problem Symptoms and Solutions

The following section describes some transmitter tester problem symptoms and possible solutions to those problems. They include:

“Key or Feature Does Not Appear in Menu” on page 234

“Frequency Unlock or External Reference Missing - Error Messages” on page 235

“LAN External Loopback Test Failed - Error Message” on page 235

“Instrument Fails Alignment - Error Message” on page 235

“Measurement Keys Do Not Appear after Pressing the Mode Key” on page 236

“Instrument Power-On Problem” on page 236

“LAN Communication Problem” on page 236

“Instrument Keyboard is Locked” on page 236

Key or Feature Does Not Appear in Menu

Symptom: You are unable to locate a key for a feature you want to use in a particular measurement.

Solution 1: Many features are available only for making specific measurements, and do not apply to other measurements. Verify that the feature you are seeking is available for that particular measurement by examining the key access table on [page 57](#). Notes in the key access path column indicate whether a feature can only be used with a particular measurement. You can also review the section which documents the measurement you are using, and indicates which features apply to that measurement.

Solution 2: Some features are only available when using a specific mode. Review the section describing the mode to verify that a feature is available.

Solution 3: Some features of the transmitter tester are not yet available and will be implemented with a future firmware release. For an update on the status of firmware upgrades you can check the following URL: <http://www.agilent.com/find/vsa/>.

Frequency Unlock or External Reference Missing - Error Messages

Symptom: A frequency unlock error message, or an external reference missing error message, appears in the annunciator bar just above the data window.

Solution 1: The *red* Ext Ref message indicates that the external reference is not locked. The external reference can be any frequency between 1 and 30 MHz. If you have connected an external reference you must enter its frequency into the instrument. The value you entered must correspond to the external reference that is in use, or it will generate the error. Note that the value entered for the external reference frequency will persist, even after the instrument has been powered off and then on.

A *green* Ext Ref message indicates that the instrument is using an external reference and it is properly locked.

Solution 2: If you want to use the internal reference signal, toggle the **Freq Ref** key to the Int (internal) setting.

LAN External Loopback Test Failed - Error Message

Symptom: During booting the instrument you see a message which reads LAN external loopback test failed.

Solution: This message indicates that no LAN cable is connected to the instrument. You can ignore this message if you don't want to use the LAN.

Instrument Fails Alignment - Error Message

Symptom: An error message indicates that the instrument has failed alignment. This message appears either at power on during the self-alignment, or when the **Align All Now** key is pressed.

Solution: These alignments will fail if an external 50 MHz signal, at a power level greater than 0 dB, is connected to the RF input of the transmitter tester. Remove the 50 MHz signal to fix this problem.

Measurement Keys Do Not Appear after Pressing the Mode Key

Symptom: After pressing the **MODE** key, you have selected a particular mode (like **Basic**, **Service**, or one of the measurement personalities), but the menu for the mode you have selected does not appear on the menu keys.

Solution: If you were already in the mode that you selected, you must press the **MEASURE** key to display the available measurements.

Instrument Power-On Problem

Symptom: The instrument will not power-on. The instrument is plugged in, but the green LED above the front panel power switch is not on. The yellow standby LED may be flashing or may be extinguished. Something appears to be causing the instrument power supply to shut down.

Solution: An external device or internal assembly is causing the instrument to shut down, or the power supply may be in thermal shutdown. Inspect the instrument to ensure that it is receiving adequate air flow. Disconnect all devices from the rear panel and remove anything connected to the front panel probe power jack. If after powering the instrument off, the instrument powers on, determine which device caused the problem.

LAN Communication Problem

Symptom: You cannot communicate with the instrument over the LAN.

Solution: Make sure the correct IP address, subnet mask, and host name are stored in the instrument. Press **System, Config I/O**, then read the IP address, subnet mask and host name which are shown on the corresponding menu key labels. The default subnet mask of 255.255.0.0 should be sufficient for most closed network applications. If the **Restore Sys Defaults** key has been used recently, the IP address, subnet mask, and host name will have been reset to factory defaults. (The IP address is changed to 10.10.10.10., the subnet mask is changed to 255.255.0.0., and the host name is set to VSA.)

Instrument Keyboard is Locked

Symptom: The keyboard is locked and does not respond to attempts to activate features.

Solution: A programmer can lock the keyboard remotely using the SCPI **KLOCK** command. You can confirm if this is the reason the keyboard is locked by examining the annunciator bar; a message saying **KLOCK** will appear if this command has been executed.

Warranty Information

Warranty

This Agilent Technologies instrument product is warranted against defects in material and workmanship for a period of three years from date of shipment. During the warranty period, Agilent Technologies will, at its option, either repair or replace products that prove to be defective.

For warranty service or repair, this product must be returned to a service facility designated by Agilent Technologies. Buyer shall prepay shipping charges to Agilent Technologies and Agilent Technologies shall pay shipping charges to return the product to Buyer. However, Buyer shall pay all shipping charges, duties, and taxes for products returned to Agilent Technologies from another country.

Agilent Technologies warrants that its software and firmware designated by Agilent Technologies for use with an instrument will execute its programming instructions when properly installed on that instrument. Agilent Technologies does not warrant that the operation of the instrument, or software, or firmware will be uninterrupted or error-free.

LIMITATION OF WARRANTY

The foregoing warranty shall not apply to defects resulting from improper or inadequate maintenance by Buyer, Buyer-supplied software or interfacing, unauthorized modification or misuse, operation outside of the environmental specifications for the product, or improper site preparation or maintenance.

NO OTHER WARRANTY IS EXPRESSED OR IMPLIED. AGILENT TECHNOLOGIES SPECIFICALLY DISCLAIMS THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

EXCLUSIVE REMEDIES

THE REMEDIES PROVIDED HEREIN ARE BUYER'S SOLE AND EXCLUSIVE REMEDIES. AGILENT TECHNOLOGIES SHALL NOT BE LIABLE FOR ANY DIRECT, INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, WHETHER BASED ON CONTRACT, TORT, OR ANY OTHER LEGAL THEORY.

Agilent Technologies Test and Measurement Support, Services, and Assistance

Agilent Technologies aims to maximize the value you receive, while minimizing your risk and problems. We strive to ensure that you get the test and measurement capabilities you paid for and obtain the support you need. Our extensive support resources and services can help you choose the right Agilent products for your applications and apply them successfully. Every instrument and system we sell has a global warranty. Support is available for at least five years beyond the production life of the product. Two concepts underlie Agilent's overall support policy: "Our Promise" and "Your Advantage."

Our Promise

Our Promise means your Agilent test and measurement equipment will meet its advertised performance and functionality. When you are choosing new equipment, we will help you with product information, including realistic performance specifications and practical recommendations from experienced test engineers. When you use Agilent equipment, we can verify that it works properly, help with product operation, and provide basic measurement assistance for the use of specified capabilities, at no extra cost upon request. Many self-help tools are available.

Your Advantage

Your Advantage means that Agilent offers a wide range of additional expert test and measurement services, which you can purchase according to your unique technical business needs. Solve problems efficiently and gain a competitive edge by contracting with us for calibration, extra-cost upgrades, out-of-warranty repairs, and on-site education and training, as well as design, system integration, project management, and other professional engineering services. Experienced Agilent engineers and technicians worldwide can help you maximize your productivity, optimize the return on investment of your Agilent instruments and systems, and obtain dependable measurement accuracy for the life of those products.

By internet, phone, or fax, get assistance with all your test & measurement needs.

Table 7-1

Contacting Agilent

Online assistance: <http://www.agilent.com/find/assist>

United States (tel) 1 800 452 4844	Japan (tel) (+81) 426 56 7832 (fax) (+81) 426 56 7840	New Zealand (tel) 0 800 738 378 (fax) (+64) 4 495 8950	Europe (tel) (+31) 20 547 2323 (fax) (+31) 20 547 2390
Canada (tel) 1 877 894 4414 (fax) (905) 282 6495	Latin America (tel) (305) 269 7500 (fax) (305) 269 7599	Australia (tel) 1 800 629 485 (fax) (+61) 3 9210 5947	

Asia Call Center Numbers

Country	Phone Number	Fax Number
Singapore	1-800-375-8100	(65) 836-0252
Malaysia	1-800-828-848	1-800-801664
Philippines	(632) 8426802 1-800-16510170 (PLDT Subscriber Only)	(632) 8426809 1-800-16510288 (PLDT Subscriber Only)
Thailand	(088) 226-008 (outside Bangkok) (662) 661-3999 (within Bangkok)	(66) 1-661-3714
Hong Kong	800-930-871	(852) 2506 9233
Taiwan	0800-047-866	(886) 2 25456723
People's Republic of China	800-810-0189 (preferred) 10800-650-0021	10800-650-0121
India	1-600-11-2929	000-800-650-1101

Returning Your Instrument to Agilent Technologies

If you are returning your transmitter tester to Agilent Technologies for servicing, fill out and attach a blue repair tag to the instrument. Repair tags are located at the end of this chapter.

Include as much information as possible about the problem. Record any error messages that appeared on the display and include performance test results or any other specific data on the performance of the instrument.

Ship the instrument in the original factory packaging materials, if they are available. If not, use similar packaging to properly protect the instrument.

Return the instrument to the nearest Agilent Technologies sales and service office. Contact the nearest office as shown in table shown above to determine the address to which the instrument should be sent.

If You Have a Problem

Agilent Technologies Test and Measurement Support, Services, and Assistance

8 **Menu Maps**

These menu maps are in alphabetical order by the front panel key label or oval cross-reference label. You can locate detailed information about each key/function at the page number listed in the figure title for each menu.

Basic Measurement Key Flow

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

“Mode” on page 244

“Mode Setup Key Flow (page 161)” on page 245

“FREQUENCY, AMPLITUDE & Meas Control Flows (page 159, page 160, and page 161)” on page 246

“Spectrum (Freq Domain) Measurement Key Flow (1 of 3) (page 180)” on page 247

“Waveform (Time Domain) Measurement Key Flow (1 of 4) (page 196)” on page 250

“ACP Measurement Key Flow (1 of 2) (page 168)” on page 254

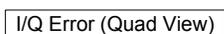
“CHP Measurement Key Flow (page 176)” on page 256

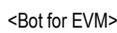
“Power Stat CCDF Measurement Key Flow (1 of 2) (page 212)” on page 257

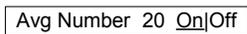
Use these flow diagrams as follows:

- There are some basic conventions:

 An oval represents one of the front-panel keys.

 This box represents one of the menu keys displayed.

 This represents an explanatory description on its specific key.

 This box represents one of the default condition menu keys displayed. Default conditions are shown as much as possible with underlined parameters or values displayed on those menu key labels.

- Follow the measurement diagram from left to right and top to bottom.
- A single menu key may allow multiple choices. For example; the **Device** menu key reveals two choices, **Base** or **Mobile**. The underlined choice is the current state of the instrument. To change choices, press the menu key one time.
- When entering a numeric value of **FREQUENCY**, for example, use the numeric keypad and terminate the entry with the appropriate unit selection from the menu keys displayed.
- When entering a numeric value of **Slot (Std)**, for example, use the

numeric keypad and terminate with the **Enter** front-panel key.

- Instead of using the numeric keypad to enter a value, it may be easier to use the RPG knob or **Up/Down** keys.

Figure 8-1 Mode

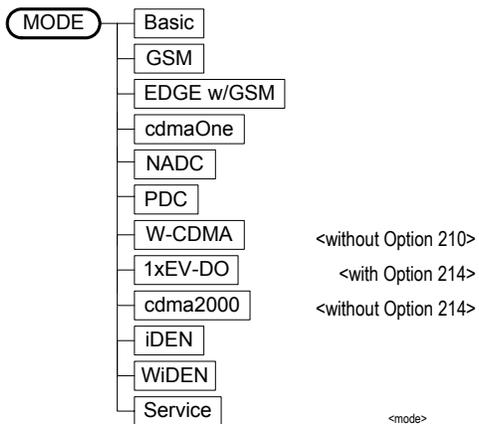
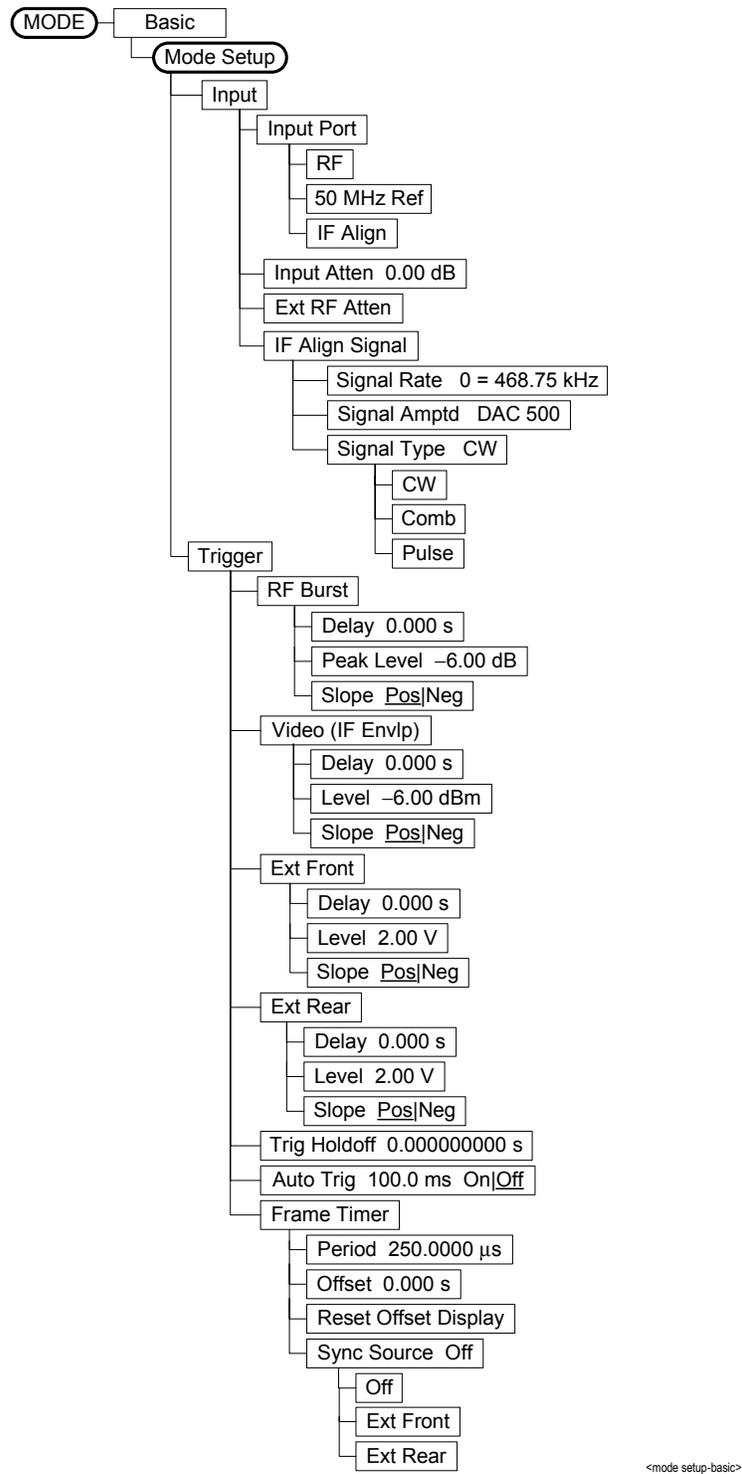


Figure 8-2 Mode Setup Key Flow (page 161)



Menu Maps

Figure 8-3 FREQUENCY, AMPLITUDE & Meas Control Flows (page 159, page 160, and page 161)

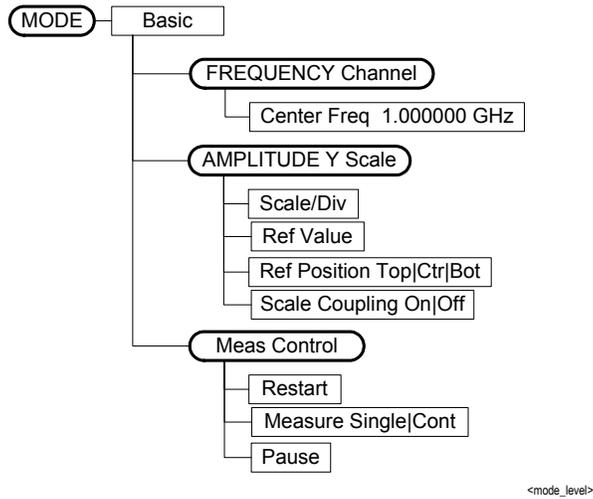
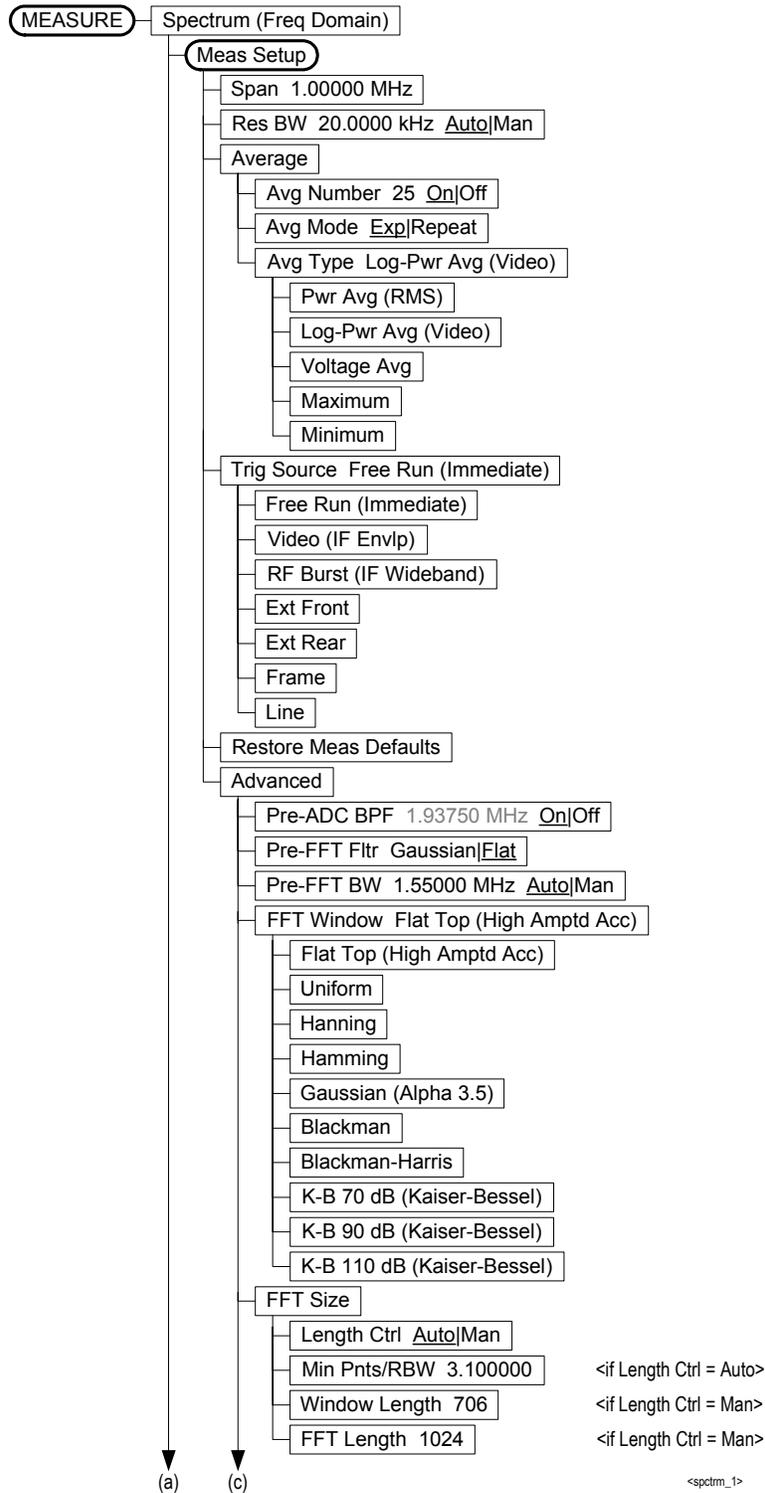


Figure 8-4 Spectrum (Freq Domain) Measurement Key Flow (1 of 3) (page 180)



Menu Maps

Figure 8-5 Spectrum (Freq Domain) Measurement Key Flow (2 of 3) (page 180)

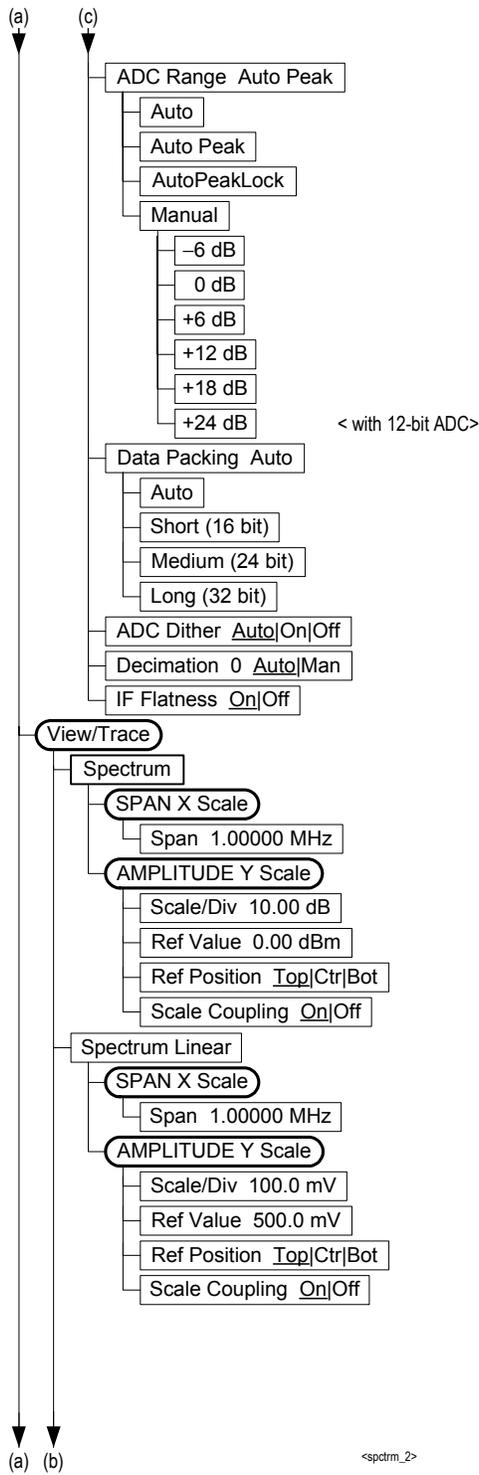
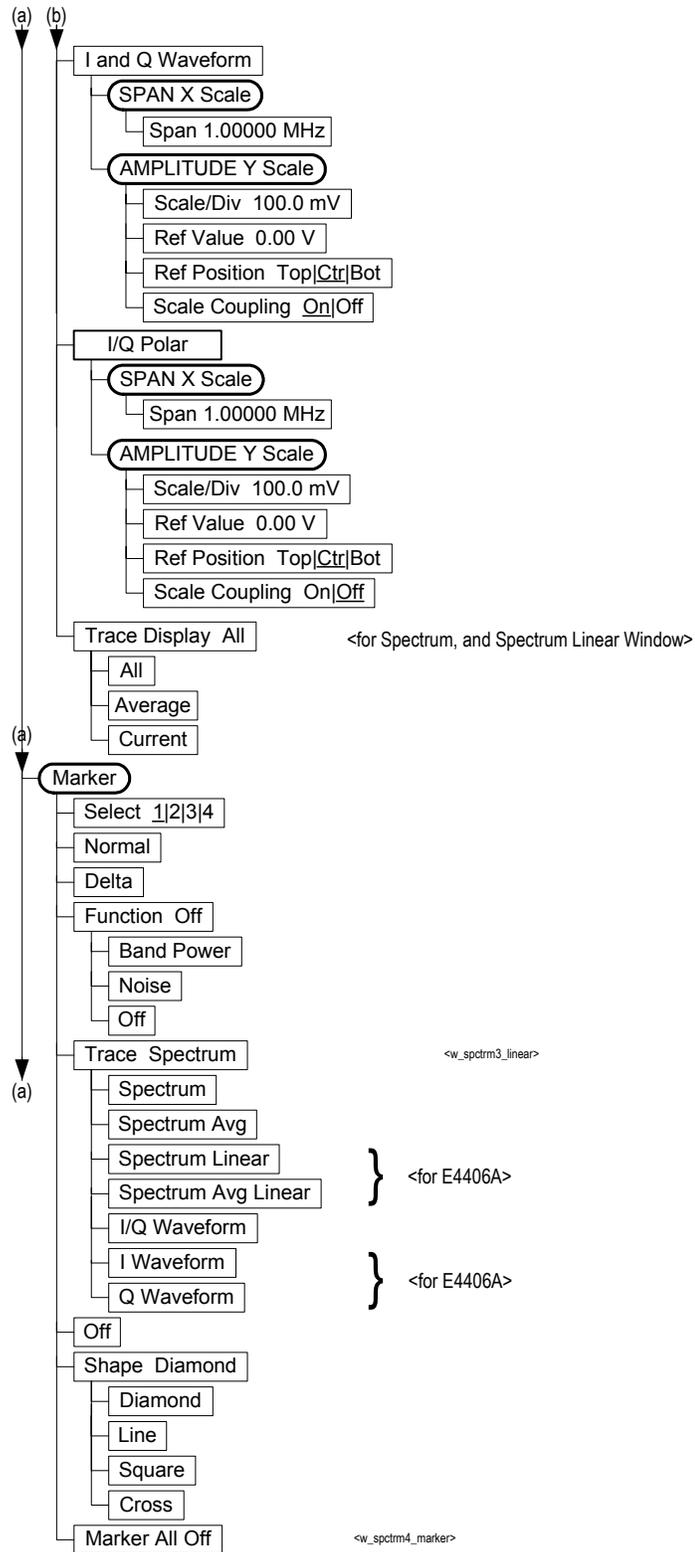


Figure 8-6 Spectrum (Freq Domain) Measurement Key Flow (3 of 3) (page 180)



Menu Maps

Figure 8-7 Waveform (Time Domain) Measurement Key Flow (1 of 4) (page 196)

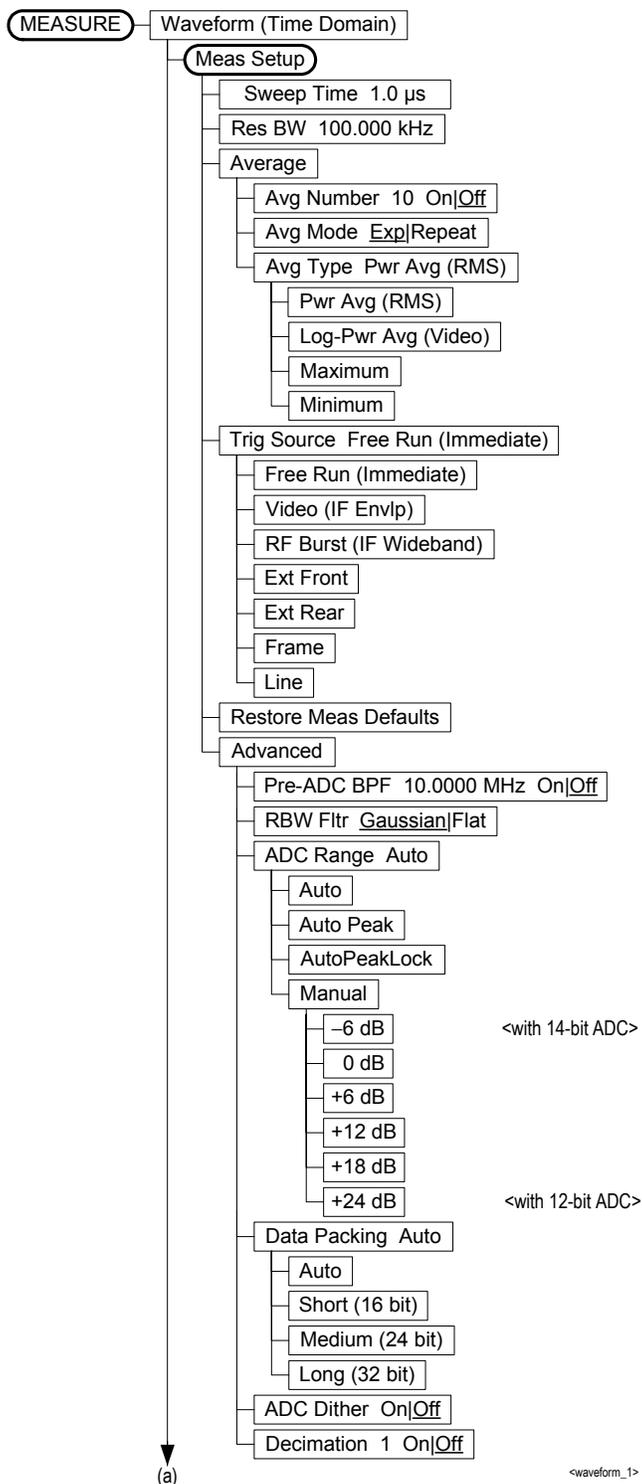
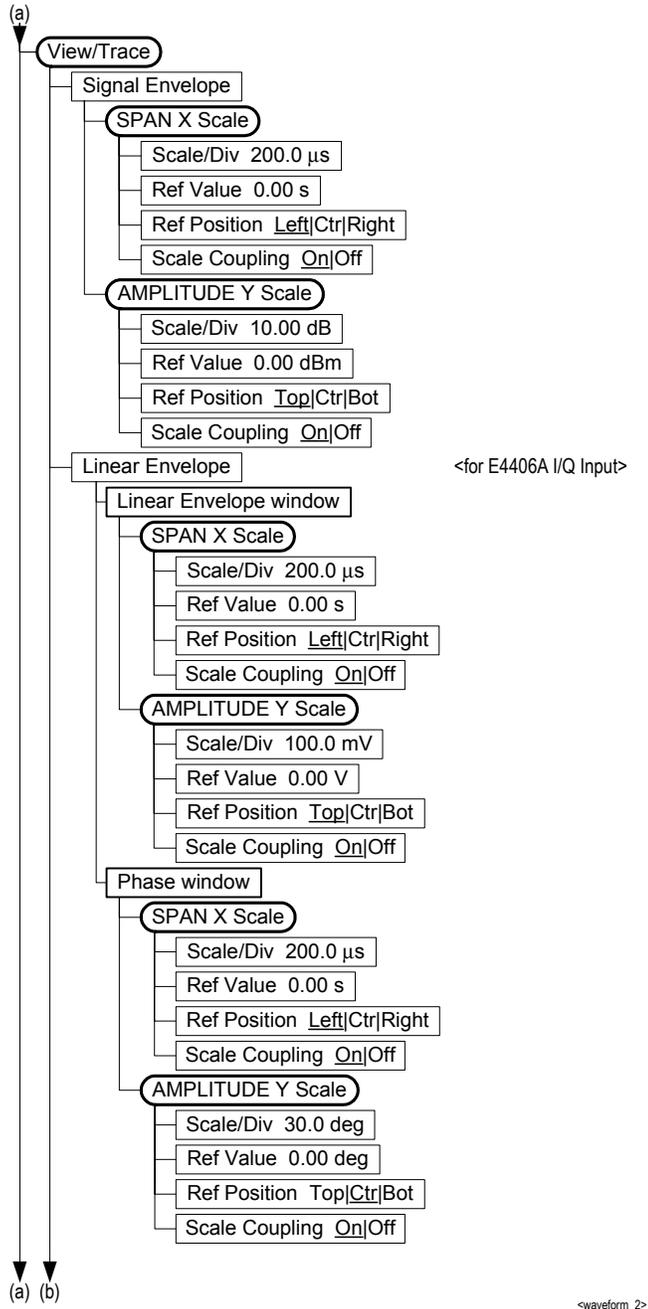


Figure 8-8 Waveform (Time Domain) Measurement Key Flow (2 of 4) (page 196)



Menu Maps

Figure 8-9 Waveform (Time Domain) Measurement Key Flow (3 of 4) (page 196)

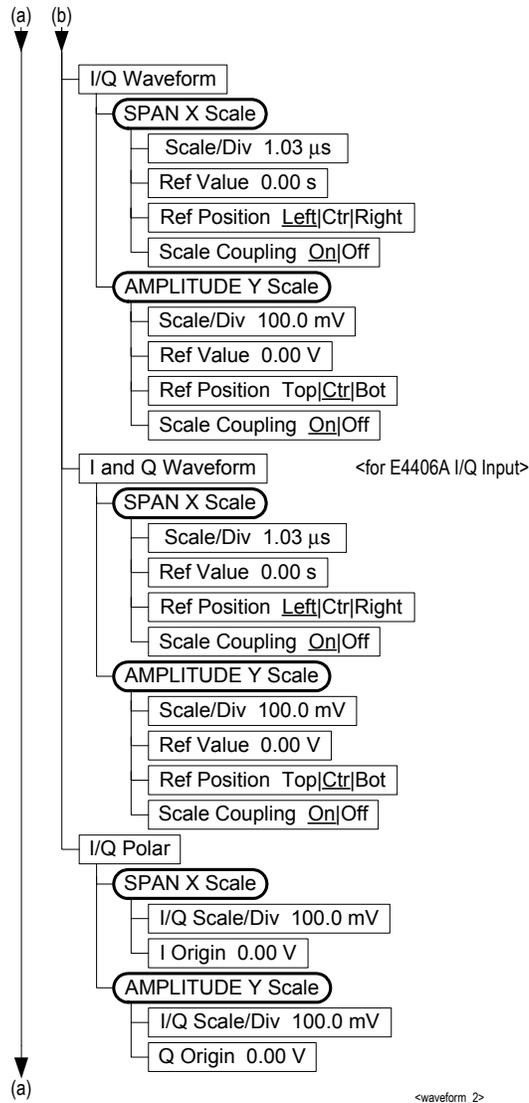


Figure 8-10 Waveform (Time Domain) Measurement Key Flow (4 of 4) (page 196)

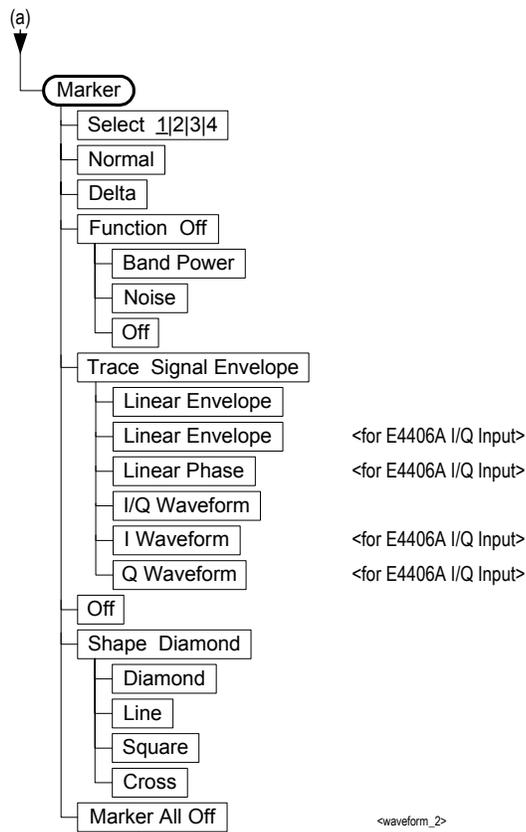


Figure 8-11 ACP Measurement Key Flow (1 of 2) (page 168)

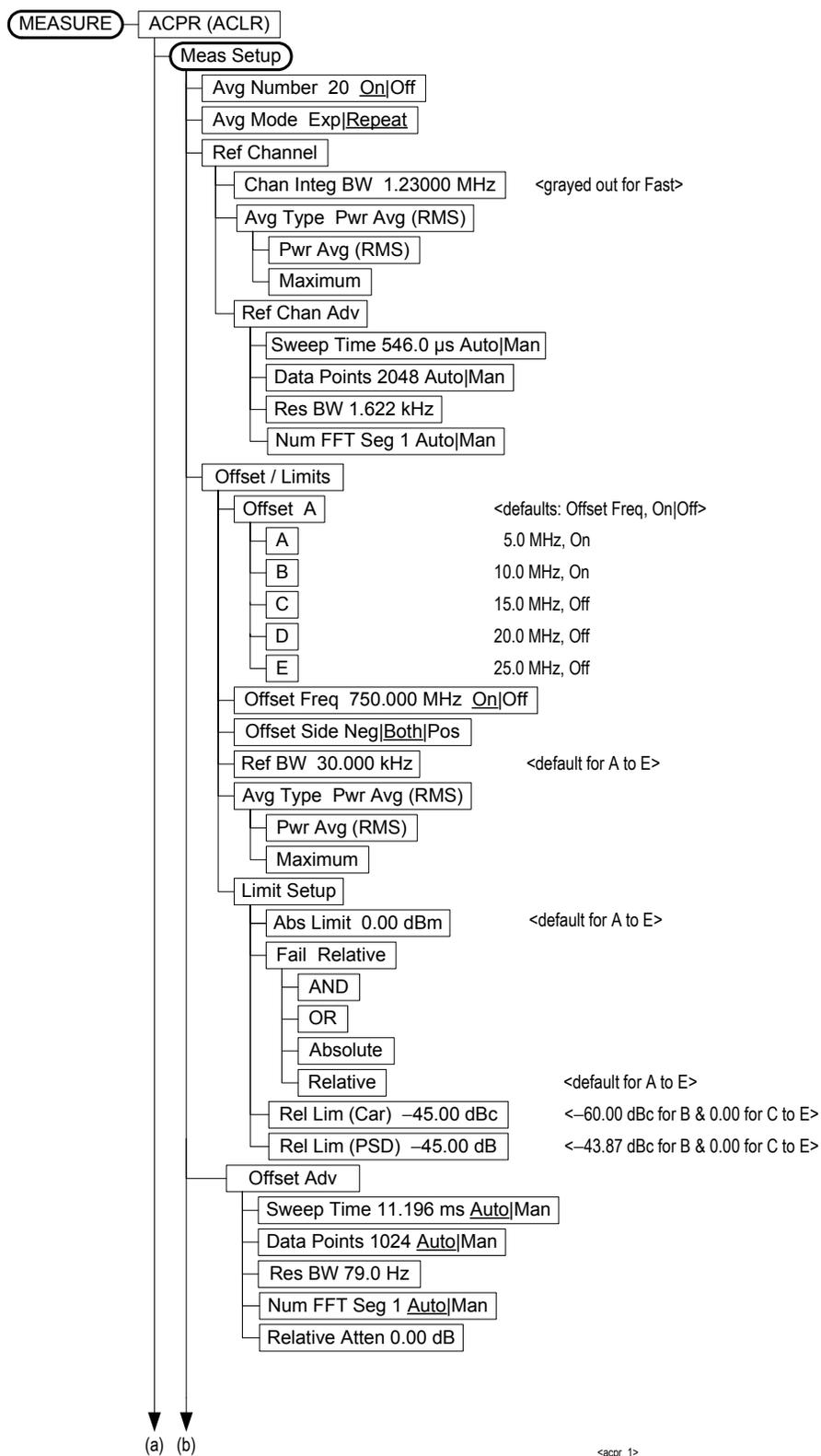


Figure 8-12 ACP Measurement Key Flow (2 of 2) (page 168)

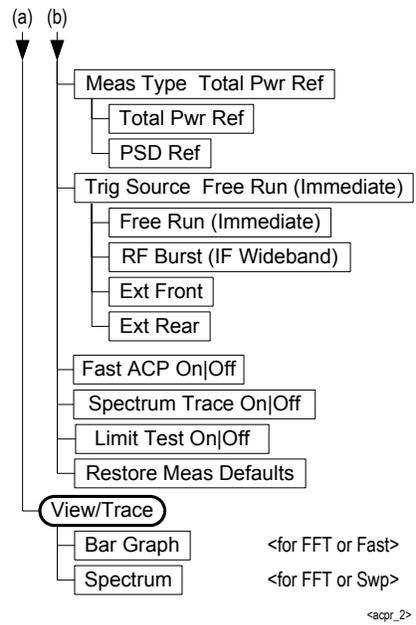
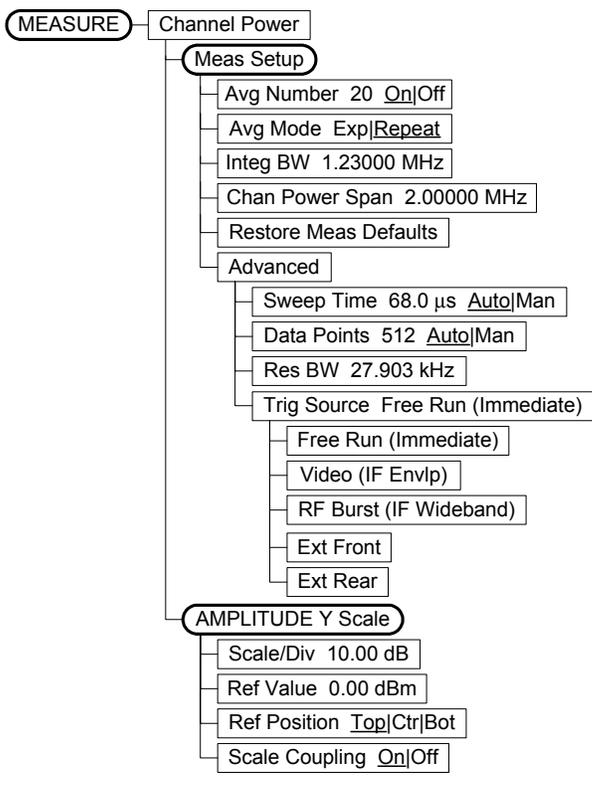
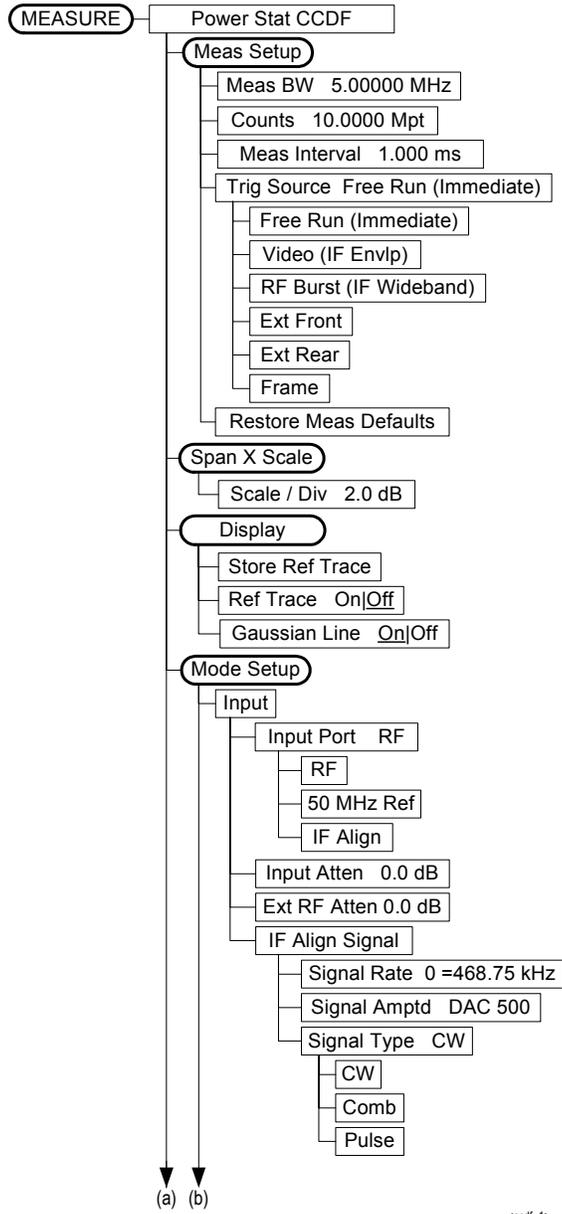


Figure 8-13 CHP Measurement Key Flow (page 176)



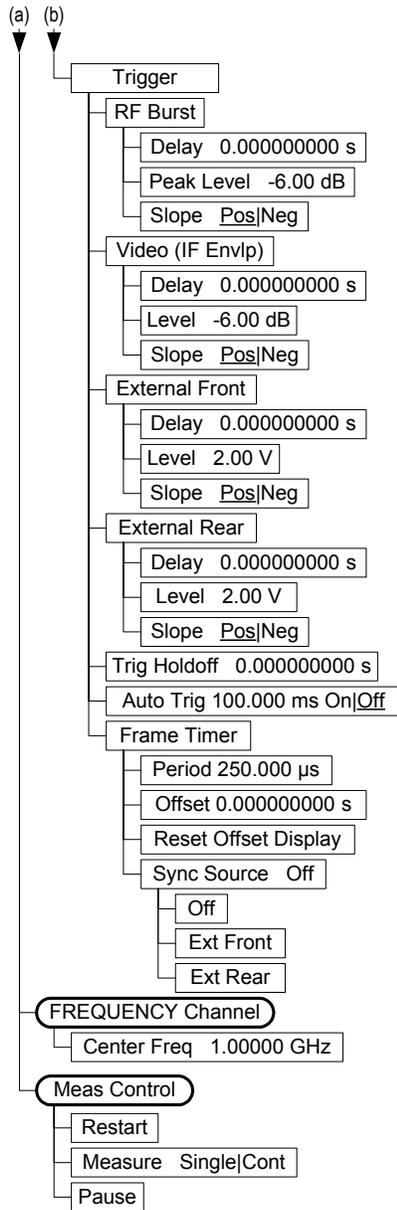
<chpwr>

Figure 8-14 Power Stat CCDF Measurement Key Flow (1 of 2) (page 212)



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Figure 8-15 Power Stat CCDF Measurement Key Flow (2 of 2) (page 212)



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