User’s Guide

Agilent Technologies

ESA Spectrum Analyzers

This guide documents firmware revision A.07.xx
This manual provides documentation for the following instruments:

Agilent Technologies ESA-E Series

E4401B (9 kHz- 1.5 GHz)
E4402B (9 kHz - 3.0 GHz)
E4404B (9 kHz - 6.7 GHz)
E4405B (9 kHz - 13.2 GHz)
E4407B (9 kHz - 26.5 GHz)

and

Agilent Technologies ESA-L Series

E4411B (9 kHz- 1.5 GHz)
E4403B (9 kHz - 3.0 GHz)
E4408B (9 kHz - 26.5 GHz)

Agilent Technologies

Manufacturing Part Number: E4401-90236
Supersedes: E4401-90220

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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.

⚠ 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 standby position of the power line switch.

∼ This symbol indicates that the input power required is AC.

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.

WARNING

If this product 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 intact) only.

CAUTION

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

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Documentation is updated periodically. For the latest information about Agilent Technologies **ESA** Spectrum Analyzers, including firmware upgrades and application information, please visit the following Internet URL:

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

Contents

6. Front-Panel Key Reference

1 Preparing for Use

This chapter provides information on how to inspect your analyzer when it arrives and what to expect when it is first powered on. It also includes the analyzer power requirements.

Initial Inspection

Inspect the shipping container and verify that the contents are complete. Keep the container and cushioning material until you have inspected the analyzer.

Table 1-1 lists the accessories shipped with the analyzer. If the contents are incomplete, or the analyzer does not pass the performance tests, notify the nearest Agilent Technologies office. If the shipping container is damaged or the cushioning material shows signs of stress, also notify the carrier. Keep the shipping materials for the carrier's inspection. The Agilent office will arrange for repair or replacement without waiting for a claim settlement.

If the shipping materials are in good condition, retain them for possible future use. You may wish to ship the analyzer to another location or to return it to Agilent Technologies for service. See "How to Return Your Analyzer for Service" in Chapter 4 for more information about shipping materials.

If cleaning is necessary, use a damp cloth only.

WARNING **To prevent electrical shock, disconnect the analyzer 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.**

Table 1-1 Accessories Supplied with the Analyzer

Description	HP/Agilent Part Number	Comments
Adapter, Type-N (m) to BNC (f)	1250-0780	Not shipped with Option 1DP. Two adapters are shipped with Option 1DN.
Adapter, BNC (m) to F (f), 75 Ω	1250-2477	Shipped only with Option 1DP. Two adapters shipped with Option 1DQ.
Adapter, Type-N (m) to SMA (f)	1250-1250	Shipped only with Option 1DN for Agilent E4402B, E4403B, E4404B, E4405B, E4407B, and E4408B. Not shipped with Option BAB.
Adapter, BNC (f) to SMA (m)	1250-1200	Shipped only with Option BAB.
Cable, BNC (m) to BNC (m), 203 mm	10502A	Shipped only with Agilent E4402B, E4403B, E4404B, E4405B, E4407B, and E4408B.
Cable, SMA (m) to Type-N (m), 220 mm	8120-5148	Shipped only with Option 1DN for Agilent E4402B, E4403B, E4404B, E4405B, E4407B, and E4408B.
Power cable	See the table on page 6.	Shipped with analyzer.

Power Requirements

The analyzer is a portable instrument and requires no physical installation other than connection to a power source. There is no need to select a line voltage.

Table 1-2 **AC Power Requirements**

Voltage	90-132 Vrms (47 to 440 Hz)
Voltage	195 - 250 Vrms (47 to 66 Hz)
Power Consumption, On	less than 300 W
Power Consumption, Standby	less than 5 W

Table 1-3 **DC Power Requirements**

Voltage	12-20 Vdc
Power Consumption	less than 200 W

Checking the Fuse

Where IEC regulations apply, use a 5 by 20 mm, rated F5A, 250 V IEC approved fuse. This fuse may be used with input line voltages of 115 V or 230 V. Its part number is 2110-0709.

Where UL/CSA regulations apply, use a 5 by 20 mm rated fast blow, 5 A, 125 V UL/CSA approved fuse (part number 2110-0756). ***This fuse may only be used with an input line voltage of 115 V***.

The line fuse is housed in a fuse holder in the upper left hand corner of the rear panel.

To remove the fuse, ***first disconnect the power cord from the instrument***. Then insert the tip of a screwdriver into the slot at the middle of the fuse holder, and turn counterclockwise to extend the fuse holder.

WARNING **For continued protection against fire hazard, replace the line fuse only with the same type and rating. The use of other fuses or material is prohibited.**

AC Power Cable

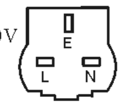
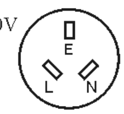
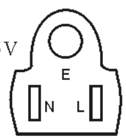
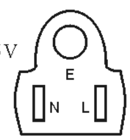
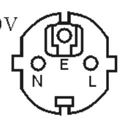
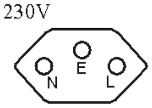
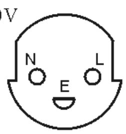
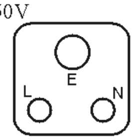
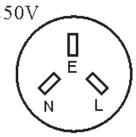
The analyzer is equipped with a three-wire power cable, in accordance with international safety standards. When connected to an appropriate power line outlet, this cable grounds the instrument cabinet.

WARNING **Failure to ground the analyzer properly can result in personal injury. Before turning on the analyzer, you must connect its protective earth terminals to the protective conductor of the main power cable. Insert the main power cable plug only into a socket outlet that has a protective earth contact. DO NOT defeat the earth-grounding protection by using an extension cable, power cable, or autotransformer without a protective ground conductor.**

If you are using an autotransformer, make sure its common terminal is connected to the protective earth contact of the power source outlet socket.

Various power cables are available to connect the analyzer to the types of ac power outlets unique to specific geographic areas. The cable appropriate for the area to which the analyzer is originally shipped is included with the unit. You can order additional ac power cables for use in different areas. The following table lists the available ac power cables, illustrates the plug configurations, and identifies the geographic area in which each cable is appropriate.

Figure 1-1 AC Mains Power Cables

Plug Type[a]	Cable Part Number	Plug[b] Description	Length cm (in.)	Cable Color	For Use in Country
250V 	8120-1351 8120-1703	Straight BS 1363A 90°	229 (90) 229 (90)	Mint Gray Mint Gray	Option 900 United Kingdom, Hong Kong, Cyprus, Nigeria, Singapore, Zimbabwe
250V 	8120-1369 8120-0696	Straight AS 3112 90°	210 (79) 200 (78)	Gray Gray	Option 901 Argentina, Australia, New Zealand, Mainland China
125V 	8120-1378 8120-1521	Straight NEMA 5-15P 90°	203 (80) 203 (80)	Jade Gray Jade Gray	Option 903 United States, Canada, Brazil, Colombia, Mexico,Philippines, Saudi Arabia, Taiwan
125V 	8120-4753 8120-4754	Straight NEMA 5-15P 90°	229 (90) 229 (90)	Gray Gray	Option 918 Japan
250V 	8120-1689 8120-1692	Straight CEE 7/VII 90°	200 (78) 200 (78)	Mint Gray Mint Gray	Option 902 Continental Europe, Central African Republic, United Arab Republic
230V 	8120-2104 8120-2296	Straight SEV Type 12 90°	200 (78) 200 (78)	Gray Gray	Option 906 Switzerland
220V 	8120-2956 8120-2957	Straight SR 107-2-D 90°	200 (78) 200 (78)	Gray Gray	Option 912 Denmark
250V 	8120-4211 8120-4600	Straight IEC 83-B1 90°	200 (78) 200 (78)	Mint Gray Mint Gray	Option 917 South Africa, India
250V 	8120-5182 8120-5181	Straight SI 32 90°	200 (78) 200 (78)	Jade Gray Jade Gray	Option 919 Israel

plugs

a. E =earth ground, L = line, and N = neutral.
b. Plug identifier numbers describe the plug only. The HP part number is for the complete cable assembly.

Preparation

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. (Refer to the *Agilent Technologies ESA Spectrum Analyzers Specifications Guide - E Series* or *Agilent Technologies ESA Spectrum Analyzers Specifications Guide - L Series*.)

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.

NOTE Install the instrument so that the detachable power cord is readily identifiable and is easily reached by the operator. The detachable power cord is the instrument disconnecting device. It disconnects the mains circuits from the mains supply before other parts of the instrument. The front-panel switch is only a standby switch and is not a LINE switch. 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.

Turning On the Analyzer for the First Time

Before using your analyzer, plug the power cord into the analyzer.

Press | (the On key).

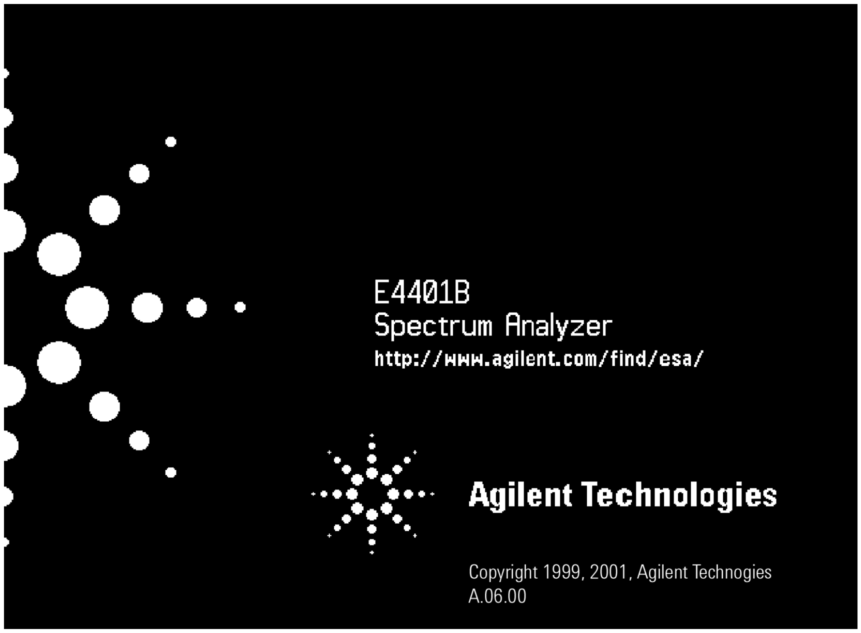
Choose a power on preference using the switch on the rear panel (refer to Figure 2-2 on page 18, item 14). The PWR ALWAYS ON setting turns the analyzer on whenever external power is applied. This mode is useful if an external power switch is used to control a rack of several instruments. Nevertheless, if you set the analyzer to standby using the front-panel Standby key (see Figure 2-1 on page 13, item 23) and the external power is removed and restored within 20 seconds, the instrument will remain in standby.

The PWR NORM setting assigns analyzer on/off control to the front-panel On and Standby keys (see Figure 2-1 on page 13, item 23). If the analyzer is on and the external power is removed and restored within 20 seconds, the instrument will turn on. On the other hand, if the external power is removed and restored after 20 seconds, the instrument will remain in standby regardless of the front-panel switch settings.

When you turn on the analyzer, the information screen (an example is shown in Figure 1-2) will be displayed during initialization of the instrument. Your analyzer product number, the firmware revision (e.g., A.06.00), and a URL for accessing product support information on the World Wide Web are shown.

NOTE This screen may be displayed for as long as 1 minute before the initialization process is complete.

Figure 1-2 Information Screen Displayed During Initialization



NOTE Record the firmware revision and keep it for reference. If you should ever need to call Agilent Technologies for service or with any questions regarding your analyzer, it will be helpful to have the firmware revision readily available. You can also obtain the firmware revision by pressing **System**, **More**, **Show System**.

To ensure your analyzer meets specifications, it must meet operating temperature conditions. Allow a 5 minute warm-up before making calibrated measurements.

If the analyzer is an Agilent Technologies E4402B, E4403B, E4404B, E4405B, E4407B, or E4408B, connect a BNC cable from the AMPTD REF OUT to INPUT 50 Ω using an adapter. After a 5 minute warm-up, press **System**, **Alignments**, **Align Now**, **All**.

NOTE It is normal to hear clicking when the Auto Alignment function is on. During the interval between sweeps, portions of the analyzer’s circuitry are realigned. Some of the circuitry is controlled by relays. It is the rapid switching of these relays between sweeps which causes the clicking sound. Under normal operation, these relays will last over 50 years.

To eliminate the clicking sound, turn off the automatic alignment. (See the **Alignments** key description in Chapter 6 , “Front-Panel Key Reference.”) With **Auto Align** turned off, however, the Align Now All function should be performed periodically. For more information on how often to perform Align Now All when the Auto Alignment function is off, refer to the appropriate “Specifications and Characteristics” chapter in the *Agilent Technologies ESA Spectrum Analyzers Specifications Guide - E Series* or *Agilent Technologies ESA Spectrum Analyzers Specifications Guide - L Series*.

CAUTION When operating in dc coupled mode ensure protection of the input mixer by limiting the input level to 0 Vdc, +30 dBm.

If you wish to use an external 10 MHz source as the reference frequency, connect an external reference source to the **10 MHz REF IN** connector on the rear panel. The signal level should be greater than –15 dBm.

NOTE It is not necessary to connect the 10 MHz REF OUT to the 10 MHz REF IN on the rear of the analyzer. Doing so results in a “Frequency Reference Error” message.

2 Getting Started

What You Will Find in This Chapter

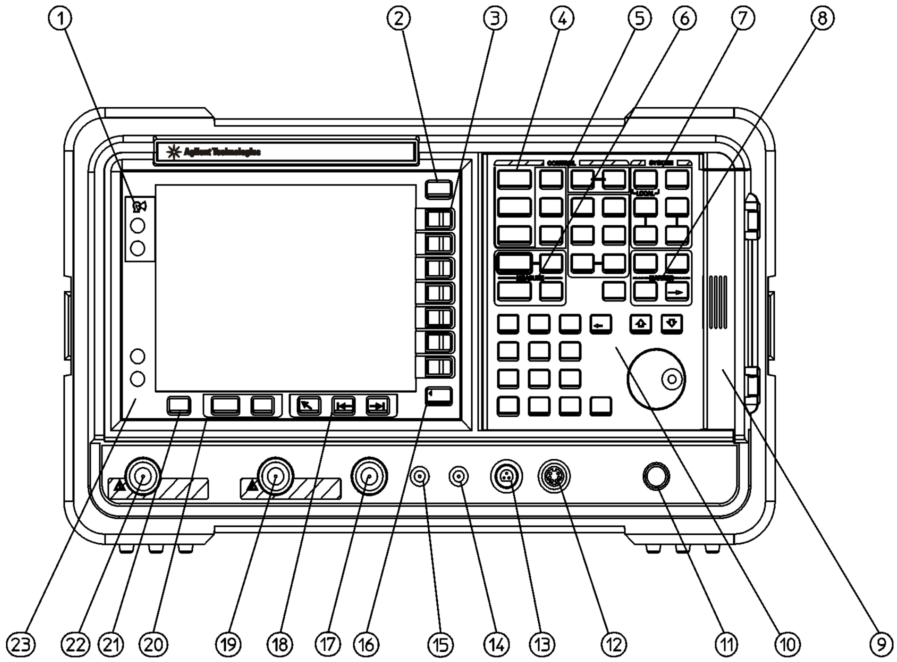
This chapter introduces the basic functions of the analyzer. In this chapter you will:

- Get acquainted with the front-panel and rear-panel features.
- Get acquainted with the function keys.
- Learn about display annotation.
- Make a basic measurement (using the internal alignment signal).
- Learn about analyzer accuracy and the internal alignment process.
- Learn about file menus.
- Set up your printer.
- Learn about the analyzer battery for retaining internal memory.

NOTE Before using your analyzer, please read Chapter 1 , “Preparing for Use.” which describes how to set up your analyzer and how to verify that it is operational. It also describes many safety considerations that should not be overlooked.

Front-Panel Features

Figure 2-1 Front-Panel Feature Overview



1 **Viewing Angle** keys allow you to adjust the display so that it can be optimally viewed from different angles.

2 **Esc**. The **Esc** (escape) key cancels any entry in progress. **Esc** will abort a print (if one is in progress) and clear error messages from the status line at the bottom of the display. It also clears input and tracking generator overload conditions.

3 **Menu keys** are the unlabeled keys next to the screen. The menu key labels are the annotation on the screen next to the unlabeled keys. Most of the labeled keys on the analyzer front panel (also called front-panel keys) access menus of keys having related functions.

4 **FREQUENCY Channel**, **SPAN X Scale**, and **AMPLITUDE Y Scale** are the three large keys that activate the primary analyzer functions and access menus of related functions. The secondary labels on these keys (Channel, X Scale, and Y Scale) are used in some measurements.

5 **CONTROL** functions access menus that allow you to adjust the resolution bandwidth, adjust the sweep time, and control the instrument display. They also set other analyzer parameters needed for making measurements.

6 **MEASURE** accesses a menu of keys that automate some common analyzer measurements. Once a measurement is running, **Meas Setup** accesses additional menu keys for defining your measurement. **Meas Control** and **Restart** access additional measurement control functions.

7 **SYSTEM** functions affect the state of the entire spectrum analyzer.

Various setup and alignment routines are accessed with the **System** key.

The green **Preset** key resets the analyzer to a known state.

The **File** key menu allows you to save and load traces, states, limit-line tables, and amplitude correction factors to or from analyzer memory or the floppy disk drive. The **Save** key immediately executes the **Save Now** function defined under **File** in Chapter 6 , “Front-Panel Key Reference.”

The **Print Setup** menu keys allow you to configure hardcopy outputs. The **Print** key immediately sends hardcopy data to the printer. See Chapter 6 for more details.

8 **MARKER** functions control the markers, read out frequencies and amplitudes along the analyzer trace, automatically locate the signals of highest amplitude, and access functions like **Marker Noise** and **Band Power**.

9 The **Media Door** on the right side of the front panel accesses the 3.5 inch disk drive and the **Earphone** connector. The earphone connector provides a connection for an earphone jack which bypasses the internal speaker.

10 The **Data Control Keys**, which include the step keys, knob, and numeric keypad, allow you to change the numeric value of an active function such as center frequency, start frequency, resolution bandwidth, and marker position.

The data controls will change the active function in a manner prescribed by that function. For example, you can change center frequency in fine steps with the knob, in discrete steps with the step keys, or to an exact (1 Hz resolution) value with the numeric keypad.

The **Knob** provides fine incremental changes of functions such as center frequency, reference level, and marker position. Clockwise rotation of the knob increases values. The extent of alteration is determined by the size of the measurement range. The speed at which the knob is turned affects the rate at which the values are changed.

For slow sweeps, the analyzer uses a smooth panning feature which is designed to move the trace display to the latest function value as the knob is turned. When center, stop or, start frequency or reference level is adjusted, the signal will shift right or left or up or down with the rotation of the knob before a new sweep is actually taken. An asterisk is placed in the message block (the upper right-hand corner of the analyzer display) to indicate that the data on the screen does not reflect data at the current setting.

The **Numeric Keypad** allows entry of exact values for many of the analyzer functions. You may include a decimal point in the number portion. If not, the decimal point is placed at the end of the number.

Numeric entries must be terminated with a units key. When a numeric entry is begun, the menu keys show the units key labels. The units keys change depending on what the active function is. For example, the units keys for frequency span are **GHz**, **MHz**, **kHz**, and **Hz**, whereas the units for reference level are **+dBm**, **–dBm**, **mV**, **μV**, and **μA**.

NOTE If an entry from the numeric keypad does not coincide with an allowed function value (for example, that of a 12 MHz bandwidth), the analyzer defaults to the nearest allowable value.

The **Step Keys** (⇓ ⇑) increase or decrease the active function value. The step size depends upon the current analyzer measurement. Each press results in a single step change. For those parameters with fixed values (resolution bandwidth), the next value in a sequence is selected each time a step key is pressed. Step size is predictable (e.g., 10% of span for center frequency) and can be set for some functions (i.e., center frequency). Out-of-range values or out-of-sequence values will not occur using these keys.

11 **VOLUME**. The **VOLUME** knob adjusts the volume of the internal speaker. The speaker is turned on and off with the **Speaker On Off** key in the **Det/Demod** menu.

12 **EXT KEYBOARD.** The **EXT KEYBOARD** connector is a 6-pin mini-DIN connector. The keyboard can be used to enter screen titles and filenames.

NOTE To avoid damage to the analyzer, always turn off power before plugging a keyboard into the instrument.

13 **PROBE POWER** provides power for high-impedance ac probes or other accessories. (+15 V, –12.6 V, 150 mA maximum)

14 **LO OUTPUT** provides the proper local oscillator signal for use with external mixers (Option AYZ).

15 **IF INPUT** connects to the IF OUTPUT of the external mixer (Option AYZ).

16 **Return**. The **Return** key accesses the previously selected menu. Continuing to press **Return** accesses earlier menus. Return also terminates entry of alpha numeric functions (e.g., Title).

17 **AMPTD REF OUT** provides an amplitude reference signal of 50 MHz at –20 dBm. *Agilent ESA models E4402B, E4403B, E4404B, E4405B, E4407B, and E4408B only.*

18 **Tab Keys** are used to move around in the Limit editor, the Correction editor, and the Segmented Sweep editor.

19 **INPUT 50Ω** (**INPUT 75Ω** for **Option 1DP**) is the signal input for the analyzer.

CAUTION When operating in dc coupled mode, ensure protection of the input mixer by limiting the input level to 0 Vdc, +30 dBm.

20 The **Next Window** key can be used to select the active window in functions which support split-screen display modes, such as Zone markers. (Refer to “Zone” in Chapter 6 for more information.) In such modes, pressing **Zoom** allows you to switch between the split-screen and full-sized display of the active window.

21 **Help**. Press the **Help** key and then any front-panel or menu key to get a short description of the key function and the associated SCPI command. The next key you press will remove the help window from the display.

22 **RF OUT 50Ω** for Option 1DN or **RF OUT 75Ω** (**for Option 1DQ**) is the source output for the built-in tracking generator. Option 1DN or 1DQ only.

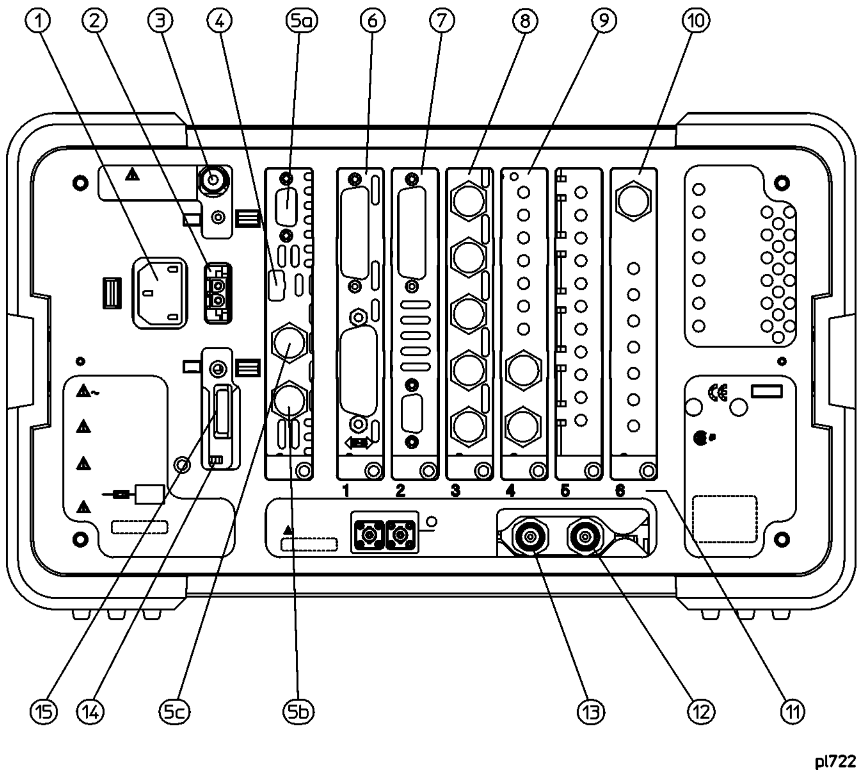
CAUTION If the tracking generator output power is too high, it may damage the device under test. Do not exceed the maximum power that the device under test can tolerate.

23 The **|** (On) key turns the analyzer on, while the ⏻ (Standby) key turns most of the analyzer off. An instrument alignment is performed (if **Auto Align** is on) every time the analyzer is turned on. After turning on the analyzer, allow 5 minutes of warm-up time to ensure the analyzer will meet all specifications.

NOTE The instrument continues to draw power even if the line power switch is in standby. The detachable power cord is the instrument disconnecting device. It disconnects the mains circuits from the mains supply before other parts of the instrument. The front-panel switch is only a standby switch and is not a LINE switch (disconnecting device).

Rear-Panel Features

Figure 2-2 **Rear-Panel Feature Overview**



1 **Power input** is the input for the ac line power source. Make sure that the line-power source outlet has a protective ground contact.

2 **DC Power** is the input for the dc power source. Refer to the "Power Requirements" section in the *Agilent Technologies ESA Spectrum Analyzers Specifications Guide - E Series* or *Agilent Technologies ESA Spectrum Analyzers Specifications Guide - L Series.*

CAUTION AC line power and dc power should not be plugged in simultaneously.

3 **Line Fuse**. The fuse is removed by twisting counterclockwise 1/4 turn. Replace only with a fuse of the same rating. See the label on the rear panel.

4 **Service Connector.** The service connector is for service use only.

5 **Inputs/Outputs** (Refer to the *Agilent Technologies ESA Spectrum Analyzers Specifications Guide - E Series* or *Agilent Technologies ESA Spectrum Analyzers Specifications Guide - L Series* for more information.)

5a **VGA OUTPUT** drives an external VGA compatible monitor with a signal that has 31.5 kHz horizontal, 60 Hz vertical synchronizing rate, non-interlaced.

5b **GATE/HI SWP OUT (TTL)** is high when the analyzer is sweeping or when **Gate** (Option 1D6) is active.

5c **GATE TRIG/EXT TRIG IN (TTL)** accepts the positive edge of an external voltage input that triggers the analyzer internal sweep source or the gate function (Time Gate, Option 1D6).

Table 2-1 and Table 2-2 show the appropriate rear panel slots to be used for the optional cards available with the Agilent ESA Spectrum Analyzers. Refer to Table 2-1 if you have an Agilent ESA-L Series Spectrum Analyzer. Refer to Table 2-2 if you have an Agilent ESA-E Series Spectrum Analyzer.

(P) = Preferred Card Slot
(A) = Acceptable Card Slot
(–) = Unacceptable Card Slot

Table 2-1 Agilent ESA-L Series (E4403B, E4408B, E4411B)

Slot #	1	2	5	6
GPIB (Opt A4H)	P	A	–	–
Serial (Opt 1AX)	P	A	–	–
IF and Sweep Ports (Opt A4J)	–	–	P	–
Frequency Extension[1]		–	–	P

1. The Frequency Extension Assembly comes standard with the Agilent E4408B.

Table 2-2 **Agilent ESA-E Series (E4401B, E4402B, E4404B, E4405B, E4407B)**

Slot #	1[1]	2	3	4	5	6
GPIB and Parallel (Opt A4H)[2]	P	A	A	A	–	–
RS-232 and Parallel Interface (Opt 1AX)[2]	P	A	A	A	–	–
FADC (Opt AYX)[3]	–	A	P	A	–	–
IF and Sweep Ports (Opt A4J)[3]	A	A	A	A	P	A
FM Demodulation (Opt BAA)[4]	–	A	P	A	A	A
Frequency Extension[5]	–	A	A	A	A	P
DSP and Fast ADC (B7D)	–	–	–	P	–	–
RF Communications Hardware (Option B7E)	–	–	–	–	P	–
ACPR Dynamic Range Extension (Opt 120)	–	P	A	A	A	A
Bluetooth™ [6] FM Demodulation (Opt 106)[4,7]	–	A	P	A	A	A

1. Some cards may not be installed due to mechanical interference.
2. Only one optional remote interface (Option A4H or Option 1AX) can be installed at a time.
3. Only one IF and Sweep Port option (Option A4J or Option AYX) can be installed at a time.
4. Only one demod option (Option BAA or Option 106) can be installed at a time.
5. The Frequency Extension Assembly comes standard with the Agilent E4404B, E4405B and E4407B.
6. Bluetooth™ is a trademark owned by its proprietor and used by Agilent Technologies under license.
7. Option 106 is required to make measurements in Bluetooth™ Measurement Personality (Option 228)

6 GPIB and parallel (Option A4H) is an optional interface. GPIB supports remote instrument operation. A parallel port is included for printing only.

7 RS-232 and parallel (Option 1AX) is an optional interface. RS-232 supports remote instrument operation. A parallel port is included for printing only.

NOTE Printing is only supported from the parallel port.

8 **IF, Video, and Sweep Ports** (Option A4J or Option AYX): (Refer to the *Agilent Technologies ESA Spectrum Analyzers Specifications Guide - E Series* or *Agilent Technologies ESA Spectrum Analyzers Specifications Guide - L Series* for more information.)

SWP OUT provides a voltage ramp corresponding to the sweep of the analyzer (0 V to 10 V).

HI SWP IN (TTL) can be grounded to stop and reset the sweep. Once the sweep has been stopped, removing the ground will trigger the start of a new sweep.

HI SWP OUT (TTL) is high when the analyzer is sweeping.

AUX VIDEO OUT provides detected video output (before the analog-to-digital conversion) proportional to vertical deflection of the trace. Output is from 0 V to 1 V. Amplitude-correction factors are not applied to this signal. Refer to "Alignments" on page 323 for more information.

AUX IF OUT is a 50 Ω, 21.4 MHz IF output that is the down-converted signal of the RF input of the analyzer. Amplitude-correction factors are not applied to this signal. This output is taken after the resolution bandwidth filters and step gains and before the log amplifier.

NOTE Only one IF and Sweep Port option (Option A4J or Option AYX) can be installed at a time.

9 **FM Demod** (Option BAA) allows you to demodulate, display, and measure deviation on FM signals. You can listen to audio signals on a built-in speaker or with an earphone. Refer to "Det/Demod" on page 216 and "FM Demodulation (Option BAA)" in Chapter 7 for more information about this option.

Bluetooth™ [1] FM Demodulation (Option 106) allows you to demodulate, display and measure deviation on Bluetooth™ signals. Refer to "Det/Demod" on page 216 and "Bluetooth™ FM Demodulation (Option 106)" on page 351 for more information about this option.

10 **Frequency Extension Assembly** controls the microwave front-end components in the Agilent E4404B, E4405B, E4407B, and E4408B.

1. Bluetooth™ is a trademark owned by its proprietor and used by Agilent Technologies under license.

PRESEL TUNE OUTPUT provides a signal to control external preselected mixers if External Mixing (Option AYZ) is installed.

11 **Card Slot Identification Numbers.** Refer to Table 2-1 and Table 2-2 for card slot versus option card compatibility information.

12 **10 MHz REF IN** accepts an external frequency source to provide the 10 MHz, –15 to +10 dBm as a timebase.

NOTE It is not necessary to connect the 10 MHz REF OUT to the 10 MHz REF IN on the rear panel of the analyzer. Doing so will result in a Frequency Reference Error message.

13 **10 MHz REF OUT** provides a 10 MHz, 0 dBm minimum, timebase reference signal.

14 **Power On Selection** selects an instrument power preference.

The **PWR ALWAYS ON** setting turns the analyzer on whenever external power is applied. This mode is useful if an external power switch is used to control a rack of several instruments. Nevertheless, if you set the analyzer to standby using the front-panel **Standby** key (see Figure 2-1 on page 13, item 23) and the external power is removed and restored within 20 seconds, the instrument will remain in standby.

Power Always On		
Analyzer state before removing power	A lapse in power < 20 sec.	A lapse in power > 20 sec.
On	On	On
Standby	Standby	On

The **PWR NORM** setting assigns analyzer on/off control to the front-panel **On** and **Standby** keys (see Figure 2-1 on page 13, item 23). If the analyzer is on and the external power is removed and restored within 20 seconds, the instrument will turn on. On the other hand, if the external power is removed and restored after 20 seconds, the instrument will remain in standby regardless of the front-panel switch settings.

Power Norm		
Analyzer state before removing power	A lapse in power < 20 sec.	A lapse in power > 20 sec.
On	On	Standby
Standby	Standby	Standby

15 **DC Fuse** protects the analyzer from drawing too much dc power. Replace only with a fuse of the same rating. See the label on the rear panel.

Display Annotation

Here is an example of the annotation that may appear on an analyzer display. The display annotation is referenced by numbers which are listed in the following table. The Function Key column indicates which key activates the function related to the annotation. Refer to Chapter 6 , “Front-Panel Key Reference.” for more information on a specific function key.

Figure 2-3 Screen Annotation

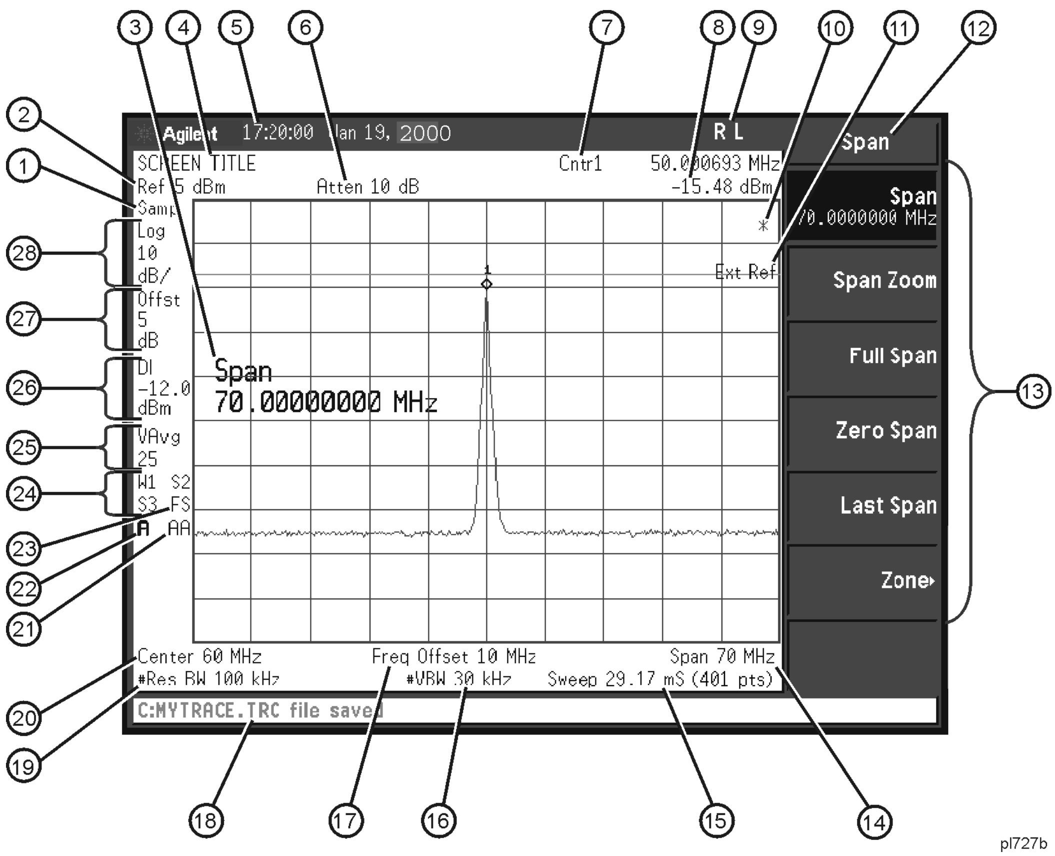


Table 2-3 Screen Annotation

Item	Description	Function Key
1	Detector mode	**Detector**
2	Reference level	**Ref Level**
3	Active function block	Refer to the description of the activated function.
4	Screen title	**Change Title**

Table 2-3 Screen Annotation (Continued)

Item	Description	Function Key
5	Time and date display	**Time/Date On Off**
6[1,2]	RF attenuation	**Attenuation Auto Man**
7	Marker frequency	**Marker Count On Off**
8	Marker amplitude	**Marker**
9	GPIB annunciators	See Table 2-4 on page 26 for more information.
10[3]	Data invalid indicator	**Sweep (Single)** or **View/Trace**
11	Status Informational messages	See Chapter 4 , "Troubleshooting."
12	Key menu title	Dependent on key selection.
13	Key menu	See key label descriptions in Chapter 6 , "Front-Panel Key Reference."
14	Frequency span or stop frequency	**Span** or **Stop Freq**
15[1]	Sweep time/Points	**Sweep Time Auto Man**, **Sweep Points**
16[1]	Video bandwidth	**Video BW Auto Man**
17	Frequency offset	**Freq Offset**
18	Display status line	Displays instrument status and error messages. Cleared by pressing **Esc** key. See Chapter 4 , "Troubleshooting."
19[1]	Resolution bandwidth	**Resolution BW Auto Man**
20	Center frequency or start frequency	**Center Freq** or **Start Freq**
21[4]	Auto alignment routine is on	**Auto Align** See below for more information.
22	Amplitude corrections are on (This indicates that the overall correction state is On. There may be any or none of the individual corrections On.)	**Correction On Off**
23[5]	Trigger/Sweep	**Trig**, **Sweep** See below for more information.
24[6]	Trace mode	**Trace** See below for more information.
25	Average	**Average On Off** VAvg indicates video average on. PAvg indicates power average on.

Table 2-3 Screen Annotation (Continued)

Item	Description	Function Key
26	Display line	**Display Line On Off**
27	Amplitude offset	**Ref Lvl Offst**
28	Amplitude scale	**Scale Type Log Lin**

1. A **#** in front of any display annotation indicates that the function is uncoupled. (Refer to "Auto Couple" in Chapter 6)
2. When the analyzer is set to the external mixer state (Option AYZ), item 6 changes to display `Ext Mix` in place of `Atten XdB`. In addition, if Mixer Bias is on, a `+I` or `–I` is appended to `Ext Mix`.
3. When the **(*)** is displayed, it means that some or all trace data may not match the annotation due to possible changes in instrument settings.
4. **AA** indicates that auto alignment of all analyzer parameters, except the tracking generator and FM demodulation options, will occur. **AB** indicates that auto alignment of all analyzer functions except the RF section (and tracking generator and FM demodulation options) will occur. No indicator will appear if auto alignment is off.
5. The first letter **F** indicates the spectrum analyzer is in free-run trigger mode. The second letter **C** indicates the spectrum analyzer is in continuous-sweep mode. Refer to Table 2-5 on page 26 for other valid annunciators for the first letter. Refer to Table 2-6 on page 27 for other valid annunciators for the second letter.
6. The first letter **W** indicates that the analyzer is in clear-write mode. The second letter is **1**, representing trace 1. The trace 2 trace mode is **S2**, indicating trace 2 (**2**) is in the store-blank mode (**S**). The trace mode annotation for trace 3 is displayed under the trace mode annotation of trace 1. The trace 3 trace mode is **S3**, indicating trace 3 (**3**) is in the store blank mode (**S**). Refer to Table 2-7 for other valid trace mode annunciators.

Refer to the following tables for the screen annotation codes for trace, trigger, and sweep modes.

Table 2-4 Screen Annotation for GPIB Annunciators

Screen Annotation	Description
R	Remote Operation
L	GPIB Listen
T	GPIB Talk
S	GPIB SRQ

Table 2-5 Screen Annotation for Trigger Mode

Screen Annotation	Description
F	Free Run
L	Line
V	Video
E	External

Table 2-5 Screen Annotation for Trigger Mode

Screen Annotation	Description
T[1]	TV

1. Option BAA and B7B only.

Table 2-6 Screen Annotation for Sweep Mode

Screen Annotation	Description
C	Continuous
S	Single Sweep

Table 2-7 Screen Annotation for Trace Mode

Screen Annotation	Description
W	Clear Write
M	Maximum Hold
V	View
S	Store Blank
m	Minimum Hold

Key Overview

The keys labeled **FREQUENCY Channel**, **System**, and **Marker** are all examples of front-panel keys. The front-panel keys are dark gray, light gray, green, or white in color. Front-panel keys that are white perform an immediate action rather than bringing up a menu. The only green key is the Preset, which performs an instrument reset (A summary of all front-panel keys and their related menu keys can be found in Chapter 6 , “Front-Panel Key Reference,” on page 195). Pressing most of the dark or light gray front-panel keys accesses menus of functions that are displayed along the right side of the display. These are called menu keys.

Menu keys list functions other than those accessed directly by the front-panel keys. To activate a menu key function, press the key immediately to the right of the annotation on the screen. The menu keys that are displayed depend on which front-panel key is pressed and which menu level is enabled.

If a menu key function’s value can be changed, it is called an active function. The function label of the active function is highlighted after that key has been selected. For example, press **AMPLITUDE Y Scale**. This calls up the menu of related amplitude functions. Note the function labeled **Ref Level** (the default selected key in the Amplitude menu) is highlighted. **Ref Level** also appears in the active function block, indicating that it is the active amplitude function and can now be changed using any of the data entry controls.

A menu key with On and Off in its label can be used to turn the menu key’s function on or off. To turn the function on, press the menu key so that On is underlined. To turn the function off, press the menu key so that Off is underlined. In the manual, when On should be underlined, it will be indicated as **Function (On)**.

A function with Auto and Man in the label can either be auto-coupled or have its value manually changed. The value of the function can be changed manually using the numeric keypad, knob, or step keys. To auto-couple a function, press the menu key so that Auto is underlined. In the manual, when **Auto** should be underlined, it will be indicated as **Function (Auto)**.

In some key menus, one key label will always be highlighted to show which key has been selected. For example, when you press **Det/Demod**, **Demod**, you will access a menu of keys in which some of the keys are grouped together by a blue bar (on analyzers with a color display) on the left side of the menu. The **Off** key, which is the **Det/Demod**, **Demod** menu default key, will be highlighted. When you press another key within the blue bar region, such as **AM**, the highlight will move to that key to show it has been selected.

In other key menus, one key label will always be highlighted to show which key has been selected but the menu is immediately exited when a selection is made. For example, when you press the **Orientation** key (on the **Print Setup** menu), it will bring up its own menu of keys. The **Portrait** key, which is the Orientation menu default key, will be highlighted. When you press the **Landscape** key, the highlight will move to that key to show it has been selected and the screen will return to the **Print Setup** menu.

Making a Measurement

Let's begin using the analyzer by measuring an input signal. Since the internal 50 MHz amplitude reference signal is readily available, we will use it as our test signal.

NOTE You cannot hurt the analyzer by using this reference signal and pressing any of the keys described in this section. Don't be afraid to play with the knob, step keys, or numeric keypad. (If you have experimented with other keys and wish to return to a known state, press the green **Preset** key and then, if present, press the **Factory Preset** menu key.)

1. First, turn the instrument on by pressing **On**. Wait for the power-up process to complete.
2. Press **System**, **Power On/Preset**, **Preset (Factory)**.
3. Press the green **Preset** key. Turn on the internal 50 MHz signal by pressing **Input**, **Amptd Ref Out (f=50 MHz) (On)** and connecting a cable from the **AMPTD REF OUT** to the **INPUT 50** Ω.

NOTE For the *Agilent E4401B and E4411B*, the above key label is **Amptd Ref (f=50 MHz)**, and no cable is required.

4. Set the frequency.

   Press the **FREQUENCY Channel**, **Center Freq** keys. `Center` appears on the left side of the screen, indicating that the center-frequency function is active. The **Center Freq** menu key label is highlighted to indicate that center frequency is the active function. The active function block is the space on the screen within the graticule where the active function messages appear. Active function values can be changed using the knob, step keys, or numeric keypad. Set the center frequency to 50 MHz with the DATA keys by pressing **50** and then **MHz**. The knob and step keys can also be used to set the center frequency.

NOTE When making low frequency measurements using the specified model numbers and configurations listed below, set the input to DC coupled mode (**Input, Coupling (DC)**).

Table 2-8 DC Couple the Input When Measuring Lower Frequencies

Frequency	Model Number
≤ 100 kHz	E4402B with Option UKB, E4404B, E4405B
≤ 10 MHz	E4407B with Option UKB

CAUTION When operating in dc coupled mode, ensure protection of the input mixer by limiting the input level to 0 Vdc and +30 dBm.

5. Set the span.

   Press **SPAN X Scale**. Span is now displayed in the active function block, and the **Span** menu key label is highlighted to indicate it is the active function. Reduce the span to 20 MHz by using the knob, pressing the down key (⇓), or pressing **20** and then **MHz**.

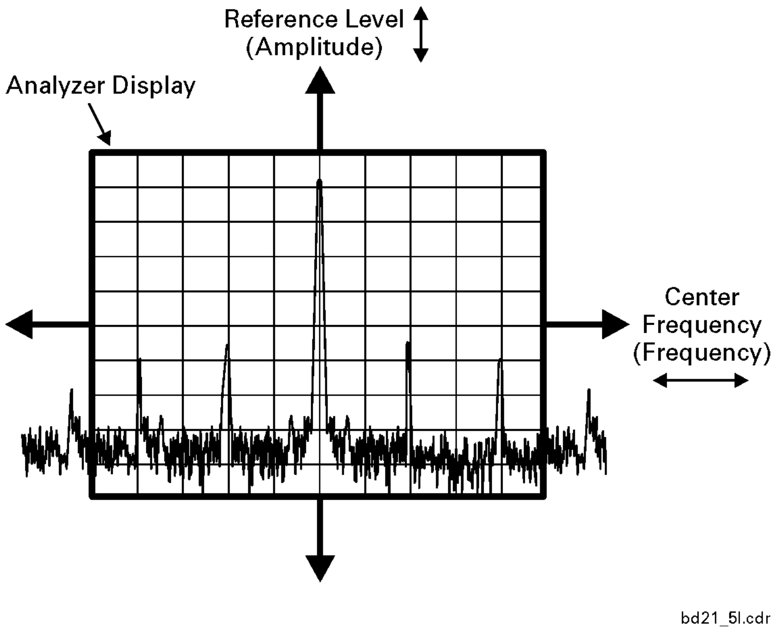
6. Set the amplitude.

   When the peak of a signal does not appear on the screen, it may be necessary to adjust the amplitude level on the screen. Press **AMPLITUDE Y Scale**. `Ref Level 0.0 dBm` appears in the active function block (48.75 dBmV with Option 1DP). The **Ref Level** menu key label is highlighted to indicate that reference level is the active function. The reference level is the top graticule line on the display and is set to 0.0 dBm (48.75 dBmV with Option 1DP). Changing the value of the reference level changes the amplitude level of the top graticule line. If desired, use the reference level function to place the signal peak at the top of the screen using the knob, step keys, or numeric keypad.

   Figure 2-4 demonstrates the relationship between center frequency and reference level. The box in the figure represents the analyzer display. Changing the center frequency changes the horizontal placement of the signal on the display. Changing the reference level changes the vertical placement of the signal on the display. Increasing the span increases the frequency range that appears horizontally on the display.

NOTE Analyzers with “75 ohm Input Impedance (Option 1DP)” default to display amplitude values in dBmV when in a log scale mode.

Figure 2-4 Relationship between Frequency and Amplitude



7. Set the marker.

   Marker functions measure the frequency and amplitude of a signal. You can place a diamond-shaped marker on the signal peak to find the signal frequency and amplitude.

   To activate a marker, press the **Marker** key (located in the **MARKER** section of the front panel). The **Normal** softkey is highlighted to show that the marker is the active function. Turn the knob to place the marker at the signal peak. You can also use the **Peak Search** key, which automatically places a marker at the highest point on the trace.

   Readouts of marker frequency and amplitude appear in the active function block and in the upper right corner of the display. Look at the marker readout to determine the amplitude of the signal. If another function is activated, the marker frequency and amplitude can still be identified by looking at the marker readout in the upper right corner of the display.

Measurement Summary

1. Press **System**, **Power On/Preset**, **Preset (Factory)**. Press the green **Preset** key. Turn on the internal 50 MHz signal by pressing **Input**, **Amptd Ref Out (f=50 MHz) (On)**, and connecting a cable from the **AMPTD REF OUT** to the **INPUT 50** Ω.

NOTE *For the Agilent E4401B and E4411B*, the above key label is **Amptd Ref (f=50 MHz)**, and no cable is required.

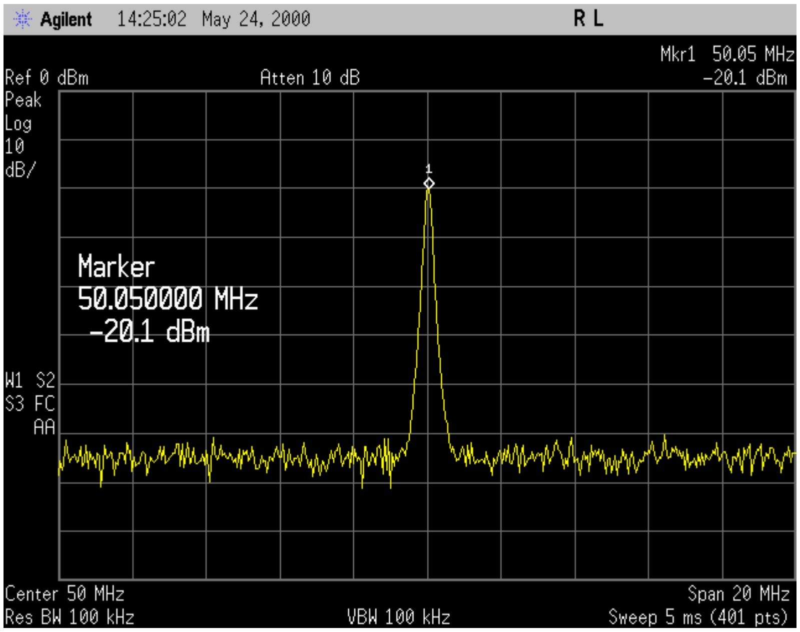
2. Set the center frequency by pressing the following keys: **Frequency**, **Center Freq**, 50, **MHz**.

3. Set the span by pressing the following keys: **Span**, 20, **MHz**.

4. The amplitude reference signal is about –27 dBm (25 dBmV for Option 1DP) *for the Agilent E4411B and E4401B*. The amplitude reference signal is about – 20 dBm *for the Agilent E4402B, E4403B, E4404B, E4405B, E4407B and E4408B*. If desired, adjust the reference level: press **AMPLITUDE Y Scale** to activate the reference level, and use the knob or step keys to change the reference level and bring the signal to the top of the screen.

5. Determine the amplitude and frequency of the signal. You can either press **Peak Search** or press **Marker** and move the marker to the signal peak. Read the amplitude and frequency. The display should look like the one in Figure 2-5. Frequency is displayed horizontally, and amplitude (power) is displayed vertically.

Figure 2-5 Reading the Amplitude and Frequency



Analyzer Accuracy and the Internal Alignment Process

Data from the internal alignment routine is necessary for spectrum analyzer operation. The internal alignment routine runs continuously to ensure that the analyzer is using current alignment data that improves the analyzer frequency and amplitude accuracy. Press the **System**, **Alignments** keys to view the alignment menus. For more detailed information on the alignment keys, refer to "Alignments" in Chapter 6.

Warm-up Time

In order for the analyzer to meet published specifications, allow it to warm up for 5 minutes after being turned on before attempting to make any calibrated measurements. If the analyzer is an Agilent E4402B, E4403B, E4404B, E4405B, E4407B, or E4408B, connect a BNC cable between AMPTD REF OUT and INPUT 50 Ω using an adapter. After a 5 minute warm-up, press **System**, **Alignments**, **Align Now**, **All**. If the analyzer is equipped with a 3.0 GHz tracking generator (Option 1DN on Agilent E4402B, E4403B, E4404B, E4405B, E4407B, or E4408B), connect a short cable from AMPTD REF OUT to INPUT 50 Ω, and press **System**, **Alignments**, **Align Now**, **TG**. If the analyzer is equipped with FM Demod (Option BAA) or Bluetooth™ FM Demodulation (Option 106), press **System**, **Alignments**, **Align Now**, **FM Demod**. If **Auto Align Off** is selected, refer to the analyzer specifications for the conditions required to maintain calibration.

NOTE Under certain conditions the warm-up time may vary. For more information about warm-up times and the special conditions that may affect them, refer to the *Agilent Technologies ESA Spectrum Analyzers Specifications Guide - E Series* or *Agilent Technologies ESA Spectrum Analyzers Specifications Guide - L Series*.

File Menu Functions

This section describes how to use the functions located under the front-panel **File** key. Data storage and retrieval are handled similarly to that of personal computers (PCs). Like PCs, these analyzers include an internal storage drive and a floppy disk drive, both of which have directory and sub-directory capability.

NOTE The descriptions in this section assume the analyzer has firmware revision A.04.00 or later. The file menu functions in earlier firmware are different. If you would like to upgrade your analyzer to the latest firmware revision, please visit the following web site:

`http://www.agilent.com/find/esa`

You will learn how to do all of the following:

- locate and view files in the catalog
- create a directory
- format a floppy disk
- save a file
- load a file
- rename a file
- copy a file
- delete a file

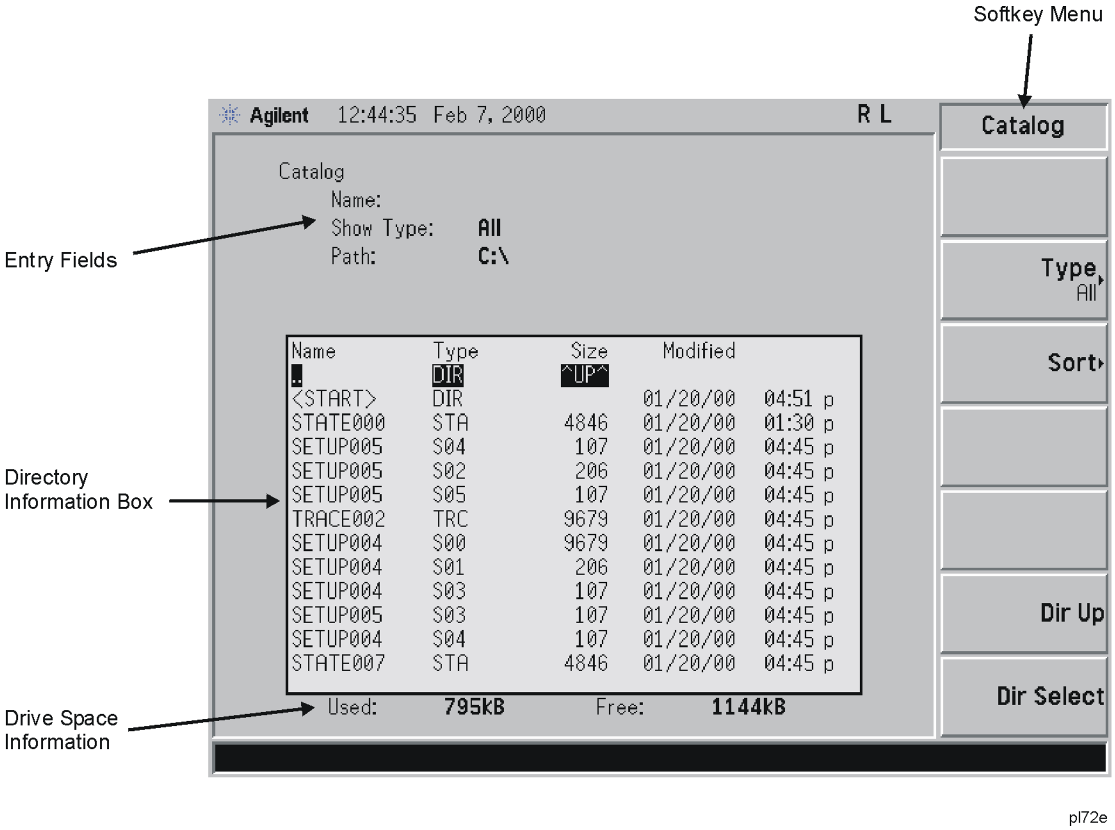
NOTE The display examples in this section are made using the Agilent E4407B, you may see some variations depending upon your analyzer.

Locate and view files in the catalog

Techniques for locating files and directories are consistent throughout the various file menu functions. Although this section provides specific information about navigation in the catalog, you may wish to refer back to this section when performing other operations of the file menu.

Press **File**, **Catalog** to bring up a screen display as shown in Figure 2-6.

Figure 2-6 Catalog Menu



1. The entry fields show the parameters for the files viewed. Entry fields that are being modified or are modifiable are indicated by highlighting (inverse video). Each file menu function has its own unique set of entry fields pertaining to that function. Below are the fields listed under the catalog key:

   a. `Name:` field states the filename.

   b. `Show Type:` field displays the type of files viewed.

   c. `Path:` field displays the drive and directory location of the files.

2. The directory information box displays the drives, directories, and/or files currently described in the entry fields. Highlighting a row of information selects that location and updates the entry fields. There are four column headings in this area of the display. They are described as follows:

   a. `Name:` column states the drive (`[-A-]` or `[-C-]`) if at the top level on the drive, directory name, or filename.

   b. `Type:` column displays the extension of the filename, for example, `.SET`, `.STA`, `.TRC`. Directories are displayed as `DIR` and drives have nothing listed under `Type:`. They are only designated by the `Name:` column (`[-A-]` or `[-C-]`).

   c. `Size:` column displays the size of the file in bytes.

   d. `Modified:` column displays the date and time the last change occurred.

3. The softkey menu has four options:

   a. **Type:** allows you to choose the type of file you wish to view. (You may view all types by using the **All** key under **Type.)**

   b. **Sort**: Under the **Sort** key, you can sort by any of the four columns and you can choose up (ascending) or down (descending).

   c. **Dir Up**: moves you up one directory level. If you are already at the top level, this key moves you up to the drive level, displaying the available disk drives.

   d. **Dir Select**: moves you down into the highlighted directory or up into the next level (directory or drive) if the ". ." under the **`Name:`** column is highlighted.

NOTE Navigation keys: Use the front-panel **Step Keys** or **Knob** and the **Dir Up** or **Dir Select** keys to move around in the directory information box.

4. The drive space line shows the number of bytes used on the drive and the number of bytes still free on the drive.

Creating a directory

Directories and sub-directories can be created on both the A: floppy disc and the internal C: drive. This allows maximum flexibility in organizing files. For this example, we will create a directory on the C: drive.

1. Press **File**, **More 1 of 2**, **Create Dir**. Your screen should look similar to Figure 2-6, except the entry fields will be `Dir Name:` and `Path:` and the Heading will read: `Directories`.
2. Navigate through the file system until the `Path:` field displays C:\. (Use the Step Keys, Knob, Dir Up, and/or Dir Select keys.)
3. Press **Name** and enter the name, "START" using the Alpha Editor. (The numeric keypad is also available for the filename.) Press **Enter** (hardkey) when the `Dir Name:` field contains this directory title. (Use the **Bk Sp** hardkey on the front-panel to make corrections.)
4. Press **Create Dir Now** to execute the operation. The message: `Creating Directory` appears on the screen. Then the status bar displays: `Directory C:\START created`.

5. To make a sub-directory, scroll down to the START directory you just created and press **Dir Select**. The `Path:` field should now read: `C:\START\`. Repeat Steps 3 and 4 above, using a *new name*. The status bar now should read: `Directory C:\START\new name created`.

Format a Floppy Disk

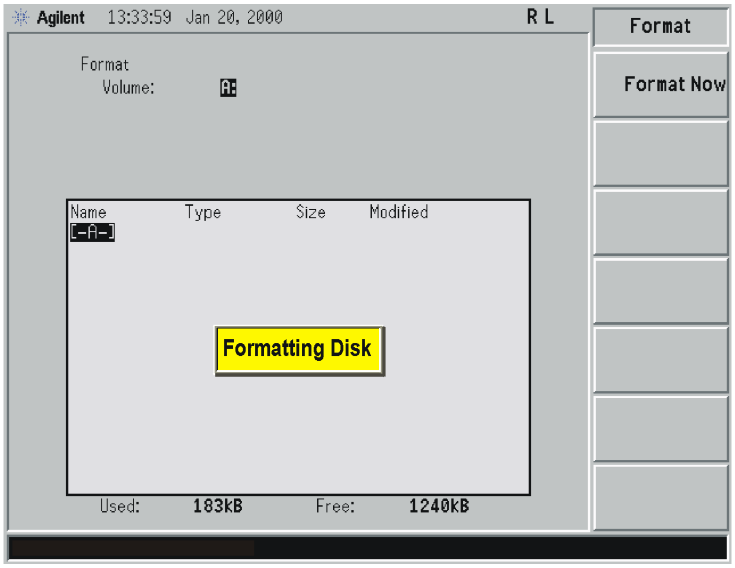
You can format a floppy disk in the analyzer. The format is MS-DOS®[1]. Note that it is not necessary to format your floppy disk with the analyzer; preformatted disks can be used with the analyzer.

1. Place the 1.44-MB disk you wish to format into the floppy drive (A:\) of the analyzer. Only 1.44-MB floppy disks are supported by the analyzer. Therefore, 720-kB floppy disks will not work reliably.
2. Access the **Format** key by pressing **File**, **More**, and then **Format**. The directory information box is active (highlighted), however, only the floppy disk volume `[-A-]` is shown on the display.

   The directory information box displays all files present on the floppy disk inserted in drive "A:". If you have not inserted a disk into drive "A:", or the disk you are attempting to format has no pre-existing formatting, the error message: `bad, missing, or unformatted disk` is displayed in the status line.
3. Press **Format Now**. The following message appears in the display window: `WARNING: You are about to destroy ALL data on Volume A:. Press Format Now again to proceed or any other key to abort`. To abort disk format, press any key but **Format Now**. *When a disk is formatted, all data on the disk is destroyed.*
4. Press **Format Now** a second time to format the disk. You will see the message: `Formatting Disk` in the display window. Pressing any other key after receiving the warning in step 3 on page 38, will abort the formatting process. See Figure 2-7. The format process takes approximately three minutes.

1. MS-DOS® is a U.S. registered trademark of Microsoft Corporation.

Figure 2-7 Format Menu



5. When formatting is complete, a message, `Volume A: formatted` appears on the status line. The disk is now ready to save files.

Save a File

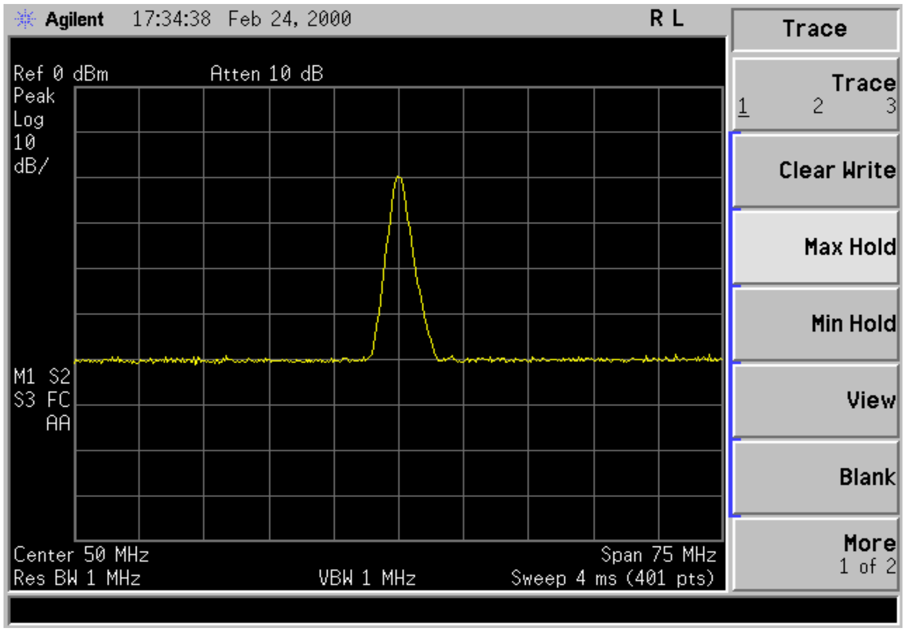
You can save files (setups, states, traces, limits, corrections, or screens) to a floppy disk (A:\), or the internal drive (C:\). In this example you will save a trace to the internal C: drive.

Step 1. Set up the analyzer trace

1. Perform a factory preset by pressing **Preset**, **Factory Preset** (if present).
2. Turn on the internal 50 MHz alignment signal of the analyzer as follows:
   - For the *Agilent E4401B and E4411B*, use the internal 50 MHz alignment signal of the analyzer as the signal being measured. Press **Input/Output**, **Amptd Ref** (On).
   - For all other models connect a cable between the front-panel AMPTD REF OUT to the analyzer INPUT, then press **Input/Output**, **Amptd Ref Out** (On).
3. Set the center frequency to 50 MHz by pressing press **FREQUENCY**, **Center Freq**, **50**, **MHz**.
4. Set the span to 75 MHz by pressing **SPAN**, **Span**, **75**, **MHz**. The reference signal will appear on the display.

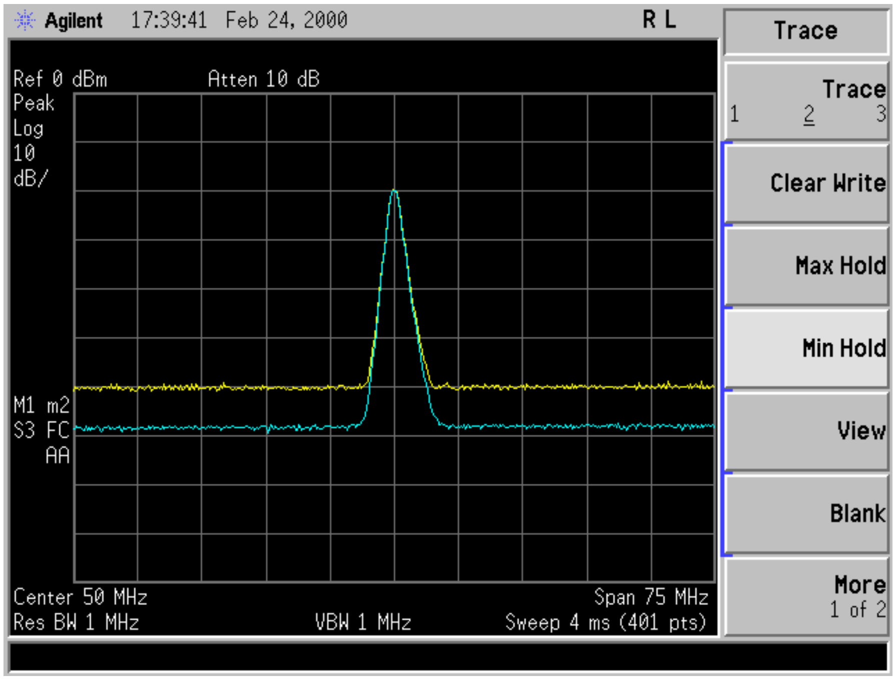
5. View trace 1 and put it into maximum hold by pressing **View/Trace**, **Max Hold**. (Trace 1 should already by underlined, but if not, press **Trace 1 2 3** until 1 is underlined and then press **Max Hold**.) Your analyzer display should look similar to Figure 2-8.

Figure 2-8 Viewing Trace 1



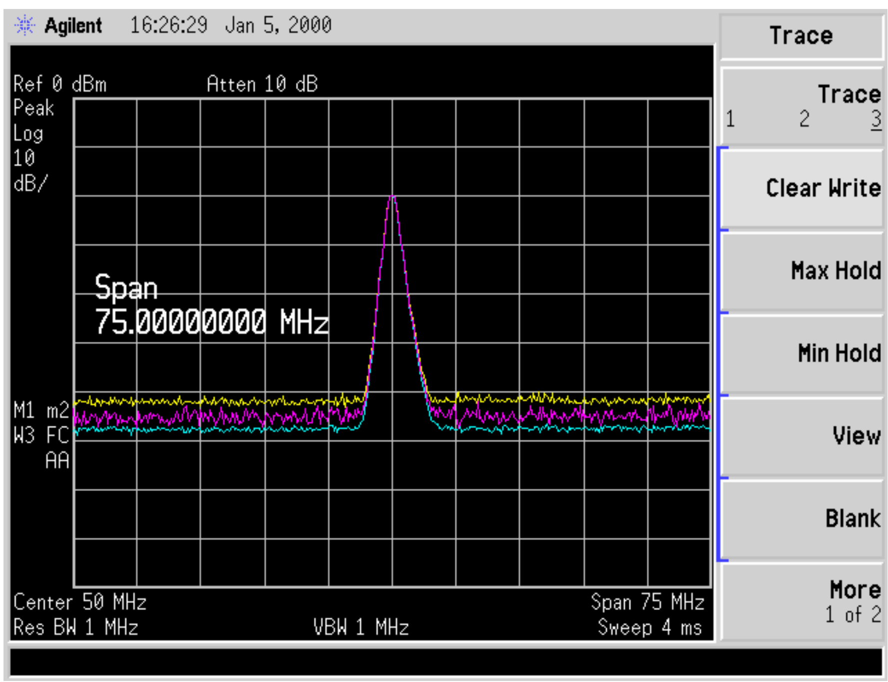
6. Activate trace 2 and put it into minimum hold by pressing **Trace (2)**, **Min Hold**. Your analyzer display should look similar to Figure 2-9.

Figure 2-9 Viewing Traces 1 and 2



7. Activate trace 3 by pressing **Trace (3)**, **Clear Write**. Your analyzer display should look similar to Figure 2-10.

Figure 2-10 Viewing Traces 1, 2, and 3



Step 2. Save the file

1. To access the **Save** menu, press, **File**, **Save**.
2. Select the type of file you want to save. In this example you are saving a trace; press **Type, Trace**.
3. Select the trace you wish to save (1, 2, 3, or all traces). In this example you will save trace 3; press **Source** (softkey), **Trace 3**.
4. Select the format you wish to use for saving the trace, either trace plus state (**Trace + State**) or comma separated value (**CSV**). In this example you will save as trace plus state; press **Format**, **Trace + State**.
5. Enter a filename by pressing **Name**. The Alpha Editor appears. For this example you will name the file, "TEST1". (The numeric keypad is also available for the filename.) Note that the file extension is always set by the system and for this file type the extension is TRC. You must now press the **Enter** (hardkey) to get back to the **Save** menu.

NOTE You need to use a filename that does not already exist in the current directory. The filename is limited to eight characters, alpha (A-Z) or numeric (0-9) in any combination. The analyzer will not allow you to overwrite an existing file. If you select a filename that already exists, the status bar will display the message: `File already exists`. If you do not choose a filename, the analyzer will automatically generate a name based on the type of file you are saving (Setup: SETUP, State: STATE, Trace: TRACE, Limits: LIMIT, Corrections: COREC, Screen: SCREN). It also generates a three digit integer (starting at 000 and extending through 999, remembering the previously saved value through a power cycle) which it adds to the name, for example: TRACE056.TRC. Also note that this three digit integer increments upon each attempted save until a unique filename is created, without regard to the success of the save.

6. The destination for the saved file is shown in the `Path:` field. In this example, you will select the path as C:\START\. If the correct location is not listed in the `Path:` field, change directories as follows:
   a. Press **Dir Up** or **Dir Select** and use the step keys or knob, to highlight the desired destination directory.
   b. Press **Dir Select** and confirm your choice displayed in the `Path:` field.
7. Press **Save Now** or **Save** (hardkey) to save the file to the `C:\Start\` location. The message **Saving Now** is displayed during this operation. For this example, the status line displays: `C:\START\TEST1.TRC file saved`.

NOTE When saving to drive (A:), never remove the floppy disk during the save operation. To do so could corrupt *all* data on the floppy disk.

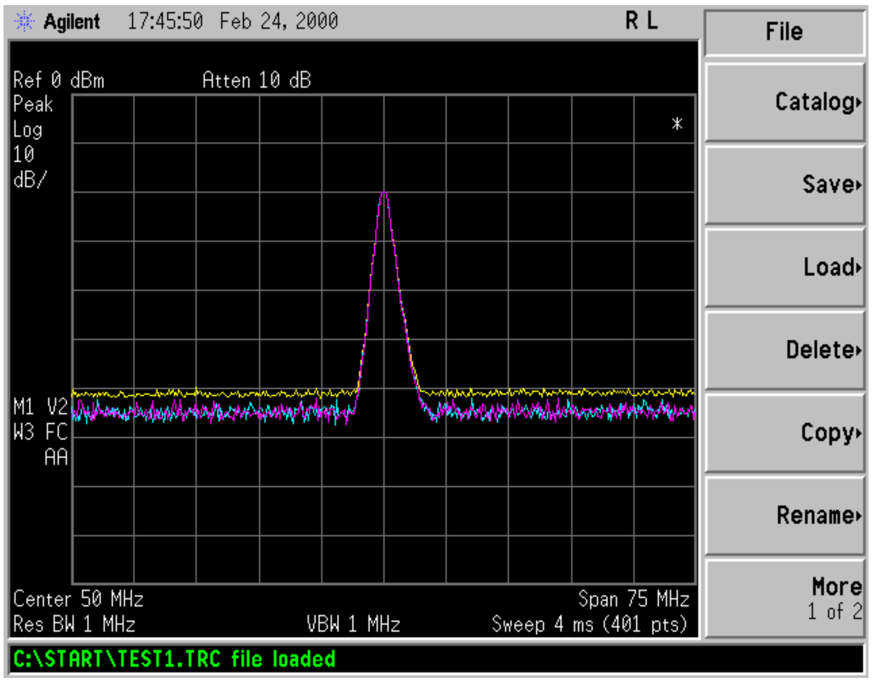
Load a file

1. Reset the analyzer by pressing **Preset**, **Factory Preset** (if present).
2. To access the **Load** menu, press **File**, **Load**.
3. Select the type of file you want to load (setup, state, trace, limits, or corrections). In this example you are loading a trace file; press **Type, Trace**.

NOTE Not all file types can be loaded back into the analyzer. For example, Screen files and CSV (comma separated value) cannot be loaded. CSV and Screen files are designed for use with a PC.

4. Select the directory where your file is located. In this example, select the **C:\START** directory. (Use the front-panel step keys, knob, **Dir Up,** and/or **Dir Select** keys to locate the directory.)
5. Select the file you want to load into the analyzer by moving the cursor with the front-panel knob to highlight the file name. In this example the file is `TEST1.TRC`. Select the trace into which you wish to load the file. In this example, load it into Trace 2. (**Destination**, **Trace 2**).
6. Press **Load Now** to load the specified file. Your display should look similar to Figure 2-11. The status bar reads: `C:\START\TEST1.TRC file loaded`.

Figure 2-11 File Loaded

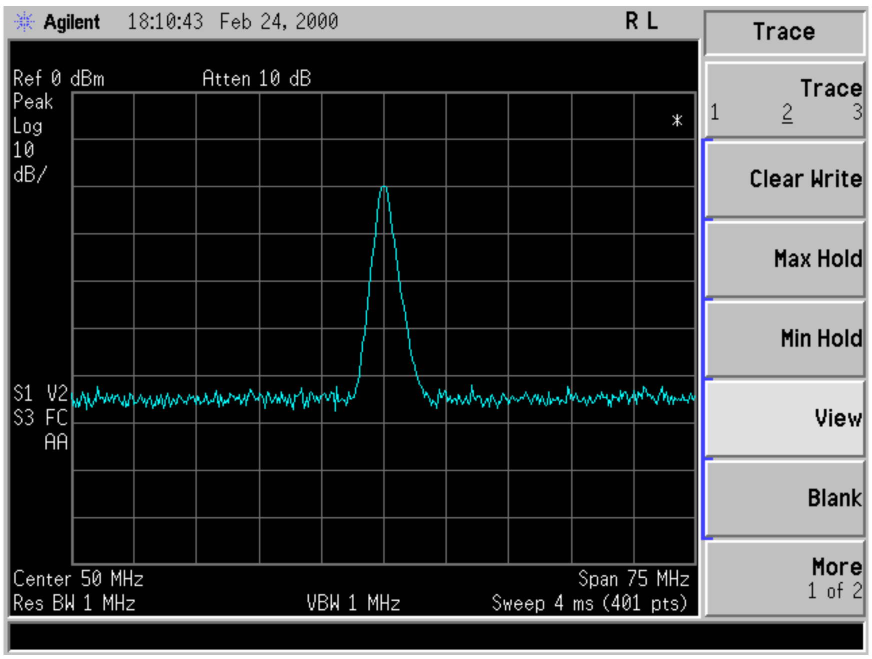


NOTE

You should notice that the trace you saved, in this example trace 3, is loaded to trace 2. If you wish to verify this condition, remove the signal input. For Agilent E4401B and E4411B, press **Input/Output**, **Amptd Ref (Off)**, for all other models, press **Input/Output**, **Amptd Ref Out (Off)**.

Note that when a trace is loaded, it is placed in view mode. To see that trace 2 is in view mode, blank traces 1 and 3 by pressing **View/Trace**, **Trace 1**, **Blank, Trace 3**, **Blank**. Then press Trace 2. Notice that trace 2 is the only trace displayed in view mode (the view key is selected, and the trace is not sweeping). Your display should look similar to Figure 2-12.

Figure 2-12 Verifying Trace 1



CAUTION

When operating in dc coupled mode, ensure protection of the input mixer by limiting the input level to 0 Vdc and +30 dBm.

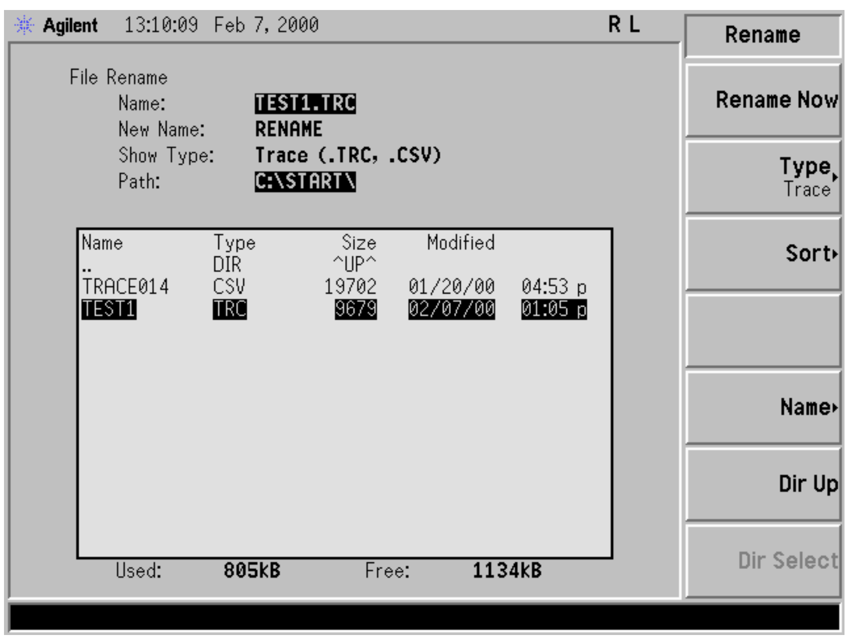
NOTE

When loading Limits files, be sure you have selected the appropriate X Axis Units: frequency or time (**Display**, **Limits**, **Properties**, **X Axis Units**). If you are in time X-Axis Units, and you load frequency limits, all current limit line data will be erased and the analyzer will switch to the frequency domain. The reverse of the this situation also holds true.

Rename a File

1. To access the **Rename** menu, press **File**, **Rename**.
2. Select the type of file you want to rename (setup, state, trace, limits, screens, or corrections). In this example you are renaming a trace file; press **Type**, **Trace**.
3. Select the drive and directory where your file is located. In this example, choose drive `C:\START`.
4. Select the file you want to rename. In this example, choose the file `TEST1.TRC`.
5. Press **Name** to open the Alpha Editor menu. For this example, rename the file to `RENAME` using the Alpha Editor softkeys. (The `Name:` field is limited to eight characters.) Your display should look similar to Figure 2-13.
6. Press **Enter**, **Rename Now**: your file is now renamed and visible within the directory displayed on your analyzer. The status line displays the message: `C:\START\TEST1.TRC file renamed to C:\START\RENAME.TRC`.

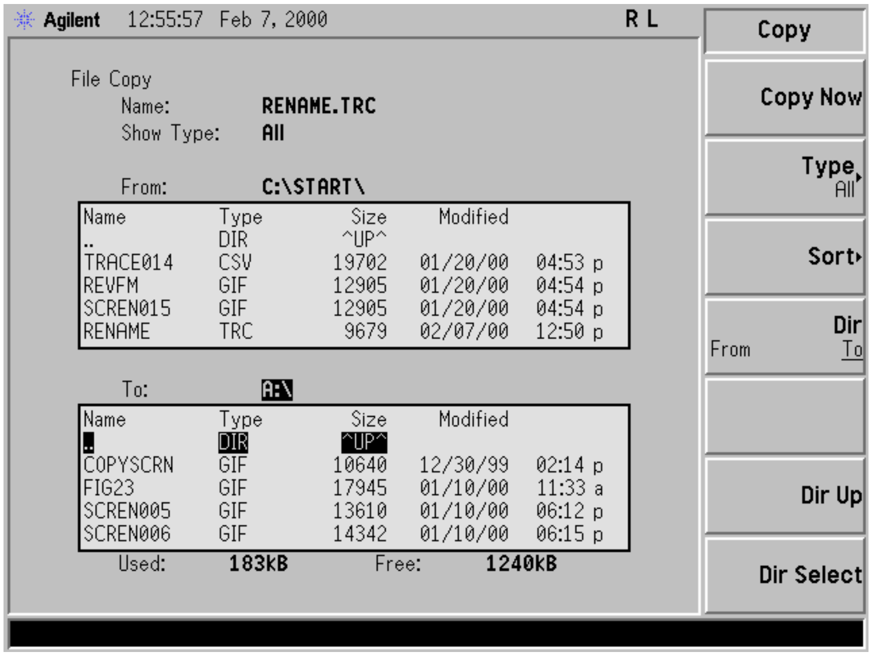
Figure 2-13 Renaming a File



Copy a File

1. To access the Copy menu, press **File**, **Copy**. This menu function brings up 2 directory boxes as described by the From: and To: fields located directly above the boxes. Refer to Figure 2-14.

Figure 2-14 Copy Menu



2. Put a formatted floppy in the A: drive.

3. Select the type of file you want to copy (setup, state, trace, limits, screens, or corrections). In this example you are copying a trace file from the C: drive to the A: drive; press, **Type**, **Trace**.

4. Press **Dir** (in the key menu) to underline From:. Notice the From: field (just above the top directory box) highlights the location from which you will be copying. Using the navigation keys (**Dir Up**, **Direct select**, step keys, or front-panel knob), locate the C:\START\ directory.

5. Scroll to highlight the file displayed in the directory box from which you wish to copy. In this example, you will need to highlight the file RENAME.

6. Press **Dir** (in the key menu) to underline To:. The To: field (just above the bottom directory box) is highlighting the location to which you will be copying. Using the navigation keys as described above, highlight the A:\ drive.

NOTE When pressing **Dir (To)**, the file chosen in the `From:` location is no longer highlighted, however the `Name:` field above the `From` directory box displays the chosen file; in this example: `RENAME.TRC`.

NOTE Highlighting a filename in the `To:` directory box has no significance. The file cannot be placed inside another file.

7. Press **Copy Now** to execute the operation. The message: `“Copying file”` is displayed during the copying process. Upon completion, the status bar reads: `“C:\START\RENAME.TRC file copied”`. You have now copied the file RENAME from the C: drive to the A: drive.

Delete a File

1. To access the Delete menu, press **File**, **Delete**.
2. Select the type of file you want to delete (setup, state, trace, limits, screens, or corrections). In this example, you are deleting a trace file; press **Type, Trace**.
3. Select the drive and directory where the file you wish to delete is located. In this example, choose `C:\START\`. Use the navigation keys (**Dir Up**, **Dir Select**, step keys, front-panel knob) to highlight this location in the `Path:` field. (Refer to “Locate and view files in the catalog” on page 35 for more instructions.)
4. Select the file you want to delete. In this example, choose the file `RENAME.TRC`. Move the cursor with the navigation keys to highlight the file name.
5. Press **Delete Now**. The message: `Deleting file` pops up on the display during the operation. Upon completion, the status bar reads: `C:\START\RENAME.TRC file deleted`. Your file is now deleted and is no longer visible in the directory displayed on your analyzer.

Printer Setup and Operation

Equipment

- Agilent ESA Spectrum Analyzer equipped with Options A4H (GPIB and Parallel Interface) or Option 1AX (RS-232 and Parallel Interface)
- IEEE 1284 compliant printer cable (such as HP/Agilent C2950A)
- Supported printer equipped with a parallel interface. (A supported printer is one that accepts Printer Control Language (PCL) Level 3 or 5.)
  - PCL3 printers include most Hewlett-Packard (HP) DeskJet printers.
  - PCL5 printers include most HP LaserJet printers (LaserJet III and after) and the HP 1100C, 1200C, 1600C, and 2000C DeskJet printers. (Early HP LaserJet printers, such as the HP LaserJet II, are not PCL5 compatible.)

Interconnection and Setup

1. Turn off the printer and the analyzer.
2. Connect the printer to the analyzer parallel I/O interface connector using an IEEE 1284 compliant parallel printer cable.
3. If appropriate, configure your printer using configuration menus or switches. Refer to your printer’s documentation for more specific information on configuring your printer.
4. Turn on the analyzer and printer.
5. Press **Print Setup** on the front panel and then press the **Printer Type** menu key. **Printer Type** accesses the following keys:

None	**None** disables the analyzer from attempting to print to a printer. This is the appropriate setting if no printer is connected to the analyzer.
Custom	**Custom** allows you to access the **Define Custom** menu keys. The **Define Custom** menu keys allow you to specify printer characteristics such as PCL Level and printer color capability.
Auto	**Auto** enables the analyzer to automatically attempt to identify the connected printer when the **Print** key is pressed or when **Printer Type** is set to **Auto**.

6. Press **Printer Type** to access the **Printer Type** menu keys. Press **Auto** to make the analyzer attempt to identify the connected printer. When you press **Auto**, the analyzer will respond in one of the three following ways:

   - The **Print Setup** menu will be displayed with the **Auto** key selected and no new message will be displayed in the display status line. This indicates that the analyzer has successfully identified the connected printer and no further setup is required. As long as **Auto** remains selected in the **Printer Type** menu, the analyzer will attempt to identify the printer when the front-panel **Print** key is pressed. The selected printer will be displayed by pressing **System**, **More 1 of 3**, **Show System**.

   - The **Print Setup** menu will be displayed with the **Custom** key selected and one of the following diagnostic messages will be displayed in the display status line:

     `Unknown printer, Define Custom to set up printer`

     `No printer response, Define Custom to set up printer`

     `Invalid printer response, Define Custom to set up printer`

     This indicates that the analyzer was unable to automatically identify the connected printer, and **Custom** has been selected in the **Printer Type** menu. Press **Print Setup**, **Define Custom** to select specific printer characteristics such as the printer language (PCL3 or PCL5) and color printing capability. Once you have set these characteristics to match those of your connected printer, the printer setup process is complete. As long as **Custom** remains selected in the **Printer Type** menu, the analyzer will not attempt to automatically identify the connected printer when the front-panel **Print** key is pressed.

   - The **Print Setup** menu will be displayed with the **None** key selected and the following message will appear in the display status line:

     `Unsupported printer, Printer Type set to None`

     This indicates that the analyzer has successfully identified the connected printer, but the printer is not supported by the analyzer. As long as **None** is selected in the **Printer Type** menu, the analyzer will respond to any print command by displaying the message `Printer Type is None` in the display status line.

Testing Printer Operation

When you have completed the analyzer's printer setup, press **Print Setup** and then press **Print** on the front panel. If the printer is ready and the printer setup was successful, a printout of the analyzer display will be printed. If the printer is not ready, the message `Printer Timeout` will appear on the analyzer display. `Printer Timeout` will remain on the display until the printer is ready or until you press **ESC** to cancel the printout request. For more information on printer setup and printing, refer to "Print" on page 295 and "Print Setup" on page 296.

Analyzer Battery Information

The analyzer uses a lithium battery to enable the internal memory to retain data. The date when the battery was installed is on a label on the rear panel of the analyzer. See Figure 2-15.

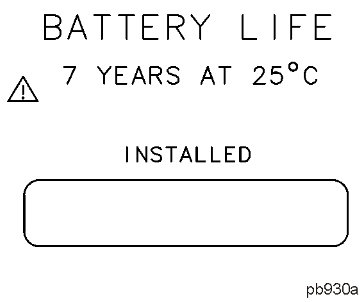
The minimum life expectancy of the battery is 7 years at 25 °C, or 1 year at 55 °C. If you experience problems with the battery or the recommended time period for battery replacement has elapsed, see "How to Return Your Analyzer for Service" in Chapter 4.

If you wish to replace the battery yourself, you can purchase the service documentation that provides all necessary test and maintenance information.

You can order the service documentation for an Agilent ESA spectrum analyzer through your Agilent Sales and Service office. The documentation is described under "Service Documentation and Adjustment Software (Option 0BW)" on page 358.

After replacing the analyzer battery, write the date of battery replacement on the rear-panel label.

Figure 2-15 Rear-Panel Battery Information Label



3 Functional Testing

What You Will Find in This Chapter

This chapter describes the functional tests and provides information on how to perform them.

What Are the Functional Tests?

Functional tests are tests of various instrument parameters that give a high degree of confidence that the instrument is operating correctly. They are recommended as a check of instrument operation for incoming inspection or after a repair. Measurement uncertainty analysis is not available for functional tests, and the instrument is checked against limits that are wider than the published specifications. The functional tests are designed to test an instrument operating within the temperature range defined by the instrument specifications using a minimum set of test equipment. If a test does not pass, performance tests must be run to confirm a problem exists.

Functional Test Versus Performance Verification

Performance verification tests check a wide range of instrument parameters and provide the highest level of confidence that the instrument is operating satisfactorily. They are used to verify that the instrument conforms to published specifications. They are time consuming and require extensive test equipment. The functional tests check a much smaller range of parameters and a limited number of data points for each parameter. They require only limited test equipment.

Test Descriptions

Each of the following test descriptions include the test limits (pass/fail criteria), a description of what the test does or what it measures, a list of equipment required for the performance of the test, an illustration of the test setup used, and a step by step test procedure. The tests are designed to be run on an instrument operating within the operational temperature range defined by the instrument specifications. Only perform tests after the specified warm-up time.

At the end of each test is a test results worksheet. Copy a worksheet to record your test results for each procedure you'll be conducting.

Table 3-1 on page 56 includes a complete list of test equipment for all procedures in this chapter.

The tests included in this chapter are as follows:

Table 3-1

Test Equipment for All Procedures in Chapter 3:	Specifications:	Recommended Model:
Signal Sources		
Synthesized Sweeper	10 MHz-to maximum specified frequency of analyzer. Ext Ref Input	8340A/B or 836XX series
Adapters		
Type-N (m), to APC 3.5 (m)		1250-1743
Type-N(m) to BNC (f)		1250-0780
Type-N(f), to APC 3.5 (f)		1250-1745
Termination, 50 Ω Type-N(m)		908A
(2) Type-N(m), to APC 3.5 (f)		1250-1476
3.5 mm (m) to 3.5 mm (m)		5061-5311
SMA (f) to BNC (m)		1250-2015
Cables		
(2) BNC,122-cm (48-in)		10503A
APC 3.5 mm		11500D
Type-N,152-cm (60-in)		11500D
BNC, 9 inch		10502A
BNC,122-cm (48-in)		10503A
APC 3.5 mm	E4407B and E4408B only	11500E
Cable (1)		10502
Meters		
Power Meter		438A or E4418A, E4419A
RF Power Sensor	100 kHz to 3.0 GHz	8482A
Microwave Power Sensor	50 MHz to 26.5GHz	8485A
Miscellaneous		
Power Splitter	E4407Bonly	11667A
Power Splitter	E4407B and E4408B only	11667B

Table 3-1

50 MHz Low pass filter	Rejection at 80 MHz: >60dB	0955-0306

Displayed Average Noise Level

Test Limits

Frequency Range	Model (50 Ω Input)	Maximum (50 Ω Input)	TR Entry
10 MHz to 500 MHz	E4401B, E4411B	– 119 dBm	1
501 MHz to 1.0 GHz	E4401B, E4411B	– 117 dBm	2
1.01 GHz to 1.5 GHz	E4401B	– 114 dBm	3
	E4411B	– 113 dBm	3
10 MHz to 1.0 GHz	E4402B, E4403B	– 117 dBm	4
	E4404B, E4405B, E4407B, E4408B	– 116 dBm	5
1.01 GHz to 2.0 GHz	E4402B, E4403B	– 116 dBm	6
	E4404B, E4405B, E4407B	– 116 dBm	7
	E4408B	– 115 dBm	8
2.01 GHz to 3.0 GHz	E4402B, E4403B	– 114 dBm	9
	E4404B, E4405B, E4407B, E4408B	– 112 dBm	10
3.01 GHz to 6.0 GHz	E4404B, E4405B, E4407B, E4408B	– 112 dBm	11
6.01 GHz to 6.7 GHz	E4404B	– 111 dBm	12
6.01 GHz to 12.0 GHz	E4405B, E4407B	– 111 dBm	13
	E4408B	– 110 dBm	14
12.01 GHz to 13.2 GHz	E4405B	– 107 dBm	15
12.01 GHz to 22 GHz	E4407B, E4408B	– 107 dBm	16
22.01 GHz to 26.5 GHz	E4407B	– 106 dBm	17
	E4408B	– 101 dBm	18

Frequency Range	Model (75 Ω Input)	Maximum (75 Ω Input)	TR Entry
10 MHz to 500 MHz	E4401B	– 66 dBmV	19
10 MHz to 500 MHz	E4411B	– 65 dBmV	20
501 MHz to 1.0 GHz	E4401B, E4411B	– 60 dBmV	21
1.01 GHz to 1.5 GHz	E4401B	– 56 dBmV	22

Frequency Range	Model (75 Ω Input)	Maximum (75 Ω Input)	TR Entry
1.01 GHz to 1.5 GHz	E4411B	– 53 dBmV	23

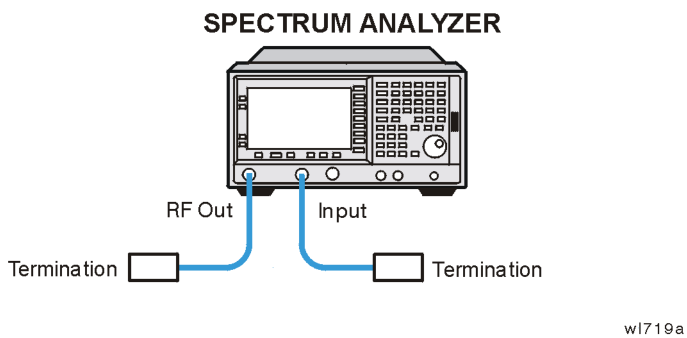
Test Description

The Displayed Average Noise Level is measured within the frequency range specified. The analyzer input is terminated into either 50 Ω or 75 Ω, depending on analyzer options.

The test tunes the analyzer frequency across the band, uses the marker to locate the frequency with the highest response, and then reads the average noise in zero span.

Required Equipment

Figure 3-1 Equipment Setup



Procedure (10 MHz to 500 MHz) *E4401B and E4411B*

1. Connect the equipment as shown in Figure 3-1.
2. Press **System**, **Power On/Preset**, **Preset (Factory)**, **Preset** on the analyzer. Wait for the preset routine to finish. Set the analyzer by pressing the following keys:

   FREQUENCY, **Start Freq**, 10, **MHz**

   Stop Freq, **500, MHz**

   AMPLITUDE, **–70, dBm** (50 Ω Input only)

   AMPLITUDE, **More**, **Y Axis Units**, **dBmV**, **Ref Level**, **–21.24, dBmV** (75 Ω Input only)

   BW/Avg, **Resolution BW**, 1, **MHz**

   Video BW, **10, kHz**

3. Press the following keys on the analyzer:

   Single

   BW/Avg, **Average (On)**, 3, **Enter**

   Single

   Wait until **AVG 3** is displayed to the left of the graticule (the analyzer will take 3 sweeps, then stop).

4. Press **Peak Search**. Record the marker frequency next to your analyzer model in the Measured Frequency column as entry (a) or (b) in Table 3-2 on page 75 for 10 MHz to 500 MHz.

5. Press the following keys on the analyzer:

   Sweep, **Sweep (Cont)**

   BW/Avg, **Average (Off)**

   BW/Avg, **Resolution BW (Auto)**

   Video BW (Auto)

   SPAN, 50, **kHz**

   FREQUENCY

6. Press **Center Freq**, and set the center frequency of the analyzer to the frequency recorded in the Measured Frequency column as entry (a) or (b) of Table 3-2 for 10 MHz to 500 MHz.

7. Press the following keys on the analyzer:

   BW/Avg, **Resolution BW**, 1, **kHz**

   Video BW, 30, **Hz**

   Single

   Wait for the sweep to finish.

8. Press the following keys on the analyzer:

   Display, **Display Line (On)**

   Adjust the display so that it is centered on the average trace noise, ignoring any residual responses.

9. Record the display line amplitude setting as TR Entry 1 (TR Entry 19 or 20 for a 75 Ω Input) in Table 3-2 on page 75. The Average Noise Level should be less than the Maximum for the appropriate input impedance.

Procedure (501 MHz to 1.0 GHz) *E4401B and E4411B*

1. Press the following keys on the analyzer:

   Sweep, **Sweep (Cont)**

   FREQUENCY, **Start Freq**, 501, **MHz**

   Stop Freq, **1.0 GHz**

   BW/Avg, **Resolution BW**, 1, **MHz**

   Video BW, **10, kHz**

2. Press the following keys on the analyzer:

   Single

   BW/Avg, **Average (On)**, 3, **Enter**

   Single

   Wait until **AVG 3** is displayed to the left of the graticule (the analyzer will take 3 sweeps, then stop).

3. Press **Peak Search**, and record the marker frequency next to your analyzer model in the Measured Frequency column as entry (c) in Table 3-2 on page 75 for 501 MHz to 1.0 GHz.

4. Press the following keys on the analyzer:

   Sweep, **Sweep (Cont)**

   BW/Avg, **Average (Off)**

   BW/Avg, **Resolution BW (Auto)**

   Video BW (Auto)

   SPAN, 50, **kHz**

   FREQUENCY

5. Press **Center Freq**. Set the center frequency of the analyzer to the frequency recorded in the Measured Frequency column as entry (c) in Table 3-2 on page 75 for 501 MHz to 1.0 GHz.

6. Press the following keys on the analyzer:

   BW/Avg, **Resolution BW**, 1, **kHz**

   Video BW, 30, **Hz**

   Single

   Wait for the sweep to finish.

7. Press the following keys on the analyzer:

   Display, **Display Line (On)**

   Adjust the display line so that it is centered on the average trace noise, ignoring any residual responses.

8. Record the display line amplitude setting as TR Entry 2 (TR Entry 21 for a 75 Ω Input) in Table 3-2 on page 75. The Average Noise Level should be less than the Maximum for the appropriate input impedance.

Procedure (1.01 GHz to 1.5 GHz) *E4401B and E4411B*

1. Press the following keys on the analyzer:

   Sweep, **Sweep (Cont)**

   FREQUENCY, **Start Freq**, 1.0 **GHz**

   Stop Freq, **1.5 GHz**

   BW/Avg, **Resolution BW**, 1, **MHz**

   Video BW, 10, **kHz**

2. Press the following keys on the analyzer:

   Single

   BW/Avg, **Average (On)**, 3, **Enter**

   Single

   Wait until **AVG 3** is displayed to the left of the graticule (the analyzer will take 3 sweeps, then stop).

3. Press **Peak Search**, and record the marker frequency next to your analyzer model in the Measured Frequency column as entry (d) or (e) in Table 3-2 for 1.01 GHz to 1.5 GHz.

4. Press the following keys on the analyzer:

   Sweep, **Sweep (Cont)**

   BW/Avg, **Average (Off)**

   BW/Avg, **Resolution BW (Auto)**

   Video BW (Auto)

   SPAN, 50, **kHz**

   FREQUENCY

5. Press **Center Freq**. Set the center frequency of the analyzer to the frequency recorded in the Measured Frequency column as entry (d) or (e) in Table 3-2 for 1.01 GHz to 1.5 GHz.

6. Press the following keys on the analyzer:

   BW/Avg, **Resolution BW**, 1, **kHz**

   Video BW, 30, **Hz**

   Single

   Wait for the sweep to finish.

7. Press the following keys on the analyzer:

   Display, **Display Line (On)**

   Adjust the display line so that it is centered on the average trace noise, ignoring any residual responses.

8. Record the display line amplitude setting as TR Entry 3 (TR Entry 22 or 23 for a 75 Ω Input) in Table 3-2. The average noise level should be less than the Maximum for the appropriate input impedance.

Procedure (10 MHz to 1 GHz) *E4402B, E4403B, E4404B, E4405B, E4407B, and E4408B*

1. Press **System**, **Power On/Preset**, **Preset (Factory)**, **Preset** on the analyzer. Wait for the preset routine to finish. Set the analyzer by pressing the following keys:

   FREQUENCY, **Start Freq**, 10, **MHz**

   Stop Freq, 1.0, **GHz**

   AMPLITUDE, –70, **dBm**

   Attenuation (Man), 0, **dB**

   BW/Avg, **Resolution BW**, 1, **MHz**

   Video BW, **10**, **kHz**

2. Press the following keys on the analyzer:

   Single

   BW/Avg, **Average (On)**, 3, **Enter**

   Single

   Wait until **AVG 3** is displayed to the left of the graticule (the analyzer will take three sweeps, then stop).

3. Press **Peak Search**. Record the marker frequency next to your analyzer model in the Measured Frequency column as entry (f) or (g) in Table 3-2 for 10 MHz to 1.0 GHz.

4. Press the following keys on the analyzer:

   Sweep, **Sweep (Cont)**

   BW/Avg, Average (Off)

   BW/Avg, **Resolution BW (Auto)**

   Video BW (Auto)

   SPAN, 50, **kHz**

   FREQUENCY

5. Press **Center Freq**. Set the center frequency of the analyzer to the frequency recorded in the Measured Frequency column as entry (f) or (g) in Table 3-2 for 10 MHz to 1.0 GHz.

6. Press the following keys on the analyzer:

   BW/Avg, **Resolution BW**, 1, **kHz**

   Video BW, 30, **Hz**

   Single

   Wait for the sweep to finish.

7. Press the following keys on the analyzer:

   Display, **Display Line (On)**

   Adjust the display line so that it is centered on the average trace noise, ignoring any residual responses.

8. If the analyzer is an E4402B or E4403B, record the display line amplitude setting as TR Entry 4 in Table 3-2. Otherwise, record the display line amplitude setting as TR Entry 5 in Table 3-2. The average noise level should be less than the Maximum.

Procedure (1.01 GHz to 2 GHz) *E4402B, E4403B, E4404B, E4405B, E4407B, and E4408B*

1. Press **System**, **Power On/Preset**, **Preset (Factory)**, **Preset** on the analyzer. Wait for the preset routine to finish. Set the analyzer by pressing the following keys:

   FREQUENCY, **Start Freq**, 1.01, **GHz**

   Stop Freq, 2, **GHz**

   AMPLITUDE, –70, **dBm**

   Attenuation (Man), 0, **dB**

   BW/Avg, **Resolution BW**, 1, **MHz**

   Video BW, 10, **kHz**

2. Press the following keys on the analyzer:

   Single

   BW/Avg, **Average (On)**, 3, **Enter**

   Single

   Wait until **AVG 3** is displayed to the left of the graticule (the analyzer will take 3 sweeps and then stop).

3. Press **Peak Search.** Record the marker frequency next to your analyzer model in the Measured Frequency column as entry (h), (i) or (j) in Table 3-2 for 1.01 GHz to 2 GHz.

4. Press the following keys on the analyzer:

   Sweep, **Sweep (Cont)**

   BW/Avg, Average (Off)

   BW/Avg, **Resolution BW (Auto)**

   Video BW (Auto)

   SPAN, 50, **kHz**

   FREQUENCY

5. Press **Center Freq**. Set the center frequency of the analyzer to the frequency recorded in the Measured Frequency column as entry (h), (i) or (j) in Table 3-2 for 1.01 GHz to 2 GHz.

6. Press the following keys on the analyzer:

   BW/Avg, **Resolution BW**, 1, **kHz**

   Video BW, 30, **Hz**

   Single

   Wait for the sweep to finish.

7. Press the following keys on the analyzer:

   Display, **Display Line (On)**

   Adjust the display line so that it is centered on the average trace noise, ignoring any residual responses.

8. If the analyzer is an E4402B or E4403B, record the display line amplitude setting as TR Entry 6 in Table 3-2. Otherwise, record the display line amplitude setting as TR Entry 7 or 8 in Table 3-2. The average noise level should be less than the Maximum.

Procedure (2.01 GHz to 3.0 GHz) *E4402B, E4403B, E4404B, E4405B, E4407B, and E4408B*

1. Press **System**, **Power On/Preset**, **Preset (Factory)**, **Preset** on the analyzer. Wait for the preset routine to finish. Set the analyzer by pressing the following keys:

   FREQUENCY, **Start Freq**, 2.01, **GHz**

   Stop Freq, 3.0, **GHz**

   AMPLITUDE, –70, **dBm**

   Attenuation (Man), 0, **dB**

   BW/Avg, **Resolution BW**, 1, **MHz**

   Video BW, 10, **kHz**

2. Press the following keys on the analyzer:

   Single

   BW/Avg, **Average (On)**, 3, **Enter**

   Single

   Wait until **AVG 3** is displayed to the left of the graticule (the analyzer will take 3 sweeps and then stop).

3. Press **Peak Search**. Record the marker frequency next to your analyzer model in the Measured Frequency column as entry (k) or (l) in Table 3-2 for 2.01 GHz to 3.0 GHz.

4. Press the following keys on the analyzer:

   Sweep, **Sweep (Cont)**

   BW/Avg, Average (Off)

   BW/Avg, **Resolution BW (Auto)**

   Video BW (Auto)

   SPAN, 50, **kHz**

   FREQUENCY

5. Press **Center Freq**. Set the center frequency of the analyzer to the frequency recorded in the Measured Frequency column as entry (k) or (l) in Table 3-2 for 2.01 GHz to 3.0 GHz.

6. Press the following keys on the analyzer:

   BW/Avg, **Resolution BW**, 1, **kHz**

   Video BW, 30, **Hz**

   Single

Wait for the sweep to finish.

7. Press the following keys on the analyzer:

   Display, **Display Line (On)**

   Adjust the display line so that it is centered on the average trace noise, ignoring any residual responses.

8. If the analyzer is an E4402B or E4403B E7402A, record the display line amplitude setting as TR Entry 9 in Table 3-2. Otherwise, record the display line amplitude setting as TR Entry 10 in Table 3-2. The Average Noise Level should be less than the maximum.

Procedure (3.01 GHz to 6.0 GHz) *E4404B, E4405B, E4407B, and E4408B*

1. Press **System**, **Power On/Preset**, **Preset (Factory)**, **Preset** on the analyzer. Wait for the preset routine to finish. Set the analyzer by pressing the following keys:

   FREQUENCY, **Start Freq**, 3.01, **GHz**

   Stop Freq, 6.0. **GHz**

   AMPLITUDE, –70, **dBm**

   Attenuation (Man), 0, **dB**

   BW/Avg, **Resolution BW**, 1, **MHz**

   Video BW, 10, **kHz**

2. Press the following keys on the analyzer:

   Single

   BW/Avg, **Average (On)**, 3, **Enter**

   Single

   Wait until **AVG 3** is displayed to the left of the graticule (the analyzer will take 3 sweeps and then stop).

3. Press **Peak Search**. Record the marker frequency next to your analyzer model in the Measured Frequency column as entry (m) in Table 3-2 for 3.01 GHz to 6.0 GHz.

4. Press the following keys on the analyzer:

   Sweep, **Sweep (Cont)**

   BW/Avg, Average (Off)

   BW/Avg, **Resolution BW (Auto)**

   Video BW (Auto)

   SPAN, 50, **kHz**

FREQUENCY

5. Press **Center Freq**. Set the center frequency of the analyzer to the frequency recorded in the Measured Frequency column as entry (m) in Table 3-2 for 3.01 GHz to 6.0 GHz.
6. Press the following keys on the analyzer:

   BW/Avg, **Resolution BW**, 1, **kHz**

   Video BW, 30, **Hz**

   Single

   Wait for the sweep to finish.
7. Press the following keys on the analyzer:

   Display, **Display Line (On)**

   Adjust the display line so that it is centered on the average trace noise, ignoring any residual responses.
8. Record the display line amplitude setting as TR Entry 11 in Table 3-2. The Average Noise Level should be less than the Maximum.

Procedure (6.01 GHz to 6.7 GHz) *E4404B*

1. Press **System**, **Power On/Preset**, **Preset (Factory)**, **Preset** on the analyzer. Wait for the preset routine to finish. Set the analyzer by pressing the following keys:

   FREQUENCY, **Start Freq**, 6.01, **GHz**

   Stop Freq, 6.7, **GHz**

   AMPLITUDE, –70, **dBm**

   Attenuation (Man), 0, **dB**

   BW/Avg, **Resolution BW**, 1, **MHz**

   Video BW, 10, **kHz**
2. Press the following keys on the analyzer:

   Single

   BW/Avg, **Average (On)**, 3, **Enter**

   Single

   Wait until **AVG 3** is displayed to the left of the graticule (the analyzer will take 3 sweeps and then stop).
3. Press **Peak Search**. Record the marker frequency next to your analyzer model in the Measured Frequency column as entry (n) in Table 3-2 for 6.01 GHz to 6.7 GHz.

4. Press the following keys on the analyzer:

   Sweep, **Sweep (Cont)**

   BW/Avg, **Average (Off)**

   BW/Avg, **Resolution BW (Auto)**

   Video BW (Auto)

   SPAN, 50, **kHz**

   FREQUENCY

5. Press **Center Freq**. Set the center frequency of the analyzer to the frequency recorded in the Measured Frequency column as entry (n) in Table 3-2 for 6.01 GHz to 6.7 GHz.

6. Press the following keys on the analyzer:

   BW/Avg, **Resolution BW**, 1, **kHz**

   Video BW, 30, **Hz**

   Single

   Wait for the sweep to finish.

7. Press the following keys on the analyzer:

   Display, **Display Line (On)**

   Adjust the display line so that it is centered on the average trace noise, ignoring any residual responses.

8. Record the display line amplitude setting as TR Entry 12 in Table 3-2. The Average Noise Level should be less than the Maximum.

Procedure (6.01 GHz to 12.0 GHz) *E4405B, E4407B, and E4408B*

1. Press **System**, **Power On/Preset**, **Preset (Factory)**, **Preset** on the analyzer. Wait for the preset routine to finish. Set the analyzer by pressing the following keys:

   FREQUENCY, **Start Freq**, 6.01, **GHz**

   Stop Freq, 12.0, **GHz**

   AMPLITUDE, –70, **dBm**

   Attenuation (Man), 0, **dB**

   BW/Avg, **Resolution BW**, 1, **MHz**

   Video BW, 10, **kHz**

2. Press the following keys on the analyzer:

   Single

   BW/Avg, **Average (On)**, 3, **Enter**

   Single

   Wait until **AVG 3** is displayed to the left of the graticule (the analyzer will take 3 sweeps and then stop).

3. Press **Peak Search**. Record the marker frequency next to your analyzer model in the Measured Frequency column as entry (o) or (p) in Table 3-2 for 6.01 GHz to 12.0 GHz.

4. Press the following keys on the analyzer:

   Sweep, **Sweep (Cont)**

   BW/Avg, Average (Off)

   BW/Avg, **Resolution BW (Auto)**

   Video BW (Auto)

   SPAN, 50, **kHz**

   FREQUENCY

5. Press **Center Freq**. Set the center frequency of the analyzer to the frequency recorded in the Measured Frequency column as entry (o) or (p) in Table 3-2 for 6.01 GHz to 12.0 GHz.

6. Press the following keys on the analyzer:

   BW/Avg, **Resolution BW**, 1, **kHz**

   Video BW, 30, **Hz**

   Single

   Wait for the sweep to finish.

7. Press the following keys on the analyzer:

   Display, **Display Line (On)**

   Adjust the display line so that it is centered on the average trace noise, ignoring any residual responses.

8. Record the display line amplitude setting as TR Entry 13 or 14 in Table 3-2. The average noise level should be less than the Maximum.

Procedure (12.01 GHz to 13.2 GHz) *E4405B*

1. Press **Preset System**, **Power On/Preset**, **Preset (Factory)**, **Preset**, on the analyzer. Wait for the preset routine to finish. Set the analyzer by pressing the following keys:

   FREQUENCY, **Start Freq**, 12.01, **GHz**

   Stop Freq, 13.2, **GHz**

   AMPLITUDE, –70, **dBm**

   Attenuation (Man), 0, **dB**

   BW/Avg, **Resolution BW**, 1, **MHz**

   Video BW, **10, kHz**

2. Press the following keys on the analyzer:

   Single

   BW/Avg, **Average (On)**, 3, **Enter**

   Single

   Wait until **AVG 3** is displayed to the left of the graticule (the analyzer will take 3 sweeps and then stop).

3. Press **Peak Search**. Record the marker frequency next to your analyzer model in the Measured Frequency column as entry (q) in Table 3-2 for 12.01 GHz to 13.2 GHz.

4. Press the following keys on the analyzer:

   Sweep, **Sweep (Cont)**

   BW/Avg, Average (Off)

   BW/Avg, **Resolution BW (Auto)**

   Video BW (Auto)

   SPAN, 50, **kHz**

   FREQUENCY

5. Press **Center Freq**. Set the center frequency of the analyzer to the frequency recorded in the Measured Frequency column as entry (q) in Table 3-2 for 12.01 GHz to 13.2 GHz.

6. Press the following keys on the analyzer:

   BW/Avg, **Resolution BW**, 1, **kHz**

   Video BW, 30, **Hz**

   Single

   Wait for the sweep to finish.

7. Press the following keys on the analyzer:

   Display, **Display Line (On)**

   Adjust the display line so that it is centered on the average trace noise, ignoring any residual responses.

8. Record the display line amplitude setting as TR Entry 15 in Table 3-2. The Average Noise Level should be less than the Maximum.

Procedure (12.01 GHz to 22 GHz) *E4407B and E4408B*

1. Press **System**, **Power On/Preset**, **Preset (Factory)**, **Preset** on the analyzer. Wait for the preset routine to finish. Set the analyzer by pressing the following keys:

   FREQUENCY, **Start Freq**, 12.01, **GHz**

   Stop Freq, 22, **GHz**

   AMPLITUDE, –70, **dBm**

   Attenuation (Man), 0, **dB**

   BW/Avg, **Resolution BW**, 1, **MHz**

   Video BW, 10, **kHz**

2. Press the following keys on the analyzer:

   Single

   BW/Avg, **Average (On)**, 3, **Enter**

   Single

   Wait until **AVG 3** is displayed to the left of the graticule (the analyzer will take 3 sweeps and then stop).

3. Press **Peak Search**. Record the marker frequency next to your analyzer model in the Measured Frequency column as entry (r) in Table 3-2 for 12.01 GHz to 22 GHz.

4. Press the following keys on the analyzer:

   Sweep, **Sweep (Cont)**

   BW/Avg, Average (Off)

   BW/Avg, **Resolution BW (Auto)**

   Video BW (Auto)

   SPAN, 50, **kHz**

   FREQUENCY

5. Press **Center Freq**. Set the center frequency of the analyzer to the frequency recorded in the Measured Frequency column as entry (r) in Table 3-2 for 12.01 GHz to 22 GHz.

6. Press the following keys on the analyzer:

   BW/Avg, **Resolution BW**, 1, **kHz**

   Video BW, 30, **Hz**

   Single

   Wait for the sweep to finish.

7. Press the following keys on the analyzer:

   Display, **Display Line (On)**

   Adjust the display line so that it is centered on the average trace noise, ignoring any residual responses.

8. Record the display line amplitude setting as TR Entry 16 in Table 3-2. The Average Noise Level should be less than the Maximum.

Procedure (22.01 GHz to 26.5 GHz) *E4407B and E4408B*

1. Press **System**, **Power On/Preset**, **Preset (Factory)**, **Preset** on the analyzer. Wait for the preset routine to finish. Set the analyzer by pressing the following keys:

   FREQUENCY, **Start Freq**, 22.01, **GHz**

   Stop Freq, 26.5, **GHz**

   AMPLITUDE, –70, **dBm**

   Attenuation (Man), 0, **dB**

   BW/Avg, **Resolution BW**, 1, **MHz**

   Video BW, 10, **kHz**

2. Press the following keys on the analyzer:

   Single

   BW/Avg, **Average (On)**, 3, **Enter**

   Single

   Wait until AVG 3 is displayed to the left of the graticule (the analyzer will take 3 sweeps and then stop).

3. Press **Peak Search**. Record the marker frequency next to your analyzer model in the Measured Frequency column as entry (s) or (t) in Table 3-2 for 22.01 GHz to 26.5 GHz.

4. Press the following keys on the analyzer:

   Sweep, **Sweep (Cont)**

   BW/Avg, Average (Off)

   BW/Avg, **Resolution BW (Auto)**

   Video BW (Auto)

   SPAN, 50, **kHz**

   FREQUENCY

5. Press **Center Freq**. Set the center frequency of the analyzer to the frequency recorded in the Measured Frequency column as entry (s) or (t) in Table 3-2 for 22.01 GHz to 26.5 GHz.

6. Press the following keys on the analyzer:

   BW/Avg, **Resolution BW**, 1, **kHz**

   Video BW, 30, **Hz**

   Single

   Wait for the sweep to finish.

7. Press the following keys on the analyzer:

   Display, **Display Line (On)**

   Adjust the display line so that it is centered on the average trace noise, ignoring any residual responses.

8. Record the display line amplitude setting as TR Entry 17 or 18 in Table 3-2. The Average Noise Level should be less than the Maximum.

Table 3-2 Display Average Noise Level Worksheet

Model Number	Frequency Range	Measured Frequency	Average Noise Level (TR Entry)	Maximum	
				50 Ω Input	75 Ω Input
E4401B	10 MHz to 500 MHz	(a) ________	(1) or (19) ________	– 119 dBm	– 66 dBmV
E4411B	10 MHz to 500 MHz	(b) ________	(1) or (20) ________	– 119 dBm	– 65 dBmV
E4401B, E4411B	501 MHz to 1.0 GHz	(c) ________	(2) or (21) ________	– 117 dBm	– 60 dBmV
E4401B	1.01 GHz to 1.5 GHz	(d) ________	(3) or (22) ________	– 114 dBm	– 56 dBmV
E4411B	1.01 GHz to 1.5 GHz	(e) ________	(3) or (23) ________	– 113 dBm	– 53 dBmV
E4402B, E4403B	10 MHz to 1.0 GHz	(f) ________	(4) ________	– 117 dBm	N/A
E4404B, E4405B, E4407B, E4408B	10 MHz to 1.0 GHz	(g) ________	(5) ________	– 116 dBm	N/A
E4402B, E4403B	1.01 GHz to 2.0 GHz	(h) ________	(6) ________	– 116 dBm	N/A
E4404B, E4405B, E4407B	1.01 GHz to 2.0 GHz	(i) ________	(7) ________	– 116 dBm	N/A
E4408B	1.01 GHz to 2.0 GHz	(j) ________	(8) ________	– 115 dBm	N/A
E4402B, E4403B	2.01 GHz to 3.0 GHz	(k) ________	(9) ________	– 114 dBm	N/A
E4404B, E4405B, E4407B, E4408B	2.01 GHz to 3.0 GHz	(l) ________	(10) ________	– 112 dBm	N/A
E4404B, E4405B, E4407B, E4408B	3.01 GHz to 6.0 GHz	(m)________	(11) ________	– 112 dBm	N/A
E4404B	6.01 GHz to 6.7 GHz	(n) ________	(12) ________	– 111 dBm	N/A
E4405B, E4407B	6.01 GHz to 12.0 GHz	(o) ________	(13) ________	– 111 dBm	N/A
E4408B	6.01 GHz to 12.0 GHz	(p) ________	(14) ________	– 110 dBm	N/A
E4405B	12.01 GHz to 13.2 GHz	(q) ________	(15) ________	– 107 dBm	N/A
E4407B, E4408B	12.01 GHz to 22 GHz	(r) ________	(16) ________	– 107 dBm	N/A
E4407B	22.01 GHz to 26.5 GHz	(s) ________	(17) ________	– 106 dBm	N/A
E4408B	22.01 GHz to 26.5 GHz	(t) ________	(18) ________	– 101 dBm	N/A

Frequency Readout Accuracy

Test Limits

Span	Minimum	Maximum
10 MHz	1.48988 GHz	1.49012 GHz
100 kHz	1.4899988 GHz	1.4900012 GHz
Marker Count Accuracy with Counter Resolution at 1 Hz	1.489999999 GHz	1.490000001 GHz

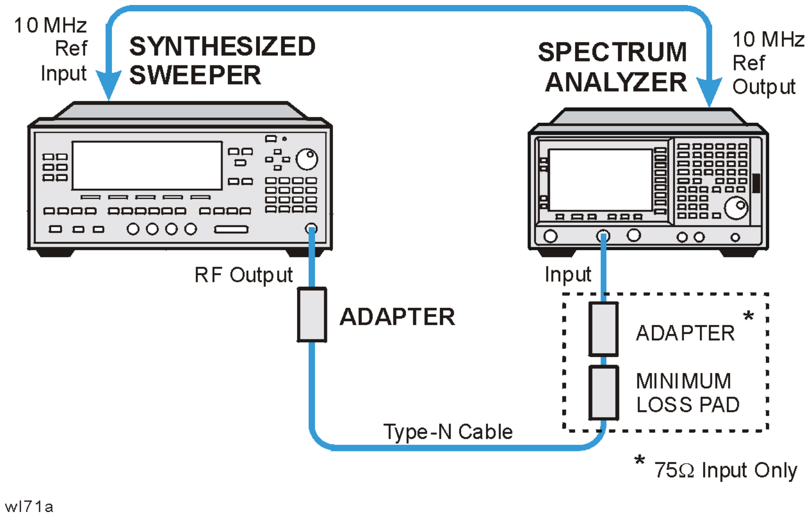
Test Description

The frequency readout accuracy of the analyzer is tested with an input signal of known frequency. Frequency reference error is eliminated by using the same frequency standard for the analyzer and the synthesized sweeper.

Required Equipment

Instrument	Critical Specifications (for this test)	Recommended HP/Agilent Model
Signal Sources		
Synthesized Sweeper	10MHz to 1.5GHz External Reference Input	8340A/B or 836XX Series
Adapters		
Type-N(f), to APC 3.5(f)		1250-1745
Cables		
Type-N,152-cm (60-in)		11500D
BNC,122-cm (48-in)		10503A
Additional Equipment for 75-Ohm Input		
Pad, minimum loss		11852B
Type-N(f), to BNC(m), 75 Ω		1250-1534

Figure 3-2 Equipment Setup



Procedure

1. Connect the equipment as shown in Figure 3-2. Remember to connect the 10MHz REF OUT of the analyzer to the 10MHz REF IN of the synthesized sweeper.

2. Perform the following steps to set up the equipment:

   a. Press **INSTRUMENT PRESET** on the synthesized sweeper, then set the controls as follows:

      CW, 1.490, **GHz**
      POWER LEVEL, 10, **– dBm**

   b. Press **System**, **Power On/Preset**, **Preset (Factory)**, **Preset** on the analyzer, then wait for the preset routine to finish. Set the analyzer by pressing the following keys:

      Frequency, 1.490, **GHz**
      SPAN, 10, **MHz**
      BW/Avg, **Resolution BW**, 100, **kHz**
      Video BW, 30, **kHz**

CAUTION Use only 75 Ω cables, connectors, or adapters on instruments with 75 Ω inputs, or damage to connectors will occur.

3. Press **Peak Search** on the analyzer to measure the frequency readout accuracy. If the instrument is functioning correctly, the result in the active function should be between 1.48988 GHz and 1.49012 GHz. Record this in the Marker Frequency Readout column in Table 3-3 on page 79.

4. Press **Span**, 100, **kHz**, **BW/Avg**, **Resolution BW**, 1, **kHz**, **Video BW**, 1, **kHz**.

5. Press **Peak Search** on the analyzer to measure the frequency readout accuracy. If the instrument is functioning correctly, the result should be between 1.4899988 GHz and 1.4900012 GHz.

NOTE The Frequency Readout Accuracy in now complete. Continue with the Marker Count Accuracy functional check.

Marker Count Accuracy

Procedure

1. Press **System**, **Power On/Preset**, **Preset (Factory)**, **Preset** on the analyzer, then wait for the preset routine to finish. Set the analyzer to measure the marker count accuracy by pressing the following keys:

   Frequency, 1.490, **GHz**
   SPAN, 10, **MHz**
   BW/Avg, **Resolution BW**, 100, **kHz**
   Freq Count, **Resolution**, 1, **Hz**

2. Press **Peak Search**, then wait for a count to be taken (it may take several seconds).

3. If the analyzer is functioning correctly, the **`Cntr1`** reading in the upper left-hand corner of the display should be between 1.489999999 GHz and 1.490000001 GHz. Record the **`Cntr1`** frequency as the Marker Frequency Readout in Table 3-3.

Table 3-3 Frequency Readout and Marker Count Accuracy Worksheet

Span	Minimum	Marker Frequency Readout	Maximum
10 MHz	1.48988 GHz		1.49012 GHz
100 kHz	1.4899988 GHz		1.4900012 GHz
Marker Count Accuracy w/Counter Resolution at 1 Hz	1.489999999 GHz		1.490000001 GHz

Frequency Response

Test Limits

ESA Model	Frequency	Minimum (dB)	Maximum (dB)
E4411B & E4401B	9 kHz to 1.5 GHz	–1.5	1.5
E4402B & E4403B	9 kHz to 3 GHz	–1.5	1.5
E4404B	9 kHz to 3 GHz	–1.5	1.5
	3.01 GHz to 6.7 GHz	–3.0	3.0
E4405B	9 kHz to 3 GHz	–1.5	1.5
	3.01 GHz to 6.7 GHz	–3.0	3.0
	6.71 GHz to 13.2 GHz	–3.5	3.5
E4407B & E4408B	9 kHz to 3 GHz	–1.5	1.5
	3.01 GHz to 6.7 GHz	–3.0	3.0
	6.71 GHz to 13.2 GHz	–3.5	3.5
	13.21 GHz to 25 GHz	–4.0	4.0
	25 GHz to 26.5 GHz	–4.5	4.5

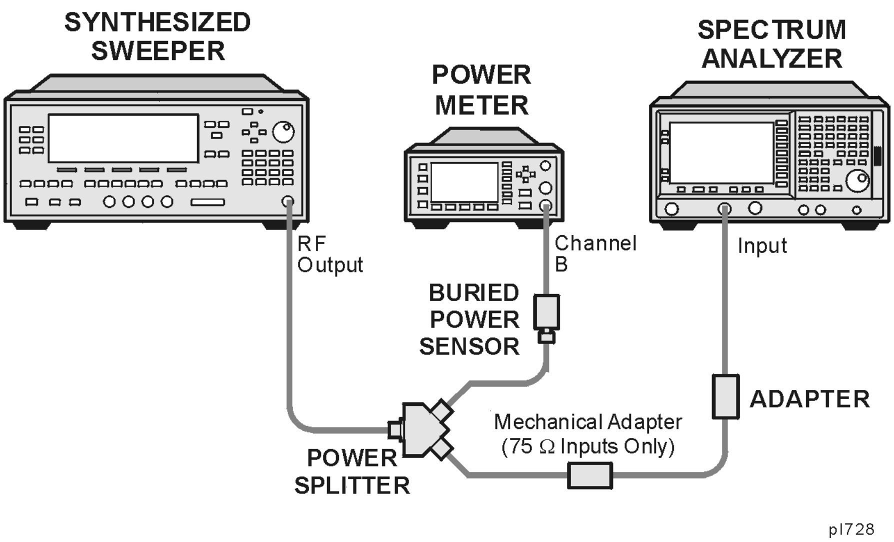
Test Description

The output of the synthesized sweeper is fed through a power splitter to a power sensor and the analyzer. The synthesized sweeper’s power level is adjusted at 50 MHz to place the displayed signal at the analyzer center horizontal graticule line. Measurements are made at various points depending on the model being tested. The signal source amplitude is measured with a power meter to eliminate errors due to source flatness. The power meter is zeroed and calibrated before starting the measurement.

Required Equipment

Instrument	Critical Specifications (for this test)	Recommended HP/Agilent Model
Signal Sources		
Synthesized Sweeper		8340A/B or 83630A Series
Adapters		
Type-N (f) to BNC (f)		1250-1474
APC 3.5 (f) to APC 3.5 (f)		5061-5311
BNC(f) to SMA(m)		1250-1237
Type-N(m), to APC 3.5(m)		1250-1743
Cables		
(2) APC 3.5mm (36in)	E407B and E4408B only	8120-4921 or 11500E
BNC(m) both ends, (48in)		10503A
Additional Equipment for 75-Ohm Input		
Pad, minimum loss		11852B
Type-N (f), to BNC (m)		1250-1534
Miscellaneous		
Power Meter		EPM-441A (E4418A)
Power Sensor, 75 Ω		8483A
Power Sensor, 50 Ω		8485A
Power Splitter		11667B

Figure 3-3 Equipment Setup



Procedure

1. Zero and calibrate the power meter and power sensor as described in the power meter operation manual.
2. Connect the equipment as shown in Figure 3-3 for a 50 Ω analyzer input.

CAUTION Use only 75 Ω cables, connectors, or adapters on instruments with 75 Ω connectors, or damage to the connectors will occur.

3. Set the synthesized sweeper controls as follows:

   FREQUENCY, **Center Freq**, **50**, **MHz**

   AMPLITUDE, **–8**, **dBm**

4. Press **System**, **Power On/Preset**, **Preset (Factory)**, **Preset** on the analyzer and wait for the preset routine to finish. Set the analyzer by pressing the following keys.

   FREQUENCY, **50**, **MHz**
   CF Step, **50**, **MHz**
   SPAN, **20**, **kHz**
   AMPLITUDE, **–10**, **dBm**
   AMPLITUDE, **More**, **Y Axis Units**, **dBm** (75 Ω RF Input Only)
   AMPLITUDE, **–10**, **dBm**, **Attenuation**, **10 dB**
   Scale/Div, **2 dB**
   BW/Avg, **Resolution BW**, 10, **kHz**
   Video BW, **3**, **kHz**
   Peak Search
   FREQUENCY, **Signal Track (On)**

5. Adjust the synthesized sweeper amplitude for a marker amplitude reading of –14 dBm +/– 0.10 dB.

NOTE The power level of the synthesized sweeper remains unchanged for the duration of the test. For each new test frequency, the power sensor cal factor should be entered to minimize measurement errors.

6. Refer to Table 3-4, “Frequency Response Worksheet.” Enter the marker readout amplitude for 50 MHz as displayed on the analyzer in the Analyzer Amplitude column.
7. Enter the power meter reading in the Power Meter Amplitude column.
8. Compute the flatness error at 50 MHz using the following equation and record the results in the Flatness Error column:

   Flatness Error = Analyzer Amplitude – Power Meter Amplitude
9. Perform the following steps for each center frequency setting listed in Table 3-4.
   a. Tune the source to the next frequency listed in the Center Frequency column.
   b. Enter the power sensor cal factor for the new test frequency.
   c. Tune the analyzer center frequency by pressing the ⇑ key or press **FREQUENCY**, **Center Freq**, “n”, and **MHz** (where “n” is the next test frequency in Table 3-4).
   d. Press **Peak Search**.
   e. Enter the power meter reading in the Power Meter Amplitude column.
   f. Enter the analyzer reading in the Analyzer Amplitude column.
   g. Compute the flatness error using the following equation and record the results in the Flatness Error column:

      Flatness Error = Analyzer Amplitude – Power Meter Amplitude

      The flatness error should be less than the specified amount.

Table 3-4 **Frequency Response Worksheet**

Model	Center Freq	Analyzer Amplitude	Power Meter Amplitude	Flatness Error	Flatness Error Test Limits (dB)
All Models	50 MHz				± 1.5
	100 MHz				± 1.5
	750 MHz				± 1.5
	1250 MHz				± 1.5
	1500 MHz				± 1.5
E4402B – E4408B	2000 MHz				± 1.5
	2500 MHz				± 1.5
	2999 MHz				± 1.5
E4402B – E4408B	4250 MHz				± 3.0
	5750 MHz				± 3.0
	6699 MHz				± 3.0
E4402B – E4408B	8000 MHz				± 3.5
	9000 MHz				± 3.5
	10000 MHz				± 3.5
	11000 MHz				± 3.5
	13199 MHz				± 3.5
E4407B & E4408B	14000 MHz				± 4.0
	19000 MHz				± 4.0
	24000 MHz				± 4.0
	26500 MHz				± 4.5

Reference Level Accuracy

Test Limits

Reference Level		Minimum (dB)	Maximum (dB)
dBm	dBmV		
–30	21.76	Reference	Reference
–20	31.76	–1.40	1.40
–10	41.76	–1.40	1.40
–40	11.76	–1.40	1.40
–50	1.76	–1.40	1.40
–60	–8.24	–1.40	1.40
–70	–18.24	–2.0	2.0

Test Description

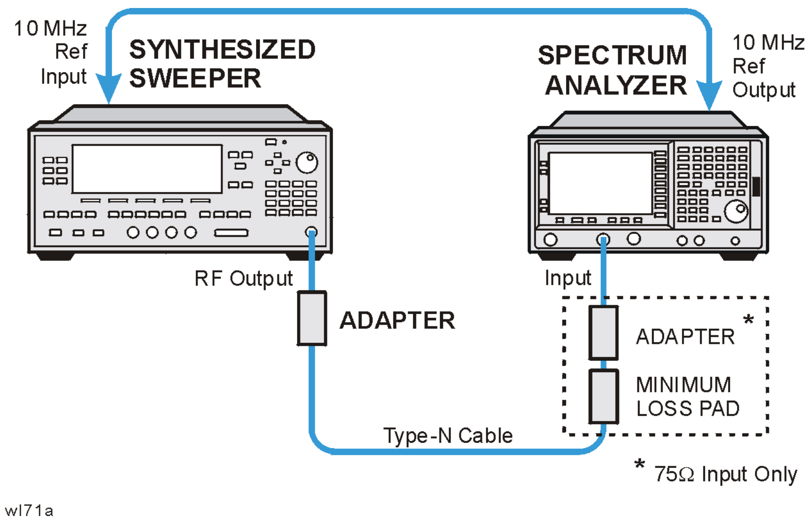
A 50 MHz CW signal is applied to the Input of the analyzer. The amplitude of the source and the analyzer’s reference level are decreased in 10 dB steps. The analyzer marker functions are used to measure the amplitude difference between steps. Reference Level Accuracy is tested in both Log and Linear Scale Modes. Most of the error is contributed from the output attenuator inaccuracy in the synthesized sweeper and not the analyzer.

Required Equipment

Instrument	Critical Specifications (for this test)	Recommended HP/Agilent Model
Signal Sources		
Synthesized Sweeper	Output Level Accuracy 0 to –15 dBm: ±1.0 dB –16 dBm to –63 dBm: ±1.4 dB ≤ –64 dBm: ≥2.0 dB	8340A/B or 836XX Series
Adapters		
Type-N(m), to BNC(f)		1250-1476
Cables		

Instrument	Critical Specifications (for this test)	Recommended HP/Agilent Model
Type-N,152-cm (60-in)		11500D
BNC,122-cm (48-in)		10503A
Additional Equipment for 75-Ohm Input		
Pad, minimum loss		11852B
Type-N(f), to BNC(m)		1250-1534

Figure 3-4 Equipment Setup



Log Mode Procedure

1. Connect the equipment as shown in Figure 3-4.
2. Press **PRESET** on the synthesized sweeper. Set the synthesized sweeper controls as follows:

   CW, 50, **MHz**
   Power Level, –30, **dBm**

3. Press **System**, **Power On/Preset**, **Preset (Factory)**, **Preset** on the analyzer, then wait for the preset routine to finish. Press **System**, **Alignments**, **Auto Align**, **Off**. Set the analyzer by pressing the following keys:

   FREQUENCY, **Center Freq**, 50, **MHz**
   SPAN, **50, kHz**
   AMPLITUDE, –30, **dBm** (50 Ω Input only)
   AMPLITUDE, **More**, **Y Axis Units**, **dBmV** (75 Ω Input)
   AMPLITUDE, 21.76, **dBmV** (75 Ω Input only)

Attenuation (Man), 5, **dB**
BW/Avg, **Resolution BW**, 3, **kHz**
Video BW, 30, **Hz**

4. Press **Peak Search** on the analyzer. Adjust the amplitude on the synthesized sweeper until the marker amplitude on the analyzer reads –30 dBm +/– 0.10 dB. Enter the synthesized sweeper power level as the Synthesized Sweeper Amplitude reference in Table 3-5 on page 87.

NOTE Under these analyzer conditions, the sweep time is 1.7 seconds. Therefore, the marker amplitude updates are fairly slow when adjusting the synthesizer output power.

5. Now that the reference has been established in step 4, adjust the synthesized sweeper power level and the analyzer reference level according to Table 3-5 on page 87. (The synthesized sweeper output power and the analyzer’s reference level will be changed in 10 dB steps.)
6. On the analyzer, press **Single**, wait for a sweep to finish, and then press **Peak Search**, **Marker**, **Delta**.
7. For each new synthesized sweeper power level and analyzer reference level change, press the following keys on the analyzer:

   Single
   Peak Search
   Record the Analyzer Marker Amplitude reading in Table 3-5.

Table 3-5 Reference Level Accuracy Worksheet (Log Mode)

Analyzer Reference Level		Synthesized Sweeper Amplitude (dBm)	Minimum (dB)	Analyzer Marker Δ Amplitude (dB)	Maximum (dB)
dBm	dBmV				
–30	21.76	Reference = _____	0 (Reference)	0 (Reference)	0 (Reference)
–20	31.76	Reference + (10 dB)	8.60		11.40
–10	41.76	Reference + (20 dB)	18.60		21.40
–40	11.76	Reference + (–10 dB)	–11.40		–8.60
–50	1.76	Reference + (–20 dB)	–21.40		–18.60
–60	– 8.24	Reference + (–30 dB)	–31.40		–28.60
–70	–18.24	Reference + (–40 dB)	–42.0		–38.0

Linear Mode Procedure

1. Set the power level on the synthesized sweeper to –30 dBm by pressing **Power Level**, –30, **dBm**.
2. **Set the analyzer by pressing the following keys:**

   Sweep, **Sweep (Cont)**
   AMPLITUDE, –30, **dBm** (50 Ω Input)
   AMPLITUDE, **More**, **Y Axis Units**, **dBmV** (75 Ω Input)
   AMPLITUDE, +21.76, **dBmV** (75 Ω Input)
   Scale Type (Lin)
   Marker, **Off**

3. Adjust the amplitude on the synthesized sweeper until the marker amplitude on the analyzer reads –30 dBm +/– 0.10 dB. Enter the synthesized sweeper power level as the Synthesized Sweeper Amplitude reference in Table 3-6.

NOTE Under these analyzer conditions, the sweep time is 1.7 seconds. Therefore, the marker amplitude updates are fairly slow when adjusting the synthesizer output power.

4. Now that the reference has been established in step 4, adjust the synthesized sweeper power level and the analyzer reference level according to Table 3-6. (The synthesized sweeper output power and the analyzer’s reference level will be changed in 10 dB steps.)
5. On the analyzer, press **Single**, wait for a sweep to finish, and then press **Peak Search**, **Marker**, **Delta**.
6. For each new synthesized sweeper power level and analyzer reference level change, press the following keys on the analyzer:

   Single
   Peak Search

   Record the Analyzer Marker Amplitude reading in Table 3-6.

Table 3-6 Reference Level Accuracy Worksheet (Linear Mode)

Analyzer Reference Level		Synthesized Sweeper Amplitude (dBm)	Minimum (dB)	Analyzer Marker Δ Amplitude (dB)	Maximum (dB)
dBm	dBmV				
–30	21.76	Reference = _____	0 (Reference)	0 (Reference)	0 (Reference)
–20	31.76	Reference + (10 dB)	8.60		11.40
–10	41.76	Reference + (20 dB)	18.60		21.40
–40	11.76	Reference + (–10 dB)	–11.40		–8.60
–50	1.76	Reference + (–20 dB)	–21.40		–18.60
–60	– 8.24	Reference + (–30 dB)	–31.40		–28.60
–70	–18.24	Reference + (–40 dB)	–42.0		–38.0

Resolution Bandwidth Switching Uncertainty

Test Limits

Resolution Bandwidth	Minimum (dB)	Maximum (dB)
1 kHz	0 (Ref)	0 (Ref)
3 kHz	–0.3 dB	0.3 dB
10 kHz	–0.3 dB	0.3 dB
30 kHz	–0.3 dB	0.3 dB
100 kHz	–0.3 dB	0.3 dB
300 kHz	–0.3 dB	0.3 dB
1 MHz	–0.3 dB	0.3 dB
3 MHz	–0.3 dB	0.3 dB
5 MHz	–0.6 dB	0.6 dB

Test Description

To measure the resolution-bandwidth switching uncertainty, an amplitude reference is taken with the resolution bandwidth set to 1 kHz. The resolution bandwidth is changed to settings between 5 MHz and 3 kHz and the amplitude variation is measured at each setting using the marker delta function and compared to the specification. The span is changed as necessary to maintain approximately the same aspect ratio.

Required Equipment

(No Equipment Required)

Instrument	Critical Specifications (for this test)	Recommended Model
Cables		
BNC, 9 inch		HP 10502A
Adapter		
Type N to BNC		1250-0780 or 1250 1476

Procedure

NOTE The 50 MHz reference output will automatically be switched internally on the E4401B and E4411B and will not require any external connections. All other ESA analyzers require that the AMPTD REF OUT be connected to the INPUT to perform this test.

1.

2. Press **System**, **Power On/Preset**, **Preset (Factory)**, **Preset** on the analyzer. Wait for the preset routine to finish. Set the analyzer by pressing the following keys:

   Input/Output, **Amptd Ref (On)** (E4401B and E4411B)
   Input/Output, **Amptd Ref Out (On)** (E4402B, E4403B, E4404B, E4405B, E4407B, and E4408B).
   Connect a cable from the **AMPTD REF OUT** to the **INPUT 50** Ω (E4402B, E4403B, E4404B, E4405B, E4407B, and E4408B).
   FREQUENCY, 50, **MHz**
   SPAN, 50, **kHz**
   AMPLITUDE, **More**, **Y Axis Units**, **dBm** (75 Ω Input only)
   AMPLITUDE, –20, **dBm**
   AMPLITUDE, **Scale/Div**, 1, **dB**
   BW/Avg, **Resolution BW**, 1, **kHz**
   Video BW, 1, **kHz**

3. Press **AMPLITUDE** and use the knob to adjust the reference level until the signal appears five divisions (mid-screen) below the reference level. Press the following keys on the analyzer:

   Peak Search
   Marker, **Delta**
   FREQUENCY, **Signal Track (On)**

4. Set the analyzer Resolution Bandwidth and Span according to Table 3-7 on page 92.

5. Press **Peak Search**, then record the Δ Mkr 1 amplitude reading in Table 3-7.

6. Repeat step 3 and 4 for each of the remaining resolution bandwidth and span settings listed in Table 3-7. The Δ Mkr 1 amplitude reading should be within the range indicated in the table “Test Limits” on page 90.

Table 3-7 Resolution Bandwidth Switching Uncertainty Worksheet

Resolution Bandwidth Setting	SPAN Setting	Δ Mkr 1 Amplitude Reading
1 kHz	50 kHz	0 (Ref)
3 kHz	50 kHz	
10 kHz	50 kHz	
30 kHz	500 kHz	
100 kHz	500 kHz	
300 kHz	5 MHz	
1 MHz	10 MHz	
3 MHz	10 MHz	
5 MHz	50 MHz	

Scale Fidelity

Test Limits

dB from Reference Level	Minimum (dB)	Maximum (dB)
–4	–1.0	1.0
–16	–1.4	1.4
–28	–1.4	1.4
–40	–1.4	1.4
–52	–1.4	1.4
–64	–2.0	2.0

Test Description

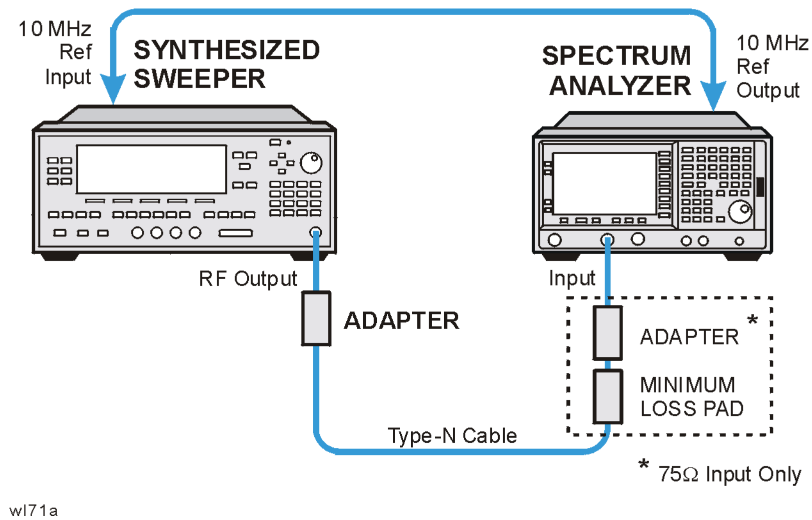
A 50 MHz CW signal is applied from a synthesized sweeper to the input of the analyzer. The source is adjusted for a response at the reference level. The synthesized sweeper amplitude is adjusted to achieve a nominal amplitude below the reference level. The analyzer's amplitude marker is compared to the actual source change to determine the scale fidelity error. Most of the error is the source's output attenuator inaccuracy from the synthesized sweeper.

Required Equipment

Instrument	Critical Specifications (for this test)	Recommended HP/Agilent Model
Signal Sources		
Synthesized Sweeper	Output Level Accuracy 0 to –15 dBm: ±1.0 dB –16 dBm to –63 dBm: ±1.4 dB ≤ –64 dBm: ≥2.0 dB	8340A/B or 836XX Series
Adapters		
Type-N(m), to BNC(f)		1250-1476
Cables		
Type-N,152-cm (60-in)		11500D
BNC,122-cm (48-in)		10503A

Instrument	Critical Specifications (for this test)	Recommended HP/Agilent Model
Additional Equipment for 75 Ohm Input		
Pad, minimum loss		11852B
Type-N(f), to BNC(m)		1250-1534

Figure 3-5 Equipment Setup



Procedure

1. Connect the equipment as shown in Figure 3-5.
2. Preset the synthesized sweeper. Set the synthesized sweeper controls as follows:

   CW, 50, **MHz**
   Power Level, 0, **dBm** (50 Ω Input)
   Power Level, 4, **dBm** (75 Ω Input)

3. Press **System**, **Power On/Preset**, **Preset (Factory)**, **Preset** on the analyzer, then wait for the preset routine to finish. Press **System**, **Alignments**, **Auto Align**, **Off**. Set the analyzer by pressing the following keys:

   FREQUENCY, **Center Freq**, 50, **MHz**
   SPAN, **45**, **kHz**
   AMPLITUDE, **Attenuation**, 10, **dB**
   BW/Avg, **Resolution BW**, 3, **kHz**
   Video BW, 1, **kHz**
   Peak Search

4. Adjust the amplitude on the sythesized sweeper until the marker amplitude on the analyzer reads 0 dBm +/– 0.10 dB. Record the synthesized sweeper output level as the reference in Table 3-8 on page 95.

NOTE *75 Ω Input only*. Adjust the synthesized sweeper amplitude until the analyzer's marker reads 48.8 dBmV +/– 0.10 dB.

5. On the analyzer, press the following keys:

   Single
   Peak Search
   Marker, **Delta**

6. Record the marker delta reading in Table 3-8. At each new synthesized sweeper power level, press **Single**, **Peak Search**, and record the marker amplitude level.

Table 3-8 Scale Fidelity Worksheet

Synthesized Sweeper Level	Minimum (dB)	Marker Level (dB)	Maximum (dB)
Reference=______	0 (Reference)		0 (Reference)
Reference –4 dB	–5.0		–3.0
Reference –16 dB	–17.40		–15.60
Reference –28 dB	–29.40		–26.60
Reference –40 dB	–41.40		–38.60
Reference –52 dB	–53.40		–50.60
Reference –64 dB	–66.0		–62.0

Second Harmonic Spurious Responses

Test Limits

Model Number	Maximum
E4401B	–55 dBc
E4402B	–55 dBc
E4403B	–50 dBc
E4404B	–55 dBc
E4405B	–55 dBc
E4407B	–55 dBc
E4408B	–50 dBc
E4411B	–55 dBc

Test Description

To test second harmonic distortion, a 50 MHz low pass filter is used to filter the source output, ensuring that harmonics read by the analyzer are internally generated and not coming from the source. The source power and input attenuation on the analyzer are adjusted so –20 dBm is the power level at the first mixer.

Required Equipment

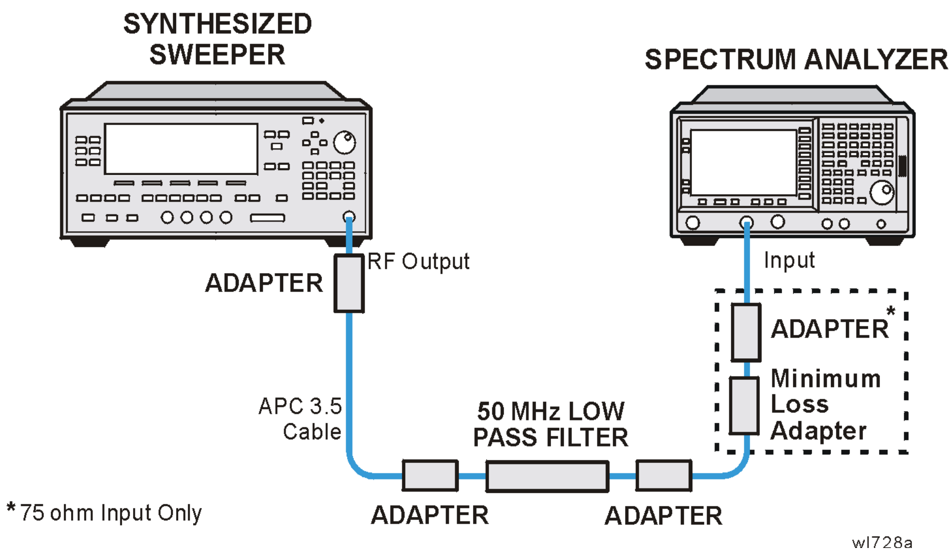
Table 3-9

Instrument	Critical Specifications (for this test)	Recommended HP/Agilent Model
Signal Sources		
Synthesized Sweeper		8340A/B or 836XX Series
Miscellaneous		
50 MHz Low pass filter	Rejection at 80 MHz: >60dB	0955-0306
Adapters		
(2) Type-N(m) to BNC(f)		1250-1476
BNC(f) to BNC(f)		1250-0080
Type-N(f), to APC 3.5(f)		1250-1745

Table 3-9

Instrument	Critical Specifications (for this test)	Recommended HP/Agilent Model
Cables		
(2) BNC,122-cm (48-in)		10503A
Additional Equipment for 75 Ohm Input		
Pad, minimum loss		11852B
Type-N(f), to BNC(m)		1250-1534

Figure 3-6 Equipment Setup



Procedure

1. Connect the equipment as shown in Figure 3-6.
2. Set the synthesized sweeper controls as follows:

   Frequency, 40, **MHz**
   Amplitude, –10, **dBm** (50 Ω Input only)
   Amplitude, –4.3, **dBm** (75 Ω Input only)

NOTE *75 Ω Input only*. Connect the minimum loss adapter between the low pass filter and 75 Ω Input.

3. Press **System**, **Power On/Preset**, **Preset (Factory)**, **Preset** on the analyzer. Wait for the preset routine to finish.
   Set the analyzer by pressing the following keys:

   FREQUENCY, **Center Freq**, 40, **MHz**
   SPAN, **1, MHz**
   AMPLITUDE, –10, **dBm** (50 Ω Input only)
   AMPLITUDE, 44, **dBmV** (75 Ω Input only)
   Attenuation (Man), 10, **dB**
   BW/Avg, **Resolution BW**, 30, **kHz**

4. Adjust the synthesized sweeper amplitude to place the peak of the signal at the reference level.

5. Set the analyzer by pressing the following keys:

   SPAN, 50, **kHz**
   BW/Avg, **Resolution BW**, 1, **kHz**
   Video BW, 100, **Hz**

6. Wait for two sweeps to finish, then press the following analyzer keys:

   Peak Search
   Mkr →
   Mkr → **CF Step**
   Marker, **Delta**
   FREQUENCY

7. Press the ⇑ key on the analyzer to step to the second harmonic (at 80 MHz). Press **Peak Search**. The marker delta amplitude reading should be less than the Maximum value listed in the Test Limits Table.

Tracking Generator Level Flatness: Models E4401B and E4411B, Options 1DN and 1DQ

Test Limits

	Minimum	**Maximum**
Flatness ≤ 10 MHz	–2.5 dB	2.5 dB
Flatness > 10 MHz	–2.0 dB	2.0 dB
Flatness > 10 MHz, 75 Ω	–3.0 dB	3.0 dB
Flatness > 10 MHz, 75 Ω	–2.5 dB	2.5 dB

Test Description

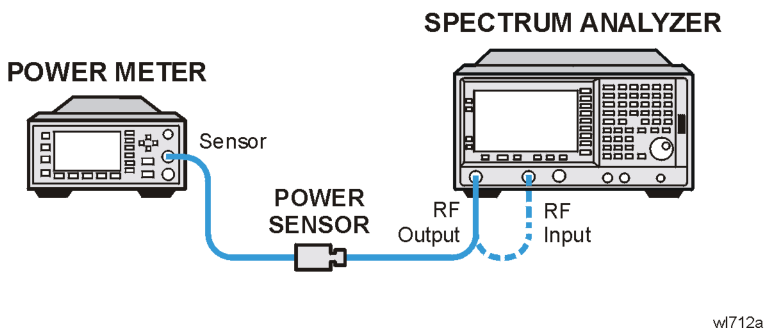
A calibrated power sensor is connected to the tracking generator output to measure the power level at 50 MHz. The power meter is set for REL mode so that future power level readings are in dB relative to the power level at 50 MHz. The tracking generator is then stepped to several frequencies throughout its range. The output power difference relative to the power level at 50 MHz is measured at each frequency and recorded. Analyzers with 75 Ω tracking generators are only tested from 1 MHz to 1500 MHz.

Required Equipment

Instrument	**Critical Specifications (for this test)**	**Recommended HP/Agilent Model**
Meters		
Power Meter		438A or E4418A, E4419A
RF Power Sensor	Frequency Range: 100 kHz to 1.5GHz	8482A
Cables		
BNC,122-cm (48-in) (2)		10503A
Additional Equipment for 75 Ω Input		
75 Ω Power Sensor	Frequency Range: 1 MHz to 1.5GHz	8483A

Instrument	Critical Specifications (for this test)	Recommended HP/Agilent Model
Type-N (f) to BNC (m), 75 Ω Adapter		1250-1534

Figure 3-7 Equipment Setup



Procedure

1. Calibrate the tracking generator by pressing **System**, **Alignments**, **Align Now**, **TG**. Connect the RF Out to the Input when prompted.
2. Press **System**, **Power On/Preset**, **Preset (Factory)**, **Preset** on the analyzer, then wait for the preset routine to finish. Set the analyzer by pressing the following keys:

   FREQUENCY, **Center Freq**, 50, **MHz**
   CF Step, 500, **MHz**
   SPAN, **Zero Span**
   Source, Amplitude (On), 0, **dBm** (50 Ω RF Output only)
   Source, **Amplitude (On)**, +42.76, **dBmV** (75 Ω RF Output only)

3. Zero and calibrate the power meter and RF power sensor. Make sure the power meter is reading out in dBm. Enter the power sensor 5 MHz cal factor into the power meter.

NOTE *75 Ω RF Out only*: Zero and calibrate the 75 Ω power sensor.

4. Connect the power sensor to the RF Out on the analyzer as shown in Figure 3-7.

NOTE *75 Ω RF Out only*: Connect the 75 Ω power sensor through an adapter to the RF Out 75 Ω.

5. Press REL on the power meter. The power meter readout amplitudes are now relative to the power level at 50 MHz.
6. Set the analyzer center frequency to 100 kHz.

NOTE *75 Ω RF Out only*: Set the analyzer center frequency to 1 MHz.

7. Enter the appropriate power sensor Cal Factor for the test frequency into the power meter as indicated on the label of the power sensor.
8. Record the power level displayed on the power meter as the Level Flatness in Table 3-10.
9. Repeat steps 7 through 8 to measure the flatness at each center frequency setting listed in Table 3-10. The ⇑ may be used to tune to center frequencies above 500 MHz.

NOTE *75 Ω RF Out only:* Repeat steps 5 through 7 to measure the flatness at the frequencies above 1 MHz listed in Table 3-10.

Table 3-10 Tracking Generator Level Flatness Worksheet

Center Frequency	**Level Flatness (dB)**
100 kHz or 1 MHz[a]	
5 MHz	
40 MHz	
50 MHz	0 (Ref)
80 MHz	
500 MHz	
1000 MHz	
1500 MHz	

a. This frequency is 100 kHz for analyzers with 50 Ω tracking generators, and 1 MHz for analyzers with 75 Ω tracking generators.

Tracking Generator Level Flatness: E4402B, E4403B, E4404B, E4405B, E4407B and E4408B, Option 1DN

Test Limits

	Minimum	Maximum
Flatness ≤ 10 MHz	–3.5 dBm	+3.5 dBm
Flatness > 10 MHz	–2.5 dBm	–2.5 dBm

Test Description

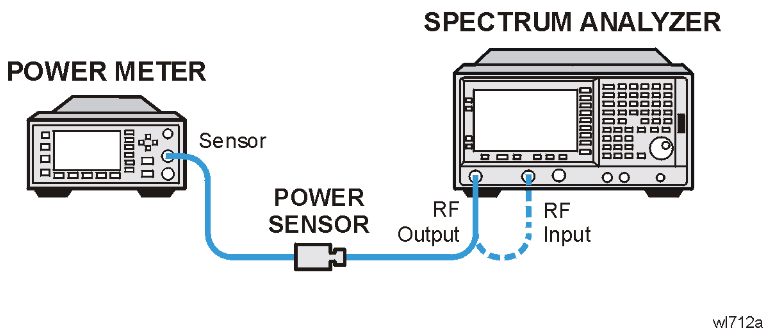
A calibrated power sensor is connected to the tracking generator output to measure the power level at 50 MHz. The power meter is set for REL mode so that future power level readings are in dB relative to the power level at 50 MHz. The tracking generator is then stepped to several frequencies throughout its range. The output power difference relative to the power level at 50 MHz is measured at each frequency and recorded.

Required Equipment

Table 3-11

Instrument	Critical Specifications (for this test)	Recommended HP/Agilent Model
Meters		
Power Meter		438A or E4418A, E4419A
RF Power Sensor	Frequency Range: 100 kHz to 3.0 GHz	8482A
Adapters		
Type-N (f) to BNC (m),75-Ohm		1250-1534
Cables		
(2) BNC,122-cm (48-in)		10503A

Figure 3-8 Equipment Setup



Procedure

1. Calibrate the tracking generator by pressing **System**, **Alignments**, **Align Now**, **TG**. Connect the RF OUT to the RF INPUT when prompted.

2. Press **System**, **Power On/Preset**, **Preset (Factory)**, **Preset** on the analyzer, then wait for the preset routine to finish. Set the analyzer by pressing the following keys:

   FREQUENCY, **Center Freq**, 50, **MHz**
   CF Step, 100, **MHz**
   SPAN, **Zero Span**
   Source, **Amplitude (On)**, –20, **dBm**
   System, **Alignments**, **Auto Align**, **Off**

3. Zero and calibrate the power meter and power sensor. Make sure the power meter is reading out in dBm. Enter the power sensor 50 MHz cal factor into the power meter.

4. Connect the power sensor to the RF Out on the analyzer as shown in Figure 3-8.

5. Press REL on the power meter. The power meter readout amplitudes are now relative to the power level at 50 MHz.

6. Set the analyzer center frequency to 100 kHz.

7. Enter the appropriate power sensor Cal Factor for the test frequency into the power meter as indicated on the label of the power sensor. This must be done at each test frequency.

8. Record the power level displayed on the power meter as the Level Flatness in Table 3-12 on page 104.

9. Repeat steps 5 through 7 to measure the flatness at each center frequency setting listed in Table 3-12. The ⇑ may be used to tune to center frequencies above 500 MHz.

10. Press **System**, **Alignments**, **Auto Align**, **On**.

Table 3-12 Tracking Generator Level Flatness Worksheet

Center Frequency	Level Flatness (dB)
100 kHz	
5 MHz	
40 MHz	
50 MHz	0 (Ref)
80 MHz	
500 MHz	
1000 MHz	
1500 MHz	
2000 MHz	
2300 MHz	
2500 MHz	
2700 MHz	
3.0 GHz	

4 Troubleshooting

What You Will Find in This Chapter

This chapter includes information on how to check for a problem with your Agilent Technologies ESA spectrum analyzer, and how to return it for service. It also includes descriptions of all of the analyzer built-in messages.

Your analyzer is built to provide dependable service. However, if you experience a problem, desire additional information, or wish to order parts, options, or accessories, Agilent Technologies' worldwide sales and service organization is ready to provide the support you need.

In general, a problem can be caused by a hardware failure, a software error, or a user error. Follow these general steps to determine the cause and to resolve the problem.

1. Perform the quick checks listed in "Check the Basics" on page 107. It is possible that a quick check may eliminate your problem altogether.
2. If the problem is a hardware problem, you have several options:
   - Repair it yourself; see "Service Options" on page 109.
   - Return the analyzer to Agilent Technologies for repair; if the analyzer is still under warranty or is covered by an Agilent Technologies maintenance contract, it will be repaired under the terms of the warranty or plan (the warranty is at the front of this manual).

     If the analyzer is no longer under warranty or is not covered by an Agilent Technologies maintenance plan, Agilent Technologies will notify you of the cost of the repair after examining the instrument. See "How to Get In Touch With Agilent Technologies" and "How to Return Your Analyzer for Service" for more information.

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

Before You Call Agilent Technologies

Check the Basics

A problem can often be resolved by repeating the procedure you were following when the problem occurred. Before calling Agilent Technologies or returning the analyzer for service, please make the following checks:

❑ Check the line fuse.

❑ Is there power at the receptacle?

❑ Is the analyzer turned on? Make sure the fan is running, which indicates that the power supply is on.

❑ If the display is dark or dim, press the upper **Viewing Angle** key in the upper-left corner of the front panel. If the display is too bright, adjust the lower **Viewing Angle** key in the upper-left corner of the front panel.

❑ If other equipment, cables, and connectors are being used with your Agilent Technologies ESA spectrum analyzer, make sure they are connected properly and operating correctly.

❑ Is the input coupling set correctly? Refer to Table 6-1, “Selecting Input Coupling,” on page 246 of the *Agilent Technologies ESA Spectrum Analyzers User’s Guide* to determine the appropriate setting.

❑ Review the procedure for the measurement being performed when the problem appeared. Are all the settings correct?

❑ If the analyzer is not functioning as expected, return the analyzer to a known state by pressing the **Preset** key.

Some analyzer settings are not affected by a Preset. If you wish to reset the analyzer configuration to the state it was in when it was originally sent from the factory, press **System, Power On/Preset, Preset (Factory), Preset** (on the front panel).

❑ Is the measurement being performed, and the results that are expected, within the specifications and capabilities of the analyzer? Refer to the “Specifications and Characteristics” chapters in the *Agilent Technologies ESA Spectrum Analyzers Specifications Guide* for analyzer specifications.

- ❑ In order to meet specifications, the analyzer must be aligned. Either Auto Align All must be selected (press **System**, **Alignments**, **Auto Align**, **All**), or the analyzer must be manually aligned at least once per hour, or whenever the temperature changes more than 3° centigrade. When **Auto Align**, **All** is selected, AA appears on the left edge of the display.

- ❑ Perform an **Align Now**, **All**. If the analyzer is an Agilent E4402B, E4403B, E4404B, E4405B, E4407B, or E4408B, connect a cable between the AMPTD REF OUT and the INPUT 50 Ω. Press **System**, **Alignments**, **Align Now**, **All**. If the analyzer is equipped with a 3.0 GHz tracking generator (Option 1DN on Agilent Technologies E4402B, E4403B, E4404B, E4405B, E4407B, or E4408B), connect a short cable from AMPTD REF OUT to INPUT 50 Ω, and press **System**, **Alignments**, **Align Now**, **TG**. If the analyzer is equipped with FM Demod (Option BAA), press **System**, **Alignments**, **Align Now**, **FM Demod**.

- ❑ If the previously performed alignments did not resolve the problem, press **System**, **Alignments**, **Load Defaults**. Now press **System**, **Alignments**, **Align Now**, **All**. If the analyzer is an Agilent Technologies E4402B, E4403B, E4404B, E4405B, E4407B, or E4408B, be sure to connect a cable from AMPTD REF OUT to INPUT 50 Ω. Since **Load Defaults** has been performed, the analyzer will perform three complete alignment sequences.

- ❑ Is the analyzer displaying an error message? If so, refer to “Error Messages” on page 114.

- ❑ If the necessary test equipment is available, perform the performance verification tests in the *Agilent Technologies ESA Spectrum Analyzers Specifications Guide - E Series* or *Agilent Technologies ESA Spectrum Analyzers Specifications Guide - L Series*. Record all results on a Performance Verification Test Record form which follows the tests.

- ❑ If the equipment to perform the performance verification tests is not available, you may still be able to perform the functional checks in the *Agilent Technologies ESA Spectrum Analyzers User’s Guide*.

Read the Warranty

The warranty for your analyzer is at the front of this manual. Please read it and become familiar with its terms.

If your analyzer is covered by a separate maintenance agreement, please be familiar with its terms.

Service Options

Agilent Technologies offers several optional maintenance plans to service your analyzer after the warranty has expired. Call your Agilent Technologies sales and service office for full details.

If you want to service the analyzer yourself after the warranty expires, you can purchase the service documentation that provides all necessary test and maintenance information.

You can order the service documentation, Option 0BW (assembly level troubleshooting and adjustment procedures) and Option 0BV (component level information including parts lists, component location diagrams and schematic diagrams), through your Agilent Technologies sales and service office. Service documentation is described under "Service Documentation and Adjustment Software (Option 0BW)" and "Component Level Service Documentation (Option 0BV)" in Chapter 7 .

How to Get In Touch With Agilent Technologies

Agilent Technologies has sales and service offices around the world to provide you with complete support for your analyzer. To obtain servicing information or to order replacement parts, get in touch with the nearest Agilent Technologies sales and service office listed in Table 4-1. In any correspondence or telephone conversations, refer to your analyzer by its product number, full serial number, and firmware revision. (Press **System**, **More 1 of 3**, **Show System**, and the product number, serial number, and firmware revision information will be displayed on your analyzer screen.) A serial number label is also attached to the rear panel of the analyzer.

Table 4-1 Agilent Technologies Sales and Service Offices

UNITED STATES		
Instrument Support Center Agilent Technologies (800) 403-0801		
EUROPEAN FIELD OPERATIONS		
Headquarters Agilent Technologies S.A. 150, Route du Nant-d'Avril 1217 Meyrin 2/ Geneva Switzerland (41 22) 780.8111	France Agilent Technologies France 1 Avenue Du Canada Zone D'Activite De Courtaboeuf F-91947 Les Ulis Cedex France (33 1) 69 82 60 60	Germany Agilent Technologies GmbH Agilent Technologies Strasse 61352 Bad Homburg v.d.H Germany (49 6172) 16-0
Great Britain Agilent Technologies Ltd. Eskdale Road, Winnersh Triangle Wokingham, Berkshire RG41 5DZ England (44 118) 9696622		
INTERCON FIELD OPERATIONS		
Headquarters Agilent Technologies 3495 Deer Creek Rd. Palo Alto, CA 94304-1316 USA (415) 857-5027	Australia Agilent Technologies Australia Ltd. 31-41 Joseph Street Blackburn, Victoria 3130 (61 3) 895-2895	Canada Agilent Technologies (Canada) Ltd. 17500 South Service Road Trans-Canada Highway Kirkland, Quebec H9J 2X8 Canada (514) 697-4232
Japan Agilent Technologies Japan, Ltd. Measurement Assistance Center 9-1, Takakura-Cho, Hachioji-Shi Tokyo 192-8510, Japan TEL (81)- 426-56- 7832 FAX (81)- 426-56- 7840	Singapore Agilent Technologies Singapore (Pte.) Ltd. 150 Beach Road #29-00 Gateway West Singapore 0718 (65) 291-9088	Taiwan Agilent Technologies Taiwan 8th Floor, H-P Building 337 Fu Hsing North Road Taipei, Taiwan (886 2) 712-0404
China China Agilent Technologies 38 Bei San Huan X1 Road Shuang Yu Shu Hai Dian District Beijing, China (86 1) 256-6888		

How to Return Your Analyzer for Service

Service Tag

If you are returning your analyzer to Agilent Technologies for servicing, fill in and attach a blue service tag. Several service tags are supplied at the rear of this chapter. Please be as specific as possible about the nature of the problem. If you have recorded any error messages that appeared on the display, or have completed a Performance Test Record, or have any other specific data on the performance of your analyzer, please send a copy of this information with your analyzer.

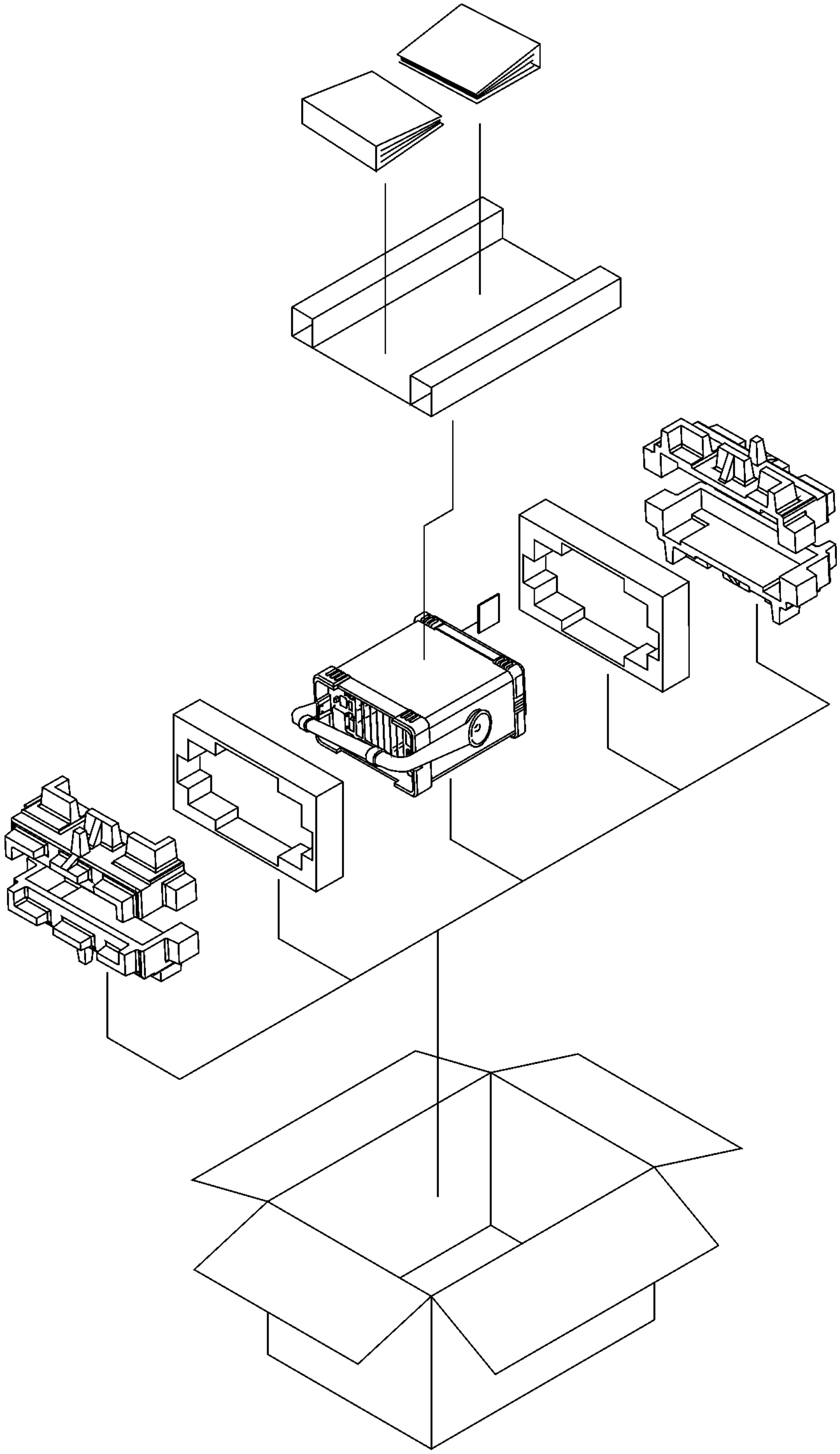
Original Packaging

Before shipping, pack the unit in the original factory packaging materials if they are available. If the original materials were not retained, see “Other Packaging” on page 113.

NOTE Ensure that the instrument handle is in the rear-facing position in order to reduce the possibility of damage during shipping. Refer to Figure 4-1.

NOTE Install the transportation disk into the floppy drive to reduce the possibility of damage during shipping. If the original transportation disk is not available, a blank floppy may be substituted.

Figure 4-1



formt122

Other Packaging

CAUTION Analyzer damage can result from using packaging materials other than those specified. Never use styrene pellets in any shape as packaging materials. They do not adequately cushion the equipment or prevent it from shifting in the carton. They cause equipment damage by generating static electricity and by lodging in the analyzer louvers, blocking airflow.

You can repackage the instrument with commercially available materials, as follows:

1. Attach a completed service tag to the instrument.
2. Install the transportation disk or a blank floppy disk into the disk drive.
3. If you have a front-panel cover, install it on the instrument. If you do not have a front-panel cover, make sure the instrument handle is in the forward-facing position to protect the control panel.
4. Wrap the instrument in antistatic plastic to reduce the possibility of damage caused by electrostatic discharge.
5. Use a strong shipping container. The carton must be both large enough and strong enough to accommodate the analyzer. A double-walled, corrugated cardboard carton with 159 kg (350 lb) bursting strength is adequate. Allow at least 3 to 4 inches on all sides of the analyzer for packing material.
6. Surround the equipment with three to four inches of packing material and prevent the equipment from moving in the carton. If packing foam is not available, the best alternative is S.D.-240 Air Cap™ from Sealed Air Corporation (Hayward, California, 94545). Air Cap looks like a plastic sheet filled with 1-1/4 inch air bubbles. Use the pink-colored Air Cap to reduce static electricity. Wrapping the equipment several times in this material should both protect the equipment and prevent it from moving in the carton.
7. Seal the shipping container securely with strong nylon adhesive tape.
8. Mark the shipping container “FRAGILE, HANDLE WITH CARE” to assure careful handling.
9. Retain copies of all shipping papers.

Error Messages

The analyzer can generate various messages that appear on the display during operation. There are four types of messages.

- Status Messages appear on the right side of the analyzer display and/or set status bits in the SCPI Status Register system. These messages indicate a condition that may result in erroneous data being displayed. Most messages will only be displayed until the error condition is corrected. Multiple messages can be displayed and will be listed in the display area.
- Informational Messages provide information that requires no intervention. These messages appear in the status line at the bottom of the display, in green if you have a color display. The message will remain until you preset the analyzer, press **ESC**, or another message is displayed in the status line.
- User Error Messages appear when an attempt has been made to set a parameter incorrectly or an operation has failed (such as saving a file). These messages are often generated during remote operation when an invalid programming command has been entered. These messages appear in the status line at the bottom of the display, in yellow if you have a color display. The message will remain until you preset the analyzer, press **ESC**, or another message is displayed in the status line. A summary of the last 11 error messages may be viewed by pressing, **System** then **Show Errors**. When generated by activity on the remote interface, the messages are output to the remote bus. When output to the remote interface, they are preceded by an error number. Note that the error number is not displayed under the **System**, **Show Errors** key sequence.
- Pop-up Messages indicate a condition that may require intervention. They appear in the middle of the display in a framed box. The message will remain until the appropriate intervention has taken place or the condition has been corrected.

Status Messages

The following messages indicate a condition that may result in erroneous data being displayed. In each case the name of the corresponding status bit is indicated in parenthesis. It will be noted if only a status bit is used (no message).

`* (Invalid Data)`

This indicator is displayed when data on the screen may not match the screen annotation, for example while analyzer settings are changing or when any trace is in view mode.

`50 MHz Osc Unlevel (50 MHz Osc Unleveled)`

The internal 50 MHz amplitude reference source has become unleveled. This condition must be corrected before a valid alignment can be performed.

`(ADC Align Failure)`

A status bit only, no message. The alignment routine was unable to align the analog-to-digital converter (ADC).

`Align Now All Needed (Align Needed)`

The instrument requires complete alignment. Press **System**, **Alignments**, **Align Now**, **All**. On all Agilent Technologies ESA spectrum analyzer models except Agilent Technologies E4401B and E4411B, you must connect the **AMPTD REF OUT** to the **INPUT** with the appropriate cable to perform this alignment. *For Agilent Technologies E4401B and E4411B only:* disconnect any signals from the **INPUT** prior to performing this procedure. If this message recurs, load defaults (**System**, **Alignments**, **Load Defaults**) and then perform **Alignment Now, All**.

`Align Now RF Needed (Align Now RF Needed)`

The instrument requires RF alignment. Press **System**, **Alignments**, **Align Now**, **RF (EXT Cable)**. On all Agilent Technologies ESA spectrum analyzer models except Agilent Technologies E4401B and E4411B, you must connect the **AMPTD REF OUT** to the **INPUT** with the appropriate cable to perform this alignment. *For Agilent Technologies E4401B and E4411B only:* disconnect any signals from the **INPUT** prior to performing this procedure.

`Align RF Skipped (Align RF Skipped)`

The RF alignment has been skipped because a 50 MHz signal was detected at the INPUT; alignment will resume when the 50 MHz signal is removed. The alignment will not work when there is too much input power at 50 MHz. The instrument may not continue to measure properly. To remove the message, remove the 50 MHz input signal, then perform an **Align Now**, **RF**. Press **System**, **Alignments**, **Align Now**, **RF**. On all Agilent Technologies ESA spectrum analyzer models except Agilent Technologies E4401B and E4411B, you must connect the **AMPTD REF OUT** to the **INPUT** with the appropriate cable to perform this alignment. *For Agilent Technologies E4401B and E4411B only:* disconnect any signals from the **INPUT** prior to performing this procedure.

`DC Coupled`

Indicates the input of the analyzer is DC coupled (**Input/Output**, **Coupling (DC)**). This setting is necessary when measuring frequencies below 100 kHz on E4402B with Option UKB, E4404B, and E4405B analyzers. For E4407Banalyzers with Option UKB, you must set the coupling to DC when measuring below 10 MHz. Take care to limit the input level to 0 Vdc and +30 dBm whenever you are in DC coupled mode.

`Ext Ref (no corresponding status bit)`

Indicates that the frequency reference is being supplied by an external 10 MHz source.

`Freq corr off (no corresponding status bit)`

Indicates that the frequency corrections have been manually disabled. Press **System**, **Alignments**, **Freq Correct**, **(On)** to restore.

`Frequency Reference Error (Freq Ref Unlocked)`

The frequency reference has been tuned too far off of 10 MHz. This condition may be corrected by cycling power on the analyzer.

`(FM Demod Align Failure) status bit only, no message`

A failure has occurred during the FM Demod alignment. Measurement results may be invalid.

`(IF Align Failure) status bit only, no message`

A failure has occurred during the IF alignment. Measurement results may be invalid.

`IF Gain fixed`

The autoranging function of the analyzer has been turned off (**Amplitude**, **More**, **More**, **IF Gain (Fixed)**). This setting is useful when measuring signals that require fast measurement time, narrow resolution bandwidths (< 1 kHz), and < 70 dB of display range. For more information on this setting, refer to IF Gain on page 210.

`IF Overload (IF/ADC Over Range)`

The IF section has been overloaded. Measurement results may be invalid.

`Input is internal (no corresponding status bit)`

This message applies to the Agilent Technologies ESA E4401B and E4411B only. Indicates the **50 MHz Amptd Ref** selection is **On**. With the 50 MHz amplitude reference on, the input is routed through an internal signal path.

`(LO Align Failure) status bit only, no message`

A failure has occurred during the alignment of the local oscillator (LO). Measurement results may be invalid.

`LO Out Unlevel (LO Out Unleveled)`

Indicates the output of the local oscillator (LO) has become unleveled. This condition must be corrected to make valid measurements.

`LO Unlevel (LO Unleveled)`

Indicates the internal circuitry of the local oscillator (LO) has become unleveled. This condition must be corrected to make valid measurements.

`LO Unlock (Synth Unlocked)`

Indicates the phase locked circuitry of the local oscillator (LO) has become unlocked. This condition must be corrected to make valid measurements.

`Log Corr Off (no corresponding status bit)`

The log amplifier corrections have been turned off.

`Marker Count:Widen Res BW`

The ratio of the resolution bandwidth to span must be greater than .002 for the marker count function to work properly. Increase the resolution bandwidth or decrease the span to continue the measurement.

`Meas Uncal (Oversweep)`

The measurement is uncalibrated. Check the sweep time, span and bandwidth settings, or press **Auto Couple**.

`Overload: Reduce Signal and press <ESC> (Input Overload Tripped)`

This message applies to the Agilent Technologies ESA E4401B and E4411B only. A signal has been applied to the input connector that caused the overload protection circuitry to engage. The input signal must be reduced. After the signal is reduced, press **ESC** to reset the overload detector so that you can continue using the analyzer.

CAUTION Exposing the analyzer to high levels of input power over a prolonged period of time can damage the internal circuitry.

`(RF Align Failure) status bit only, no message`

A failure has occurred during the alignment of the RF section. Measurement results may be invalid.

`Signal Ident On, Amptd Uncal (Signal Ident On)`

Indicates that the amplitude measurement could be uncalibrated because the signal identification feature is on.

`Signal level is low.`

Indicates the signal can be correlated, however the level is below that specified to ensure accurate measurement results.

`Source LO Unlevel (Source LO Unleveled)`

The internal circuitry of the local oscillator (LO) in the tracking generator has become unleveled. This condition must be corrected to make valid measurements.

`Source LO Unlock (Source Synth Unlocked)`

The phase-locked circuitry of the local oscillator (LO) in the tracking generator has become unlocked. This condition must be corrected to make valid measurements.

`Source Unlevel (Source Unleveled)`

Indicates the source power is set higher or lower than the analyzer can provide, the frequency span extends beyond the specified frequency range of the tracking generator, or the calibration data for the source is incorrect.

`System Alignments, Align Now, All Required`

Internal alignment correction data has been lost. Press **System**, **Alignments**, **Align Now, All** to clear this message from the display.

`(TG Align Failure) status bit only, no message`

A failure has occurred during the tracking generator (TG) alignment.

Informational Messages

The following messages provide information that requires no intervention. The information provided in brackets, for example <filename> or <directory>, is a variable that represents a specific input provided previously.

Informational messages are displayed at the bottom of the screen in the status line (green on color displays).

`<directoryname> directory deleted`

The directory indicated has been successfully deleted.

`<directoryname1> directory renamed to <directoryname2>`

Directory name1 has been successfully renamed to directory name2.

`<filename> file copied`

The filename indicated has been successfully copied.

`<filename> file deleted`

The filename indicated has been successfully deleted.

`<filename> file loaded`

The filename indicated has been successfully loaded.

`<filename1> file renamed to <filename2>`

Filename1 has been successfully renamed to filename2.

`<filename> file saved`

The filename indicated has been successfully saved.

`<filename> too many data entries`

This message may appear when loading data from a limit line or ampcor disk file. The [DATA] section of such a file can contain at most 200 lines of data. This message is displayed if that limit is exceeded.

`Atten auto set to 15 dB`

Indicates that an input signal has been detected which is of sufficient level to force the input attenuator to be autocoupled at 15 dB. If the signal level is reduced, the attenuator will stay at 15 dB. This overload protection occurs at an input power level of 13 dBm (68 dBmV for Option 1DP) ± 7 dB when the input attenuation is autocoupled and set to <15 dB. To return to the original measurement setup, reduce the input signal level and press **Amplitude**. Then press **Attenuation (Auto)**.

Overload protection is only available in the Agilent Technologies E4401B and E4411B.

`Auto ranging...`

Displayed during autoranging.

`B7D and/or B7E not found. Code Domain not available.`

Digital Signal Processing and Fast Analog to Digital Converter (B7D) and/or RF Communications Hardware (B7E) are not installed options on your analyzer. Code domain is therefore not available.

`B7D and/or B7E not found. Mod Acc not available.`

Digital Signal Processing and Fast Analog to Digital Converter (B7D) and/or RF Communications Hardware (B7E) are not installed options on your analyzer. Modulation accuracy is therefore not available.

`Carrier Not Present.`

A carrier signal/burst is expected at the analyzer input. This signal cannot be found; however, the measurement will still run. Check input signal connection.

`Channel frequency outside device’s transmit band.`

Reset channel number or frequency.

`Default spur table values loaded.`

No spur table has been previously saved when the Out-of-Band Spurious measurement begins. Press **Meas Setup, Edit Table** to enter the frequency ranges of interest and press **Save Table** to save that information. This saved table will be loaded the next time the measurement is run.

`Device = Mobile. Code Domain not available.`

Code Domain measurement is grayed out when the device is set to mobile under the **Mode Setup** front-panel key. Code Domain measurement is only accessible when the device is set to base and RF Communications Hardware (Option B7E) or Enhanced Memory Upgrade (Option B72) are installed.

`Device = Mobile. Mod Acc not available.`

Modulation accuracy measurement is grayed out when the device is set to mobile under **Mode Setup,** front-panel key. Modulation accuracy is only accessible when the device is set to base and RF Communications Hardware (Option B7E) or Enhanced Memory Upgrade (Option B72) are installed.

`Directory already exists`

Each directory and file must have a unique name. The directory name you have entered is currently being used on the selected drive. You may either enter a new name or rename the directory currently existent. Refer to “File Menu Functions” in the Agilent ESA Spectrum Analyzer User’s Guide.

`Entire trace is below the threshold level.`

The measurement cannot operate properly because the trace has fallen completely below the threshold level. Change the threshold level to view signal.

`Measurement halted. Press a measurement key to continue.`

This error occurs after you choose **Cancel** to refrain from setting the attenuator to 0 dB during the Receive Channel Power and Receive Spur measurements.

`Not enough frequency range to measure harmonics for channel.`

Selected harmonics are above the frequency range of the instrument.

`No Fast ADC hardware installed. Meas unavailable.`

The analyzer cannot use sweep times of less than 5 msec when (Option B7D or Option AYX) is not installed. Therefore the measurement will not be executed.

`One or more harmonics past freq limit: number decreased.`

The resolution bandwidth required to measure the highest harmonic is not available on your analyzer. Reduce the resolution bandwidth and restart the measurement.

`Option activated`

This message is displayed after entering the selected option's License Key.

`Please set RF input range (INPUT menu) to manual first.`

In order to manually set the reference level and/or the attenuation under the **Amplitude** front-panel key, the RF Input Range menu under the **Input** front-panel key must be set to **Man** (manual).

`Table loaded successfully.`

When the **Load Table** key was pressed on the second page of the edit table form while in the out-of-band spurious measurement, the file was present. The information has been loaded into the measurement where it may be edited again. This message will also appear when the out-of-band spurious measurement is opened if a spur table has been previously saved.

`Table saved successfully.`

This message appears after you press the **Save Table** key on the second page of the edit table for the out-of-band spurious measurement. It indicates that the current spur table has been written successfully to disk and is available to be loaded by means of the **Load Table** key.

`Volume <name> formatted`

The indicated disk has been successfully formatted.

`The calibration data is invalid, and has been cleared.`

A parameter has changed that affects calibration. Therefore the calibration data has been reset, and for best results recalibration is recommended.

`The file containing the list of cable types has been updated.`

The file update was successful.

`This operation requires a measurement to be active.`

The analyzer cannot perform this operation, as it requires a measurement to be running.

Error Queues

When a user error condition occurs in the instrument as a result of SCPI (remote interface) activity, it is reported to both the front-panel display error queue and the SCPI error queue. If it is a result of front-panel activity, it reports to the front-panel display error queue, and may also report to the SCPI error queue depending on the error. These two queues are viewed and managed separately.

Table 4-2 Characteristics of the Error Queues

Characteristic	front-panel Display Error Queue	SCPI Remote Interface Error Queue
Capacity (number of errors)	11	30
Overflow Handling	Circular (rotating). Drops oldest error as new error comes in.	Linear, first-in/first-out. Replaces newest error with: `-350,Queue overflow`
Viewing Entries	Press: **System**, **Show Errors**	Use SCPI query `SYSTem:ERRor?`
Clearing the Queue	Press: **System**, **Show Errors**, **Clear Error Queue**	Power up. Send a `*CLS` command. Read last item in the queue.

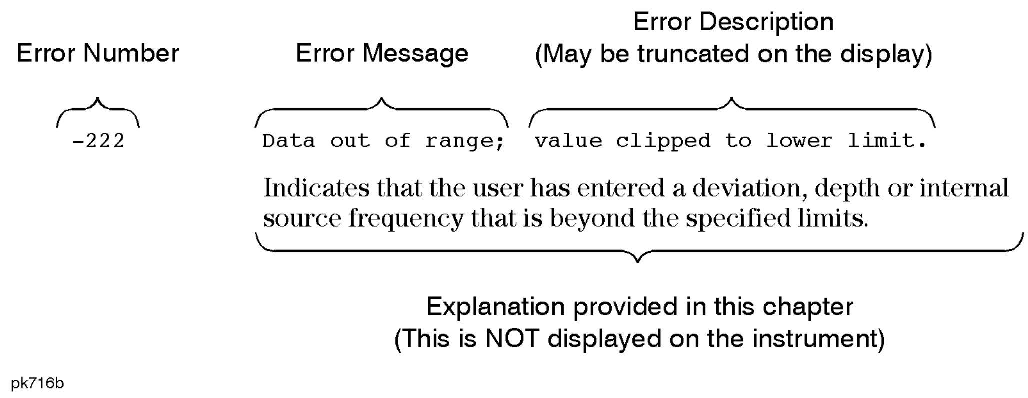
Error Message Format

The system–defined error numbers are chosen on an enumerated ("1 of N") basis. The error messages are listed in alphabetical order within each error message type section.

In this chapter, an explanation is included with each error to further clarify its meaning. The last error described in each class (for example, –400, –300, –200, –100) is a "generic" error. There are also references to the IEEE Standard 488.2-1992, *IEEE Standard Codes, Formats, Protocols and Common Commands for Use with ANSI/IEEE Std 488.1-1987*. New York, NY, 1992.

Error messages are displayed at the bottom of the screen in the status line (yellow on color displays).

Figure 4-2 Error Message Example



Error Message Types

Events do not generate more than one type of error. For example, an event that generates a query error will not generate a device-specific, execution, or command error.

–499 to –400: Query Errors

These errors indicate that the instrument output queue control has detected a problem with the message exchange protocol described in IEEE 488.2, Chapter 6. Errors in this class set the query error bit (bit 2) in the event status register (IEEE 488.2, section 11.5.1). These errors correspond to message exchange protocol errors described in IEEE 488.2, 6.5. In this case:

- Either an attempt is being made to read data from the output queue when no output is either present or pending, or
- data in the output queue has been lost.

–399 to –300: Device-Specific Error Messages

These errors indicate that the instrument output queue control has detected a problem with the message exchange protocol described in IEEE 488.2, Chapter 6. Errors in this class set the query error bit (bit 2) in the event status register (IEEE 488.2, section 11.5.1). These errors correspond to message exchange protocol errors described in IEEE 488.2, 6.5. In this case:

- Either an attempt is being made to read data from the output queue when no output is either present or pending, or
- data in the output queue has been lost.

–299 to –200: Execution Error Messages

These errors indicate that an error has been detected during instrument execution.

–199 to –100: Command Errors

These errors indicate that the instrument parser detected an IEEE 488.2 syntax error. Errors in this class set the command error bit (bit 5) in the event status register (IEEE 488.2, section 11.5.1). In this case:

- Either an IEEE 488.2 syntax error has been detected by the parser (a control-to-device message was received that is in violation of the IEEE 488.2 standard. Possible violations include a data element which violates device listening formats or whose type is unacceptable to the device.), or
- an unrecognized header was received. These include incorrect device-specific headers and incorrect or unimplemented IEEE 488.2 common commands.

201 to 799: Device-Specific Errors

These errors indicate that a device operation did not properly complete, possibly due to an abnormal hardware or firmware condition. These codes are also used for self-test response errors. Errors in this class set the device-specific error bit (bit 3) in the event status register (IEEE 488.2, section 11.5.1).

The <error_message> string for a positive error is not part of the SCPI standard. A positive error indicates that the instrument detected an error within the GPIB system, within the instrument firmware or hardware, during the transfer of block data, or during calibration.

Greater than 10000: Measurement Applications Error Messages

These errors indicate that an error has been detected while executing measurements requiring a personality option such as Option BAH, the GSM Measurement Personality or those measurements found under the **Measure** front-panel key in SA mode.

0:
No Error

0 `No error`

The queue is empty. Every error in the queue has been read or the queue was purposely cleared by power-on or `*CLS`.

–499 to –400: Query Errors

The instrument output queue control has detected a problem with the message exchange protocol described in IEEE 488.2, Chapter 6. Errors in this class set the query error bit (bit 2) in the event status register (IEEE 488.2, section 11.5.1). These errors correspond to message exchange protocol errors described in IEEE 488.2, 6.5.

In this case, either an attempt is being made to read data from the output queue when no output is either present or pending, or data in the output queue has been lost.

–430 `Query DEADLOCKED`

Indicates that a condition causing a DEADLOCKED query error occurred (see IEEE 488.2, 6.3.1.7). For example, both the input buffer and the output buffer are full and the device cannot continue. The system automatically discards output to correct the deadlock.

–400 `Query Error`

This is a generic query error for devices that cannot detect more specific errors. The code indicates only that a query error as defined in IEEE 488.2, 11.5.1.1.7, and 6.3 has occurred.

–410 `Query INTERRUPTED`

Indicates that a condition causing an INTERRUPTED query error occurred (see IEEE 488.2, 6.3.2.7). For example, a query was followed by DAB or `GET` before a response was completely sent.

–420 `Query UNTERMINATED`

Indicates that a condition causing an UNTERMINATED query error occurred (see IEEE 488.2, 6.3.2.2). For example, the device was addressed to talk and an incomplete program message was received.

–440	`Query UNTERMINATED after indefinite response`
	Indicates that a query was received in the same program message after a query requesting an indefinite response was executed (see IEEE 488.2, 6.3.7.5).

–399 to –300: Device-Specific Error Messages

An error number in the range –399 to –300 indicates that the instrument has detected an error where some device operations did not properly complete, possibly due to an abnormal hardware or firmware condition. This is not a error in response to a SCPI query or command, or command execution. The occurrence of any error in this class will cause the device-specific error bit (bit 3) in the event status register to be set.

`-300`	`Device-specific error`
	This is a generic device-dependent error for devices that cannot detect more specific errors. The code indicates only that a device-dependent error as defined in IEEE 488.2, 11.5.1.1.6 has occurred.
`-310`	`System error`
	Indicates that an error, termed “system error” by the device, has occurred.

–299 to –200: Execution Error Messages

An error number in the range –299 to –200 indicates that an error has been detected during instrument execution.

–230 `Data corrupt or stale.`

Possibly invalid data. A new measurement was started but not completed.

–200 `Execution error`

This is a generic execution error for devices that cannot detect more specific errors. The code indicates only that a execution error as defined in IEEE 488.2, 11.5.1.1.4 has occurred

–221 `Settings conflict; parameter currently disabled`

This parameter is grayed out (unavailable) in the current context. Check the individual parameter help/documentation for more information.

–223 `Too much data; <description of the type of data exceeded>`

Indicates that a legal program data element of block, expression or string type was received that contained more data than the device could handle due to memory or related device-specific requirements.

–199 to –100: Command Errors

The instrument parser detected an IEEE 488.2 syntax error. Errors in this class set the command error bit (bit 5) in the event status register (IEEE 488.2, section 11.5.1). In this case:

- Either an IEEE 488.2 syntax error has been detected by the parser (a control-to-device message was received that is in violation of the IEEE 488.2 standard. Possible violations include a data element which violates device listening formats or whose type is unacceptable to the device.), or
- an unrecognized header was received. These include incorrect device-specific headers and incorrect or unimplemented IEEE 488.2 common commands.

–160 `Block data error`

This error, as well as errors –161 through –169, is generated when parsing a block data element. This particular error message is used if the device cannot detect a more specific error.

–168 `Block data not allowed`

A legal block data element was encountered, but not allowed by the device at this point in the parsing.

–140 `Character data error`

This error, as well as errors –141 through –149, is generated when parsing a character data element. This particular error message is used if the device cannot detect a more specific error.

–148 `Character data not allowed`

A legal character data element was encountered where prohibited by the device.

–144 `Character data too long`

The character data element contains more than twelve characters (see IEEE 488.2, 7.7.1.4).

–100 `Command error`

This is a generic syntax error for devices that cannot detect more specific errors. The code indicates only that a command error as defined in IEEE 488.2, 11.5.1.1.4 has occurred.

–110 `Command header error`

An error was detected in the header. This message is used when the device cannot detect the more specific errors described for errors –111 through –119.

–104 `Data type error`

The parser recognized a data element that is not allowed. For example, numeric or string data was expected, but block data was encountered.

–123 `Exponent too large`

The magnitude of an exponent was greater than 32000 (see IEEE 488.2, 7.7.2.4.1).

–170 `Expression data error`

This error, as well as errors –171 through –179, is generated when parsing an expression data element. This particular error message is used if the device cannot detect a more specific error.

–178 `Expression data not allowed`

A legal expression data was encountered, but was not allowed by the device at this point in parsing.

–105 `GET not allowed`

A Group Execute Trigger was received within a program message (see IEEE 488.2, 7.7). Correct the GPIB controller program so that the GET does not occur within a line of GPIB program code.

–111 `Header separator error`

A character which is not a legal header separator was encountered while parsing the header.

–114 `Header suffix out of range`

The value of a header suffix attached to a program mnemonic makes the header invalid.

–161 `Invalid block data`

A block data element was expected, but was invalid (see IEEE 488.2, 7.7.6.2). For example, an END message was received before the end length was satisfied.

–101 `Invalid character`

A syntactic command contains a character which is invalid for that type. For example, a header containing an ampersand, such as “SETUP&”. This error might be used in place of error numbers –114, –121, –141, and some others.

–141 `Invalid character data`

Either the character data element contains an invalid character or the particular element received is not valid for the header.

–121 `Invalid character in number`

An invalid character for the data type being parsed was encountered. For example, an alpha in a decimal numeric or a “9” in octal data.

–171 `Invalid expression`

The expression data element was invalid (see IEEE 488.2, 7.7.7.2). For example, unmatched parentheses or an illegal character.

–103	`Invalid separator` The parser was expecting a separator and encountered an illegal character. For example, the semicolon was omitted after a program message unit.
–151	`Invalid string data` A string data element was expected, but was invalid (see IEEE 488.2, 7.7.5.2). For example, an END message was received before the terminal quote character.
–131	`Invalid suffix` The suffix does not follow the syntax described in IEEE 488.2, 7.7.3.2, or the suffix is inappropriate for this device.
–109	`Missing parameter` Fewer parameters were received than required for the header. For example, the `*ESE` common command requires one parameter, so receiving `*ESE` is not allowed.
–120	`Numeric data error` This error, as well as errors –121 through –129, is generated when parsing a data element which appears to be numeric, including non-decimal numeric types. This particular error message is used if the device cannot detect a more specific error.
–128	`Numeric data not allowed` A legal numeric data element was received, but the device does not accept one in this position for the header.
–108	`Parameter not allowed` More parameters were received than expected for the header. For example, the `*ESE` common command only accepts one parameter, so receiving `*ESE 0,1` is not allowed.

–112	`Program mnemonic too long` The header contains more than twelve characters (see IEEE 488.2, 7.6.1.4.1).
–150	`String data error` This error, as well as errors –151 through –159, is generated when parsing a string data element. This particular error message is used if the device cannot detect a more specific error.
–158	`String data not allowed` A string data element was encountered, but not allowed by the device at this point in the parsing.
–130	`Suffix error` This error, as well as errors –131 through –139, is generated when parsing a suffix. This particular error message is used if the device cannot detect a more specific error.
–138	`Suffix not allowed` A suffix was encountered after a numeric element which does not allow suffixes.
–134	`Suffix too long` The suffix contained more than twelve characters (see IEEE 488.2, 7.7.3.4).
–102	`Syntax error` An unrecognized command or data type was encountered. For example, a string was received when the device does not accept strings.
–124	`Too many digits` The mantissa of a decimal-numeric data element contained more than 255 digits excluding leading zeros (see IEEE 488.2, 7.7.2.4.1).

–113	`Undefined header`
	The header is syntactically correct, but it is undefined for this specific device. For example, *XYZ is not defined for any device.

201 to 799:
Device-Specific Errors

Some device operations did not properly complete, possibly due to an abnormal hardware or firmware condition. These codes are also used for self-test response errors. Errors in this class set the device-specific error bit (bit 3) in the event status register (IEEE 488.2, section 11.5.1).

The <error_message> string for a *positive* error is not defined by SCPI. A positive error indicates that the instrument detected an error within the GPIB system, within the instrument firmware or hardware, during the transfer of block data, or during calibration.

653 `Auto Align not available when using Calibration Defaults`

The Auto Alignment system cannot be used until an **Align Now All** is executed by pressing **System**, **Alignments**, **Align Now**, **All**. On all Agilent Technologies ESA spectrum analyzer models except Agilent Technologies E4401B and E4411B, you must connect the **AMPTD REF OUT** to the **INPUT** with the appropriate cable to perform this alignment. *For Agilent Technologies E4401B and E4411B only:* disconnect any signals from the **INPUT** prior to performing this procedure.

614 `Bad or missing floppy disk`

The floppy is not inserted or the directory could not be read. Insert a known good disk and try again.

205 `Command not recognized`

Indicates that the command sent from the remote interface was not recognized. Check the programming guide for correct syntax.

219 `Command not valid in this model`

Indicates that the command sent from the remote interface does not apply to this model number. For example, attempting to center the preselector in an analyzer without a preselector will generate this error.

222	`Command not valid when no measurement is active` Indicates that the command sent from the remote interface must be issued while a measurement is running in the analyzer.
772	`Cannot load a directory, please choose a file` You have selected a directory instead of a file when attempting to perform the Load function under the **File** front-panel key.
652	`Connect Amptd Ref Output to Input` *For Agilent Technologies ESA E4402B, E4403B, E4404B, E4405B, E4407B, and E4408B only:* you must connect the **AMPTD REF OUTPUT** to the analyzer **INPUT** with the appropriate cable.
651	`Connect RF OUT to INPUT` Attempt to align the tracking generator without its output connected. Connect the tracking generator RF OUT to the analyzer **INPUT**.
615	`Corrupted file` The file that you were trying to load is corrupt.
610	`File access is denied` The file is protected or hidden and cannot be accessed.
604	`File already exists` Attempt to save to a file that already exists. Delete or rename the old file and try again.
607	`File Name Error` An invalid file name has been specified. Use filenames with a maximum of 8 characters (letters and digits only) and use a 3 character extension. Note that lowercase and uppercase are perceived as the same.

This error will also occur if you attempt to delete a nonexistent file.

612 `File not found`

The analyzer could not find the specified file.

613 `Flash memory is full`

The internal flash memory is full. Clear some space by deleting unwanted files. You may also increase the flash memory size by purchasing Option B72.

602 `Floppy disk error`

An unknown error has occurred while accessing the floppy disk.

601 `Floppy disk full`

The floppy disk is full. Clear some space by deleting unwanted files.

618 `Illegal write access of Flash memory`

Attempt to write to an unavailable area of internal flash memory.

727 `In <filename>: [DATA] header missing`

This message indicates that the data section of a file did not begin with the token [**DATA**].

728 `In <filename>, line <nnn>: separator missing`

The [**HEADER**] section of a file contains entries requiring an equal (=) sign, such as <keyword> = <value>. This message appears if the equal sign does not appear on the line.

729 `In <filename>: error reading file`

Appears when loading data from a limit line or corrections disk file and a failure to the file occurs.

730 `In <filename>, line <numeric_value>: line too long`

When loading data from a limit line or corrections disk file, this message will appear if the length of any line in the file exceeds 255 characters.

731 `In <command>: bad data count (<numeric_value>): expected multiple of <numeric_value>`

This message indicates that the data sent to a corrections or limit table via the **DATA** or **MERGE** commands does not have the expected length for the table. For example, this message would appear if an attempt were made to merge 7 numeric values into a limit table, since each logical entry requires 3 values (frequency, amplitude, and connected).

732 `In <filename>, line <numeric_value>: error parsing tokens`

This message may appear when loading data from a limit line or corrections disk file. It indicates a problem in the attempt to break a string of text into tokens. There may be too few tokens in the string. This typically happens when there are too few numeric values in the [**DATA**] section of a limit or corrections file.

733 `In <filename>, line <numeric_value>: <xxx> is not numeric`

This message may appear when loading data from a limit line or corrections disk file. It indicates that a non-numeric token <xxx> was found where a numeric token was expected.

735 `In <filename>: bad amplitude unit <unit>`

This message indicates that unit <unit> is not recognized or supported.

763 `Incorrect filename, allowable extensions are .gif or .wmf`

Attempt to save a screen image to a file with an incorrect extension.

762 `Incorrect filename, allowable extensions are .trc or .csv`

Attempt to save a trace to a file with an incorrect extension.

770 `Instrument mode requested is not supported`

Instrument mode specified with: INST command is not valid. Refer to Chapter 5, “Instrument Subsystem” of *Agilent Technologies ESA Series Spectrum Analyzers Programmer’s Guide* for more information.

751 `Instrument state may be corrupt, state has been reset to initial values`

An error in the internal instrument state has been detected. The state has been reset to a default value.

734 `Interpolation error: cannot compute log of <negative_frequency_value>`

Occurs when the frequency interpolation of a limit line is set to log and the start frequency of the instrument is negative. The <negative_frequency_value> is limited to – 80 MHz, so it may not match the frequency that caused the error.

216 `Invalid Baud Rate`

Attempt to use invalid baud rate. Refer to Chapter 5, “Instrument Subsystem” of *Agilent Technologies ESA Series Spectrum Analyzers Programmer’s Guide* for more information.

769 `Invalid instrument mode`

You have attempted to switch to an instrument mode that is currently not installed. Confirm that the mode name (for `INST:SEL`) or number (for `INST:NSEL`) was entered correctly and that the requested personality is actually installed in the instrument.

221 `Invalid option, unable to uninstall package`

You have attempted to remove a personality that is not currently installed. Verify command was entered correctly.

701 `Invalid printer response`

In attempting to identify the printer an invalid response was received. Check that you are using a supported printer. Be sure you are using the proper cable and that it is securely fastened.

606 `Media is corrupt`

A save was attempted to a corrupt device.

609 `Media is not writable`

A save was attempted to a read-only device.

605 `Media is protected`

A save was attempted to a write-protected device.

202 `No peak found`

No signal peak was found.

201 `Option not installed`

The desired operation cannot be performed because a required option is not installed. For example, pressing **Source** with no tracking generator installed in the analyzer will generate this error.

224 `Option not licensed.`

The selected option requires a license. Refer to the installation procedures in the user's guide available for this particular option.

209 `Preselector centering failed`

An attempt to center the preselector failed.

704 `Printer interface error`

An error occurred while trying to print. Make sure the printer is turned on and properly connected.

705 `Printer Type is None`

The current printer type is set to **None**, so no print operations are possible. Change the type in the **Print Setup** menu and try again.

211 `RBW limited to 1kHz when Span > 5MHz`

In spans greater than 5 MHz, narrow (digital) resolution bandwidths, below 1 kHz, are not available.

217 `RS-232 Interface Error`

An error occurred on the serial interface.

213 `Span limited to 5MHz when RBW < 1kHz`

In narrow (digital) resolution bandwidths, below 1 kHz, spans greater than 5 MHz are not available.

771 `Store Ref trace before turning on Normalize`

A reference trace must be available for the Normalize function to be activated. Refer to "View/Trace" in the Agilent ESA Spectrum Analyzer User's Guide where the **Normalize** key function is explained in detail.

223	`Trigger Offset unavailable in swept spans` Trigger Offset is only available in Zero Span. Refer to “Trig” in the Agilent ESA Spectrum Analyzer User’s Guide for a description of this function.
215	`TG start freq is less than 1/2 res bw` Tracking generator uncalibrated at start frequencies below 1/2 the current resolution bandwidth.
214	`TG start freq is less than 9kHz` Tracking generator uncalibrated below 9 kHz.
204	`TG Frequency Limit` The tracking generator has reached the limit of its allowable frequency range.
736	`Too many data values at <freq_or_time_value>` This message may appear when data is sent to a corrections or limit table using the **DATA** or **MERGE** commands. These tables limit the number of amplitudes associated with a frequency or time to 2 or less. This message will appear if an attempt is made to attach 3 or more values to a frequency or time.
206	`Unable to initialize flatness data` A failure occurred in setting the flatness data in the internal EEROM. Get in touch with your local Agilent Technologies sales and service office.
762	`Unable to load file` A failure occurred while loading a file; the file was not loaded.
759	`Unable to load state` A saved state file from a newer firmware revision was attempted to be loaded into an older instrument.

752 `Unable to load state from file`

Loading of state from a file failed.

755 `Unable to load state from register`

Loading a state from an internal state register failed.

757 `Unable to load user state, factory preset was done`

An attempt to perform a **User Preset** failed, so the **Factory Preset** values were used. Save a valid state into **User Preset** and try again.

760 `Unable to query state`

Query of state over the remote interface was unsuccessful.

764 `Unable to save file`

A failure occurred while saving a file; the file was not saved.

756 `Unable to save state to register`

Saving of state to an internal register failed.

753 `Unable to save state to file`

Saving of state to a file failed.

758 `Unable to save user state`

An attempt to save to the **User Preset** state failed.

761 `Unable to set state`

Attempt to set the state over the remote interface was unsuccessful.

207 `Unable to store flatness data`

A failure occurred in setting the flatness data in the internal EEROM. Get in touch with your local Agilent Technologies sales and service office.

703 `Unknown printer`

In attempting to identify the printer, a valid response was received but the printer is not known to the analyzer. Use the **Custom** printer menu under **Print Setup** to configure the printer.

702 `Unsupported printer`

A printer which is recognized, but known to be unsupported was identified. This printer cannot be used with the analyzer. For example, a printer only supported by Microsoft Windows will generate this error.

617 `Wrong density floppy inserted`

The floppy disk has the wrong density. It should be 1.44 MB.

Greater than 10000: Measurement Applications Error Messages

An error detected with a number greater than 10000 indicates the instrument has detected an error relating to a measurement application.

10340 `‘10101010’ pattern not detected - results may be inaccurate.`

This message is displayed if the measurement cannot detect the ‘10101010’ pattern in the payload. The measurement will continue and carry out the calculations on the payload data supplied, but may not be correct.

10219 `Awaiting trigger`

The measurement requires a trigger to be present. If the trigger does not occur or is delayed, this message will be displayed. Check your trigger settings.

10164 `Band Measurement not defined for Out of Band.`

You are attempting to monitor the band but have set the frequency outside the band. Reset the band for the particular standard for which you are testing or use the channel setting which does not require a frequency to be set. (**Meas Setup**, **Method (Channel)**).

10286 `Burst not found.`

The signal being analyzed has insufficient power, the rising or falling edges cannot be detected, or the burst is less than 120µseconds.

10228 `Cannot correlate to input signal.`

This error is normally generated because of one of the following reasons: 1. There is no carrier signal.
2. Walsh channels other than the pilot are active.
3. There is some other modulation problem that will prevent the measurement from being made.

This problem must be corrected before the measurement can continue.

10163	`Cannot find the Power vs Time Limits File.` The limit line definition file for the GSM standards has been deleted. This message is displayed while the **Measure** key is grayed out. Reinstall the GSM measurement personality.
10166	`Cannot update the list of cable types.` The cable file may have been moved or deleted accidentally. Reinstall the GSM measurement personality.
10168	`Cannot update the list of cable types on drive C:` The file update failed.
10360	`Can’t compute result - not enough transitions.` This message is displayed when the measurement cannot find either a 111, 000, 101 or 010 pattern and is therefore unable to calculate the low or high frequency deviations.
10179	`Carrier Present. Test Stopped!` A carrier was found in the transmit band. Either disable the carrier or insert a bandpass filter for the receive bandwidth.
10153	`DSP algorithm timeout, aborting measurement` The Digital Signal Processor demodulation algorithm timed-out for an unknown reason. This message normally indicates a problem with the modulated signal.

10230 `DSP timed out, resetting DSP.`

Digital Signal Processor was unable to finish the selected measurement within the given period of time. Restart the measurement.

10264 `Emission bandwidth not found. Consider increasing span.`

This error is normally generated when attempting occupied bandwidth measurements. The “X dB” value you entered (**Meas Setup**, **X dB**) to calculate the emission bandwidth is the difference between the highest point on the trace and the point “X dB” down on either side of the maximum. If the actual difference is less than the value entered, the emission bandwidth cannot be computed. Some responses to this situation are as follows:

1. Connect a signal to the input. (If there is no signal present, the difference between the trace minimum and maximum will generally be less than “X dB”.)
2. Increase the span. (If the signal is wide, the shoulders of the signal might not be present on the screen, and again, the difference between the trace minimum and maximum will be less than “X dB”.)
3. Center the signal. (There must be a point on the trace that is “X dB” down from the maximum on both sides of that maximum.)

10246 `Error reading file: CDMASTUN.CSV. Please reinstall cdmaOne.`

The file is missing or corrupt. Please reinstall the cdmaOne personality.

10159 `Entire trace is below threshold level`

The measurement cannot operate properly because the trace has completely fallen below the threshold level. Change the threshold level to view trace.

10247	`Error reading file: CDPDMDA. Please reinstall cdmaOne.` The file is missing or corrupt. Please reinstall the cdmaOne personality.
10248	`Error reading file: CDPPMCO. Please reinstall cdmaOne.` The file is missing or corrupt. Please reinstall the cdmaOne personality.
10249	`Error reading file: CDPPMDA. Please reinstall cdmaOne.` The file is missing or corrupt. Please reinstall the cdmaOne personality.
10256	`Error reading file: OOBSTAB.CSV. Use Edit Table | Save Table.` This error is generated when you try to load a table (using the **Load Table** key on page 2 of the edit table form menu) before a table has been saved. You must first save a table using the **Save Table** key before trying to load a table using the **Load Table** key.
10250	`Error reading file: RHODMDA. Please reinstall cdmaOne.` The file is missing or corrupt. Please reinstall the cdmaOne personality.
10251	`Error reading file: RHOPMCO. Please reinstall cdmaOne.` The file is missing or corrupt. Please reinstall the cdmaOne personality.

10245 `Error reading file: SPCLIMIT.CSV. Cannot use custom limits.`

The file could be missing or corrupt. Create a new limits file. Alternatively, the actual limits defined in the file might not allow the measurement to be executed. Redefine the limits or use the default limits. Restart the measurement.

10180 `Gate option not installed. Results may not be accurate.`

This measurement method requires the use of the time-gate (option 1D6) in order to gate the spectrum during the 50-90% part of the burst. If the gate option is not installed, the measurement will still run although this warning will be displayed.

10218 `Hardkeys are disabled.`

Some of the forms (for example Receiver Spurious in GSM) do not allow you to close the form without either formally accepting or cancelling the form settings. For this reason, all of the hardkeys are disabled until you terminate the form.

None `Hardware Fail`

A hardware failure has occurred. Get in touch with your service center.

10233 `Level is low, results may degrade.`

The signal being measured is of low power. The results may not be as accurate as they would be if the signal was stronger.

10152 `Lost trigger, aborting measurement.`

The selected trigger source was present at the start of the measurement, but timed out before the measurement completed.

10161 `Lower Custom Mask is Invalid!`

The user-specified lower custom mask cannot be resolved into a limit line.

10449 `Measurement does not support this particular signal type.`

The measurement you have chosen can not be applied to this type of signal. Choose another measurement type under the **Measure** front-panel key, a different radio standard (**Mode Setup**, **Radio Std**) or set the measurement up manually.

10231 `Measurement failed for unknown reasons.`

Check instrument settings and restart measurement.

10154 `Measurement not defined for Out of Band.`

You have changed to an out-of-band frequency range. The band measurement only operates in the selected band.

10227 `Measurement suspended until carrier is turned off.`

The receive channel power and the receive spur measurements are specified with the attenuation set to 0 dB. To prevent overload, the frequency spectrum of interest is monitored for signal levels which exceed a specified threshold before setting the attenuator to 0 dB. If a carrier is found, this message is displayed and the completion of the measurement will not occur until the carrier is removed. The carrier check may be turned off using the properties form under the front-panel **Mode Setup** key. You may also change the signal threshold which determines a carrier on the properties form.

10013 `No Fundamental > -50 dBm found in given span.`

A fundamental was not found, so the measurement was stopped.

10012	`No Fundamental > 0 Hz found in given span.` There were no frequencies greater than 0 Hz in the starting span, so the measurement was stopped.
None	`Not enough frequency range to measure harmonics for channel.` Selected harmonics are above the frequency range of the instrument.
10145	`Opt AYX hardware required. Meas unavailable.` Option AYX must be installed for this measurement to be enabled.
10289	`Opt 106 demod hardware required. Meas unavailable.` A demod measurement was attempted with no Bluetooth™ FM demod card present (Option 106).
10320	`Opt 106 hardware required. Preamble sync unavailable.` You have selected (by remote SCPI command) preamble sync with no Bluetooth™ FM demodulation card present (Option 106).
10147	`Opt B7D bootrom requires upgrade.` The (Option B7D) bootrom revision is not supported by the currently loaded personality version. Refer to the user’s guide for the personality in use.
10291	`Opt B7E RF hardware required. RF Burst unavailable.` You have selected (by remote SCPI command) RF Burst Trigger with no digital demodulation RF card present (RF Communications Hardware (Option B7E)).

10149	`Opt BAH DSP algorithm code file requires upgrade.` The Digital Signal Processing algorithm code file revision is not supported by the currently loaded personality version. Refer to the user's guide for the personality in use for more information on installation/upgrade.
10150	`Opt BAH DSP algorithm coef. file requires upgrade.` The Digital Signal Processor algorithm coefficient file revision is not supported by the currently loaded personality version. Refer to the user's guide for the personality in use.
10151	`Opt BAH DSP algorithm files failed to load, aborting measure.` The Digital Signal Processor algorithm files required to perform the demodulation are corrupt and cannot be loaded properly. Reinstall measurement personality.
10148	`Opt BAH DSP algorithm files not installed. Meas unavailable.` The Digital Signal Processor algorithm files required to perform the demodulation are not present in the analyzer.
10145	`Opt AYX hardware required. Meas unavailable.` Option AYX must be installed for this measurement to be enabled.
10288	`Opt B7D or AYX FADC hardware required. Meas unavailable.` The measurement you are attempting requires either the DSP and Fast ADC (Option B7D) or the Fast ADC (Option AYX) card to perform the demodulation, but neither are present in the analyzer.

10146 `Opt B7D & B7E hardware required. Meas unavailable.`

The (Option B7E) and (Option B7D) cards required to perform the demodulation are not present in the analyzer.

10239 `Opt Freq Ref setting does not match external reference.`

This message is generated if Source is set to External on the properties form under the front-panel **Mode Setup** key and the frequency on the same form is set to a frequency that does not match the frequency of the signal being used as the external reference.

10290 `Parameter unavailable in demod measurements.`

You have selected (by remote SCPI command) either RF Amplitude sync or Video trigger while running one of the demod measurements.

10350 `Payload data pattern '10101010' not present.`

This message is displayed when the "Payload Data" parameter is set to Auto and the measurement has not detected either of the required patterns in the payload.

`Preferred resolution bandwidth not available.`

The calculated required resolution bandwidth for this measurement is not available.

10351 `Required payload data pattern '10101010' not present.`

This message is displayed after successfully measuring and holding the '11110000' pattern if the measurement is restarted and the '10101010' data pattern is not detected.

10352 `Required payload data pattern ‘11110000’ not present.`

This message is displayed after successfully measuring and holding the ‘10101010’ pattern if the measurement is restarted and the ‘11110000’ data pattern is not detected.

10232 `RF Signal not found.`

This message is generated if there is no signal at the center frequency that is greater than 10 dB above the displayed average noise level.

10241 `RF Board could not detect any bursts in signal.`

This message is generated when the trigger is set to RF Burst and (Option B7E) cannot detect a burst.

10237 `RF Board LO Unlocked. Contact service center.`

This message occurs if the local oscillator on the (Option B7E) is in an unlocked state. This indicates broken hardware.

10240 `RF Board RF Osc Unlocked. Contact service center.`

This message occurs if the reference oscillator on the (Option B7E) is in an unlocked state. This indicates broken hardware.

10238 `RF Board SR Osc Unlocked. Contact service center.`

This message occurs if the sample rate oscillator on Option B7E is in an unlocked state. This indicates broken hardware.

10162 `Resolution BW <300kHz.`

This error message is a warning that the resolution bandwidth has been set below 300 kHz. The test results will not meet GSM specifications.

10011 `Second harmonic is past analyzer frequency limit.`

The frequency range of your analyzer does not include the first multiple of the captured fundamental frequency. If you have the Agilent E4407B analyzer, Option AYZ allows the use of HP/Agilent 11970 Series, and HP/Agilent 11974 external mixers to extend the frequency range to 110 GHz. Operation to 325 GHz is also possible with non-HP/Agilent mixers.

10321 `Start Marker must be at least 1% < Stop Marker.`

You have attempted to input a start marker value that will result in the difference between the start and stop markers being less than 1%.

10322 `Stop Marker must be at least 1% > Start Marker.`

You have attempted to input a stop marker value that will result in the difference between the start and stop markers being less than 1%.

10172 `Sweep Time too fast(<2sec)`

The sweep time must be set to 2 seconds or longer for the results to be valid.

10141 `Sync word not found in frame (Burst Type)`

One or more active GSM bursts that match the selected Burst Type have been detected in the RF Input signal, but none contain the selected Training Sequence Code (TSC). The search was performed over the complete GSM frame.

10143 `Sync word not found in frame (Ref Burst)`

One or more active GSM bursts that match the selected Burst Type have been detected in the RF Input signal, but none contain the selected Training Sequence Code (TSC). The search was only performed using the Reference Burst type and Reference TSC settings over the complete GSM frame.

10142	`Sync word not found in specified timeslot (Burst Type)` One or more active GSM bursts that match the selected Burst Type have been detected in the RF Input signal, but none contain the selected Training Sequence Code (TSC). The search was only performed over the specified timeslot setting.
10353	`There is no valid result to hold.` You have attempted to hold either Δ f1 or Δf2 before it has been measured.
10260	`Table could not be loaded.` When trying to load a table, the previous table has been somehow corrupted. Use the **Save Table** key to save a valid table. Then edit the valid table, save it, and try to load it again.
10259	`Table could not be saved.` This message occurs if the C: drive is full or corrupt. Check the amount of space left on the drive.
10170	`The Cable Fault Measurement is active. Mode Setup is disabled.` Mode setup is not available in the cable fault utility.
10177	`There are no spurs to inspect.` You have attempted to switch the **Inspect Spur** softkey to the **On** position after the measurement has finished, but found no spurs.
10229	`The regression portion failed.` This message occurs when (Option B7D) is not functioning properly. Demodulation measurements (modulation accuracy and code domain) might fail as a result of this error.

10157 `Tracking Generator hardware is not present. Meas unavailable.`

The measurement requires a built-in tracking generator.

10323 `Unable to Calculate Result using Current Setup.`

You have changed the setup parameters such that the marker lines used to measure the power cannot be displayed therefore accurate measurements cannot be made.

None `Unable to uninstall personality, file not deletable.`

This message occurs when you try to delete a personality which has been marked as non-deletable. The personality is marked non-deletable at the factory. Get in touch with your nearest service center for further problems.

10144 `Unknown demod status.`

Demodulation is in an unknown state. Press **Preset**. If the error persists, get in touch with your service center.

10160 `Upper Custom Mask is Invalid!`

The user-specified upper custom mask cannot be resolved into a limit line. The format is incorrect.

10287 `Valid Bluetooth burst not found.(Check Packet Type)`

The burst that has been found does not correspond to the currently selected Bluetooth™ packet type (the burst length may be too short).

10138 `Valid GSM burst not found in frame (Burst Type).`

No active GSM bursts that match the selected Burst Type have been detected in the RF input signal. The search was performed over the complete GSM frame.

10140	`Valid GSM burst not found in frame (Ref Burst).` No active GSM bursts that match the selected Burst Type have been detected in the RF input signal. The search was performed using the Ref Burst type setting over the complete GSM frame.
10139	`Valid GSM burst not found in specified timeslot (Burst Type).` No active GSM bursts that match the selected Burst Type have been detected in the RF input signal. The search was only performed over the specified timeslot setting.

5 Menu Maps

This chapter provides a visual representation of the front-panel keys and their associated menu keys when the analyzer is in spectrum analyzer (SA) mode. Refer to the Chapter 6 , "Front-Panel Key Reference." for key function descriptions.

What You Will Find in This Chapter

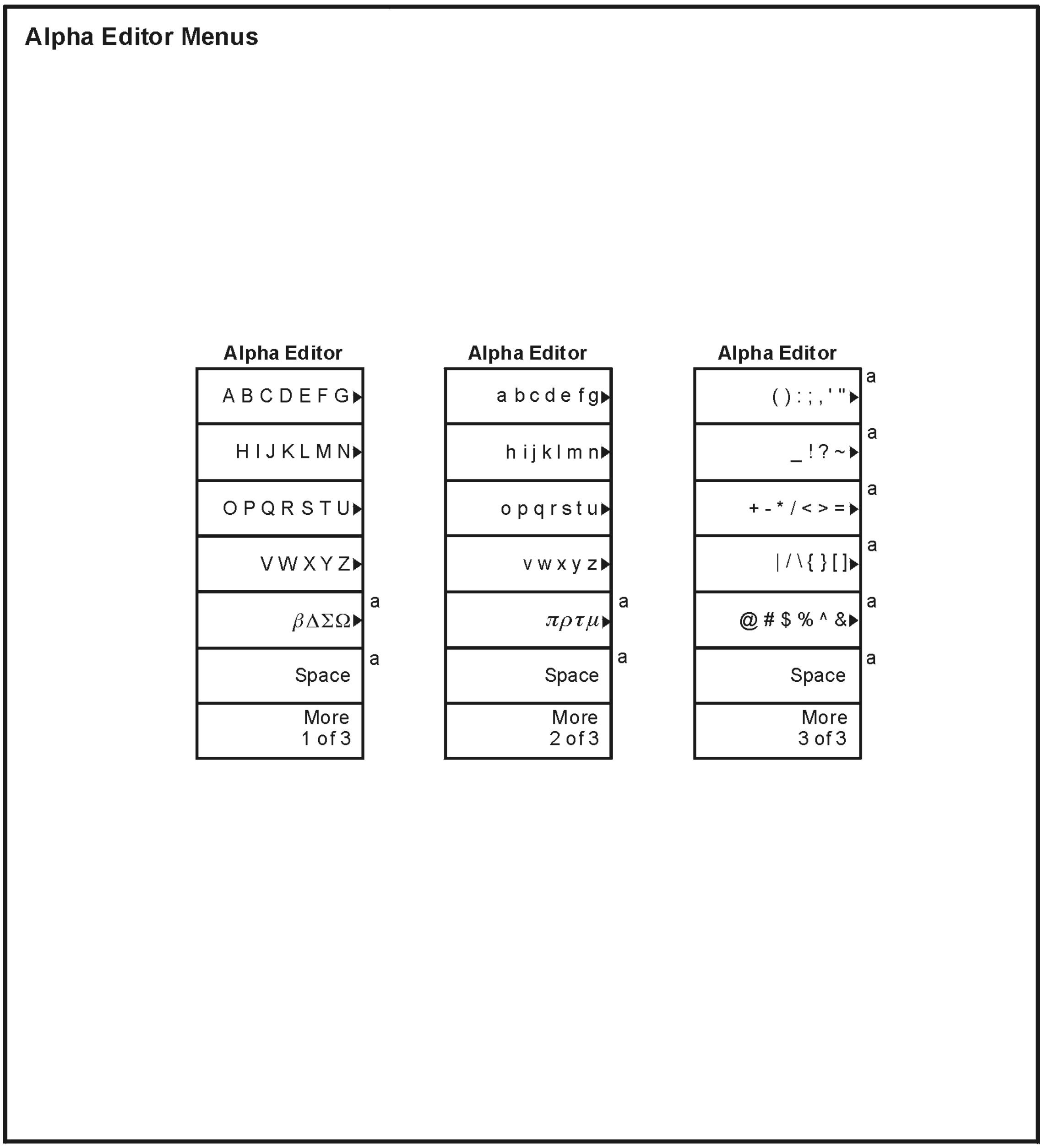
This chapter provides menu maps for the front-panel keys having associated menus. The Alpha Editor Menus are associated with both the **Display** and **File** keys, but they are shown separately. The front-panel key menus appear in alphabetical order as follows:

Table 5-1

Table 5-1

Menus

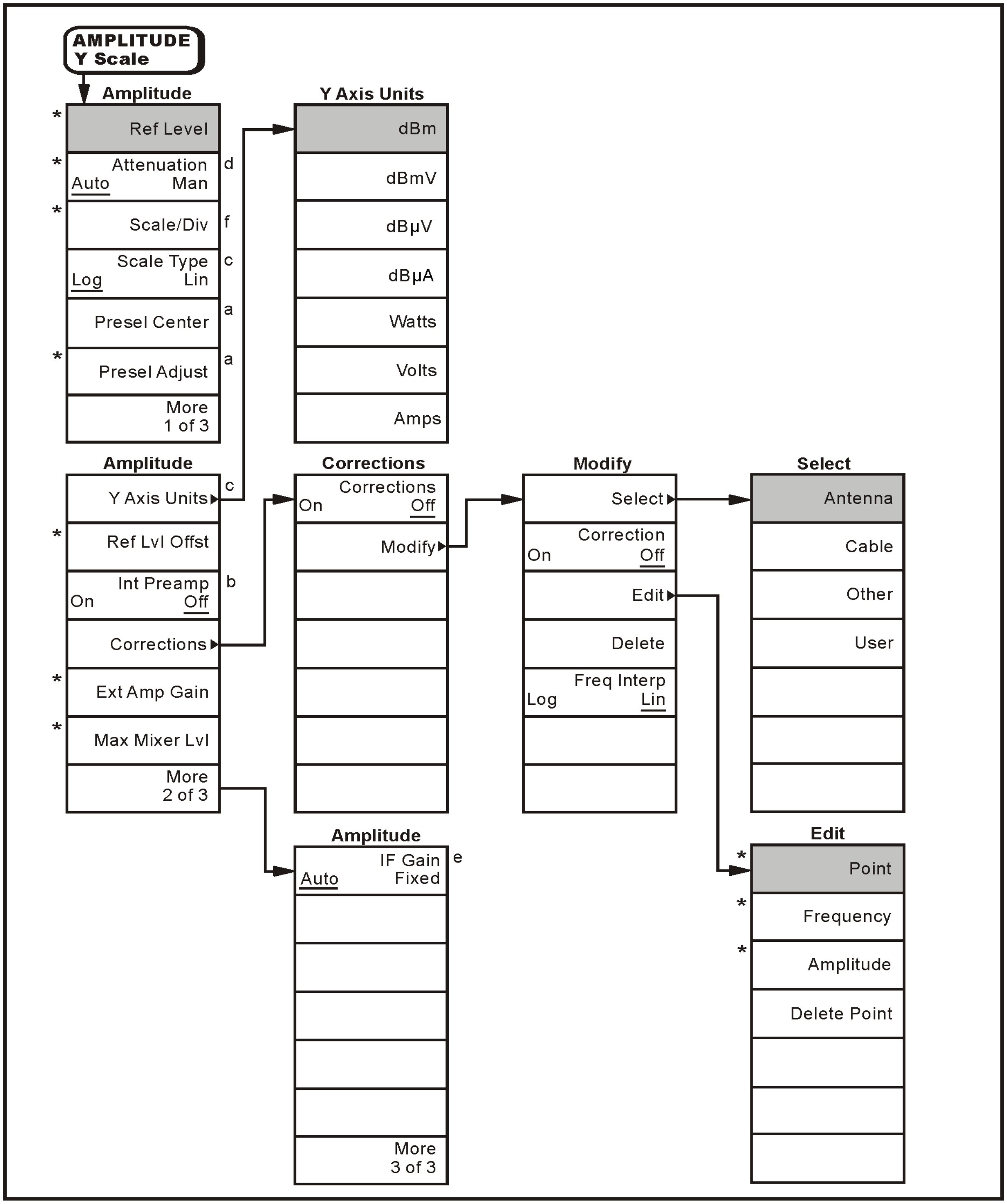
Alpha Editor Menu



a. Not available when entering filenames

pl720

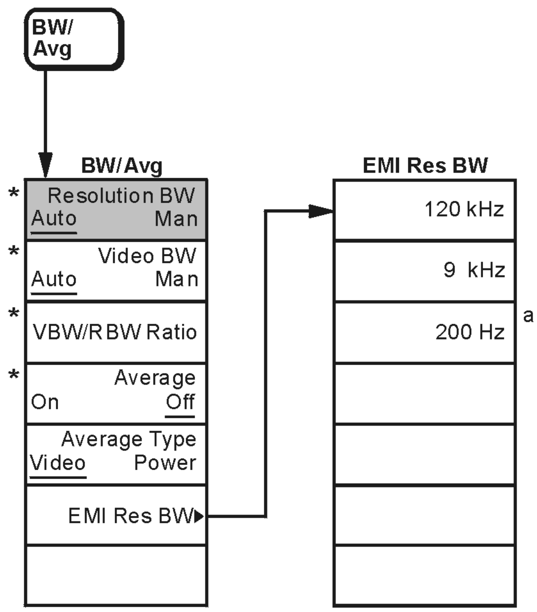
AMPLITUDE Y Scale Menu



a. Agilent E4404B, E4405B, E4407B and E4408B only
b. ESA-E Series only (E4401B, E4402B, E4404B, E4405B and E4407B)
c. Grayed out in FM Demod. **Demod View (On)**
d. Not available in External Mixing Mode (Option AYZ)
e. Available only with Option 1DR (Narrow Resolution Bandwidth) and firmware revision ≥ A.06.00
f. Grayed out when Demod View is accessed through Option 106 (Bluetooth FM Demodulation)
* An active function which allows data entry

pl741b

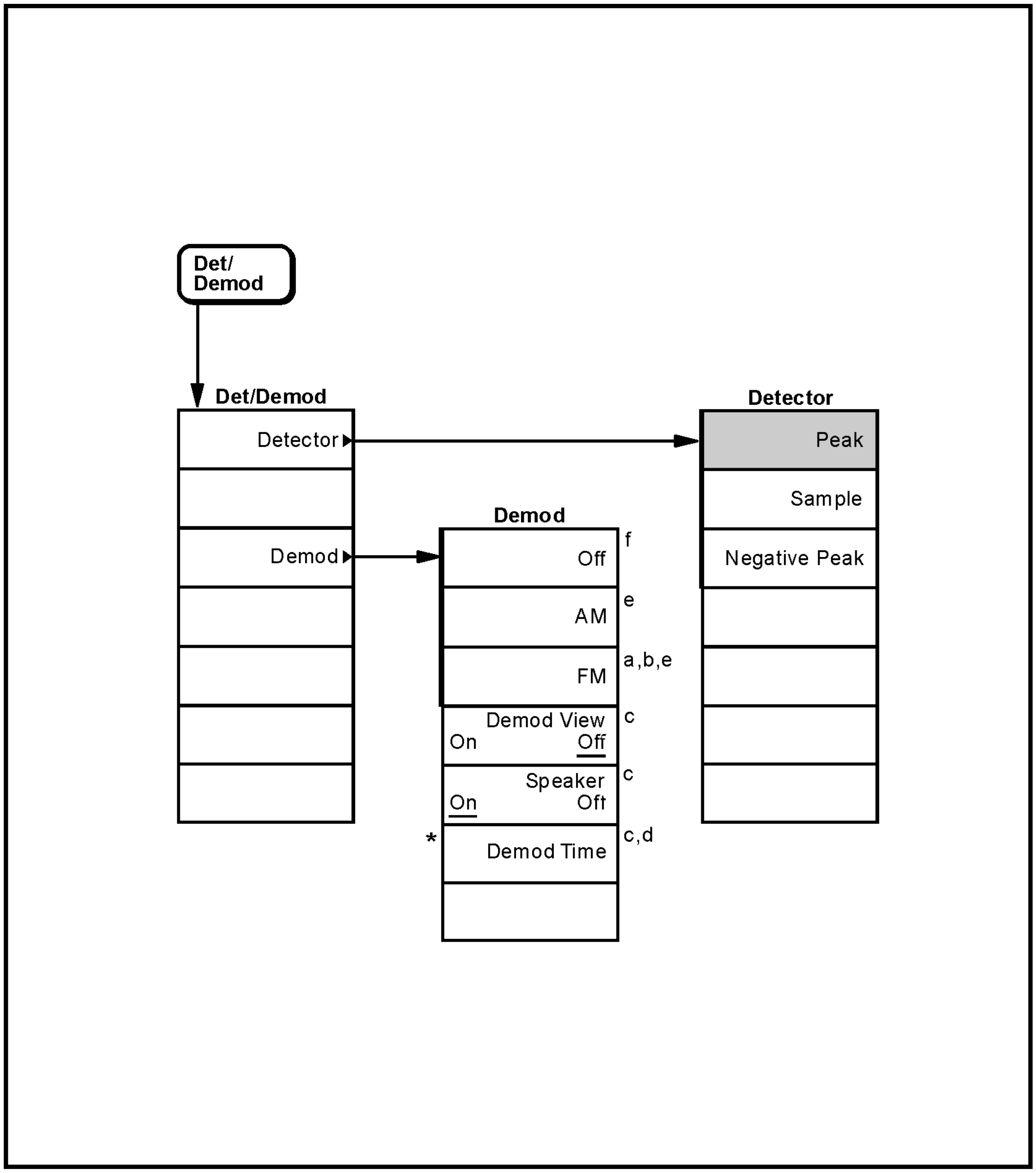
BW/Avg Menu



a. Available only with Option 1DR (narrow resolution bandwidth) and spans < 5MHz
* An active function which allows data entry

pl72

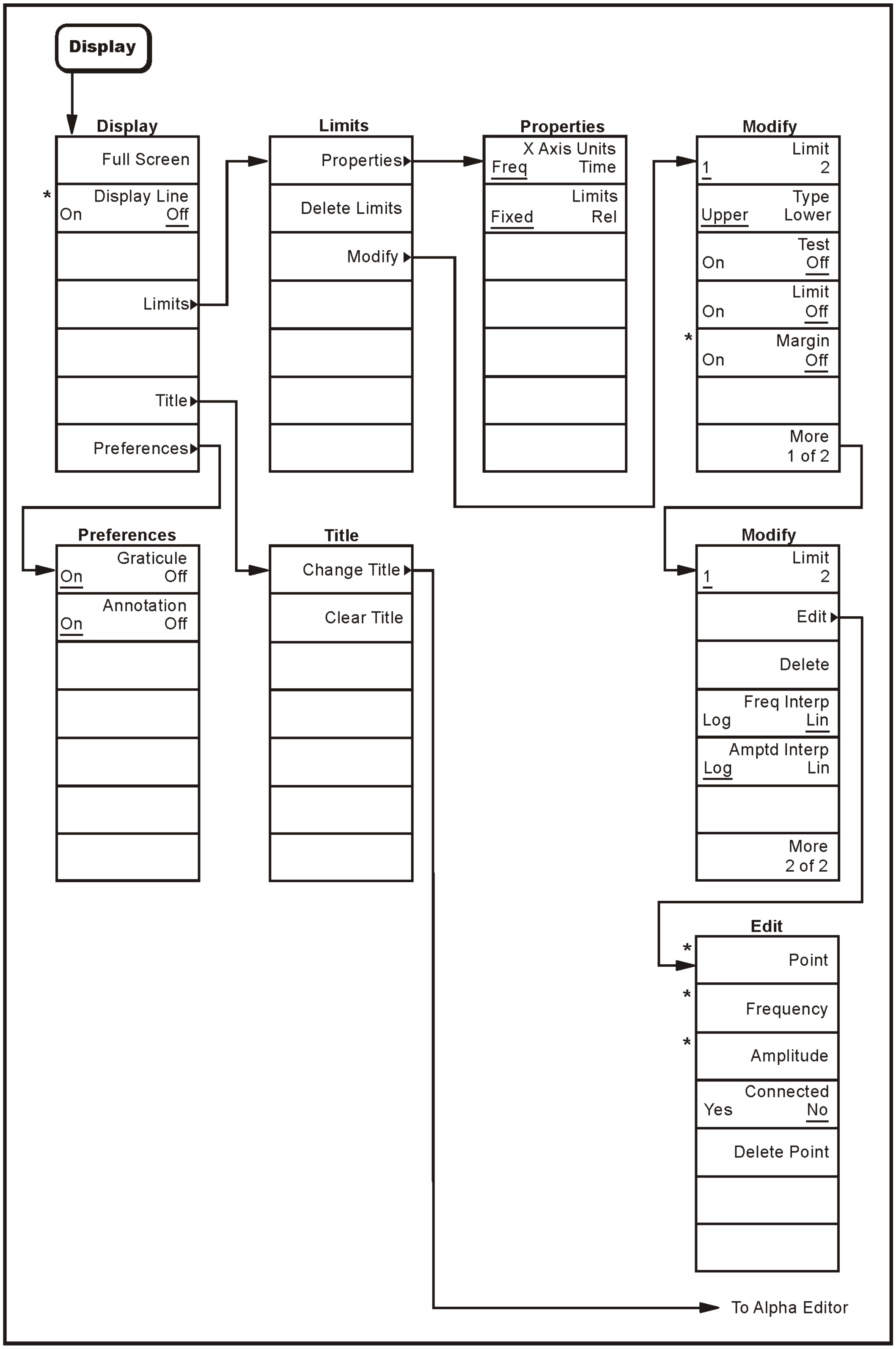
Det/Demod Menu



a. Agilent ESA-E Series only (E4401B, E4402B, E4404B, E4405B and E4407B)
b. Available only with Option BAA (FM Demod) or Option 106 (Bluetooth FM Demodulation)
c. Grayed out unless **AM** or **FM Demod** is on
d. Grayed out when span = 0 Hz
e. Turns the speaker on
f. Turns the speaker off
* An active function which allows data entry

pl73

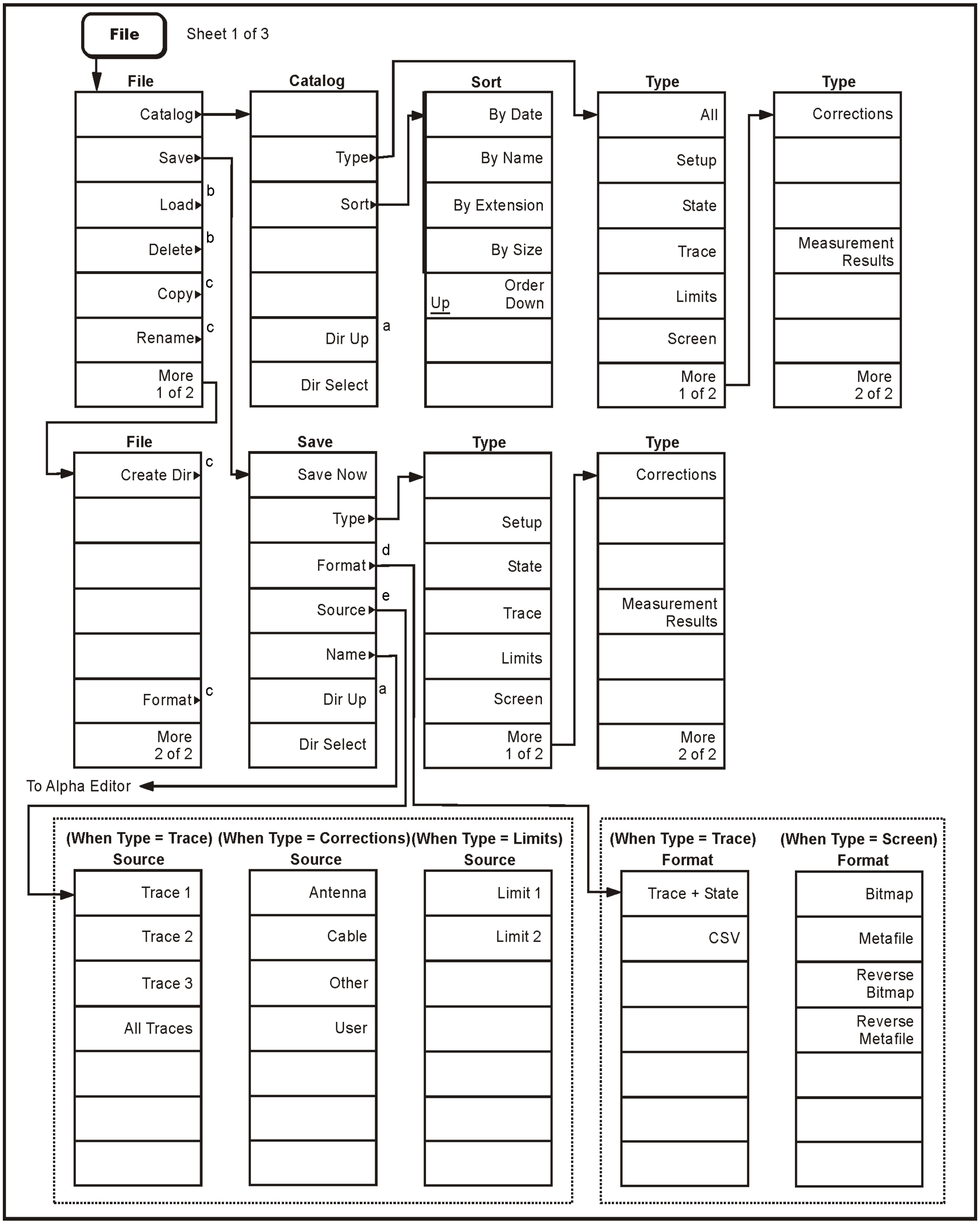
Display Menu



* An active function which allows data entry

pl74

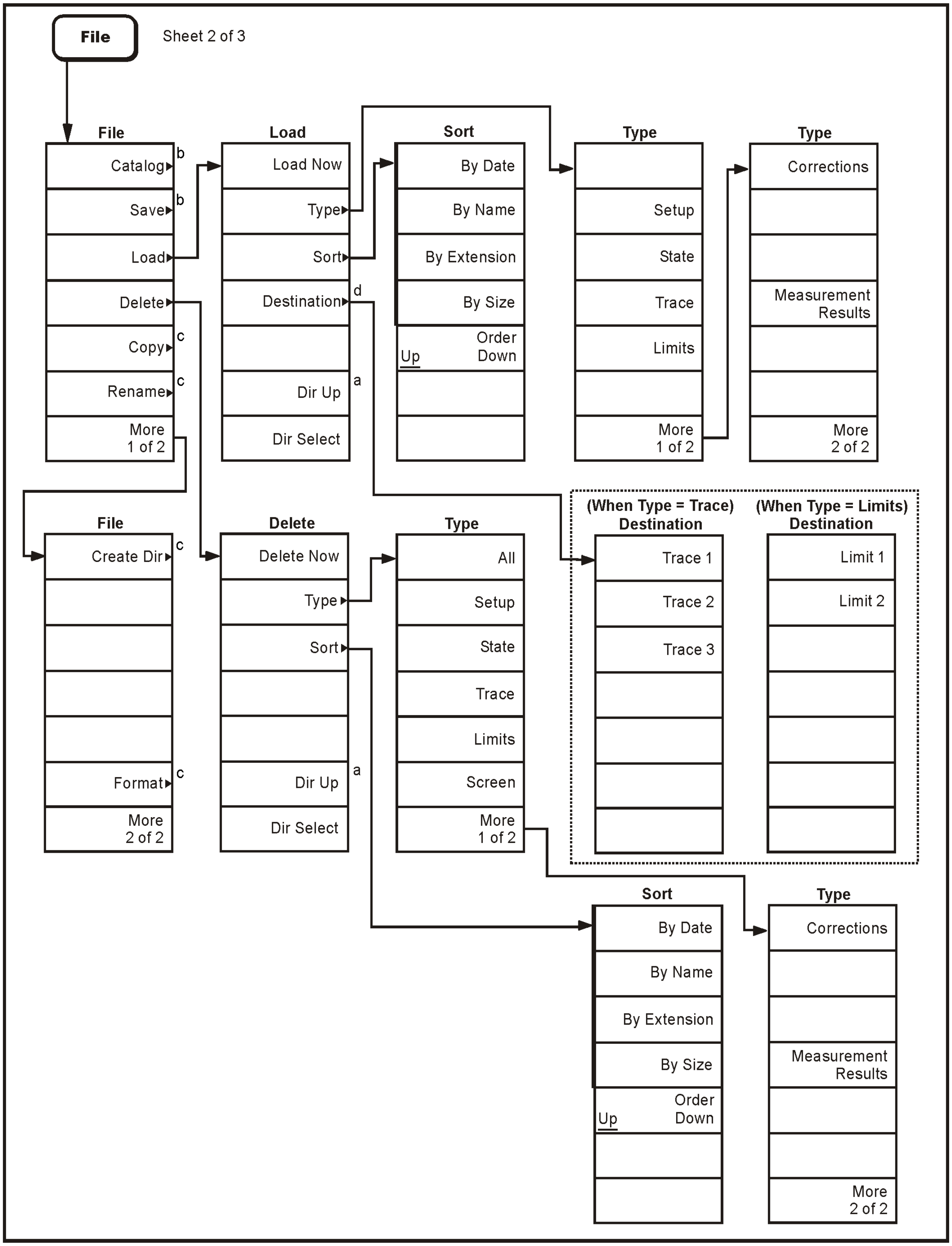
File Menus (1 of 3)



a. Grayed out if no directory selected.
b. Continued on sheet 1 of 3.
c. Continued on sheet 3 of 3.
d. Available only when **Type** is set to **Trace** or **Screen**.
e. Available only when **Type** is set to **Trace**, **Limits**, or **Corrections**.

pl71d

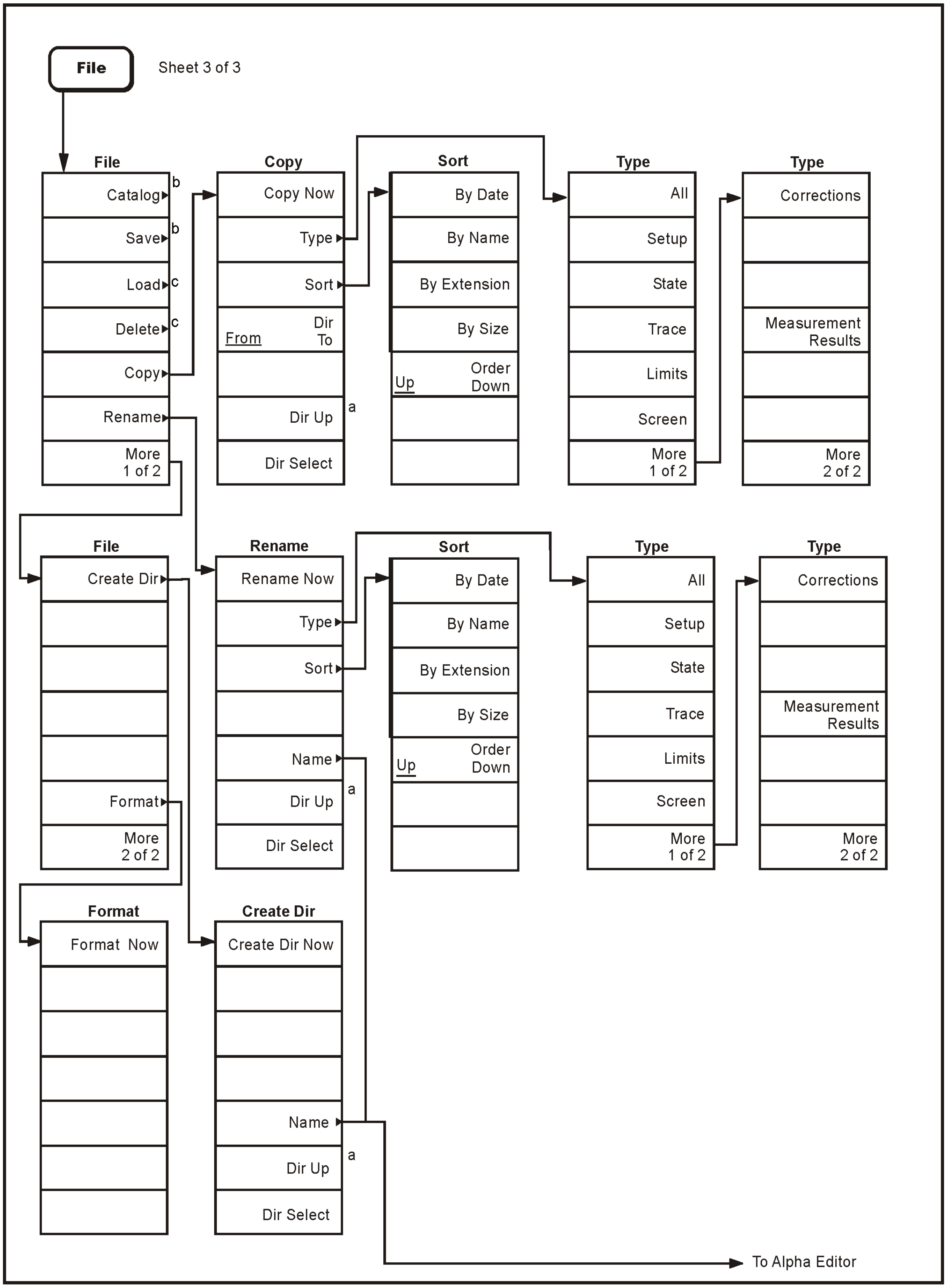
File Menus (2 of 3)



a. Grayed out if no directory selected.
b. See sheet 1 of 3.
c. Continued on sheet 3 of 3.
d. Only available when **Type** is set to **Trace** or **Limits**.

pl73d

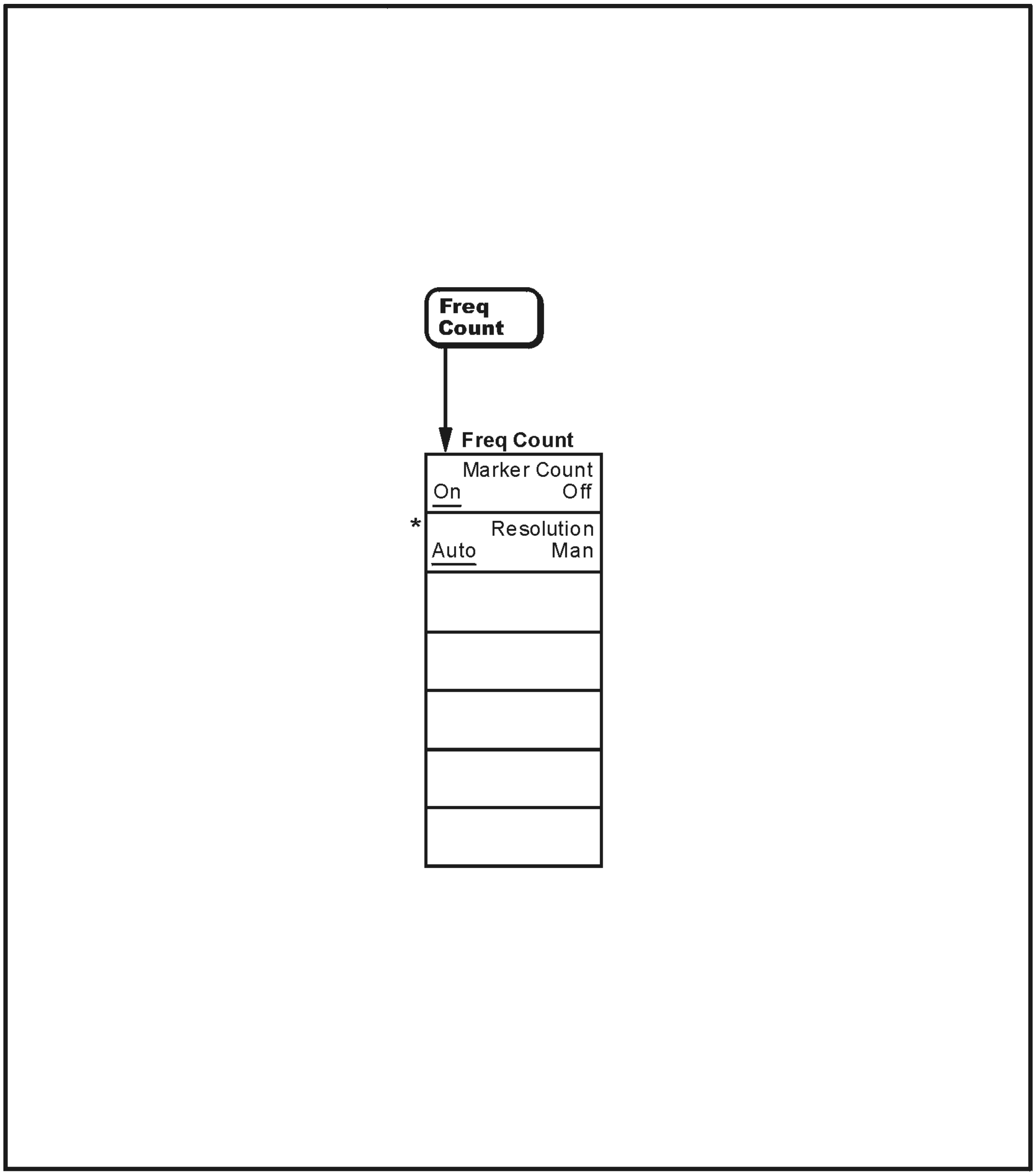
File Menus (3 of 3)



a. Grayed out if no directory selected
b. See sheet 1 of 3
c. Continued on sheet 2 of 3

pl72d

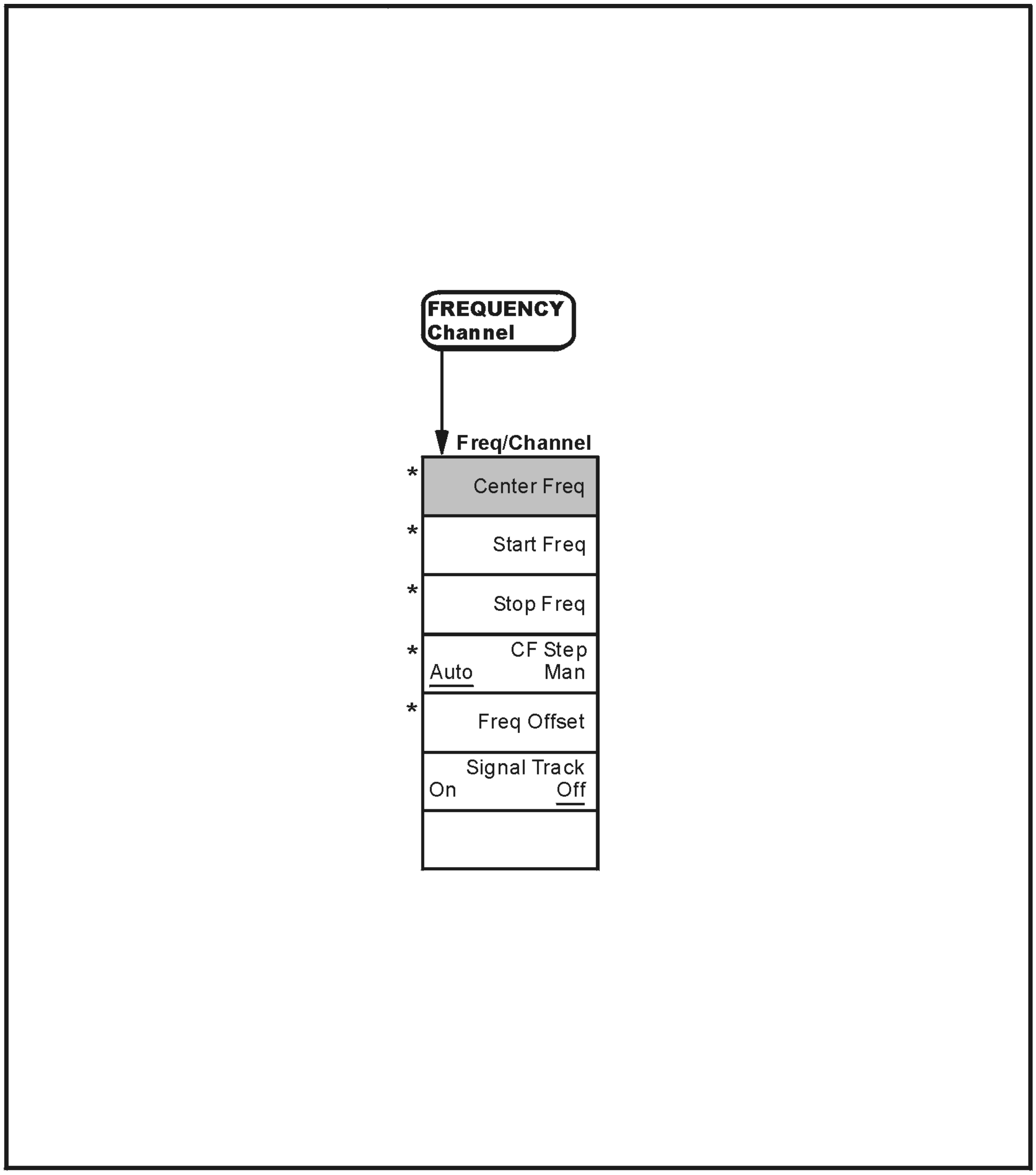
Freq Count (Marker) Menu



* An active function which allows data entry

pl76

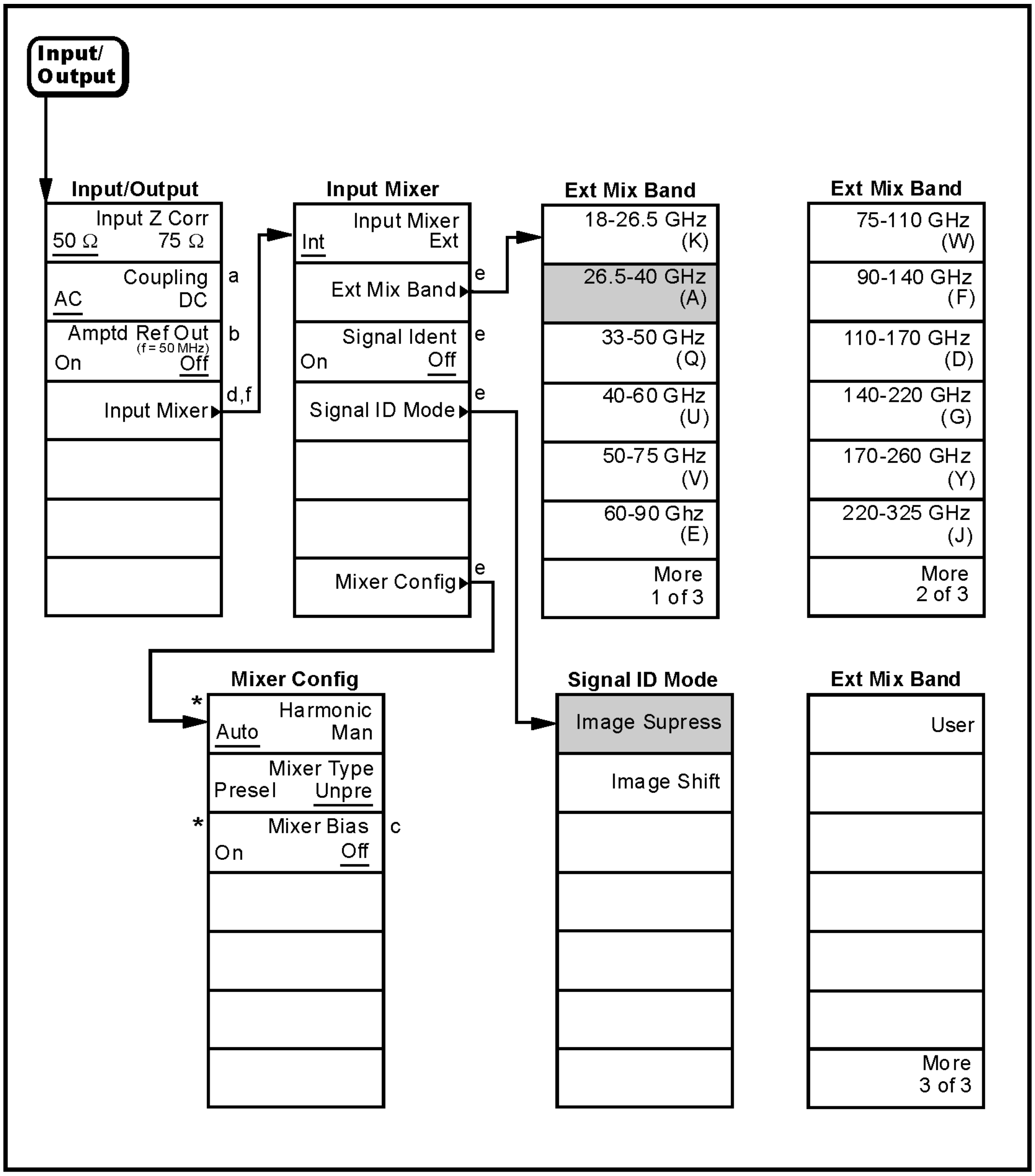
FREQUENCY Channel Menu



* An active function which allows data entry

pl77

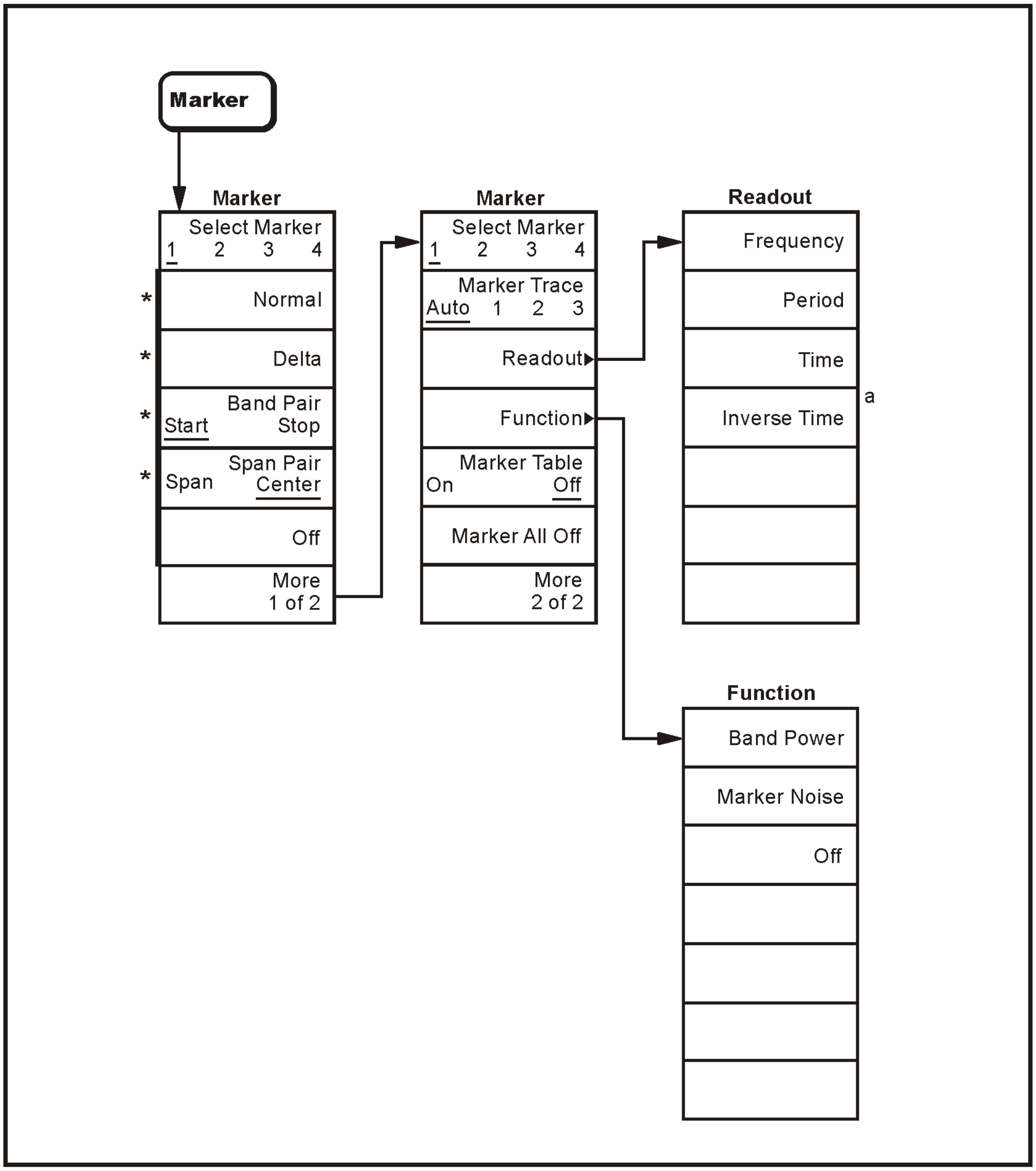
Input/Output Menu



a. Agilent E4402B or E4407B with Option UKB, E4404B, and E4405B only
b. Key label is **Amptd Ref** for E4401B and E4411B
c. Grayed out if **Mixer Type** is **Presel**
d. E4407B Option AYZ (External Mixing) only
e. Grayed out if **Input Mixer** is **Int**
f. Grayed out if the Tracking Generator is on
(**Source, Amplitude (On)**) or **Internal Preamp (On)**
is selected.
* An active function which allows data entry

pl729b

Marker Menu

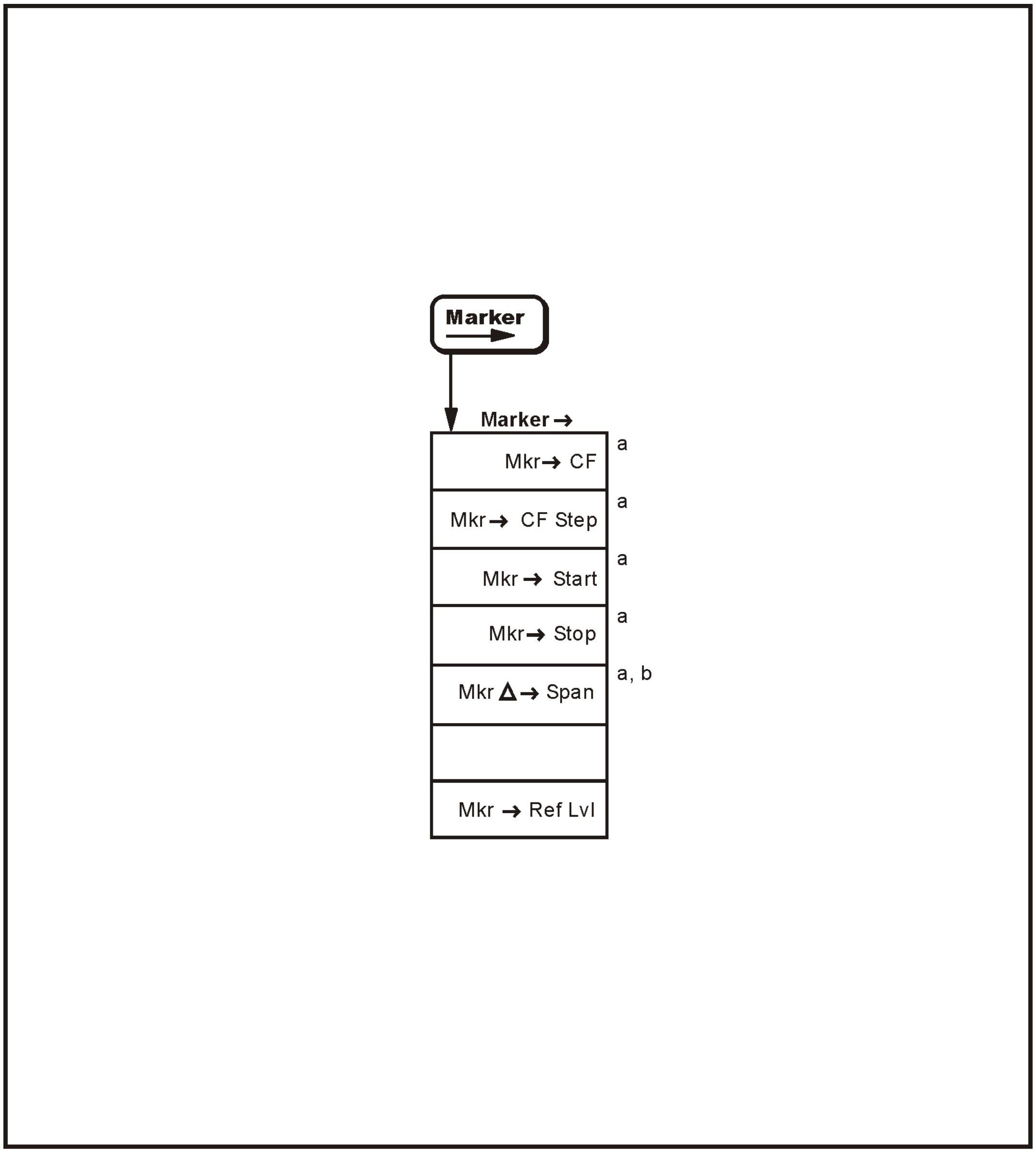


* An active function which allows data entry

a. Available in zero span with **Marker Delta** active.

pb940a

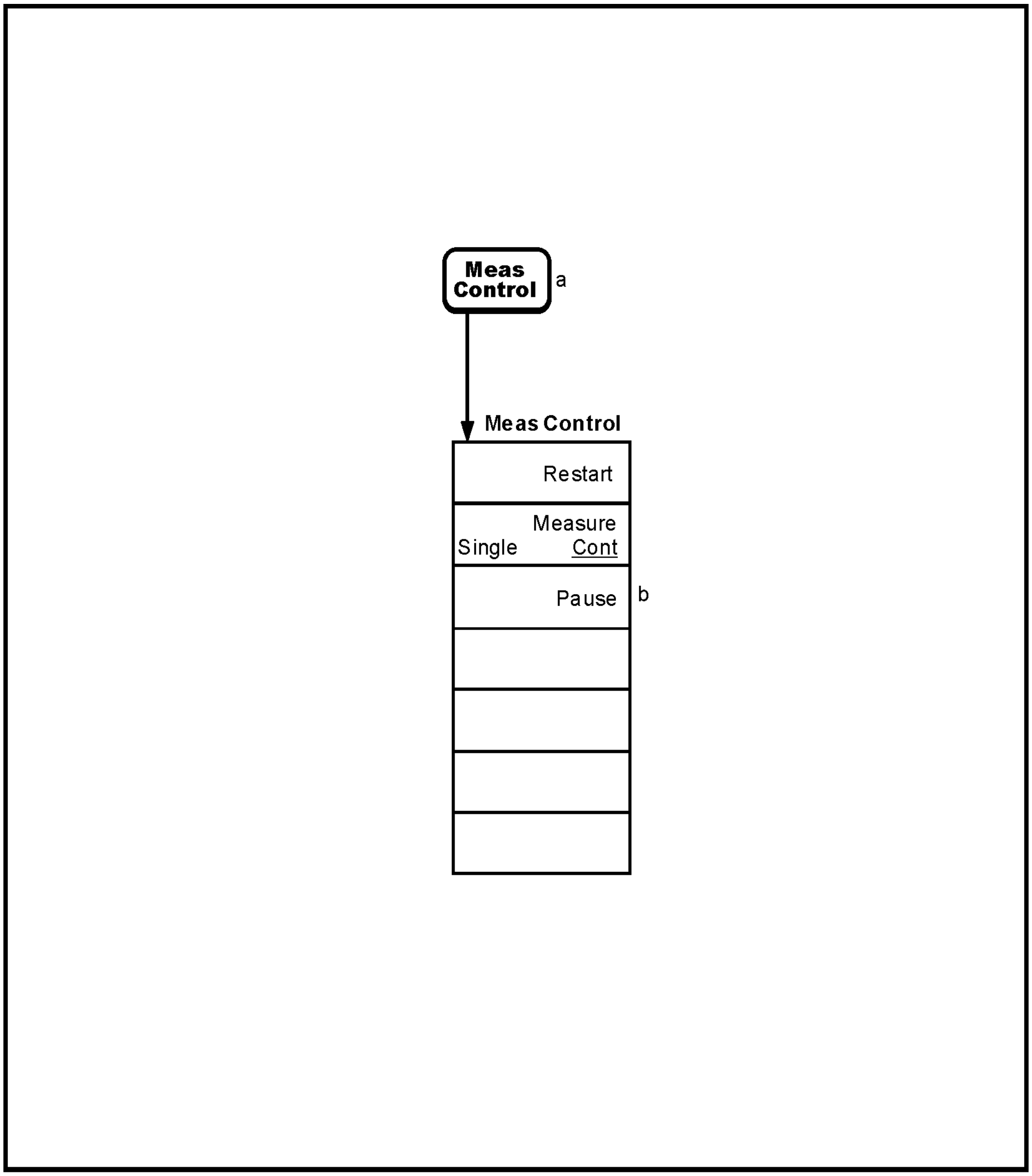
Marker → Menu



a. Not active when **span** is set to zero (Zero Span)
b. Active only when **Marker**, **Delta** is selected.

pb910a

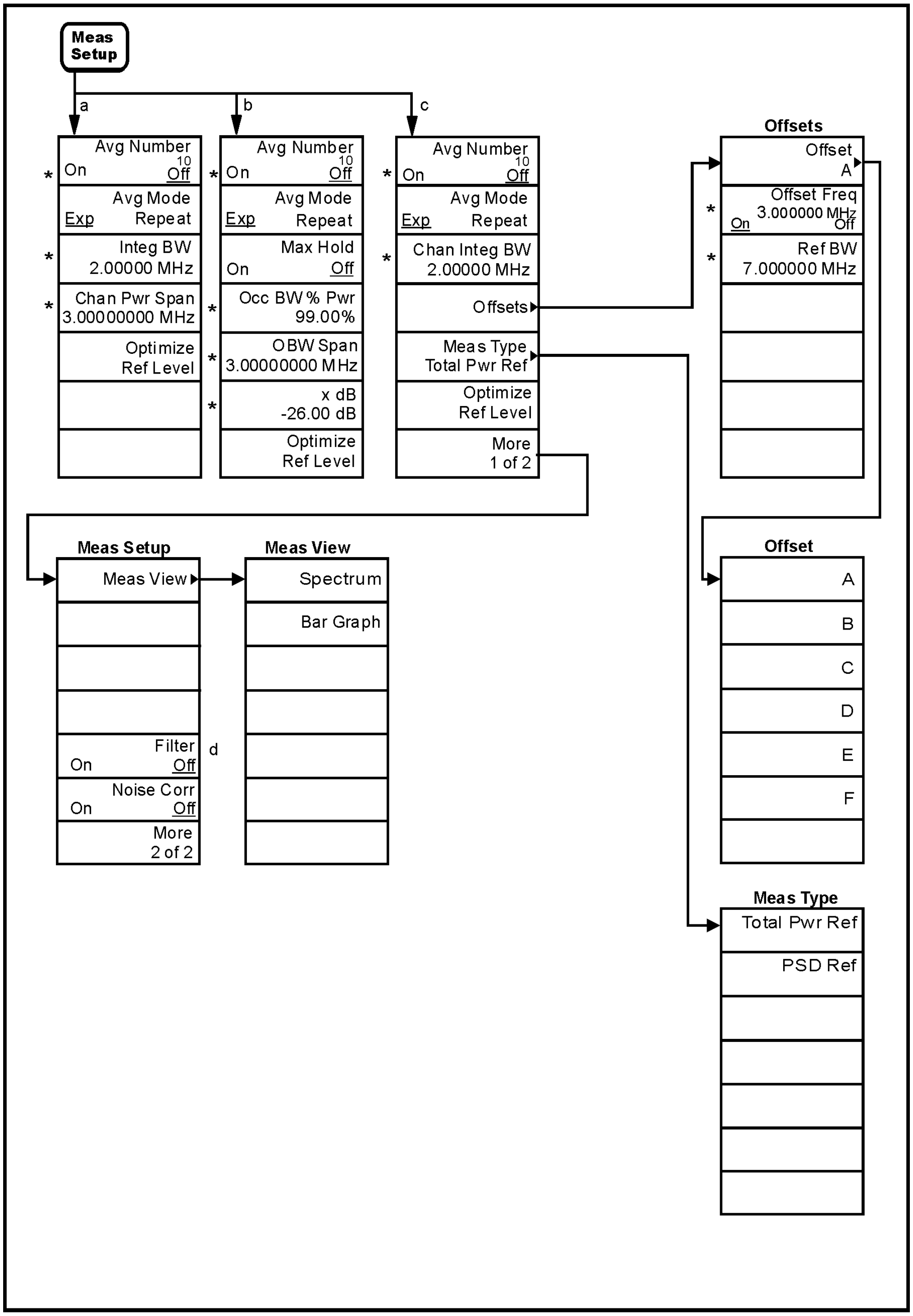
Meas Control Menu



a. Appears only when **Channel Power**, **Occupied BW**, **ACP**, **Power Stat CCDF**, **Harmonic Distortion**, or **Bursted Power** is selected in the **Measure** menu.
b. Displays "Resume" if the measurement is paused.

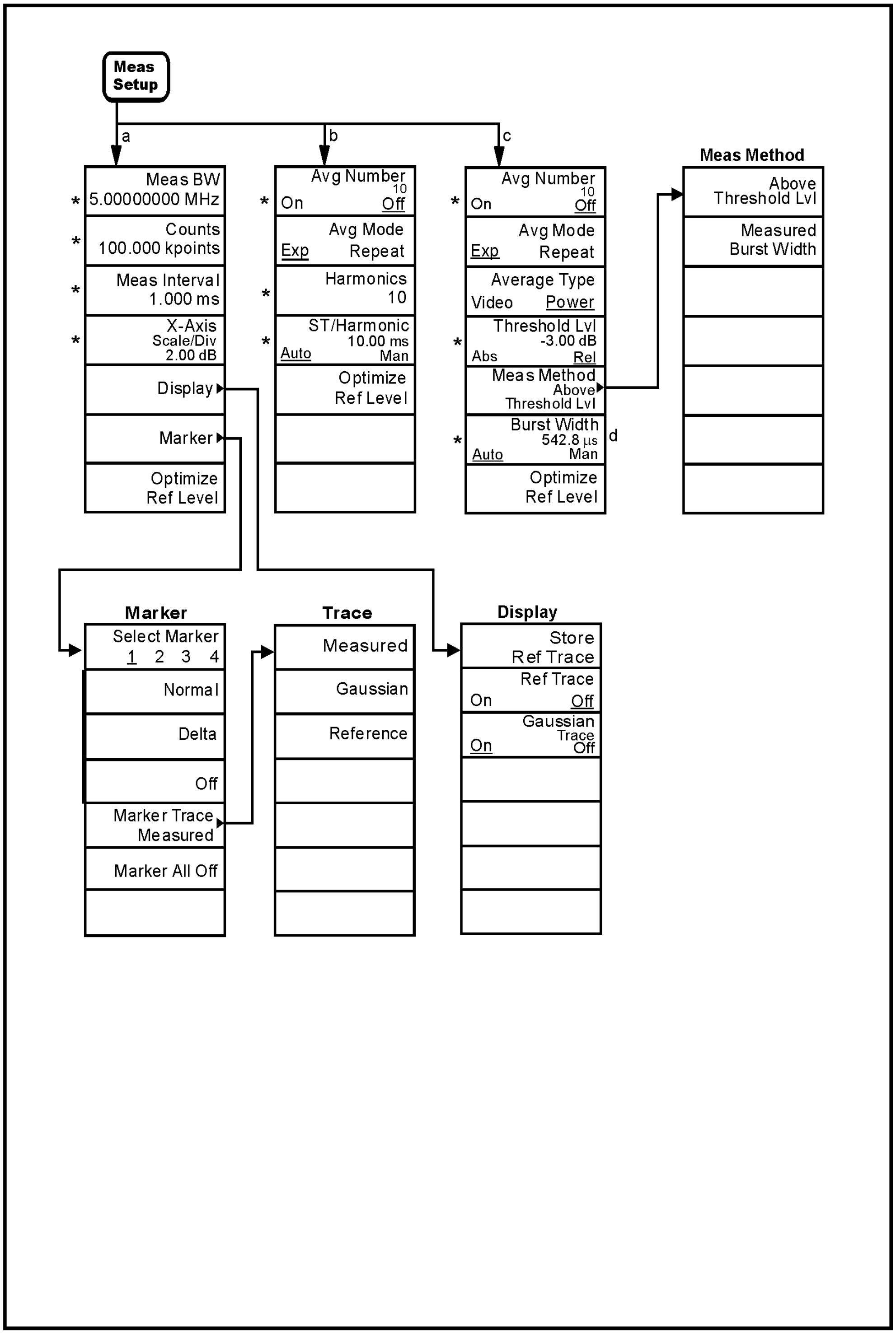
pn82a

Meas Setup Menu for Channel Power, Occupied BW, and ACP



a. Appears only when **Channel Power** is selected in the **Measure** menu.
b. Appears only when **Occupied BW** is selected in the **Measure** menu.
c. Appears only when **ACP** is selected in the **Measure** menu.
d. Always grayed out except when **Radio Std**, **NADC** or **Radio Std**, **W-CDMA 3GPP** is selected.
* An active function which allows data entry

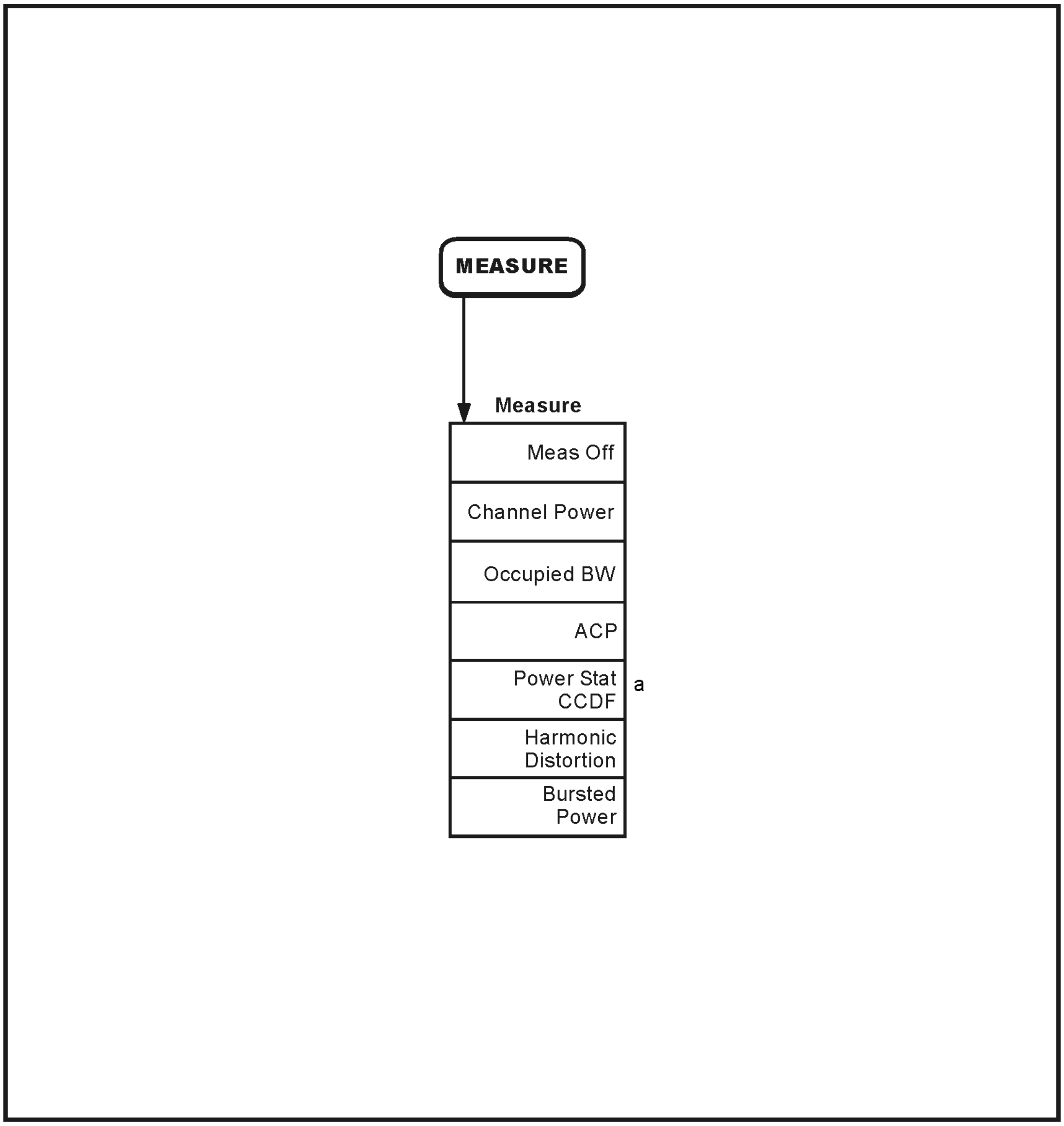
Meas Setup Menu for Power Stat CCDF, Harmonic Distortion, and Bursted Power



a. Appears only when **Power Stat CCDF** is selected in the **Measure** menu.
b. Appears only when **Harmonic Dist** is selected in the **Measure** menu.
c. Appears only when **Bursted Power** is selected in the **Measure** menu.
d. Greyed out when **Meas Method**, **Above Threshold Lvl** is selected.
* An active function which allows data entry.

pn86a

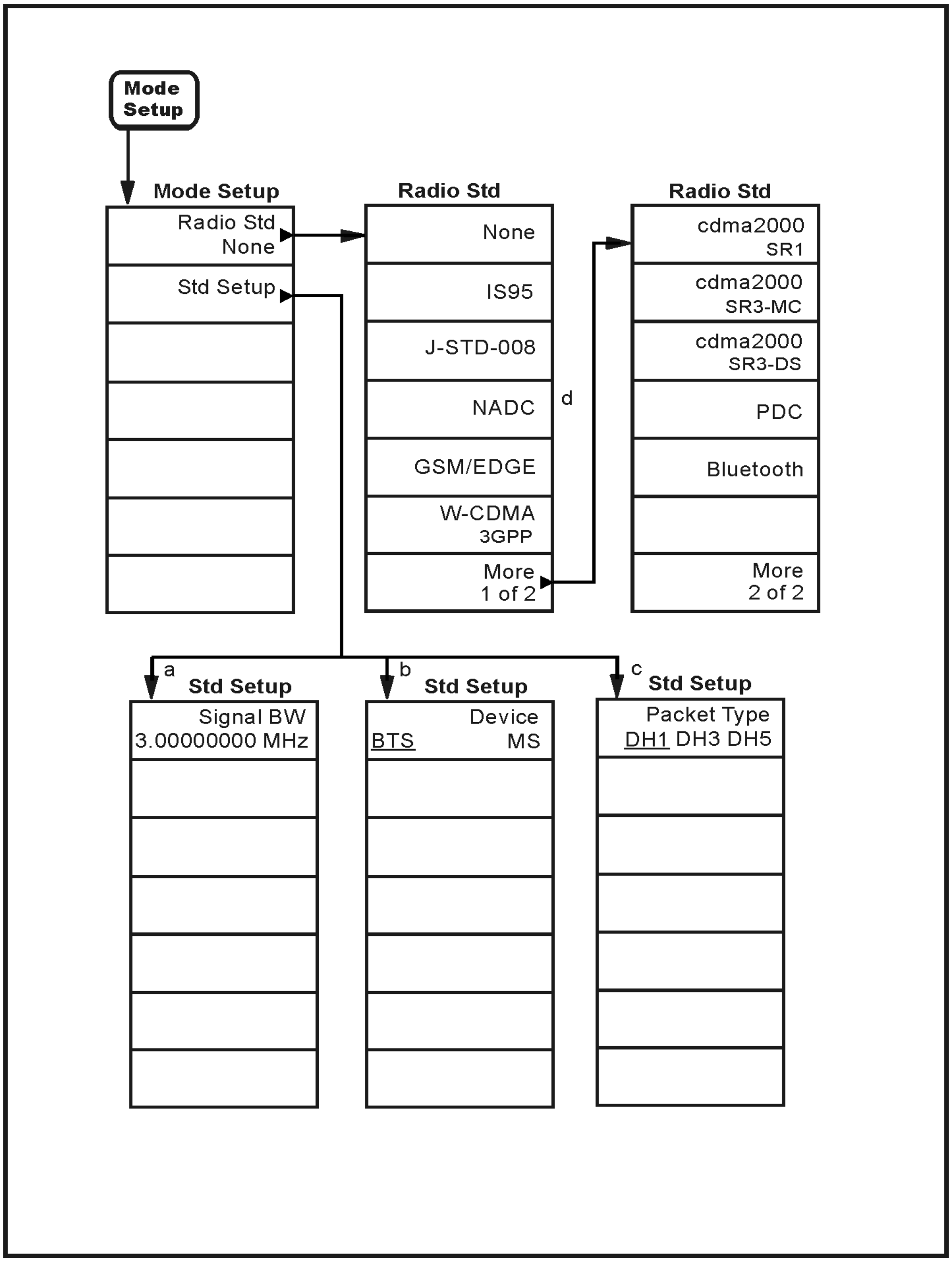
MEASURE Menu



a. Option AYX (Fast Digitized Time Domain Sweeps) or Option B7D (Digital Signal Processing and Fast ADC) is required to ensure measurement accuracy.

pn81a

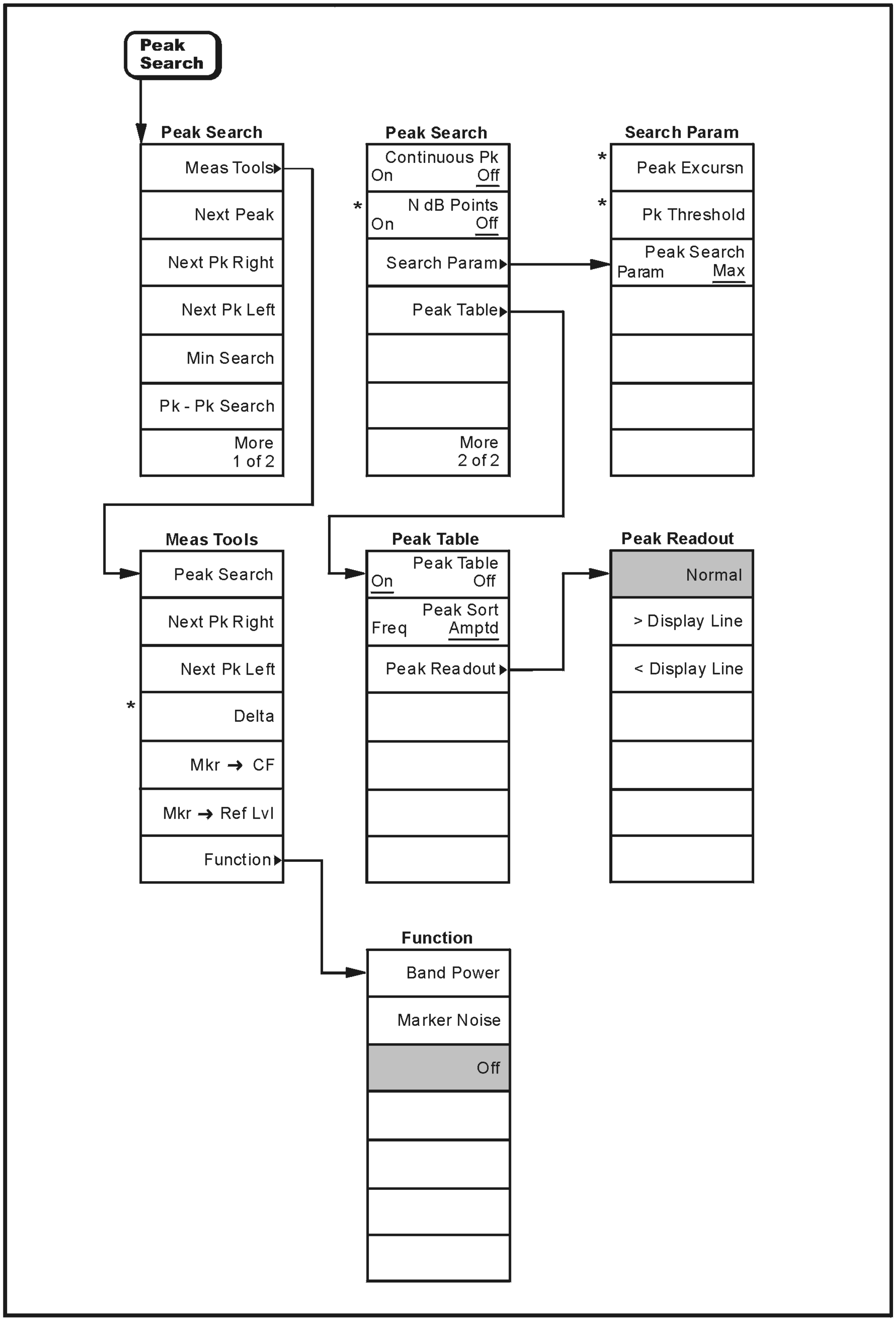
Mode Setup Menu



a. After selecting **Radio Std**, **None**, **Std Setup**, this menu appears.
b. After selecting **Std Setup**, this menu appears for the following radio standards: IS95, J-STD-008, cdma2000, W-CDMA, NADC, PDC, or GSM.
c. After selecting **Std Setup** this menu appears for the Bluetooth radio standard.
d. Option AYX (Fast Digitized Time Domain Sweeps) or Option B7D (Digital Signal Processing and Fast ADC) is required to measure ACP when this standard is selected.

pn84a

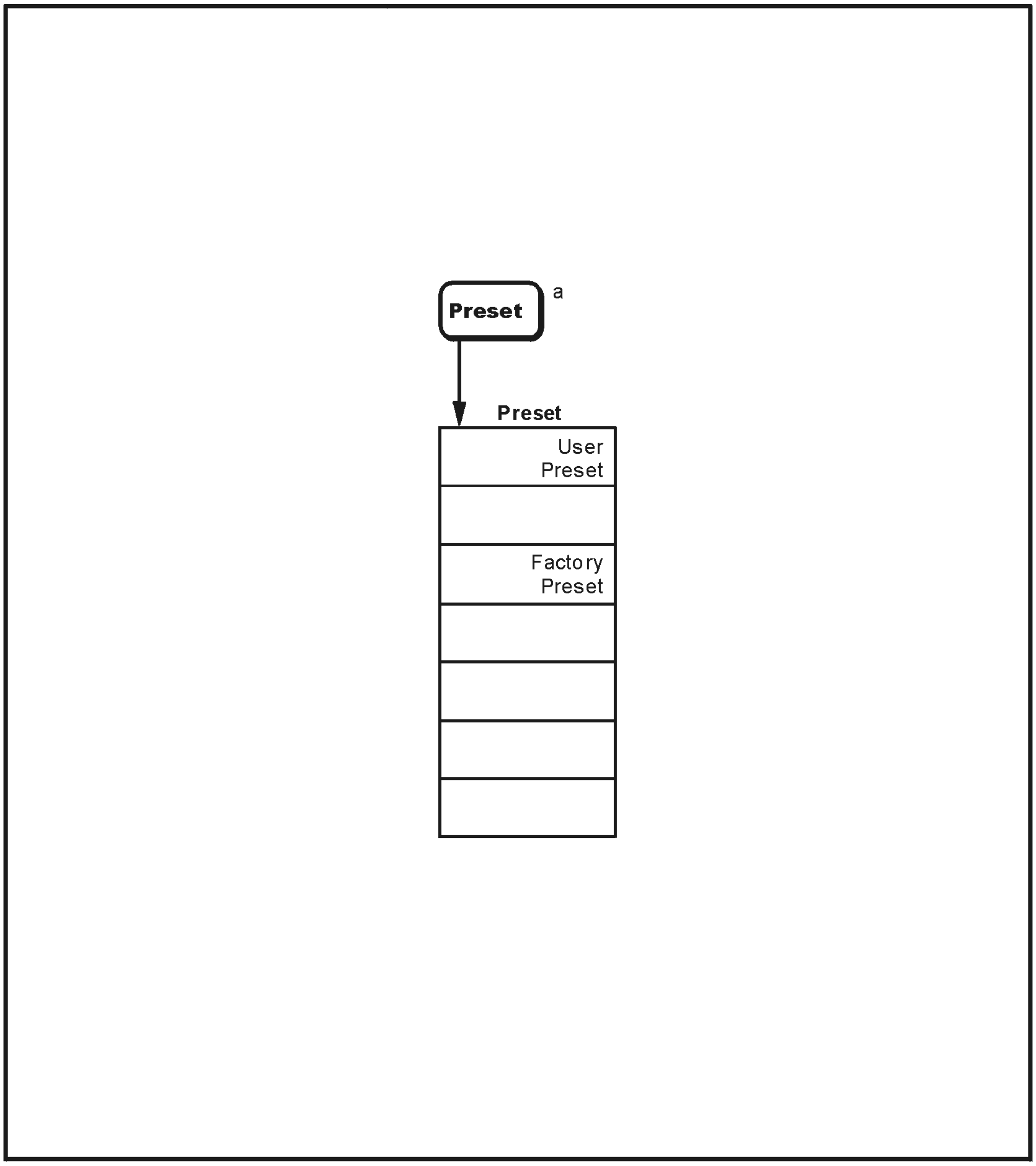
Peak Search Menu



* An active function which allows data entry

pl712

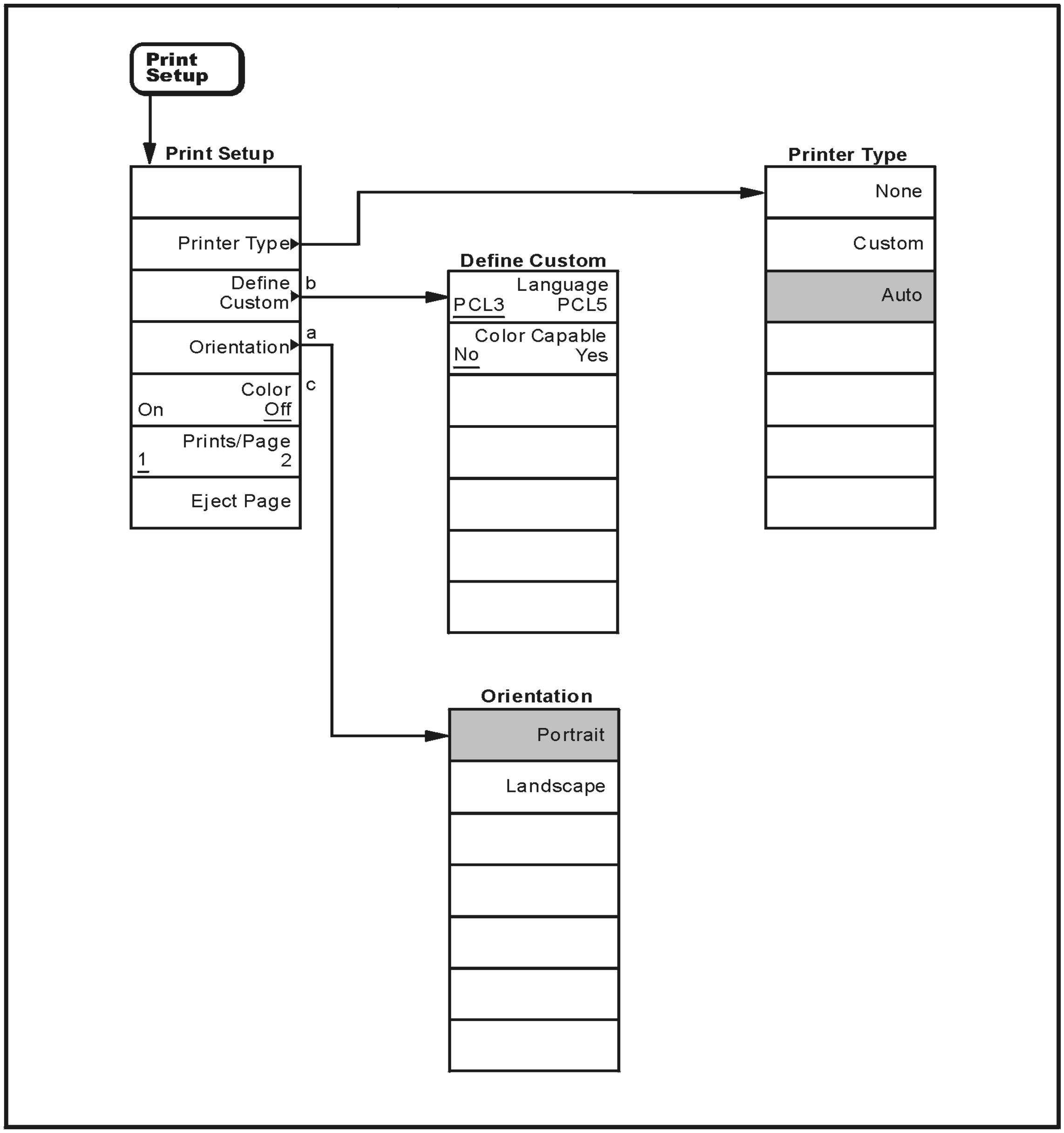
Preset Menu



a. Appears only when Preset is set to User in the **System, Power On/Preset** menu, otherwise **Preset** performs a **Factory Preset**.

pl74d

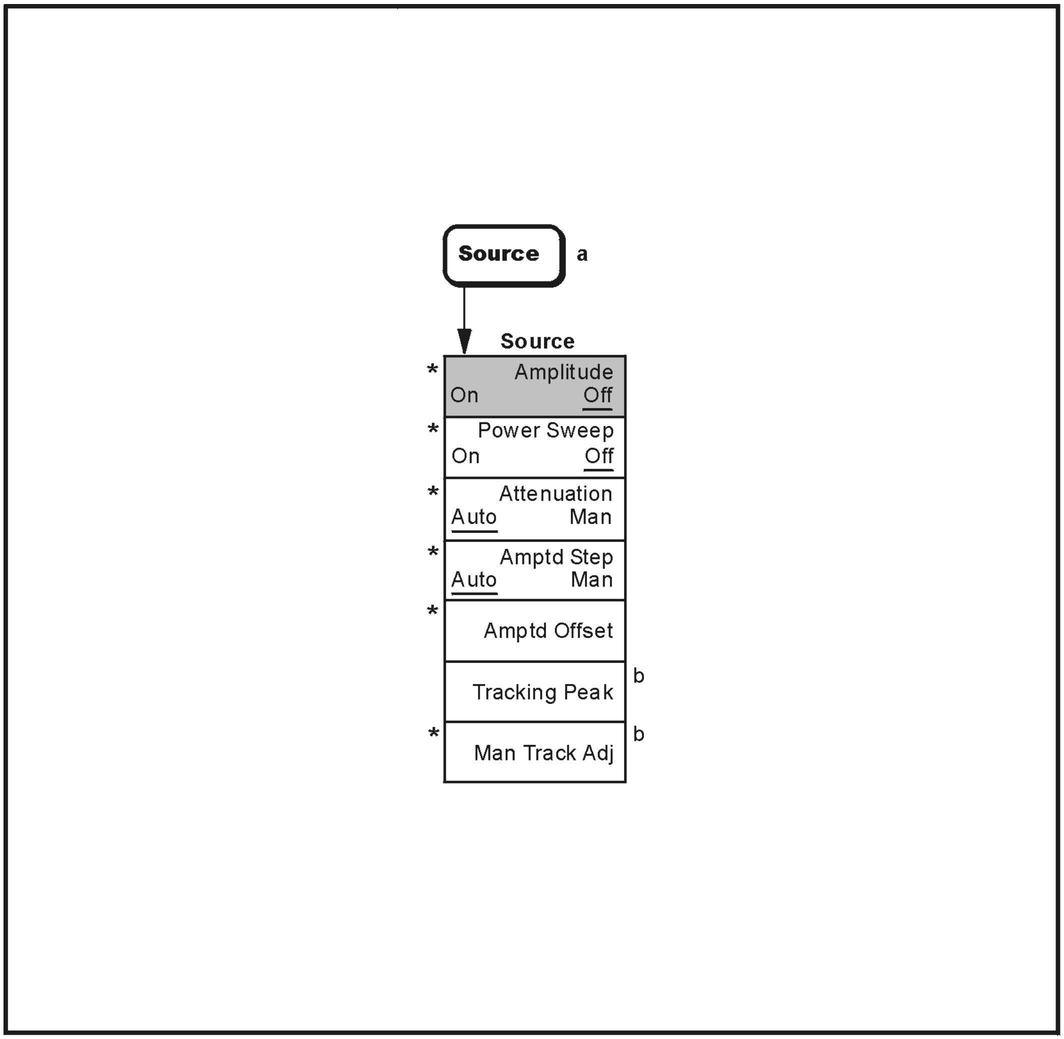
Print Setup Menu



a. Available only with PCL5 printers.
b. Grayed out unless **Custom** is selected in the **Printer Type** menu.
c. Available only with color printers.

pl717

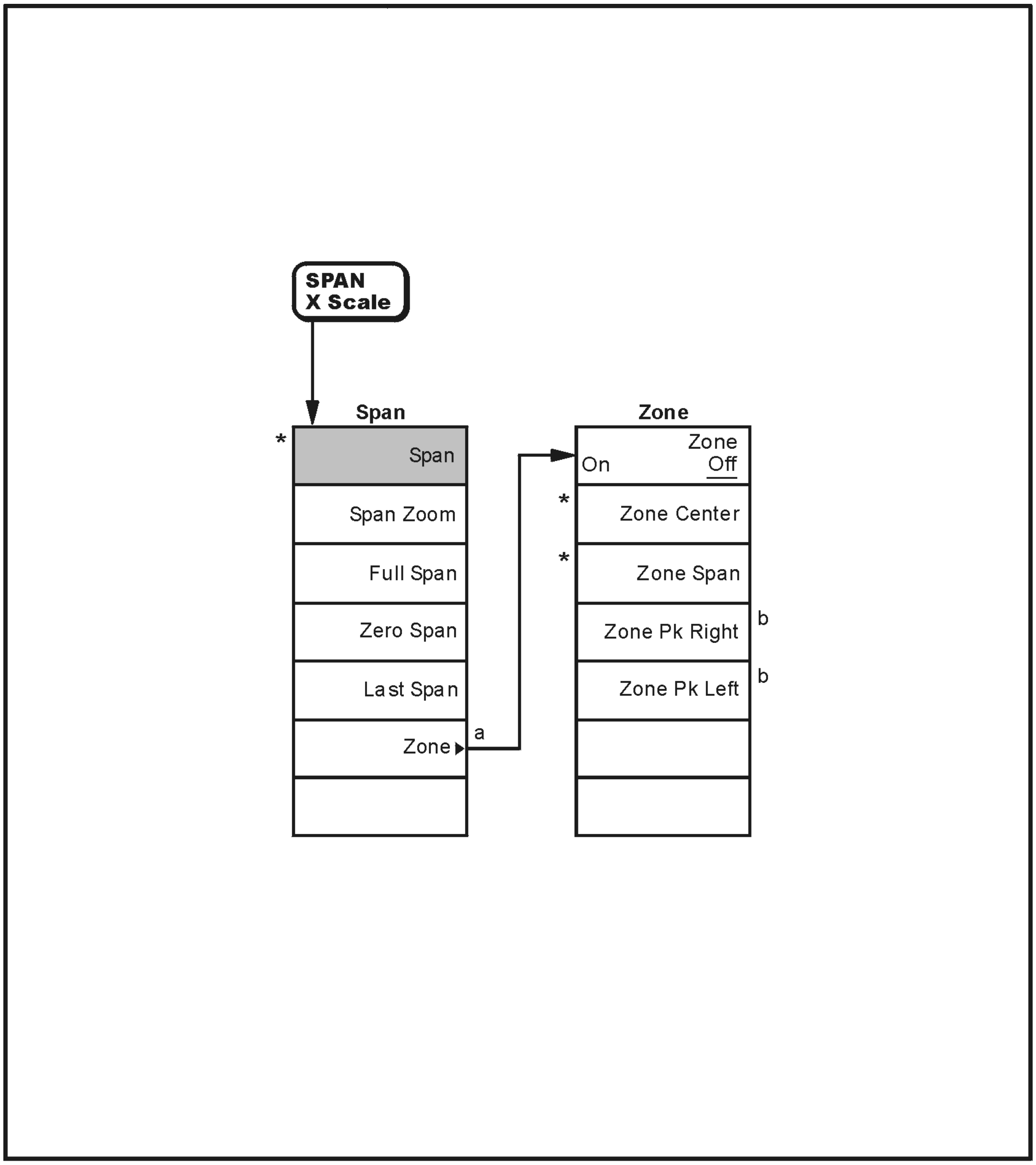
Source Menu



a. Source menu available only with Option 1DN or Option 1DQ installed
b. Agilent E4402B, E4403B, E4404B, E4405B, E4407B and E4408B only
* An active function which allows data entry

pl713

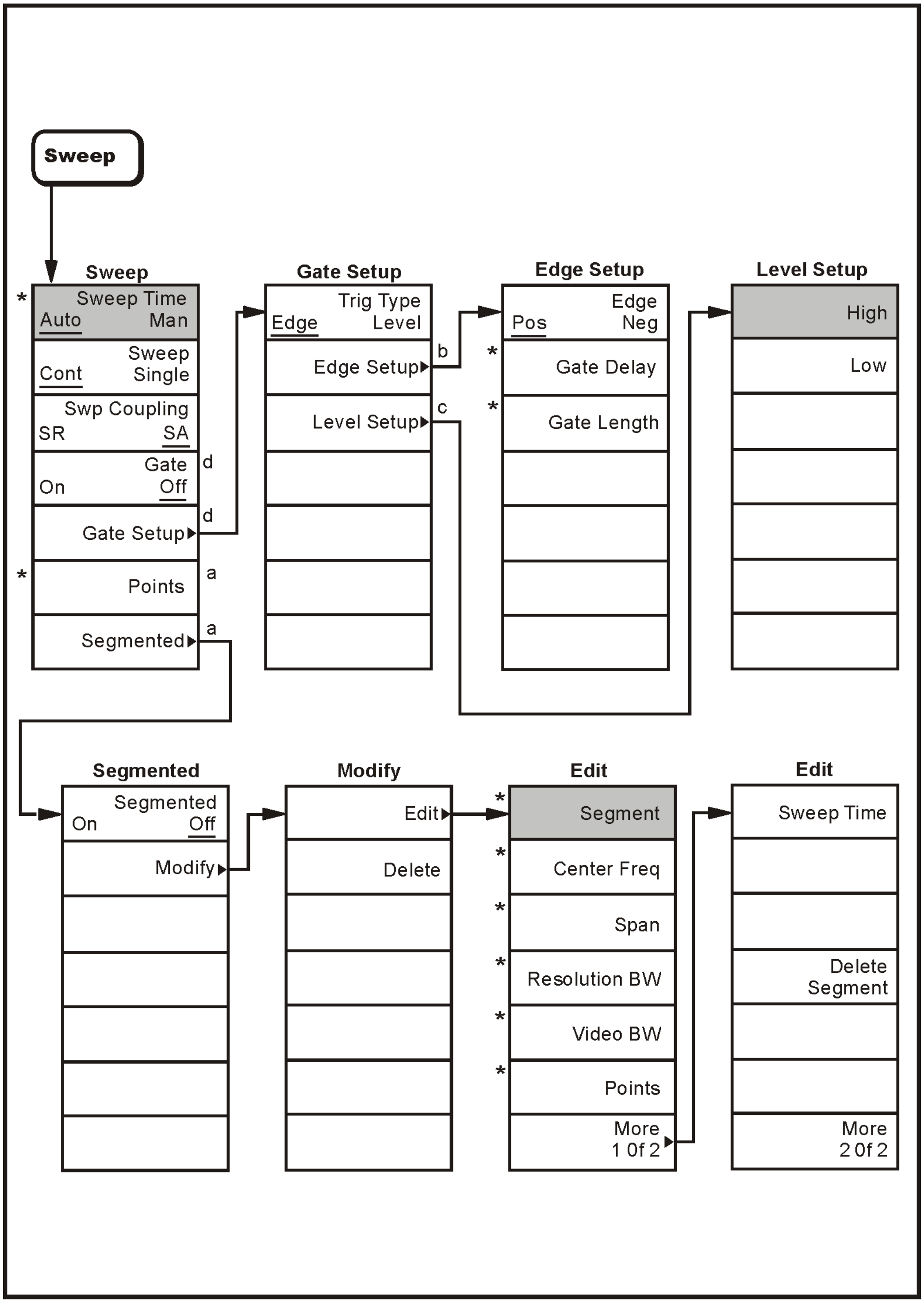
SPAN (X Scale) Menu



a. Agilent ESA E-Series only (E4401B, E4402B, E4404B, E4405B and E4407B)
b. Available only when the upper window is active
* An active function which allows data entry

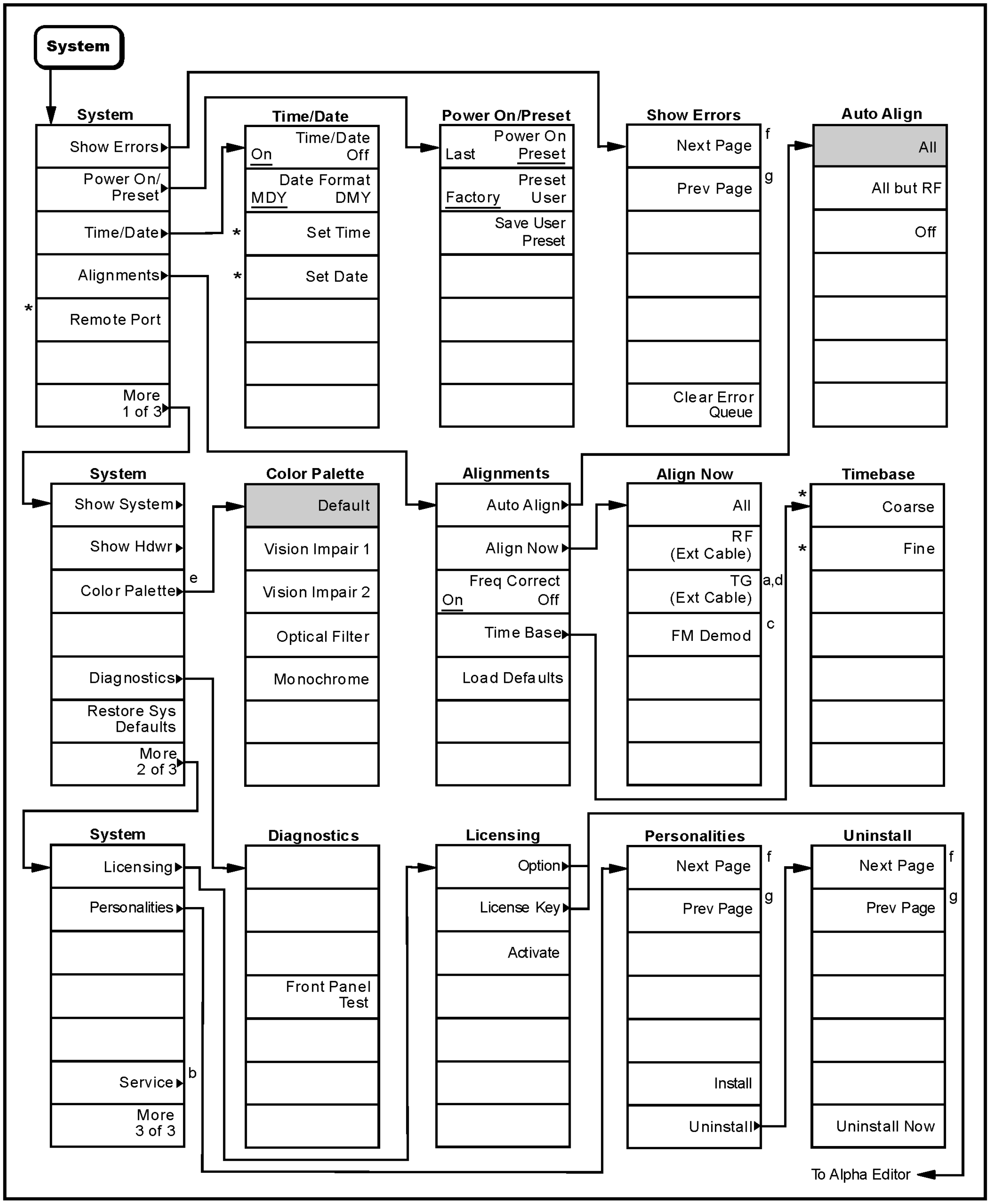
pl714

Sweep Menu



a. Agilent ESA-E Series only (E4401B, E4402B, E4404B, E4405B and E4407B)
b. Grayed out unless Edge is selected as Trig Type
c. Grayed out unless Level is selected as Trig Type
d. Agilent ESA - E Series only with Option 1D6 (Time Gated Spectrum Analysis) (E4401B E4402B, E4404B, E4405B and E4407B)
* An active function which allows data entry

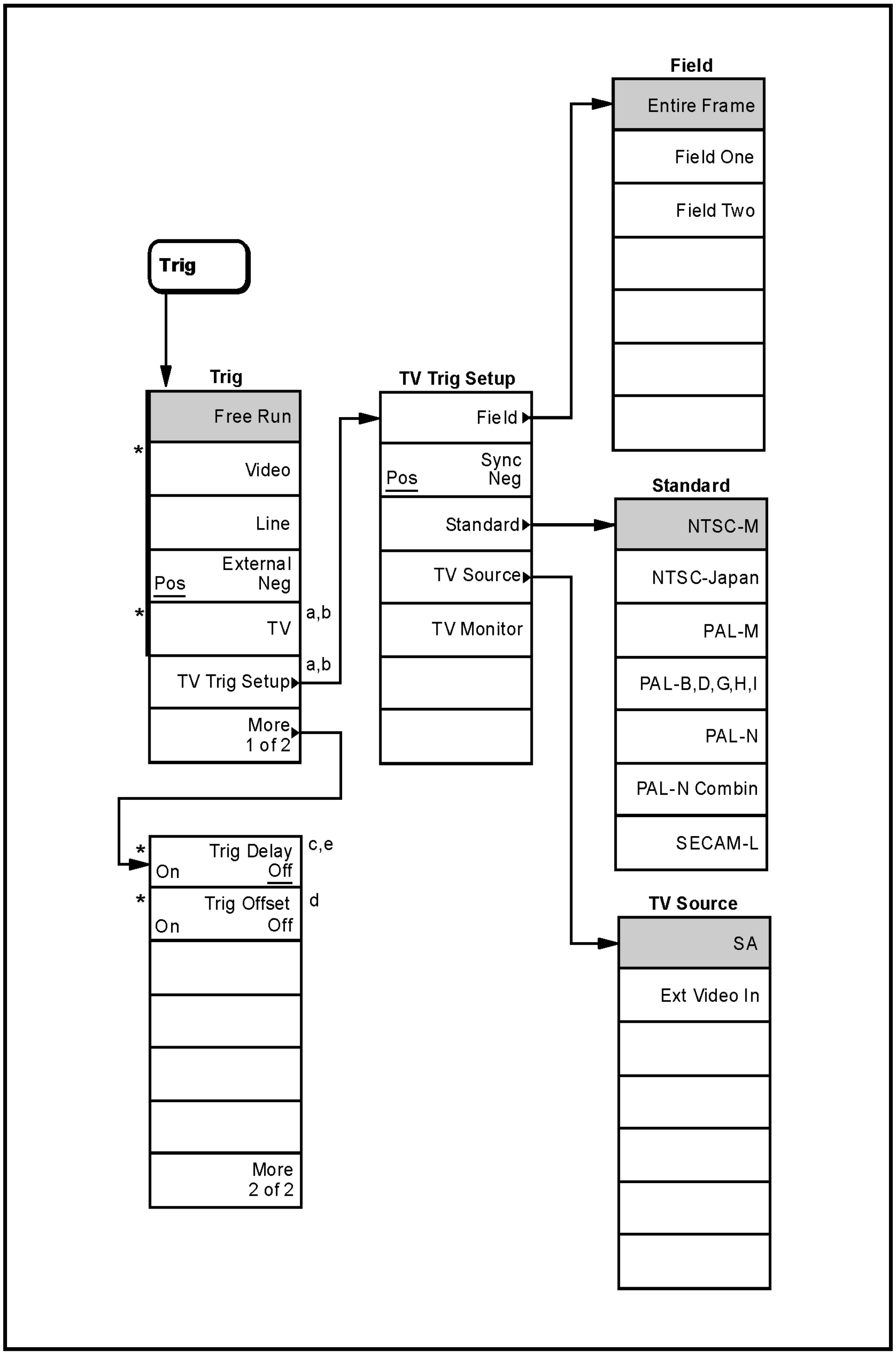
System Menu



a. Agilent E4402B, E4403B, E4404B, E4405B, E4407B and E4408B with Option 1DN only
b. For Service menus, refer to the ESA Spectrum Analyzers Service Guide
c. Available only with Option BAA (FM Demodulation)
d. Available only with Option 1DN or Option 1DQ installed
e. Agilent ESA-E series only (E4401B, E4402B, E4404B, E4405B, and E4407B)
f. Grayed out when on the last page or if there is only one page
g. Grayed out when on the first page or if there is only one page
* An active function which allows data entry

pl716

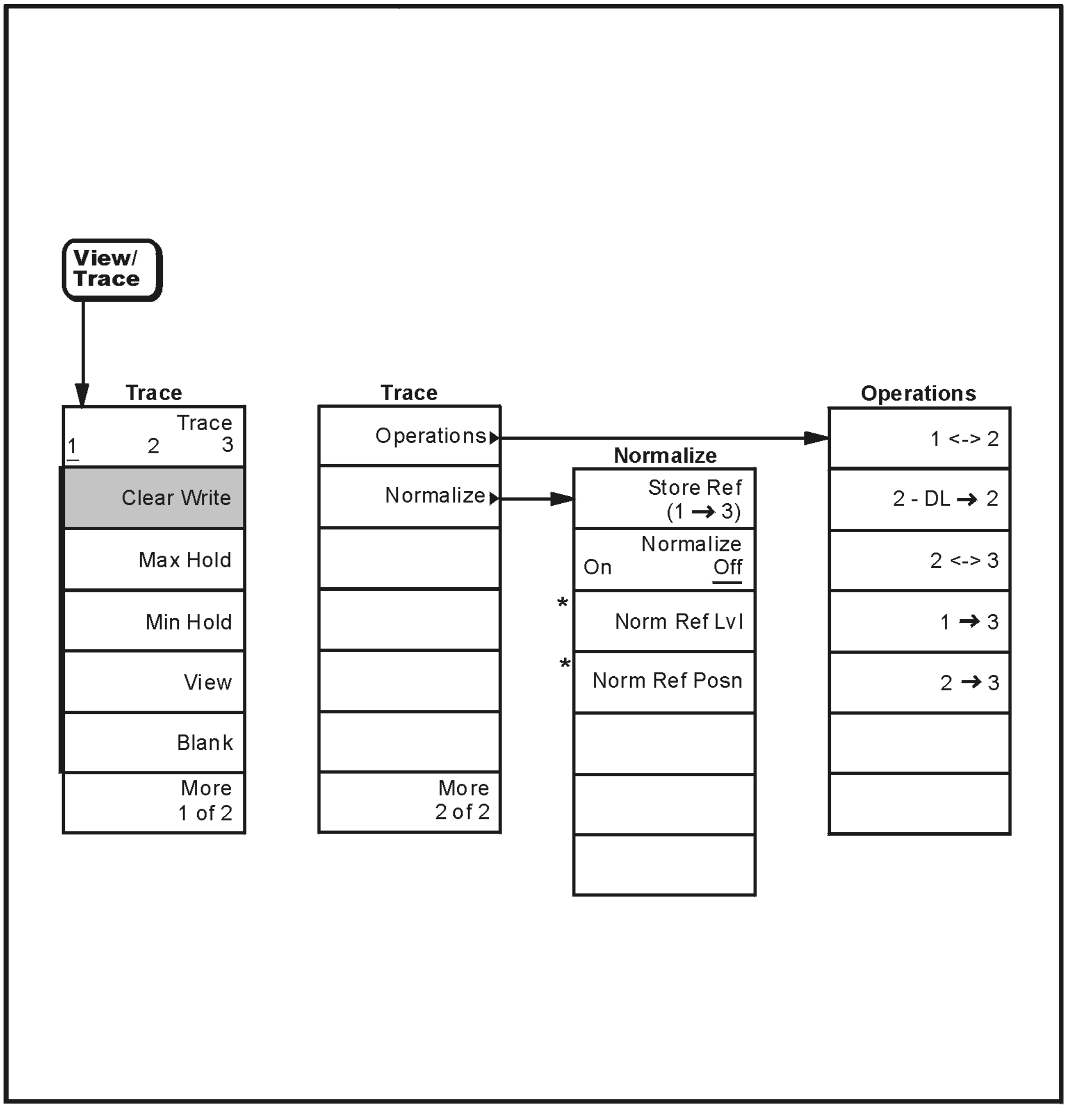
Trig Menu



a. Agilent ESA-E Series only (E4401B, E4402B, E4404B, E4405B, and E4407B)
b. Available only with Option B7B (TV Trigger and Picture on Screen)
c. Trig Delay cannot be turned on if Gate is turned on
d. Available only in zero span and in resolution bandwidths ≥ 1 kHz
e. Available only in **Line** and **External** trigger modes
* An active function which allows data entry

pl719

View/Trace Menu



* An active function which allows data entry

pl718

6 Front-Panel Key Reference

The front-panel keys in this chapter are listed alphabetically and are described with their associated menu keys. The menu keys are arranged as they appear in your analyzer menus. Use the following table to locate a specific key.

Key Label	Page Location
< Display Line	page 289
> Display Line	page 289
1 ↔ 2	page 339
1 → 3	page 339
2 → 3	page 339
2 ↔ 3	page 339
2 – DL → 2	page 339
Above Threshold Level	page 268
ACP	page 262, page 273
Align Now	page 324
Alignments	page 323
All	page 324
All but RF	page 323
AM	page 216
Amplitude	page 208, page 223
AMPLITUDE Y Scale	page 203
Amplitude On Off	page 302
Amptd Interp Log Lin	page 225
Amptd Offset	page 303
Amptd Ref (f = 50 MHz) On Off	page 246
Amptd Ref Out (f=50 MHz) On Off	page 247
Amptd Step Auto Man	page 303
Annotation On Off	page 226
Antenna	page 206, page 233
Attenuation Auto Man	page 203, page 303
Auto	page 296

Key Label	Page Location
Auto Align	page 323
Auto Couple	page 211
Average On Off	page 213
Average Type Video Power	page 214
Average Mode Exp Repeat	page 259, page 261, page 262, page 267, page 268
Avg Number On Off	page 213, page 259, page 260, page 262, page 267, page 268
Band Pair Start Stop	page 252
Band Power	page 253, page 285
Bitmap	page 232
Blank	page 339
Bluetooth™	page 283
Bursted Power	page 268, page 277
BW/Avg	page 213
Cable	page 206, page 233
cdma2000 SR1	page 282
cdma2000 SR3-DS	page 282
cdma2000 SR3-MC	page 282
Center Freq	page 243
CF Step Auto Man	page 243
Channel Power	page 259, page 271
Chan Pwr Span 3.0 MHz	page 260

Key Label	Page Location
Format	page 230, page 241
Free Run	page 332
Freq Correct On Off	page 325
Freq Count	page 242
Freq Interp Log Lin	page 225
Freq Offset	page 244
Frequency	page 207, page 223
FREQUENCY Channel	page 243
Front Panel Test	page 327
Full Screen	page 219
Full Span	page 305
Function	page 253, page 285
Gate Delay	page 313
Gate Length	page 313
Gate On Off	page 312
Gate Setup	page 312
GSM/EDGE	page 282
Graticule On Off	page 226
Harmonic Auto Man	page 249
Harmonic Distortion	page 267, page 276
Harmonics	page 267
Help	page 245
High	page 313
IF Gain	page 210
Image Shift	page 248
Image Suppress	page 248
Input/Output	page 246

Key Label	Page Location
Input Mixer	page 247
Input Mixer Int Ext	page 247
Input Z Corr 50 Ω 75 Ω	page 246
Install	page 329
Int Preamp On Off	page 205
Integration BW 1.230 MHz	page 259
Inverse Time	page 253
IS95	page 281
J-STD-008	page 281
Landscape	page 297
Language PCL3 PCL5	page 296
Last Span	page 306
Level Setup	page 313
Limit 1 2	page 221
Limit On Off	page 222
Limits	page 219, page 219
Limits Fixed Rel	page 220
Line	page 332
Load	page 233
Load Defaults	page 325
Local (System)	page 321
Low	page 313
Man Track Adj	page 303
Margin On Off	page 222
Marker	page 251, page 265
Marker →	page 257
Marker All Off	page 256
Marker Count On Off	page 242

AMPLITUDE Y Scale

Activates the reference level function and accesses the amplitude menu keys. Amplitude menu keys allow you to set functions that affect the way data on the vertical axis is displayed or corrected.

Ref Level

Allows the reference level to be changed. This function is activated when **AMPLITUDE Y Scale** is pressed. The reference level is the amplitude power or voltage represented by the top graticule on the display. Changing the value of the reference level changes the absolute amplitude level (in the selected amplitude units) of the top graticule line. The reference level can be changed using the step keys, the knob, or the numeric keypad. Pressing any digit (0 through 9) on the numeric keypad brings up the terminator menu.

Key Access: **AMPLITUDE / Y Scale**

Attenuation Auto Man

Sets the input attenuation to manual or automatic and allows you to set the attenuation level in 5 dB increments when **Attenuation** (Man) is selected. The attenuator maybe set over a range of 0 dB to 65 dB. The analyzer input attenuator, which is normally coupled to the reference level control, reduces the power level of the analyzer input signal at the input mixer. The attenuator is recoupled when **Attenuation** (Auto) is selected. Attenuation can be changed using the step keys, the knob, or the numeric keypad. To select 0 dB, the numeric keypad must be used.

Key Access: **AMPLITUDE / Y Scale**

CAUTION

To prevent damage to the input mixer, do not exceed a power level of +30 dBm at the input. To prevent signal compression, keep the power at the input mixer below 0 dBm. With the attenuator set to Auto, a signal at or below the reference level will result in a mixer level at or below the **Max Mixer Lvl**.

Scale/Div

Sets the logarithmic units per vertical graticule division on the display. The **Scale/Div** function is only available when the **Scale Type** key is set to **Log**. Scale/Div values may range from 0.1 to 20 dB per division With FM Demod (Option BAA) installed and **Demod View** (On) selected, the range is 1 kHz to 240 kHz/div. With Bluetooth™ FM Demodulation (Option 106) installed and **Demod View** (On) selected, the scale/division is fixed at approximately 40 kHz/division.

Key Access: **AMPLITUDE / Y Scale**

Scale Type Log Lin Scales the vertical graticule divisions in logarithmic units when **Log** is underlined. Logarithmic units may range from 0.1 to 20 dB per division. When **Lin** is underlined, the vertical divisions are linearly scaled and the default amplitude units are volts. The top of the display is set to the reference-level value and the bottom graticule becomes zero volts. (Each division of the graticule is one-tenth of the reference level in volts.) Pressing **Scale Type** always sets the units specified for the current amplitude scale. Pressing **Preset** or powering on the analyzer sets the default units.

Key Access: **AMPLITUDE / Y Scale**

Presel Center *Agilent E4404B, E4405B, E4407B and E4408B only*. Adjusts the frequency of the preselector filter (above 2.85 GHz) to optimize the amplitude accuracy at the active marker frequency. With **Input Mixer** (Ext) selected and the Mixer Type set to Presel (preselected), **Presel Center** adjusts the frequency of the external preselector filter to maximize the amplitude at the active marker frequency. If activated in a non-preselected band, **Presel Center** does nothing.

Preselector center should be used to improve amplitude accuracy for signals which fall into any one of the harmonic mixing bands. The harmonic mixing bands Frequency Ranges are:

Band	Frequency Range
1	2.85 - 6.7 GHz
2	6.2 - 13.2 GHz
3	12.8 - 19.2 GHz
4	18.7 - 26.5 GHz

Key Access: **AMPLITUDE / Y Scale**

Presel Adjust *Agilent E4404B, E4405B, E4407B and E4408B only*. Allows manual adjustment of the preselector frequency to optimize its response on the signal of interest.

By changing the **Presel Adjust**, the center of the preselector filter can be moved in frequency. The signal of interest will appear to change in amplitude with the frequency response of the preselector filter.

Key Access: **AMPLITUDE / Y Scale**

Y Axis Units Accesses the menu keys that change the amplitude units. Amplitude units are maintained for both logarithmic and linear modes. The amplitude units can be changed by pressing **dBm**, **dBmV**, **dBμV**, **dBμA, Watts**, **Volts**, and **Amps**.

Key Access: **AMPLITUDE Y Scale**, **More**

Ref Lvl Offst

Adds an offset value to the displayed reference level. Reference-level offsets are only entered by using the numeric keypad. Entering an offset does not affect the trace or the attenuation value. Reference-level offsets are used when gain or loss occurs between a device under test and the analyzer input. Thus, the signal level measured by the analyzer may be referred to as the level at the input of an external amplitude-conversion device. When an amplitude offset is entered, its value appears on the left side of the display under `Offst` (as opposed to frequency offsets which appear at the bottom of the display). To eliminate an offset, press **Ref Lvl Offst**, **0**, **dB**. Pressing **Preset** also sets the offset to zero. See also the **Ext Amp Gain** key description.

Key Access: **AMPLITUDE Y Scale**, **More**

Int Preamp On Off

Agilent ESA-E Series only (E4401B, E4402B, E4404B, E4405B and E4407B) with Option 1DS. Turns the internal preamp on and off. Pressing **Int Preamp** (On) results in a correction being applied to compensate for the gain of the preamp so that amplitude readings show the value at the input connector. The preamp is switched off in frequency bands above 3 GHz and the correction is not applied. When the preamp is on, a PA indication appears on the left side of the display.

Key Access: **AMPLITUDE Y Scale**, **More**

Corrections

Accesses the **Corrections On Off** and **Modify** keys and allows you to enable the corrections function and edit the correction factor sets.

Key Access: **AMPLITUDE Y Scale**, **More**

Corrections On Off

Pressing **Corrections** (On) turns on the amplitude-correction factors. Corrections will only be applied to the sets of correction factors whose correction state is set to On. To turn a set of correction factors on, use the **Correction On Off** key in the Modify menu. When **Corrections** (On) is selected, an A will appear on the screen annotation whether or not a correction set has been turned on using the **Correction** (On) key in the Modify menu.

Key Access: **AMPLITUDE / Y Scale**, **More**, **Corrections**

Modify

Accesses the **Select**, **Corrections On Off**, **Edit**, **Delete**, and **Freq Interp Log Lin** menu of keys that will allow you to create or modify an amplitude-correction factors table.

Key Access: **AMPLITUDE / Y Scale**, **More**, **Corrections**

Select

Allows you to select which set of correction factors is to be modified. Once the selection has been made, the menu automatically returns to the previous menu. Pressing **Return** will return you to the previous menu without making a selection.

Key Access: **AMPLITUDE Y Scale**, **More, Corrections**, **Modify**

Antenna

Allows you to correct for antenna loss, but may be used for any kind of correction.

Key Access: **AMPLITUDE Y Scale**, **More, Corrections**, **Modify**, **Select**

Cable

Allows you to correct for cable loss, but may be used for any kind of correction.

Key Access: **AMPLITUDE Y Scale**, **More, Corrections**, **Modify**, **Select**

Other

Allows you to correct for gain or loss other than those for antenna, cable, or user.

Key Access: **AMPLITUDE Y Scale**, **More, Corrections**, **Modify**, **Select**

User

Allows you to correct for gain or loss and may be used for any kind of correction.

Key Access: **AMPLITUDE Y Scale**, **More, Corrections**, **Modify**, **Select**

Corrections On Off

Turns the amplitude correction function on or off for the selected set. The corrections state must be set to On for the correction to be applied.

Key Access: **AMPLITUDE Y Scale**, **More, Corrections**, **Modify**

Edit

Accesses menu keys that allow you to create and edit an amplitude-correction factor set. It puts the analyzer into a split-screen mode where the correction data is displayed in a table under the trace data. Pressing **ESC** while in this menu will exit the menu and remove the table from the screen. New points will be applied only after the editor is closed. The Tab keys are very useful for navigation between rows in the corrections table.

Key Access: **AMPLITUDE Y Scale**, **More, Corrections**, **Modify**

Point

Allows you to create or edit an amplitude-correction factor data point. Up to 200 points may be defined for each set. Enter the point number to be created or edited by using the numeric keypad, then press **Enter**, or use the knob, tab, or step keys to move to an existing point. Press **Bk Sp** to correct errors. After selecting a point, **Frequency** becomes active.

Key Access: **AMPLITUDE Y Scale**, **More, Corrections**, **Modify**, **Edit**

Frequency

Allows you to enter the frequency value for an amplitude-correction point. Enter the frequency value by using the numeric keypad. Change the frequency value by using the step keys or the knob. Press **Bk Sp** to correct errors. After selecting a point, **Amplitude** becomes active.

A frequency coordinate must always be specified for amplitude-correction factors.

Key Access: **AMPLITUDE Y Scale**, **More, Corrections**, **Modify**, **Edit**

NOTE The amplitude correction entered for the lowest frequency will be applied to all frequencies less than the lowest frequency entered. Similarly, the amplitude correction for the highest frequency entered will be applied to all frequencies greater than the highest frequency entered.

NOTE For amplitude-correction factors, a maximum of two entries with the same frequency are valid. Only the first and last points of a series with the same frequency values are used; any middle points are ignored.

NOTE Amplitude-correction data is sorted in the table by frequency. The sorting occurs immediately after you have entered the frequency value via the front-panel.

Amplitude

Allows you to enter the amplitude value for the current amplitude-correction point. After selecting a point, the point number automatically increments and **Frequency** becomes active to allow entry of the frequency of the next point. Press **Bk Sp** to correct errors.

Key Access: **AMPLITUDE Y Scale**, **More, Corrections**, **Modify**, **Edit**

Delete Point

Allows you to delete the amplitude-correction data for the currently selected point. The prompt `If you are sure, press key again to delete` will appear on the display. Pressing **Delete Point** again will delete the point and adjust all of the point numbers as appropriate.

Key Access: **AMPLITUDE Y Scale**, **More, Corrections**, **Modify**, **Edit**

Delete Allows you to clear all data from the selected amplitude-correction set. The prompt `If you are sure, press key again to delete` will appear on the display. Pressing **Delete** again will delete the correction set.

Key Access: **AMPLITUDE Y Scale**, **More**, **Corrections**, **Modify**

Freq Interp Log Lin

Allows you to determine how trace values are computed between points in a correction table. If the linear mode is selected, a straight line is used between points in a correction table. If the logarithmic mode is selected, frequency values between points are computed by first taking the logarithm of both table values and the intermediate value.

Key Access: **AMPLITUDE Y Scale**, **More**, **Corrections**, **Modify**

Ext Amp Gain

Adds a positive or negative preamplifier gain value, which is subtracted from the displayed signal. (Use Negative values for Gain and Positive values for Loss.) The function is similar to the **Ref Lvl Offset** function, however with the **Ext Amp Gain** function, the attenuation may be changed depending on the preamplifier gain entered. A preamplifier gain offset is used for measurements that require an external preamplifier or long cables. The offset is subtracted from the amplitude readout so that the displayed signal level represents the signal level at the input of the preamplifier. The preamplifier gain offset is displayed at the top of the screen and is removed by entering zero. The preamplifier gain offset can only be entered using the numeric keypad. The preamplifier gain value is not affected by an instrument preset or a power cycle.

Key Access: **AMPLITUDE Y Scale**, **More**

Max Mixer Lvl

Allows you to change the maximum input mixer level from 10 dBm to –100 dBm in 10 dB steps using the step keys, and 1 dB steps using the knob. In addition, you may use the keypad to specify a value. The mixer level is equal to the reference level minus the attenuator setting. As the reference level changes, the input attenuator setting is changed to keep the power levels of on-screen signals less than the selected level at the input mixer. Pressing **Preset** resets the maximum input mixer level to –10 dBm.

Key Access: **AMPLITUDE Y Scale**, **More**

IF Gain Auto Fixed

When using digital resolution bandwidths (RBW < 1 kHz), the analyzer uses IF Gain autoranging to set the optimum signal gain for digital processing. This technique produces the maximum measurement range without overloading the digital system. To increase measurement speed, select **IF Gain** (Fixed). This setting decreases the display range to 70 dB, so you may have to adjust the reference level to ensure complete view of the signal.

Key Access: **Amplitude**, **More**, **More**

Auto Couple

Couples the following functions: resolution bandwidth, video bandwidth, sweep coupling (SR/SA), attenuation, sweep time, center-frequency step, source attenuation, source amplitude step, source power step, and frequency counter resolution.

NOTE This function is not available when the segmented sweep function is set to On (**Segmented** (On)).

Coupled functions are functions that are linked. If one function is changed, the coupled function is changed. During normal operation, the sweep time, resolution bandwidth, video bandwidth, and center frequency step are coupled to span; the input attenuation is coupled to the reference level.

If any of these functions become uncoupled (is manually set), a # sign appears next to the screen annotation representing the function on the screen. If one or more functions are manually set so that the amplitude or frequency becomes uncalibrated “Meas UNCAL” appears on the top right side of the graticule.

To recouple the analyzer functions, the uncoupled function(s) must be individually set back to Auto. Or, you can press **Auto Couple** to return all of the functions to their default auto state. Pressing Auto Couple will couple the following functions:

- Sweep time will couple to the span, resolution bandwidth, and video bandwidth.
- RF attenuation couples to reference level.
- Center frequency step size will couple to 10% of span.
- Sweep coupling (SR/SA) will couple back to SA mode.
- Source attenuation couples to source amplitude.
- Source power step couples to one vertical scale division.

Bk Sp (Backspace)

The backspace key is located on the front panel and is used to change or correct a text entry before you save to a file.

BW/Avg

Activates the resolution bandwidth function and accesses the menu keys that control the bandwidth functions and averaging.

Resolution BW Auto Man

Changes the 3 dB resolution bandwidth on the analyzer from 1 kHz to 5 MHz in a 1, 3, 10 sequence using the knob or step keys. If an unavailable bandwidth is entered using the numeric keypad, the closest available bandwidth in the 1, 3, 10 sequence is used. (Option 1DR provides additional 300 Hz, 100 Hz, 30 Hz and 10 Hz bandwidths.) As the resolution bandwidth is decreased, the sweep time is modified to maintain amplitude calibration. Resolution bandwidth is also related to span. As span is decreased, the resolution bandwidth is decreased. As the resolution bandwidth changes, the video bandwidth, if in auto couple mode, changes to maintain the VBW/RBW ratio.

Key Access: **BW/Avg**

A “#” mark appears next to `Res BW` on the display when it is not coupled. To recouple the resolution bandwidth, press **Resolution BW** (Auto) (or press **Auto Couple**). The resolution bandwidth can be changed using the step keys, the knob, or the numeric keypad.

Key Access: **BW/Avg**

Video BW Auto Man

Changes the analyzer post-detection filter from 30 Hz to 3 MHz in a 1, 3, 10 sequence using the knob, step keys, or the numeric keypad. If an unavailable bandwidth is entered using the numeric keypad, the closest available bandwidth in the 1, 3, 10 sequence is used. (Option 1DR provides additional 1 Hz, 3 Hz and 10 Hz video bandwidths when the resolution bandwidth is ≤ 300 Hz.)

As the video bandwidth is decreased, the sweep time is increased to maintain amplitude calibration. A “#” mark appears next to VBW on the bottom of the analyzer display when it is not coupled. To couple the video bandwidth, press **Video BW** (Auto) (or press **Auto Couple**).

Key Access: **BW/Avg**

Average On Off

Turns the selected averaging function (video or power) on or off. The detector is changed to sample when averaging is on. Pressing **Restart** resets the average trace and set the average count to 0.

Key Access: BW/Avg

Average Type Video Power

When **Average** is set to **On**, **Average Type** (Video) initiates a digital averaging routine that averages on a point-by-point basis over a number of successive sweeps. The effect is to minimize the impact of transients on the displayed signals and noise. The number of sweeps (N) to average is the number that is set by the average function. This function automatically selects the **Sample** detector, but does not affect the sweep time, bandwidth, or other analog characteristics of the analyzer. Annotation on the left side of the display indicates the current number of sweeps averaged. The default number of sweeps is 100. To turn off the averaging function, press **Average** (Off). The number of sweeps can only be entered using the numeric keypad.

In single sweep mode (**Sweep**, **Sweep** (Single)), N sweeps are taken. After each sweep, the new value of each display point is averaged in with the previously averaged data using the following formula:

$$A_{avg} = \left[\frac{M-1}{M}\right]A_{prior\ avg} + \left[\frac{1}{M}\right]A_m$$

Where:

A_{avg} = new average value

$A_{prior\ avg}$ = average from prior sweep

A_m = measured value on current sweep

M = number of current sweep

In continuous sweep mode (**Sweep**, **Sweep** (Cont)), the same sequence is followed until M=N. At that point, the sweeps continue rather than stopping. For each new sweep, the measured value of the current sweep divided by N is added to (N-1)/N times the prior average, creating a weighted rolling average.

If any measurement parameter, such as **Center Freq**, **Span**, **Ref Level**, or N, is changed while **Video Average** is On, the video average counter is reset to 0, i.e. M=0, and the trace average resets. If the analyzer is in single sweep mode, a new set of sweeps is taken only after **Sweep** (Single) is pressed again.

When **Average Type** (Video) is selected, VAvg appears on the left side of the analyzer display if **Average** is On.

When **Average Type** (Power) is selected, power averaging is performed by converting the trace data from dB to power units, and then averaging the power trace data. When **Average Type** (Power) is selected, PAvg appears on the left side of the analyzer display if **Average** is On. Power averaging is slower than video averaging due to the additional computations necessary.

Key Access: **BW/Avg**

VBW/RBW Ratio Selects the ratio between the video and resolution bandwidths. If signal responses near the noise level are visually masked by the noise, the ratio can be set to less than 1 to lower the noise. The knob and step keys change the ratio in a 1, 3, 10 sequence. Pressing **Preset** sets the ratio to 1.000 X. The ratio can be changed using the step keys, knob, or numeric keypad.

Key Access: **BW/Avg**

EMI Res BW Accesses the **EMI Res BW** menu keys and allows you to choose between bandwidths of **120 kHz**, **9 kHz** and **200 Hz**. The 200 Hz bandwidth is only available if Option 1DR (narrow resolution bandwidth) is installed and the span is less than 5 MHz. (*Option 1DR is available with Agilent ESA-E Series only (E4401B, E4402B, E4404B, E4405B and E4407B.)*

This function is set to **None** when the resolution bandwidth is set to any other value using the **Resolution BW** key.

Key Access: **BW/Avg**

Det/Demod

Accesses the menu keys controlling detector functions, demodulation functions, the speaker, and FM gain.

NOTE The FM Demod internal circuitry must be aligned before use. Press **System**, **Alignments**, **Align Now**, **FM Demod**.

Detector Accesses the **Detector** menu keys which allow you to select between **Peak**, **Sample**, and **Negative Peak** detection.

Key Access: **Det/Demod**

Peak Peak detection is used primarily when measuring sinusoidal (spectral) components. Peak detection obtains the maximum video signal value between the last display point and the present display point and stores this value in memory. Peak detection is selected at power on and by pressing **Preset**. When **Peak** detection is selected, Peak appears in the upper-left corner of the display.

Key Access: **Det/Demod**, **Detector**

Sample Sample detection is used primarily to display noise or noise-like signals. This detection should not be used to make the most accurate amplitude measurement of non noise-like signals. In sample mode, the instantaneous signal value at the present display point is placed in memory. Sample detection is activated automatically for noise level markers or during averaging. When **Sample** detection is selected, Samp appears in the upper-left corner of the display.

Key Access: **Det/Demod**, **Detector**

Negative Peak Negative peak detection functions the same as peak detection, but selects the minimum video signal value. This detection should not be used to make the most accurate amplitude measurements of signals. When **Negative Peak** is selected, NPeak appears in the upper-left corner of the screen.

Key Access: **Det/Demod**, **Detector**

Demod Accesses the menu keys to select **AM** demodulation, **FM** demodulation or demodulation **Off**. It also accesses the **Demod View On Off**, **Speaker On Off,** and **Demod Time** menu keys described below.

Key Access: **Det/Demod**

NOTE The **FM** menu key only appears when the FM demod option (Option BAA) or Bluetooth™ FM Demodulation (Option 106) is installed. The two options are available on *Agilent ESA-E Series spectrum analyzers only (E4401B, E4402B, E4404B, E4405B and E4407B).*

NOTE Segmented sweep is not available with the demodulation functions in this section.

AM Activating AM demodulation turns off FM demodulation (if it is on). For for non-zero spans, a 30 kHz resolution bandwidth is used during demodulation, regardless of the screen annotation.

Key Access: **Det/Demod**, **Demod**

FM Turning FM demodulation on turns off AM demodulation (if it is on).For for non-zero spans, a 100 kHz resolution bandwidth is used during the demodulation, regardless of the screen annotation. When the span is set to zero span, the displayed bandwidth is used. For best results, move the signal to be demodulated to within 3 graticules of the top of the display.

Key Access: **Det/Demod**, **Demod**

Demod View On Off When **Demod View** (On) is pressed, the vertical scaling of the display is in frequency, and marker will read out the FM deviation in kHz. When Demod View is On, the following functions are not available: Log/Lin (the display is always linear and calibrated in Hz), Y Axis Units, Normalize, Display Line, Peak Excursion, and Peak Threshold. In AM Demod, pressing **Demod View** (On) has no effect. The Bluetooth™ FM Demod (Option 106) has a fixed vertical scale of approximately 40 kHz/Div.

Key Access: **Det/Demod**, **Demod**

Speaker On Off Turns the internal speaker on and off. The volume from the speaker is controlled by the front-panel volume control knob. Selecting AM or FM turns the speaker on. Turning AM or FM off, pressing **Preset**, or cycling the power sets the speaker function to **Speaker** (Off).

Key Access: **Det/Demod**, **Demod**

Demod Time Allows you to set the time, in non-zero spans, to pause and demodulate the signal after each sweep. The demodulated signal can be heard during demodulation when in **Speaker** (On) mode. (In zero span, demodulation is performed (and can be heard) throughout the sweep.) In AM, the Video BW is set to 3 kHz and the Resolution BW is set to 10 kHz. In FM, the Video BW is set to 30 kHz and the Resolution BW is set to 100 kHz.

When AM or FM Demod is enabled, the instrument will tune to the marker frequency and wait for the Demod to take place. For long Demod times, pressing **Preset** will abort the Demod function. The default value is 500 ms.

Key Access: **Det/Demod**, **Demod**

NOTE It is normal to hear clicking sounds when the Auto Alignment function is On. During retrace, a small portion of the analyzer circuitry is realigned. Some of the switching of the analyzer circuitry is done using relays. It is the rapid switching of these relays during retrace that causes the clicking sounds. To eliminate the clicking sounds, turn the auto alignment off by pressing **System**, **Alignments**, **Auto Align**, **Off**. When this is done, the **Align Now**, **All** function should be performed periodically. Refer to the appropriate “Specifications and Characteristics” chapter in the *Agilent Technologies ESA Spectrum Analyzers Specifications Guide - E Series* or *Agilent Technologies ESA Spectrum Analyzers Specifications Guide - L Series* for more information on how often to perform **Align Now**, **All** when the auto alignment is off.

Display

Accesses menu keys that allow you to control what is displayed on the analyzer, including titles, the display line, graticule and annotation, as well as the testing of trace data against user entered limits.

Full Screen

Allows the measurement window to expand horizontally over the entire instrument display. Pressing a key that brings up a new menu will cancel the full screen function.

Key Access: **Display**

Display Line On Off

Activates an adjustable horizontal line that is used as a visual reference line. The line, which can be used for trace arithmetic, has amplitude values that correspond to its vertical position when compared to the reference level. The value of the display line appears in the active function block and on the left side of the display. The display line can be adjusted using the step keys, knob, or numeric keypad. Pressing any digit, 0 through 9, on the numeric keypad brings up the selected terminator menu. To deactivate the display line, press **Display Line** (Off). The display line turns off when in demod view (**Det/Demod**, **Demod**, **Demod View** (On)) and turns back on when demod view is turned off.

Key Access: **Display**

Limits

Accesses menu keys that allow you to create, modify, and change the properties of limit lines.

Key Access: **Display**

Properties

Accesses the following **Properties** menu keys:

Key Access: **Display**, **Limits**

X Axis Units Freq Time

Selects whether limit lines will be entered using frequency or sweep time to define the segments. They can be specified as a table of limit line segments of amplitude versus frequency, or of amplitude versus time. Time values are evaluated with respect to the analyzer sweep time. A time value of zero corresponds to the start of the sweep, which is at the left edge of the graticule.

Switching the limit line definition between frequency and time will erase both of the current limit lines. The message `Changing X axis units will delete all limits. If you are sure, press key again to change units` will appear. Press **X Axis Units Freq Time** again to purge both limit lines and switch between frequency and time.

Key Access: **Display**, **Limits**, **Properties**

Limits Fixed Rel

Allows you to choose fixed or relative limit lines. The fixed (**Fixed**) type uses the current limit line as a reference with fixed frequency and amplitude values. The relative (**Rel**) setting causes the current limit line value to be relative to the displayed center frequency and reference level amplitude values. When limit lines are specified with time, rather than frequency, the **Rel** setting only affects the amplitude values. The current amplitude values will be relative to the displayed reference level amplitude, but the time values will always start at the left edge of the graticule.

As an example, assume you have a frequency limit line. If the limit line is specified as fixed, entering a limit line segment with a frequency coordinate of 300 MHz displays the limit line segment at 300 MHz. If the same limit line table is specified as relative, it is displayed relative to the analyzer center frequency and reference level. If the center frequency is at 1.0 GHz, a relative limit line segment with a frequency coordinate of 300 MHz will display the limit line segment at 1.3 GHz. If the amplitude component of the relative limit line segment is –10 dB, then –10 dB is added to the reference level value to obtain the amplitude of the given segment (reference level offset included).

A limit line entered as fixed may be changed to relative, and one entered as relative may be changed to fixed. When changing between fixed and relative limit lines, the frequency and amplitude values in the limit line table change so that the limit line remains in the same position for the current frequency and amplitude settings of the analyzer. If a time and amplitude limit line is used, the amplitude values change but the time values remain the same.

Key Access: **Display**, **Limits**, **Properties**

Delete Limits Allows you to purge data from the limit-line tables. Pressing **Delete Limits** after the prompt, `If you are sure, press key again to delete`, will delete the limits.

Key Access: **Display**, **Limits**

Modify Accesses menu keys that allow you to modify individual limit lines.

Key Access: **Display**, **Limits**

Limit 1 2 Allows you to select between the two available limits. The menu keys below the **Limit 1 2** key allow you to set parameters for the selected limit.

Key Access: **Display**, **Limits**, **Modify**

Type Upper Lower Allows you to define the limit you are editing as either an upper or lower limit. An upper limit fails if the trace exceeds the limit. A lower limit fails if the trace falls below the limit.

Key Access: **Display**, **Limits**, **Modify**

Test On Off

Turns the testing of the limit lines on and off. If the trace is at or within the bounds of the set limit or margin, `PASS LIMIT #` or `PASS MARGIN #` is displayed in green in the upper left corner of the measurement area where # is the number of the selected limit line. (Colored annotation appears only with a color display.) Only positive margins are allowed for lower limits and only negative margins are allowed for upper limits. If the trace is out of the limit or margin boundaries, `FAIL LIMIT #` or `FAIL MARGIN #` is displayed in red. The results for Limit 2 are displayed below those for Limit 1. Either **Limit** or **Margin** must be turned on for **Test** to work.

Key Access: **Display**, **Limits**, **Modify**

Limit On Off

Turns limit line display on and off. Either **Limit** or **Margin**, as well as **Test**, must be turned on for a limit test to work.

Key Access: **Display**, **Limits**, **Modify**

Margin On Off

Margin (Off) turns the margin off. **Margin** (On) allows you to set a limit line offset for the selected limit line. Either **Limit** or **Margin** as well as **Test**, must be turned on for a limit test to work.

Key Access: **Display**, **Limits**, **Modify**

Edit

Accesses the **Edit** menu keys which include **Point**, **Frequency** (or **Time** if **X Axis Units** (Time) has been selected), **Amplitude**, **Connected No Yes**, and **Delete Point**. **Edit** also accesses the limits table. The Tab keys allow you to move between the rows in the limits table. New limit segments will only be applied after the editor is closed. Pressing **Return**, or any key not associated with the editor, will close the editor.

Key Access: **Display**, **Limits**, **Modify**, **More**

Point

Allows you to create or edit a limit point. Up to 200 points may be defined for each limit line. Enter the point number to be created or edited using the numeric keypad, then Press **Enter**, or use the knob, Tab or step keys to move to an existing point. After selecting a point, **Frequency** becomes active.

Key Access: **Display**, **Limits**, **Modify**, **More**, **Edit**

Frequency (The key label is **Time** if **X Axis Units** (Time) has been selected.)

Allows you to enter the frequency value for a limit point. After entering a value, the limit table is sorted to place the frequency or time in the correct order. For a new point, **Amplitude** defaults to 0 dBm and **Connected** defaults to **Yes**. **Amplitude** then becomes active.

Key Access: **Display**, **Limits**, **Modify**, **More**, **Edit**

Amplitude

Allows you to enter the amplitude value for the current limit point. After entering a value, **Connected** becomes active. If a Tab key is pressed without entering a value, the current **Amplitude** and **Connected** values of the point are selected. If Tab ⇑ is pressed, the Point number automatically increments to allow entry of the amplitude of the next point, or if a new point, to allow **Frequency** to be entered for the new point.

Key Access: **Display**, **Limits**, **Modify**, **More**, **Edit**

Connected No Yes

Allows you to determine whether the current point will be connected to the previous point. No limit testing is performed between disconnected points. Pressing this key when the Connected field is selected toggles the Connected value of the current point and increments the Point number to allow entry or editing of the Frequency of the next point. If a Tab key is pressed without entering a value, the current Connected value of the point is selected. If Tab ⇑ is pressed, the Point number automatically increments to allow entry of the Connected value of the next point, or if a new point, to allow **Frequency** to be entered for the new point.

Key Access: **Display**, **Limits**, **Modify**, **More**, **Edit**

Delete Point

Allows you delete the current point in the limit line. You will be prompted with the message `If you are sure, press key again to delete`. Pressing **Delete Point** again will delete the point.

Key Access: **Display**, **Limits**, **Modify**, **More**, **Edit**

Delete

Allows you to delete the current limit set. You will be prompted with the message `If you are sure, press key again to delete`. Pressing **Delete** again will delete the limit set.

Key Access: **Display**, **Limits**, **Modify**, **More**

Freq Interp Log Lin

Allows you to determine how limit trace values are computed between points in a limit table. The available interpolation modes are linear and logarithmic. If the linear mode is used for both frequency and amplitude, a straight line is used when interpolating between points in a limit table. If frequency interpolation is logarithmic, frequency values between limit points are computed by first taking the logarithm of both the table values and the intermediate value. A linear interpolation is then performed in this logarithmic frequency space. An exactly analogous manipulation is done for logarithmic amplitude interpolation.

Key Access: **Display**, **Limits**, **Modify**, **More**

Amptd Interp Log Lin

Allows you to determine how limit trace values are computed between points in a limit table. The available interpolation modes are linear and logarithmic. If the linear mode is used for both frequency and amplitude, a straight line is used when interpolating between points in a limit table.

Key Access: **Display**, **Limits**, **Modify**, **More**

NOTE Interpolation modes determine how limit values are computed between points in the limit table. The appearance of a limit trace is also affected by the amplitude scale, which may be linear or logarithmic.

Title

Accesses the following **Title** menu keys which allows you to change or clear a title on your display.

Key Access: **Display**

Change Title

Allows you to write a title across the top of the display. The marker readout may interfere with the last characters. The markers can be turned off by pressing **Marker**, **More**, **Marker All Off**. Pressing **Change Title** accesses the Alpha Editor Menus that contain available characters and symbols.

NOTE Pressing **ESC** before exiting the Alpha Editor menus will retain the previous title.

The display title will remain until either **Change Title** is pressed again, or a trace is recalled that was previously saved with a title. A display title can also be cleared by using the clear function. Press **Display**, **Title, Clear Title**.

Key Access: **Display**, **Title**

Clear Title Allows you to clear a title from the front-panel display. Once cleared, the title cannot be retrieved.

Key Access: **Display**, **Title**

Preferences Accesses a menu of the following display functions which allow you to turn the graticule and annotation on or off.

Key Access: **Display**

Graticule On Off Turns the display graticule on and off.

Key Access: **Display**, **Preferences**

Annotation On Off Turns the screen annotation on or off, however, menu key annotation will remain on the screen. The screen annotation may not be required for prints or during remote operation.

Key Access: **Display**, **Preferences**

Enter

Terminates and enters into the analyzer a numerical value that has been entered from the front panel using the numeric keypad. (For most applications, it is better to use the units menu keys.)

When using the **File** key menus, the **Enter** key is used to terminate filename entries. When entering titles (**Display**, **Title**, **Change Title**), the **Enter** key is used to terminate title entries.

ESC

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 and cancels the active function (see the section on display annotation on page 24 for a description of the active function area and other display features).
- Clear any title entry that you have begun to enter and cause the title to revert to the previous name.
- Clear input or output overloads.
- Clear error messages from the status line along the bottom of the display.
- Clear peak threshold from the display (turn it off) if the peak threshold line is on.
- Cancels a print, if one is in progress.

File

Accesses the menu keys used to view, save, load, and manage data on a floppy disk or the internal analyzer drive. See "File Menu Functions" in Chapter 2, for more information.

Catalog

Displays all directories and files located on the selected drive, depending upon the preferences set under the **Type** and **Sort** keys defined below.

Key Access: **File**

Type

Allows you to select all types or one type of file(s) for viewing.

Key Access: **File, Catalog**

All

Displays all files located on the selected drive.

Key Access: **File, Catalog, Type**

Setup

Displays all setup files in the selected directory. Setups are a complete set of instrument parameters including traces, states, limits, and corrections.

Key Access: **File, Catalog, Type**

State

Displays all state files in the selected directory. State files contain most instrument settings.

Key Access: **File, Catalog, Type**

Trace

Displays all trace files (.TRC and .CSV) in the selected directory.

Key Access: **File, Catalog, Type**

Limits

Displays all limits files in the selected directory.

Key Access: **File, Catalog, Type**

Screen

Displays all screen (GIF and WMF) files in the selected directory.

Key Access: **File, Catalog, Type**

Corrections

Displays all correction files (.ANT, .CBL, .OTH, .AMP) in the selected directory.

Key Access: **File, Catalog, Type, More**

Measurement Results Displays all measurement results files in the selected directory. Measurement results files are saved in .CSV format (for importing into spreadsheets). *This key is not available in the SA mode.*

Key Access: **File**, **Save**, **Type**, **More**

Sort Accesses the **Sort** menu keys that allow you to sort your files according to a selected file attribute.The selections include, **By Date**, **By Name**, **By Extension**, **By Size**, and **Order Up Down**. **Order** (Up) allows you to sort files in ascending order (for instance, A,B,C). **Order** (Down) allows you to sort files in descending order (for instance, C,B,A).

Key Access: **File, Catalog**

Save Accesses menu keys that allow you to save analyzer setups, states, traces, limits, corrections and screen data to a floppy (A:) drive or internal flash (C:) drive.

NOTE Never remove the floppy disk during a save operation. To do so could corrupt *all* data on the floppy disk.

Key Access: **File**

Save Now Executes the save function. When the save is complete, the message `XXXXXX file saved` (where XXXXXX is the filename) will appear in the status line on your display.

Note that once you have used the **File**, **Save**, **Save Now** keys to setup and save a file, the **Save** hardkey will perform an immediate **Save Now** of your file in the same format and to the same location using a new automatically generated filename.

Key Access: **File, Save**

NOTE If the **`Path:`** field above the directory box is empty when pressing **Save Now**, the status line will display the error message: `Unable to save file, invalid path`. In this case, please select a drive.

Type Allows you to select the type of data you want to save.

Setup Displays all previously saved setup files and detects the current setup parameters in preparation to save them in a file for retrieval at a future date. Setup files include all instrument settings including traces, states, limits, and corrections.

Key Access: **File, Save, Type**

State Displays all previously saved state files and detects the current state parameters in preparation to save them in a file for retrieval at a future date. State files include all instrument settings but not traces, limits, and corrections. (This is the default setting when power is applied to the analyzer.)

Key Access: **File, Save, Type**

Trace Displays all previously saved trace files (.TRC) and detects the current trace in preparation to save it in a file for retrieval at a future date. A trace can be saved individually or as a group of traces. It can also be saved in .CSV (comma separated values) format (for importing into spreadsheets) or in .TRC format, accompanied by the analyzer state (for later recalling into the analyzer). (Note that CSV formatted data cannot be reloaded into the analyzer.) Refer to the **Format** key description.

Key Access: **File, Save, Type**

Limits Displays all previously saved limits files and detects the current limits in preparation to save them in a file for retrieval at a future date. Limits provide data sets to determine whether a trace has exceeded preset specifications. Limit sets can hold up to 200 points and can only be saved individually. Refer to the **File, Source** key description.

Key Access: **File, Save, Type**

Screen Displays all previously saved screen files and captures the current screen displayed in preparation to save it in a file for retrieval at a future date. Screen files can be saved in any of the following formats: Bitmap, Metafile, Reverse Bitmap, and Reverse Metafile. Refer to the **Format** key description.

Key Access: **File, Save, Type**

NOTE Screen files saved in WMF format can *only* be loaded into Microsoft®[1] Applications such as Microsoft Word.

NOTE The screen saved is that which was displayed before pressing **File**. For this reason, the screens seen while in the file menus cannot be saved.

Corrections Displays all previously saved correction files and detects the current corrections in preparation to save them in a file for retrieval at a future date. Corrections provide a way to adjust the trace display for preset gain factors (such as for cable loss). A correction set may hold up to 200 points. Pressing **Corrections** activates the **Source** key. Refer to the **Source** key description.

Key Access: **File, Save, Type, More**

Measurement Results Displays all previously saved measurement results files and detects the current measurement results in preparation to save them in a file for retrieval at a future date. Measurement results files are saved in .CSV format (for importing into spreadsheets).

Key Access: **File, Save, Type, More**

Format *When **Type** is set to **Trace**,* **Format** allows you to save a trace accompanied by the analyzer state. The **CSV** format is readable by a spreadsheet on your PC, but cannot be loaded back into the analyzer. The TRC format cannot be loaded into a PC, but can be loaded back into the analyzer. TRC files include the state of

1. Microsoft® is a U.S. registered trademark of Microsoft Corporation.

the analyzer and restore all settings when loaded.

*When **Type** is set to **Screen***, **Format** allows you to choose between bitmap and metafile formats. **Bitmap** saves the screen image in Graphics Interchange Format (GIF) and **Metafile** saves the screen image in Windows Metafile Format (WMF). **Reverse Bitmap** and **Reverse Metafile** turn black backgrounds to white and yellow traces to green so they can be printed visibly and with less use of black ink. Screen images cannot be loaded back into the analyzer.

Key Access: **File, Save**

Source *When **Type** is set to **Trace***, **Source** allows you to save trace **1**, **2**, or **3** along with state. Saving trace **All** saves all traces in a single .trc file, along with the state.

*When **Type** is set to **Corrections***, **Source** accesses the **Antenna**, **Cable**, **Other** and **User** menu keys, which allow you to select the type of correction to be saved.

*When **Type** is set to **Limits***, **Source** accesses the **Limit 1** and **Limit 2** menu keys. **Limit 1** and **Limit 2** provide data sets to determine whether a trace has exceeded preset specifications. Limit sets can hold up to 200 points and can only be saved individually.

Key Access: **File, Save**

Name Accesses the Alpha Editor and allows you to enter a filename. The external keyboard can also be used to enter a filename while the alpha editor is accessed.

Key Access: **File, Save**

NOTE Only capital letters (A-Z) and digits (0-9) may appear in file names (8 characters, maximum). Additionally, file names include a 3 digit extension which is automatically set by the instrument.

Dir Up Allows you to move up one directory level. If at the top level, **Dir Up** moves to the drive level, displaying the available disk drives.

Key Access: **File, Save**

Dir Select Accesses the highlighted directory on your display.

Key Access: **File, Save**

Load Accesses menu keys that allow you to load analyzer setups, states, traces, limits and corrections into the analyzer from a floppy (A:) drive or internal flash (C:) drive.

Key Access: **File**

Load Now Executes the load function. When the load is complete, the message `XXXXXX file loaded` (where XXXXXX is the filename) will appear in the status line on your display.

Key Access: **File, Load**

Type Allows you to select the type of file you want to load.

Setup Displays all setup files you may wish to load (SET). Setup files include a complete set of instrument parameters including traces, states, limits, and corrections. Loading a setup restores the analyzer (as closely as possible) to all previous instrument settings at the time of the save.

Key Access: **File, Load, Type**

State Displays all state files you may wish to load (STA). Loading a state restores most settings to the previously saved values.

Key Access: **File, Load, Type**

Trace Displays all trace files (.TRC) you may wish to load. Traces can be loaded individually or as a group. When a trace is loaded, the state that existed when that trace was saved is loaded along with the trace. Also, the loaded trace is placed in view mode.

Key Access: **File, Load, Type**

NOTE If you wish to compare two saved traces, place traces in view mode before saving them. This prevents the trace from being rewritten based on a state change from subsequent loads.

Limits Displays all limits files you may wish to load to determine whether a trace has exceeded preset specifications (LIM). Limit sets can hold up to 200 points. Limits can only be loaded individually.

Key Access: **File, Load, Type**

NOTE When loading Limits files, be sure you have selected the appropriate X Axis Units: frequency or time (**Display**, **Limits**, **Properties**, **X Axis Units**). If you are in time X-Axis Units, and you load frequency limits, all current limit line data will be erased and the analyzer will switch to frequency units. The reverse of the this situation also holds true.

Corrections Displays all corrections files you may wish to load (CBL, ANT, OTH, AMP). Corrections provide a way to adjust the trace display for preset gain factors (such as for cable loss). A correction set may hold up to 200 points.

Key Access: **File, Load, Type, More**

Measurement Results Displays all previously saved measurement results files you may wish to load. Measurement results files are saved in .CSV format (for importing into spreadsheets).

Key Access: **File, Save, Type, More**

Sort Accesses the **Sort** menu key.

Sort accesses a menu of keys that allow you to view your saved files according to a selected file attribute. The selections include, **By Date**, **By Name**, **By Extension**, **By Size**, and **Order Up Down**. **Order** (Up) allows you to view files in ascending order (for instance, A,B,C). **Order** (Down) allows you to view files in descending order (for instance, C,B,A).

Key Access: **File, Load**

Destination *When **Type** is set to **Trace**,* **Destination** allows you to direct your data to **Trace 1**, **Trace 2**, or **Trace 3**. If the data is for all three traces (for instance, **Source** was **All** when they were saved), the data will be returned to the original trace registers.

*When **Type** is set to **Limits***, **Destination** allows you to direct your data to **Limit 1** or **Limit 2**.

Key Access: **File, Load**

Dir Up Allows you to move up one directory level. If at the top level, **Dir Up** moves to the drive level, displaying the available disk drives.

Key Access: **File, Load**

Dir Select Accesses the highlighted directory on your display. If `[..]` is highlighted, this key acts in the same manner as **Dir Up**.

Key Access: **File, Load**

Delete Allows you to delete files and directories.

Key Access: **File**

Delete Now Executes the delete function. If a directory is selected to be deleted, the message `WARNING: You are about to delete the contents of directory XXXXXX` (where XXXXXX is the full path and directory name) will appear on your display. After a successful delete, the message `XXXXXX file deleted` (where XXXXXX is the filename) will appear in the status line on your display.

Key Access: **File, Delete**

Type Allows you to select the type of file you want to delete.

Key Access: **File, Delete**

All Displays all files you may wish to delete.

Key Access: **File, Delete**, **Type**

Setup Displays all setup files you may wish to delete (SET). A Setup file is a complete state of instrument parameters including traces, states, limits and corrections.

Key Access: **File, Delete**, **Type**

State Displays all state files you may wish to delete (STA).

Key Access: **File, Delete**, **Type**

Trace Displays all trace files you may wish to delete (TRC and CSV).

Key Access: **File, Delete**, **Type**

Limits Displays all limits files you may wish to delete (LIM).

Key Access: **File, Delete**, **Type**

Screen Displays all screen files you may wish to delete (GIF and WMF).

Key Access: **File, Delete**, **Type**

Corrections Displays all corrections files you may wish to delete (CBL, ANT, OTH, AMP).

Key Access: **File, Delete**, **Type**, **More**

Measurement Results Displays all previously saved measurement results files you may wish to delete. Measurement results files are saved in .CSV format (for importing into spreadsheets).

Key Access: **File, Save, Type, More**

Sort **Sort** accesses a menu of keys that allow you view the files you wish to delete, according to a selected file attribute. The selections include, **By Date**, **By Name**, **By Extension**, **By Size**, and **Order Up Down**. **Order** (Up) allows you to view files you may wish to delete in ascending order (for instance, A,B,C). **Order** (Down) allows you to view files you may wish to delete in descending order (for instance, C,B,A).

Key Access: **File, Delete**

Copy Allows you to copy files from one directory to another or to one or more mass storage devices.

Copy Now Executes the copy function. If the copy is successful, the message `xxxxx file copied` (where xxxxx is the filename) will appear on the display.

Type Allows you to select the type of file you want to copy.

All Displays all files you may wish to copy.

Setup Displays all setup files you may wish to copy (SET). A Setup file is a complete state of instrument parameters including traces, states, limits and corrections.

State Displays all state files you may wish to copy (STA).

Trace Displays all trace files you may wish to copy (TRC and CSV).

Limits Displays all limit files you may wish to rename (LIM).

Screen Displays all screen files you may wish to rename (GIF and WMF).

Corrections Displays all corrections files you may wish to rename (CBL, ANT, OTH, AMP).

Measurement Results Displays all previously saved measurement results files you may wish to delete. Measurement results files are saved in .CSV format (for importing into spreadsheets).

Key Access: **File, Save, Type, More 1 of 2**

Sort **Sort** accesses a menu of keys that allow you to view the files you wish to copy according to a selected file attribute. The selection includes, **By Date**, **By Name**, **By Extension**, **By Size**, and **Order Up Down**. **Order** (Up) allows you to view files you may wish to copy in ascending order (for instance, A,B,C). **Order** (Down) allows you to view files you may wish to copy in descending order (for instance, C,B,A).

Key Access: **File, Delete**, **Type**

Dir From To Allows you to select the source and destination directories for your copy on one or more drives.

Key Access: **File, Delete**, **Type**

Dir Up Allows you to move up one directory level. If at the top level, **Dir Up** moves to the drive level, displaying the available disk drives.

Key Access: **File, Delete**

Dir Select Accesses the highlighted directory on your display.

Key Access: **File, Delete**

Rename Allows you to rename a file.

Key Access: **File**

Rename Now Executes the rename function. When the rename is complete, the message `XXXXXX file renamed to YYYYYY` (where XXXXXX and YYYYYY are the filenames) will appear in the status line on your display.

Key Access: **File, Rename**

Type Allows you to select the type of file you want to rename.

Key Access: **File, Rename**

All Displays all files you may wish to rename.

Key Access: **File, Rename**, **Type**

Setup Displays all setup files you may wish to rename (SET). A Setup file is a complete state of instrument parameters including traces, states, limits and corrections.

Key Access: **File, Rename**, **Type**

State Displays all state files you may wish to rename (STA).

Key Access: **File, Rename**, **Type**

Trace Displays all trace files you may wish to rename. (TRC and CSV).

Key Access: **File, Rename**, **Type**

Limits Displays all limit files you may wish to rename (LIM).

Key Access: **File, Rename**, **Type**

Screen Displays all screen files you may wish to rename (GIF and WMF).

Key Access: **File, Rename**, **Type**

Corrections Displays all corrections files you may wish to rename (CBL, ANT, OTH, AMP).

Key Access: **File, Rename**, **Type**, **More**

Measurement Results Displays all previously saved measurement results files you may wish to rename. Measurement results files are saved in .CSV format (for importing into spreadsheets).

Key Access: **File, Save, Type, More**

Sort **Sort** accesses a menu of keys that allow you to view the files you wish to rename according to a selected file attribute. The selections include, **By Date**, **By Name**, **By Extension**, **By Size**, and **Order Up Down**. **Order** (Up) allows you to view files you may wish to rename in ascending order (for instance, A,B,C). **Order** (Down) allows you to view files you may wish to rename in descending order (for instance, C,B,A).

Key Access: **File, Rename**

Name Accesses the Alpha Editor and allows you to enter a filename. The external keyboard can also be used to enter a filename while the alpha editor is accessed. Complete your entry by pressing **Return** or **Enter**.

NOTE Only capital letters (A-Z) and digits (0-9) may appear in file names (8 characters, maximum). Additionally, file names include a 3 digit extension which is automatically set by the instrument.

Key Access: **File, Rename**

Dir Up Allows you to move up one directory level. If at the top level, **Dir Up** moves to the drive level, displaying the available disk drives.

Key Access: **File, Rename**

Dir Select Accesses the highlighted directory on your display.

Key Access: **File, Rename**

Create Dir Allows you to create subdirectories.

Key Access: **File**

Create Dir Now Executes the create directory function. When the directory has been created, the message `Directory XXXXXX created` (where XXXXXX is the directory name) will appear in the status line on your display.

Key Access: **File, Create Dir**

Name Accesses the Alpha Editor and allows you to enter a filename. The external keyboard can also be used to enter a filename while the alpha editor is accessed. Complete your entry by pressing **Return** or **Enter**.

Key Access: **File, Create Dir**

NOTE Only capital letters (A-Z) and digits (0-9) may appear in file names (8 characters, maximum). Additionally, file names include a 3 digit extension which is automatically set by the instrument.

Dir Up Allows you to move up one directory level. If at the top level, **Dir Up** moves to the drive level, displaying the available disk drives.

Key Access: **File, Create Dir**

Dir Select Accesses the highlighted directory on your display.

Key Access: **File, Create Dir**

Format Formats a double-density floppy disk to 1.44 MB format. 720 kB disks are not supported.

Key Access: **File**

Format Now Executes the format function. After pressing **Format Now**, the following message will appear on the display: `WARNING: You are about to destroy ALL data on volume A: Press Format Now again to proceed or any other key to abort.` During the formatting, `Formatting Disk` will appear on the display. Once formatted, `Volume A: formatted` will appear in the status line on the display.

Key Access: **File, Format**

Freq Count

Activates the **Marker Normal** function if there are no markers, and then turns the marker count function on.

Marker Count On Off

Marker Count (On) turns on the marker counter. If no marker is active before **Marker Count** (On) is pressed, a marker is activated at the center of the display. Press **Marker Count** (Off) to turn the marker counter off. Press **Resolution** (Man) to change the marker counter resolution to an uncoupled value.

NOTE

Marker Count frequency readings are not affected by the frequency offset function.

An asterisk (*) may appear in the upper-right area of the display along with the message `Cntr 1` (the number in the message depends on the active marker). The ratio of the resolution bandwidth to span must be greater than 0.002 for the marker count function to work properly. `Marker Count iden Res BW` appears on the display if the bandwidth to span ratio is less than 0.002. `Widen RES BW` indicates that the resolution bandwidth must be increased or the span decreased.

Key Access: **Freq Count**

Resolution Auto Man

Allows the resolution of the marker counter to be selected manually or auto-coupled. The marker counter has a resolution range of 1 Hz to 100 kHz. The available resolution values are 1 Hz, 10 Hz, 100 Hz, 1 kHz, 10 kHz, and 100 kHz. The resolution can be changed by using the step keys or by entering the resolution using the numeric keypad or knob. The marker counter resolution can be auto coupled to the span by pressing **Resolution** (Auto).

Key Access: **Freq Count**

FREQUENCY Channel

Activates the center frequency function, and accesses the menu of frequency functions. The center frequency, or start and stop frequency values appear below the graticule on the display.

Although the analyzer allows entry of frequencies greater than the specified frequency range, using frequencies greater than the frequency span of the analyzer is not recommended

NOTE When changing both the center frequency and the span, change the frequency first since the span can be limited by the frequency value.

CAUTION When operating in dc coupled mode, take care to protect the input mixer by limiting the input level to 0 Vdc and +30 dBm.

Center Freq

Activates the center frequency function which allows you to set the horizontal center of the display to a specific frequency.

Key Access: **FREQUENCY Channel**

Start Freq

Sets the frequency at the left side of the graticule. The left and right sides of the graticule correspond to the start and stop frequencies. When these frequencies are activated, their values are displayed below the graticule in place of center frequency and span.

Key Access: **FREQUENCY Channel**

Stop Freq

Sets the frequency at the right side of the graticule. The left and right sides of the graticule correspond to the start and stop frequencies. When these frequencies are activated, their values are displayed below the graticule in place of center frequency and span.

Key Access: **FREQUENCY Channel**

CF Step Auto Man

Changes the step size for the center frequency function. Once a step size has been selected and the center frequency function is activated, the step keys change center frequency by the step-size value. The step size function is useful for finding harmonics and sidebands beyond the current frequency span of the analyzer. When auto-coupled, the center frequency step size is set to one division (10 percent of the span).

Key Access: **FREQUENCY Channel**

Freq Offset

Allows you to input a frequency offset value that is added to the frequency readout of the marker, to account for frequency conversions external to the analyzer. Offset entries are added to all frequency readouts including marker, start frequency, and stop frequency. Offsets may only be entered using the numeric keypad. Offsets are not added to the span or frequency count readouts. Entering an offset does not affect the trace display. When a frequency offset is entered, its value appears on the bottom of the display. To eliminate an offset, press **Preset** or **Freq Offset**, **0**, **Hz**.

When a frequency offset is entered, its value appears on the bottom of the display (as opposed to reference level offsets, which appear on the left side of the display). To eliminate an offset, press **Freq Offset**, **0**, and **Enter**. Pressing **Preset** also sets the offset to zero.

Key Access: **FREQUENCY Channel**

Signal Track On Off

Moves the signal that is nearest to the active marker to the center of the display and keeps the signal there. ST appears in the lower-left corner of the display. An (*) may appear in the upper-right corner of the display while the analyzer is verifying that it has the correct signal.

Pressing **Signal Track** (Off); **Preset**; or **Marker**, **More**, **Marker All Off** turns off the signal track function.

When signal track is on and the span is reduced, an automatic zoom is performed and the span is reduced in steps so that the signal remains at the center of the display. If the span is zero, signal track cannot be activated.

Key Access: **FREQUENCY Channel**

NOTE If no marker is active, pressing **Signal Track** (On) will activate a marker, perform a peak search, and center the marker on the display.

NOTE Switching to zero span sets **Signal Track** (Off).

NOTE Segmented sweep is not available when **Signal Track** (On) is selected.

Help

Accesses a short description of any front-panel or menu key. After pressing **Help**, an explanation of the next key pressed will appear on the display. After the information is displayed, press any key to remove the help window. Pressing **ESC** allows you to remove the help window without changing functions.

Input/Output

Input Z Corr
50Ω 75Ω

Sets the input impedance for voltage-to-power conversions. The impedance you select is for computational purposes only, since the actual impedance is set by internal hardware to 50 Ω (except for Option 1DP). The default is 50 Ω (75 Ω with Option 1DP). Setting the computational input impedance to 75 Ω is useful when using a 75 Ω to 50 Ω adapter to measure a 75 Ω device on an analyzer having a 50 Ω input impedance.

Key Access: **Input/Output**

Coupling
AC DC

Only available in Agilent models E4402B or E4407B with Option UKB, and E4404B or E4405B. Specifies alternating current (ac) or direct current (dc) coupling at the analyzer input. Selecting ac coupling blocks any dc voltage at the analyzer input, but also decreases the frequency range of the analyzer. Input coupling is set to ac by an instrument preset. Some amplitude specifications apply only when coupling is set to dc. Refer to the appropriate amplitude specifications and characteristics for your analyzer.

Table 6-1 Selecting Input Coupling

ESA Model #	AC Frequency Range	DC Frequency Range
E4402B with Option UKB	100 kHz to 3 GHz	100 Hz to 3 GHz
E4404B	100 kHz to 6.7 GHz	9 kHz to 6.7 GHz
E4404B with Option UKB	100 kHz to 6.7 GHz	100 Hz to 6.7 GHz
E4405B	100 kHz to 13.2 GHz	9 kHz to 13.2 GHz
E4405B with Option UKB	100 kHz to 13.2 GHz	100 Hz to 13.2 GHz
E4407B with Option UKB	10 MHz to 26.5 GHz	100 Hz to 26.5 GHz

CAUTION When operating in dc coupled mode, ensure protection of the input mixer by limiting the input level to 0 Vdc, +30 dBm.

Key Access: **Input/Output**

Amptd Ref
(f=50 MHz)
On Off

Agilent E4401B and E4411B only. Turns the internal amplitude reference signal on or off. When the internal amplitude reference signal is on, the RF input is disabled.

Key Access: **Input/Output**

Amptd Ref Out (f=50 MHz) On Off

Agilent E4402B, E4403B, E4404B, E4405B, E4407B and E4408B only. Turns the external amplitude reference signal on or off.

Key Access: **Input/Output**

Input Mixer

Agilent E4407B with Option AYZ only. Accesses the following Input Mixer menu keys:

Key Access: **Input/Output**

Input Mixer Int Ext

Allows you to select either the internal or an externally connected mixer as the input device. Selecting **Input Mixer** (Ext) activates all other keys in the Input Mixer menu and changes the attenuator annotation to `Ext Mix`. When **Input Mixer** (Ext) is selected, the attenuator function in the **AMPLITUDE** key menu is unavailable.

Key Access: **Input/Output**, **Input Mixer**

Ext Mix Band

Accesses the Ext Mix Band key menus and allows you to select one of the pre-defined bands corresponding to the external mixer being used. The start and stop frequencies and a letter corresponding to the letter suffix of the mixer model number in use, appears on each menu key. If **Mixer Type** (Presel) is selected, selecting **(K)**, **(E)**, **(W)**, **(F)**, **(D)**, **(G)**, **(Y)**, or **(J)** is not allowed. If **Harmonic** (Man) is selected, the word **User** will appear on the **Ext Mix Band** key.

Key Access: **Input/Output**, **Input Mixer**

NOTE Segmented sweep is only operable for this function when center frequency and span are set within the frequency band of the mixer. If the mixer range is changed, segmented sweep is turned off.

Signal Ident On Off

Activates a signal identification algorithm when **Signal Ident** (On) is selected, that either removes or aids with the identification of multiple and image responses of true input signals. Multiple and image responses maybe generated when using unpreselected external mixers.

Key Access: **Input/Output**, **Input Mixer**

NOTE Segmented sweep is not available when **Signal Ident (On)** is selected.

NOTE If the input signal is too broad band or unstable for the identifications process to properly identify it, turn off the signal identification and look for two similar responses separated by about 642.8 MHz (twice the 321.4 MHz first IF). If a “–” mixer mode (for example: 8–) is active, the right member of the response pair is the correct response; if a “+” mixer mode is active, the left member of the response pair is the correct response.

The amplitude accuracy of the analyzer is degraded when signal identification is active, and the message `Signal Ident On, Amptd Uncal` will appear on the display.

Signal ID Mode

Allows you to select either of the following types of signal identification methods:

Key Access: **Input/Output**, **Input Mixer**

Image Suppress Selects a signal identification mode that attempts to suppress all but valid responses by mathematically removing all image and multiple responses of signals present at the mixer input. The analyzer internally acquires the data in a two sweep sequence, operates on the acquired data, and displays the result in Trace 1. Since two measurements are taken for each display cycle, the display update rate is reduced.

Key Access: **Input/Output**, **Input Mixer**, **Signal ID Mode**

Image Shift Allows the analyzer, in a two sweep sequence, to place data from the first sweep in Trace 1, and data from the second (frequency shifted) sweep in Trace 2. Signal responses of Trace 1 and Trace 2 having the same horizontal position are considered to be in the current band and therefore can be analyzed with the amplitude and frequency measurement systems of the analyzer. All other responses are invalid and should be ignored.

Key Access: **Input/Output**, **Input Mixer**, **Signal ID Mode**

Mixer Config Accesses the Mixer Config menu keys allowing you to manually set the harmonic, control the preselected mixers, and adjust the internal bias source for use with mixers requiring bias.

Key Access: **Input/Output**, **Input Mixer**

Harmonic Auto Man The harmonic value with its associated sign is automatically determined from the Ext Mix Band selected when in **Harmonic** (Auto) mode. **Harmonic** (Man) allows you to enter a harmonic value when required. If the harmonic mode for the external mixer is listed as "8 –", for example, enter the harmonic number as "– 8". The minus sign indicates that the tuned frequency is below the desired LO harmonic by the IF of 321.4 MHz. Similarly, if the harmonic mode of the external mixer is listed as "8 +", enter the harmonic number as "8".

Key Access: **Input/Output**, **Input Mixer**, **Mixer Config**

Mixer Type Presel Unpre Allows you to select which type of mixer is in use. **Mixer Type** (Presel) activates a tuning signal that is routed to the **PRESEL TUNE OUTPUT** connector on the rear panel of the analyzer. This signal has a sensitivity of 1.5V/GHz and drives the tune input of the HP/Agilent 11974 series of preselected mixers. The sweep rate in **Presel** mode is limited to 40 MHz/msec.

Key Access: **Input/Output**, **Input Mixer**, **Mixer Config**

Mixer Bias On Off **Mixer Bias** (On) activates and allows adjustment of an internal bias source for use with external mixers. The bias signal is present on the center conductor of the IF INPUT connector on the front-panel. The mixer bias will be **Off** if **Harmonic** (Auto) and **Mixer Type** (Presel) is selected.

Key Access: **Input/Output**, **Input Mixer**, **Mixer Config**

Marker

Accesses the marker control keys which select the type and number of markers and turns them on and off. Markers are diamond-shaped characters that identify points of traces. Up to four pairs of markers may appear on the display simultaneously; only one pair can be controlled at a time. The marker that is controlled is called the “active” marker. Pressing **Marker** activates the **Normal** menu key.

Select Marker 1 2 3 4

Selects one of the four possible markers. A marker that has already been turned on will become active when it is selected. If a marker has been turned on and assigned to a specific trace, it will become active on that trace if that marker is selected.

Key Access: **Marker**

Normal

Activates a single frequency marker at the center frequency on the active trace if a marker is not already displayed. If a marker is displayed before the **Normal** function is enabled, the marker is enabled at the position of the selected marker. The marker number is indicated above the marker. Use the data controls to position the marker. The knob and/or Up/Down keys move the marker left or right. If a value is entered from the numeric keypad, the marker is moved to the trace point nearest to that value. Annotation in the active function block and in the upper-right corner of the display indicates the frequency and amplitude of the marker. The marker stays on the trace at the horizontal screen position where it was placed unless **Signal Track**, or a “marker to” key function (such as **Mkr → CF**, **Mkr → RL**, **Mkr → CF STEP**, **Mkr ∆ Span**, or **Min Search**) is selected.Pressing **Normal** turns off the **Delta** function and moves the active marker to the delta marker position.

Key Access: **Marker**

Delta

Activates a second marker at the position of the first marker. (If no marker is present, two markers appear at the center of the display.) The amplitude and frequency of the first marker is fixed. The marker number is indicated above the delta marker, and the same number is indicated with an R (for example, 1R) above the reference marker. Use the data controls to position the delta marker. Annotation in the active function block and in the upper-right corner of the display indicates the frequency and amplitude differences between the two markers. The delta marker readout will be incorrect if the scale type is changed between log and linear. (For information on using this function while in segmented sweep, refer to “Interaction with Other Analyzer Functions” in the segmented sweep section of this chapter which begins on “Segmented” on page 315.)

Key Access: **Marker**

NOTE

Pressing **Delta** again moves the reference marker to the active marker position, so you can make delta measurements from differing reference points without having to turn off the markers and begin again.

NOTE

The delta marker function permits signal-to-noise measurements provided the signal is a single spectral component (sinusoid). Place a normal marker on the signal, press **Delta**, place the delta marker in the noise, and activate **Marker Noise** (see below). The indicated amplitude difference is signal-to-noise/Hz.

Band Pair Start Stop

Enters a mode that allows adjustment of both the ref (start) and delta (stop) markers independently. Pressing **Band Pair**, toggles between the start and stop markers. The start marker number is indicated with a number and an R above the marker (for example, 1R) and the stop marker is indicated with a marker number. This mode is useful in functions such as **Band Power**. (For information on using this function while in segmented sweep, refer to "Interaction with Other Analyzer Functions" in the segmented sweep section of this chapter which begins on page 315.)

Key Access: **Marker**

Span Pair Span Center

Enters a mode that allows adjustment of both the ref and delta markers. Pressing **Span Pair**, toggles between the span and center markers. The start marker number is indicated with a number and an R above the marker (for example, 1R) and the stop marker is indicated with a marker number. Adjusting the span changes the frequency difference between the two markers while maintaining the midpoint between the two markers at a fixed frequency. Changing the center changes the center point between the two markers while maintaining the frequency difference. This mode is useful in functions such as **Band Power**. (For information on using this function while in segmented sweep, refer to "Interaction with Other Analyzer Functions" in the segmented sweep section of this chapter which begins on page 315.)

Key Access: **Marker**

Off

Turns off the marker that has been selected by the **Select Marker 1 2 3 4** key. **Off** also turns off functions related to the selected marker such as signal track and demodulation. It also removes marker annotation from the display.

Key Access: **Marker**

Select Marker 1 2 3 4

Selects one of the four possible markers. A marker that has already been turned on will become active when it is selected. If a marker has already been turned on and assigned to a specific trace, it will become active on that trace if that marker is selected.

Key Access: **Marker**, **More**

Marker Trace Auto 1 2 3

Assigns a marker to a trace. Pressing **Marker Trace Auto 1 2 3** will activate a marker on trace 1 if there are no markers turned on. If a marker is currently active, press **Marker Trace Auto 1 2 3** until **1**, **2**, or **3** are underlined. The active marker will be moved to the selected trace.

Selecting the **Auto** mode will move the marker to the trace that is automatically selected. The selection order is to first look for a trace in the clear-write mode, in the order of trace 1, then trace 2, then trace 3. If no traces are currently being written, it will select a trace in the view-store mode, again in the order of trace 1, 2, then 3.

Key Access: **Marker**, **More**

Readout

Accesses the following menu keys that allow you to change the active marker readout.

Key Access: **Marker**, **More**

Frequency

Sets the marker to **Frequency**. The default selection in non-zero spans, displays the absolute frequency of a normal marker or the frequency of the delta marker relative to the reference marker.

Key Access: **Marker**, **More**, **Readout**

Period

Sets the marker readout to **Period**. Displays the reciprocal of the above frequency.

Key Access: **Marker**, **More**, **Readout**

Time

Sets the marker readout to **Time**. The default selection in zero span, displays the time interval between a normal marker and the start of the sweep or the time of the delta marker relative to the reference marker.

Key Access: Marker, More, Readout

Inverse Time

Sets the marker readout to **Inverse Time**. Displays the reciprocal of the above time interval.

Key Access: **Marker**, **More**, **Readout**

Function

Accesses the following marker function menu keys listed below.

Key Access: **Marker**, **More**

Band Power

Indicates the power over that part of the trace between the reference and active markers. If only one marker is present when you press **Band Power**, a second marker is placed at the same location as the first marker. To reposition the markers, press **Marker** to access **Band Pair** and **Span Pair** keys. Pressing **Band Power** also changes the display mode to sample, the correct mode for power measurements.

Key Access: **Marker**, **More**, **Function**

NOTE For best accuracy, set the video bandwidth to at least ten times the resolution bandwidth to minimize its averaging effect.

NOTE **Band Power** has no meaning in zero span, and the indicated value is independent of signal level and marker placement.

Marker Noise Reads out the average noise level, referenced to a 1 Hz noise power bandwidth. If no marker is present, a marker appears at the center of the display. The sample detector is activated.If the marker delta function is on and the noise marker is activated and moved to measure the noise floor, the marker readout will display the signal-to-noise ratio.

NOTE You can use **Delta** and **Marker Noise** to indicate noise level relative to sinusoidal signal (signal to noise). However, be sure to activate the delta marker before pressing **Marker Noise** or the reference marker units may be incorrect.

The noise marker averages 5% of the trace data values (one-half a horizontal division), centered on the location of the marker on the frequency or time scale. Marker noise indicates noise power density per hertz or noise voltage per root hertz depending upon the amplitude units selected. The number of sweep points is noted in parenthesis to the right of the sweep time in the lower right corner of the graticule. If the analyzer has a firmware revision prior to A.04.00, 32 trace data values are averaged, and the number of points per sweep is fixed at 401. Note that the data values averaged will not always be symmetrical with respect to the marker position.

If the marker is positioned within 2.5% of the beginning of the trace (one-quarter division), the trace data values in the first half-division will be averaged. Similarly, if the marker is positioned within 2.5% of the end of the trace, the trace data values in the last half-division will be averaged. If the analyzer has a firmware revision prior to A.04.00, and the marker is positioned within 16 trace points of the beginning or end of the trace, the first 32 or last 32 trace data points, respectively, will be averaged.

NOTE Do not use Marker Noise to evaluate the displayed average noise level of the analyzer relative to the specification. Read the displayed average noise level directly from the display or use the normal marker. Refer to Application Note 150 for a discussion of how noise is displayed on a spectrum analyzer.

A nominal correction for equivalent noise bandwidth is made by the firmware based on a nominal 3 dB resolution bandwidth. The firmware assumes the noise bandwidth is 1.12 times the resolution bandwidth. This means the shape of the resolution bandwidth filters causes the noise power to be overstated by 1.12 times. The detection mode also affects the measurement. If in log mode, the log detector understates the noise response. To compensate, 2.51 dB is added to the measurement. If the detector is in linear mode, the firmware uses 1.049 dB as a correction value.

In log detector mode, with the result reported in dBm in a 1 Hz bandwidth, the final reported value will be:

$$(\text{Averaged value over 32 values}) - 10 \times (\log[1.12 \times \text{Resolution bandwidth}]) + 2.51\ \text{dB}$$

In linear detector mode (dBm) units, with the result reported in dBm in a 1 Hz bandwidth, the final reported value will be:

$$(\text{Averaged value over 32 values}) - 10 \times (\log[1.12 \times \text{Resolution bandwidth}]) + 1.049\ \text{dB}$$

In linear detector mode with the normal display of voltage units, the noise marker voltage value will be related to the present marker voltage by this relation.

$$(\text{V\_noise\_marker})^2 = (\text{V\_average})^2 / (1.12 \times \text{Resolution bandwidth} \times 0.7824)$$

$$\text{V\_noise\_marker} = \text{V\_average} / (1.12 \times \text{Resolution bandwidth} \times 0.7824)^{0.5}$$

$$\text{V\_noise\_marker} = \text{V\_average} \times 1.06633 / (\text{Resolution bandwidth})^{0.5}$$

Key Access: **Marker**, **More**, **Function**

Off Turns off the active function markers.

Key Access: **Marker**, **More**, **Function**

Marker Table On Off Compresses the graticule and displays marker information in a table. The information includes the marker number, trace number, marker type, X axis value, and the amplitude.

Key Access: **Marker**, **More**

Marker All Off Turns off all of the markers, including markers used for signal track and demodulation. Marker annotation is also removed.

Key Access: **Marker**, **More**

Marker →

Accesses the following marker function menu keys:

Mkr → CF Sets the center frequency of the analyzer to the marker frequency. In Delta mode, Mkr → CF sets the center frequency to the marker delta value. Mkr → CF is not available in zero span.

Key Access: **Marker →**

Mkr → CF Step Changes the center-frequency step size to match the value of the active marker. Press **Frequency** then **CF Step Auto Man** to view the step size. If marker delta is active, the step size will be set to the frequency difference between the markers. This function can be used to step from one signal harmonic to another. Mkr → CF Step is not available in zero span.

Key Access: **Marker →**

Mkr → Start Changes the start frequency so that it is equal to the frequency of the active marker. In Delta mode, Mkr → Start sets the start frequency to the marker delta value. Mkr→ Start is not available in zero span.

Key Access: **Marker →**

Mkr→ Stop Changes the stop frequency so that it is equal to the frequency of the active marker. In Delta mode, Mkr → Stop sets the stop frequency to the marker delta value. Mkr → Stop is not available in zero span.

Key Access: **Marker →**

Mkr Δ → Span Sets the start and stop frequencies to the values of the delta markers. The marker is then set to normal at the center frequency. Mkr Δ → Span is not available if the marker is off, or in zero span.

Key Access: **Marker →**

NOTE The above menu keys are not available when **Segmented** (On) is selected.

Mkr → Ref Lvl Changes the reference level to the active marker value, moving the marked point to the reference level (top line of the graticule). In Delta mode, Mkr → Ref Lvl sets the reference level to the amplitude difference between the markers.

Key Access: **Marker →**

Meas Control

If in a measurement, accesses a menu of keys that allow you to pause or restart one of the measurements available in the **MEASURE** key menu. **Meas Control** also allows you to select between continuous and single sweeps or measurements.

Press **MEASURE** and then select one of the available measurements (**Channel Power**, **Occupied BW**, **ACP**, **Power Stat CCDF, Harmonic Distortion,** or **Bursted Power**). Once the desired measurement is selected, press **Meas Control** to access the following keys:

Restart

Performs the same functions as the "Restart" front-panel key. Repeats your measurement from the beginning. Pressing **Restart** while a measurement is being made will halt the current measurement routine at the first possible stopping point and repeat the measurement.

Key Access: **Meas Control**

Measure Cont Single

Measure (Single) allows you to take one measurement sweep and display the measurement results. **Measure** (Cont) allows you to continuously run a measurement, displaying the results after each measurement sweep.

Key Access: **Meas Control**

Pause

Allows you to pause a measurement. Pressing **Pause** will toggle between pausing and resuming your measurement. The key label will toggle between **Pause** and **Resume**. If an averaged measurement was in progress, the average counter is frozen and the measurement sweeping is halted.

Key Access: **Meas Control**

Resume

Allows you to resume a measurement that had been paused. The key label will toggle between **Pause** and **Resume**. Resume is active only if pause has been executed first. If an averaged measurement was in progress when paused, the measurement continues and the average counter resumes from its frozen value.

Key Access: **Meas Control**

NOTE The measurements described above are those available in SA mode (see **Mode** key). Other measurements are available in other modes if an optional personality is installed.

Meas Setup

If in a measurement, displays one of six measurement setup menus. The setup menu displayed depends on which measurement **(Channel Power, Occupied BW, ACP, PowerStat CCDF, Harmonic Distortion, or Bursted Power)** has been selected in the **MEASURE** menu.

NOTE The measurements described below are those available in SA mode (see **Mode** key). Other measurements are available in other modes if an optional personality is installed.

Channel Power Meas Setup Menu Keys

To access the following keys for setting up a channel power measurement, press **MEASURE**, **Channel Power** and then the front-panel **Meas Setup** key.

Avg Number On Off

Press **Avg Number** (On) to specify the number of averages used when calculating the measurement result. The average will be displayed at the end of each sweep. **Avg Number** (Off) disables measurement averaging.

Key Access: **Meas Setup**

Avg Mode Exp Repeat

Allows you to select the type of termination control used for the averaging function. This determines the averaging action after the specified number of measurements (average count) is reached. **Avg Mode** has no effect on measurements that are not averaged.

Exp	Each successive data acquisition after the average count is reached is exponentially weighted and combined with the existing average. Exponential averaging weights new data more than old data, which facilitates tracking of slow-changing signals.
Repeat	After reaching the average count, all previous result data is cleared and the average count is set back to 1.

Key Access: **Meas Setup**

Integration BW

Allows you to specify the range of integration used in calculating the power in the channel, defaults to 2.0 MHz, or is defined by the radio standard selected. See Table 6-2, “Channel Power Radio Standard Parameter Definitions”. The range for this parameter is the available non-zero span range of the analyzer.

Key Access: **Meas Setup**

Table 6-2 Channel Power Radio Standard Parameter Definitions

Standard	Format	Device	Integration BW	Chan Pwr Span
IS95		BTS/MS	1.23 MHz	2 MHz
J-STD-008		BTS/MS	1.23 MHz	2 MHz
cdma2000	SR1	BTS/MS	1.23 MHz	2 MHz
cdma2000	SR3 DS	BTS/MS	3.69 MHz	2 MHz
cdma2000	SR3 MC	BTS/MS	3.69 MHz	2 MHz
W-CDMA	3GPP	BTS/MS	5.0 MHz	2 MHz
NADC		BTS	32.8 kHz	80 kHz
NADC		MS	N/A	N/A

Chan Pwr Span Allows you to specify the frequency span for the channel power measurement, defaults to 3.0 MHz, or is defined by the radio standard selected. See Table 6-2, “Channel Power Radio Standard Parameter Definitions”. Although channel power span is coupled to the integration bandwidth (IBW) at approximately 1.6 times the IBW, this parameter can be set manually: minimum = IBW, maximum = 10 times the IBW or the span of the analyzer.

Key Access: **Meas Setup**

Optimize Ref Level Sets the reference level and attenuator to optimum values based on the signal present at the input.

Key Access: **Meas Setup**

Occupied BW Meas Setup Menu Keys

To access the following keys for setting up an occupied bandwidth measurement, press **MEASURE**, **Occupied BW** and then the front-panel **Meas Setup** key.

Avg Number On Off Press **Avg Number** (On) to specify the number of averages used when calculating the measurement result. The average will be displayed at the end of each sweep. **Avg Number** (Off) disables measurement averaging.

Key Access: **Meas Setup**

Avg Mode Exp Repeat

Allows you to select the type of termination control used for the averaging function. This determines the averaging action after the specified number of measurements (average count) is reached. **Avg Mode** has no effect on measurements that are not averaged.

Exp Each successive data acquisition after the average count is reached is exponentially weighted and combined with the existing average. Exponential averaging weights new data more than old data, which facilitates tracking of slow-changing signals.

Repeat After reaching the average count, all previous result data is cleared and the average count is set back to 1.

Key Access: **Meas Setup**

Max Hold On Off

Allows you to turn maximum hold trace feature **On** or **Off** for the measurement. Maximum hold displays and holds the maximum responses of a signal.

Key Access: **Meas Setup**

Occ BW % Pwr

Allows you to change the percentage of the total input signal power used when determining the occupied bandwidth. The acceptable range for this parameter is from 10% to 99.99%.

Key Access: **Meas Setup**

OBW Span

Allows you to specify the range of integration used in calculating the total power from which the percent occupied bandwidth is then calculated. The analyzer span will be set to the same value as the OBW Span for the measurement. OBW Span should be set to approximately 2 times the expected occupied bandwidth result.

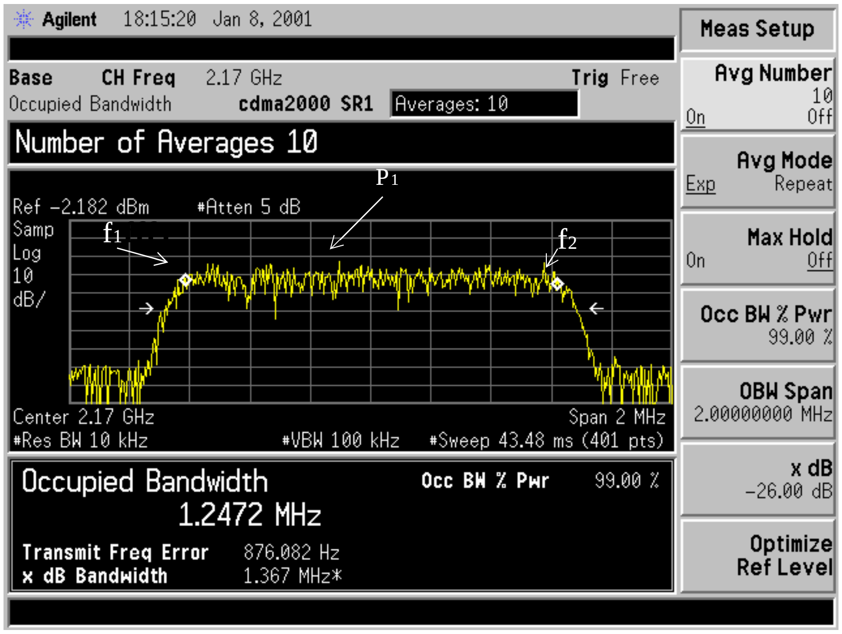
Key Access: **Meas Setup**

x dB

Allows you to specify the power level used to determine the emission bandwidth as the number of dB down from the highest signal point (P_1), within the occupied bandwidth span. Frequencies f_1 and f_2 are determined as the furthest frequencies xdB below and above P_1, respectively. The emission bandwidth is then calculated as $f_2 – f_1$ as shown in Figure 6-2.

NOTE The asterisk next to the x dB value in Figure 6-2 indicates the results may not have been determined with optimal analyzer settings. If emission bandwidth is your primary interest, select **Meas Setup**, **Max Hold**. Then change detector mode to peak by pressing **Det/Demod**, **Detector**, **Peak**. Acquiring peak data ensures accuracy of this measurement.

Figure 6-1 Occupied Bandwidth Measurement Results



NOTE The “Transmit Freq Error” displayed above is defined as the difference between the $(f_2 + f_1)/2$ and the tuned center frequency of the signal.

Optimize Ref Level Sets the reference level and attenuator to optimum values based on the signal present at the input.

Key Access: **Meas Setup**

ACP Meas Setup Menu Keys

To access the following keys for setting up an adjacent channel power measurement, press **MEASURE**, **ACP** and then the front-panel **Meas Setup** key.

Avg Number On Off Press **Avg Number** (On) to specify the number of averages used when calculating the measurement result. The average will be displayed at the end of each sweep. **Avg Number** (Off) disables measurement averaging.

Key Access: **Meas Setup**

Avg Mode Exp Repeat Allows you to select the type of termination control used for the averaging function. This determines the averaging action after the specified number of measurements (average count) is reached. **Avg Mode** has no effect on measurements that are not averaged.

Exp Each successive data acquisition after the average count is reached is exponentially weighted and combined with the existing average. Exponential averaging weights new data more than old data, which facilitates tracking of slow-changing signals.

Repeat After reaching the average count, all previous result data is cleared and the average count is set back to 1.

Key Access: **Meas Setup**

Chan Integ BW Allows you to specify the range of integration used in calculating the power in the main channel. The default value is 2.0000 MHz. The range for this parameter is 300 Hz to 20 MHz. When selecting a radio standard by pressing **Mode Setup**, **Radio Std**, this parameter is defined by Table 6-3, “Channel Frequencies and Other Settings for Radio Standards”.

Table 6-3 Channel Frequencies and Other Settings for Radio Standards

Standard	Format	Device	Main Channel IBW	Offset A Frequency	Offset A IBW	Offset B Frequency	Offset B IBW	RBW/ VBW
IS-95	None	BTS	1.23 MHz	750 kHz	30 kHz	1.98 MHz	30 kHz	10 kHz/ 100 kHz
IS-95	None	MS	1.23 MHz	885 kHz	30 kHz	1.98 MHz	30 kHz	10 kHz/ 100 kHz
J-STD-008	None	BTS	1.23 MHz	750 kHz	30 kHz	1.25625 MHz	12.5 kHz	3 kHz/ 30 kHz
J-STD-008	None	MS	1.23 MHz	1.265 MHz	30 kHz	N/A	N/A	10 kHz 100 kHz
cdma2000	SR1	BTS	1.23 MHz	750 kHz	30 kHz	1.98 MHz	30 kHz	10 kHz/ 100 kHz
cdma2000	SR1	MS	1.23 MHz	885 kHz	30 kHz	1.98 MHz	30 kHz	10 kHz/ 100 kHz
cdma2000	SR3 DS	BTS	3.69 MHz	2.65 MHz	30 kHz	3.75 MHz	30 kHz	10 kHz/ 100 kHz
cdma2000	SR3 DS	MS	3.69 MHz	2.65 MHz	30 kHz	3.75 MHz	30 kHz	10 kHz/ 100 kHz
cdma2000	SR3 MC	BTS	3.69 MHz	2.13 MHz	30 kHz	2.5 MHz	30 kHz	10 kHz/ 100 kHz
cdma2000	SR3 MC	MS	3.69 MHz	2.65 MHz	30 kHz	3.75 MHz	30 kHz	10 kHz/ 100 kHz
W-CDMA	3GPP	BTS	3.84 MHz	5 MHz	3.84 MHz	10 MHz	3.84 MHz	30 kHz/ 300 kHz
W-CDMA	3GPP	MS	3.84 MHz	5 MHz	3.84 MHz	10 MHz	3.84 MHz	30 kHz/ 300 kHz
NADC	None	BTS	32.8 kHz	30 kHz	32.8 kHz	60 kHz	32.8 kHz	3 kHz/ 30 kHz
NADC	None	MS	32.8 kHz	30 kHz	32.8 kHz	60 kHz	32.8 kHz	3 kHz/ 30 kHz

Table 6-3 Channel Frequencies and Other Settings for Radio Standards

Standard	Format	Device	Main Channel IBW	Offset A Frequency	Offset A IBW	Offset B Frequency	Offset B IBW	RBW/ VBW
PDC	None	BTS	21 kHz	50 kHz	21 kHz	100 kHz	21 kHz	3 kHz/ 30 kHz
PDC	None	MS	21 kHz	50 kHz	21 kHz	100 kHz	21 kHz	3 kHz/ 30 kHz
GSM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Bluetooth™	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Key Access: **Meas Setup**

Offsets Allows you to edit frequencies and reference bandwidths for a maximum of 6 offsets (labeled A-F).

Key Access: **Meas Setup**

Offset Allows you to select which offset (A-F) you wish to define.

Offset Freq When **Radio Std**, **None** is selected, the default is 3.0 MHz.

Ref BW When **Radio Std**, **None** is selected, the default is 2.0 MHz.

Key Access: **Meas Setup**, **Offsets**,

Meas Type Total Pwr Ref Allows you to specify the reference for the ACP measurement. Relative values can be displayed referenced to either the total power (Total Pwr Ref) or the power spectral density (PSD) measured in the main channel.

Optimize Ref Level Sets the reference level and attenuator to optimum values based on the signal present at the input.

Key Access: **Meas Setup**

Meas View Allows you to specify the measurement results display as either Spectrum (Figure 6-3 on page 273) or Bar Graph (Figure 6-4 on page 274).

Key Access: **Meas Setup, More**

Filter On Off Adds root raised cosine filtering required by the standards when **Radio Std**, **NADC** or **Radio Std**, **W-CDMA 3GPP** are selected. The filter rolloff (α) is 0.22 for W-CDMA 3GPP and 0.35 for NADC.

Key Access: **Meas Setup, More**

Noise Corr On Off When **Noise Corr** (On) is selected, calibration data is accessed to determine and correct for analyzer noise floor contribution to measurement levels near the noise floor of the analyzer.

Key Access: **Meas Setup, More**

Power Stat CCDF Meas Setup Menu Keys

To access the following keys for setting up a power statistics or complementary cumulative distribution function (CCDF) measurement, press **MEASURE**, **Power Stat CDF** and then the front-panel **Meas Setup** key.

Meas BW
5.0 MHz

Allows you to set the measurement bandwidth according to the channel bandwidth. The range is 1.00 kHz to 5.00 MHz.

Key Access: **Meas Setup**

Counts
100.000 kpoints

Allows you to set the accumulated number of sampling points for data acquisition. The range is 1.00 kpoints (1 x 10^3 points) to 1.00 Gpoints (1 x 10^9 points).

Key Access: **Meas Setup**

Meas Interval
1.00 ms

Allows you to specify the time interval over which the measurement is made. The range is dependent upon the measurement bandwidth.

Key Access: **Meas Setup**

X-Axis Scale/Div
2.00 dB

Allows you to enter a numeric value to change the horizontal display sensitivity. The range is 0.1 to 20.00 dB with 0.01 dB resolution. The default setting is dependent upon the radio standard selected (refer to “Mode Setup” on page 281 for a list of the various standards available).

Key Access: **Meas Setup**

Display

Allows you to control the trace and line displays of the power statistics CCDF curves. The currently measured curve is always shown.

Store Ref Trace Allows you to copy the currently measured curve as the user-definable reference trace. The captured data will remain until the other mode is chosen. Pressing this key refreshes the reference trace.

Ref Trace On Off Allows you to toggle the reference trace display between On and Off.

Gaussian Trace On Off Allows you to toggle the gaussian trace display between On and Off.

Key Access: **Meas Setup**, **Display**

Marker

Accesses the marker control keys which allows you to select the type and number of markers and turns them on and off. Refer to “Marker” on page 251 for more information on marker control keys.

Select Marker 1 2 3 4 Selects one of the four possible markers. A marker that has already been turned on will become active when it is selected. If a marker has been turned on and assigned to a specific trace, it will become active on that trace if that marker is selected.

Normal Activates a single CCDF marker at 0 dB on the active trace if a marker is not already displayed. If a marker is displayed before the **Normal** function is enabled, the marker is enabled at the position of the selected marker. The marker number is indicated above the marker. The knob and/or Up/Down keys move the marker left or right. If a value is entered from the numeric keypad, the marker is moved to the trace point nearest to that value. Annotation in the active function block and in the upper-right corner of the display indicates the x-axis (dB level) and y-axis (of the marker). Pressing **Normal** turns off the **Delta** function.

Delta Activates a second marker in normal mode at 0 dB on the active trace. If the marker is not present, two markers appear at the beginning of the trace. It is important to note that these two markers must be on the same trace. Annotation in the active function block indicates the x-axis of the first marker and annotation in the upper-right corner of the display indicates the dB and probability differences between the two markers.

Off Turns off the marker that has been selected by the **Select Marker 1 2 3 4** key. It also removes marker annotation from the display.

Trace Measured Accesses the menu to identify the marker trace as Measured, Gaussian, or Reference.

Key Access: **Meas Setup**, **Marker**

Optimize Ref Level Sets the reference level and attenuator to optimum values based on the signal present at the input.

Key Access: **Meas Setup**

Harmonic Distortion Meas Setup Menu Keys

To access the following keys for setting up a harmonic distortion measurement, press **MEASURE**, **Harmonic Distortion** and then the front-panel **Meas Setup** key.

Avg Number On Off

Press **Avg Number** (On) to specify the number of averages used when calculating the measurement result. The average will be displayed at the end of each sweep. (Off) disables measurement averaging.

Key Access: **Meas Setup**

Avg Mode Exp Repeat

Allows you to select the type of termination control used for the averaging function. This determines the averaging action after the specified number of measurements (average count) is reached. **Avg Mode** has no effect on measurements that are not averaged.

Exp	Each successive data acquisition after the average count is reached is exponentially weighted and combined with the existing average. Exponential averaging weights new data more than old data, which facilitates tracking of slow-changing signals.
Repeat	After reaching the average count, all previous result data is cleared and the average count is set back to 1.

Key Access: **Meas Setup**

Harmonics

Harmonics indicates the number of harmonics to measure before computing the total harmonic distortion. The minimum number is 2 (only the fundamental and second harmonic will be measured). The maximum number is 10.

Key Access: **Meas Setup**

ST/Harmonic Auto Man

ST/Harmonic (Auto) sets the sweeptime to 200 divided by the resolution bandwidth or 10 ms, whichever is greater. **ST/Harmonic** (Man) allows you to specify any sweeptime from 10 ms to the analyzer maximum. This sweeptime is used only for measuring harmonics. The sweeptime set before the measurement began is used for finding the fundamental.

Key Access: **Meas Setup**

Optimize Ref Level

Sets the reference level and attenuator to optimum values based on the signal present at the input.

Key Access: **Meas Setup**

Bursted Power Meas Setup Menu Keys

To access the following keys for setting up a bursted power measurement, press **MEASURE**, **Bursted Power** and then the front-panel **Meas Setup** key.

Key Access: **Meas Setup**

Avg Number On Off

Press **Avg Number** (On) to specify the number of averages used when calculating the measurement result. The average will be displayed at the end of each sweep. **Avg Number** (Off) disables measurement averaging.

Key Access: **Meas Setup**

Avg Mode Exp Repeat

Allows you to select the type of termination control used for the averaging function. This determines the averaging action after the specified number of measurements (average count) is reached. **Avg Mode** has no effect on measurements that are not averaged.

Exp Each successive data acquisition after the average count is reached is exponentially weighted and combined with the existing average. Exponential averaging weights new data more than old data, which facilitates tracking of slow-changing signals.

Repeat After reaching the average count, all previous result data is cleared and the average count is set back to 1.

Key Access: **Meas Setup**

Avg Type Video Power

Allows you to specify the type of result averaging to be performed.

Video Selects averaging that sums the trace data and divides by the number of data points.

Power Selects averaging that converts trace data from dB to power units, then averages the power trace data. This selection requires more time to perform.

Key Access: **Meas Setup**

Threshold Lvl Abs Rel

Allows you to set the level above which the mean carrier power calculation is based upon. The threshold level may be described in dB (relative to the carrier) or dBm (absolute).

Key Access: **Meas Setup**

Meas Method

Allows you to select the measurement method.

Above Threshold Lvl

Selects the user defined threshold level or default level (-3.00 dB) as the criteria in making the measurement.

Measured Burst Width

This measurement method is not available for the following radio standards: IS95, J-STD-008, cdma2000-SR1, cdma2000-SR3, W-DCMA 3GPP.

Key Access: **Meas Setup**

Table 6-4 Quick Setup Parameters for Radio Standards

Standard	Format	Device	Method	Sweep Time	Burst Width	Threshold Level	Resolution BW	Video BW
IS95		BTS/ MS	ATL[1]	2 ms	N/A	-6 dB	3 MHz	Auto
J-STD-008		BTS/ MS	ATL[1]	2 ms	N/A	-6 dB	3 MHz	Auto
cdma2000	SR1	BTS/ MS	ATL[1]	2 ms	N/A	-6 dB	100 kHz	Auto
cdma2000	SR3-DS	BTS/ MS	ATL[1]	2 ms	N/A	-6 dB	100 kHz	Auto
cdma2000	SR3-MC	BTS/ MS	ATL[1]	2 ms	N/A	-6 dB	100 kHz	Auto
W-CDMA	3GPP	BTS/ MS	ATL[1]	2 ms	N/A	-6 dB	100 kHz	Auto
NADC	N/A	BTS	MBW[2]	10 ms	Auto	-30 dB	100 kHz	Auto
NADC	N/A	MS	MBW[2]	6 ms	Auto	-30 dB	100 kHz	Auto
PDC	N/A	BTS	MBW[2]	10 ms	Auto	-30 dB	100 kHz	Auto
PDC	N/A	MS	MBW[2]	6 ms	Auto	-30 dB	100 kHz	Auto
GSM/ EDGE	N/A	N/A	MBW[2]	640 µs	542.8 µs	-20 dB (Relative)	300 kHz	300 kHz
Bluetooth™	DH1	N/A	MBW[2]	625 µs	Auto	-3 dB	3 MHz	3 MHz
Bluetooth™	DH3	N/A	MBW[2]	1875 µs	Auto	-3 dB	3 MHz	3 MHz
Bluetooth™	DH5	N/A	MBW[2]	3125 µs	Auto	-3 dB	3 MHz	3 MHz

1. Above threshold level
2. Measured Burst Width

NOTE The measurements described above are those available in SA mode (see **Mode** key). Other measurements are available in other modes if an optional personality is installed.

MEASURE

In the Spectrum Analyzer **(SA)** mode, accesses a menu of keys that allow you to make channel power, occupied bandwidth, adjacent channel power, power statistics: complementary cumulative distribution function (Power Stat CCDF), harmonic distortion, and bursted power measurements. These measurements can be setup by you or you may select one of several radio standards available by pressing **Mode Setup**, **Radio Standard**. The standards currently available are: IS95, J-STD-008, cdma2000 (SR1), W-CDMA (3GPP), cdma2000 (SR3-MC), cdma2000 (SR3-DS), NADC, PDC, GSM/EDGE, and Bluetooth™.

NOTE The measurements described below are those available in SA mode (see **Mode** key). Other measurements are available in other modes if an optional personality is installed.

NOTE When a measurement is activated, Signal Track, Video Averaging, Segmented Sweep, Band Power and Marker Noise will be turned off.

NOTE When Signal Track, Video Averaging, Band Power, Marker Noise or Span Zoom are activated, a running measurement will be turned off.

Meas Off Turns the active measurement function off.

Key Access: **MEASURE**

Channel Power Measures and reports the power in the channel (integration) bandwidth as well as the computed power spectral density as shown in Figure 6-1.

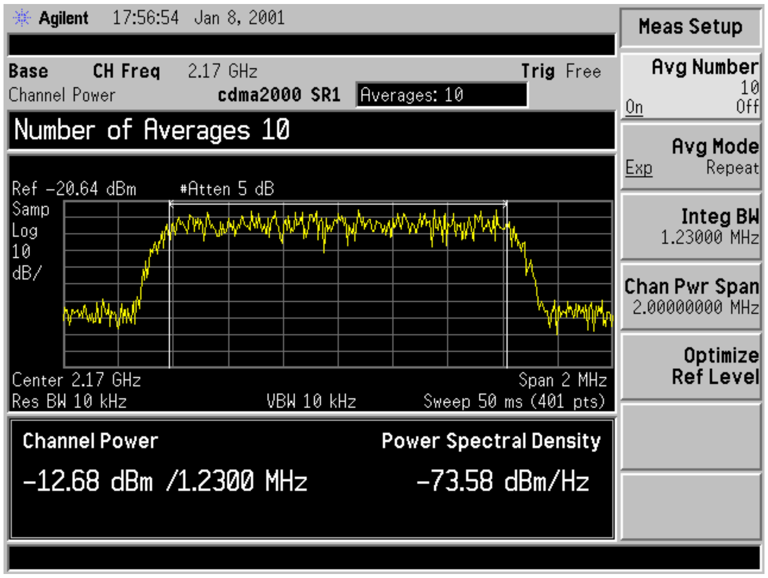
The power calculation method used to determine the channel power is a traditional method known as the integration bandwidth (IBW) method. A swept spectrum is used as the basis for this calculation. Therefore, it is important to set the resolution bandwidth correctly before making this measurement using the following formula:

$$RBW = k(span)/n$$

Where k is a value between 1.2 and 4.0 and n is the number of trace points.

NOTE Because of the noise-like nature of the signals being measured, the video bandwidth should be ≥ 10 times the resolution bandwidth.

Figure 6-2 Channel Power Measurement Results



NOTE The displayed trace is the current trace, not the averaged trace.

Pressing **Meas Setup** after **Channel Power** has been selected will access the channel power measurement setup menu. Pressing **Radio Standard** after **Mode Setup** has been selected will access all the Radio Standards available for which this measurement can be applied (NADC MS, excluded). Pressing **Meas Control** after **Channel Power** has been selected will access the channel power measurement control menu which allows you to pause or restart your measurement, or toggle between continuous and single measurement.

Key Access: **MEASURE**

Occupied BW Integrates the power of the displayed spectrum and puts markers at the frequencies between which the selected percentage of the power is contained. (Refer to Figure 6-1 on page 262.) The measurement defaults to 99% of the occupied bandwidth power. The power-bandwidth routine first computes the combined power of all signal responses contained in the trace. For 99% occupied power bandwidth, markers are placed at the frequencies on either side of 99% of the power. 1% of the power is evenly distributed outside the markers. The difference between the marker frequencies is the 99% power bandwidth and is the value displayed.

The occupied bandwidth function also indicates the difference between the analyzer center frequency and the center frequency of the channel. This difference is referred to as “Transmit Freq Error” in Figure 6-1 on page 262.

Pressing **Meas Setup** after **Occupied BW** has been selected will access the occupied bandwidth power measurement setup menu. Pressing **Radio Standard** after **Mode Setup** has been selected will access all the Radio Standards available for which this measurement can be applied (GSM/EDGE and Bluetooth™, excluded). Pressing **Meas Control** after **Occupied BW** has been selected will access the occupied bandwidth measurement control menu which allows you to pause or restart your measurement, or toggle between continuous and single measurement.

Key Access: **MEASURE**

ACP

Measures the power present in adjacent transmit channels. The span is set according to the six available offsets and their associated integration bandwidths defined by you or the selected radio standard (**Mode Setup**, **Radio Std**). The root-raised cosine filter also affects the span and is only available for NADC and W-CDMA 3GPP radio standards.

When (**Mode Setup**, **Radio Std, None**) is selected and continuously-transmitted signals (CDMA, CDMA2000, PDC BTS, and NADC BTS) are under test, one sweep of the trace will be taken, and the band power for each offset will be computed. Results will be displayed relative to the total power or the power spectral density, depending on your selection after pressing **Meas Setup**, **Meas Type.** You may view the results as the current trace (refer to Figure 6-3) or a bar graph (refer to Figure 6-4).

Figure 6-3 ACP Measurement Results - Spectrum View

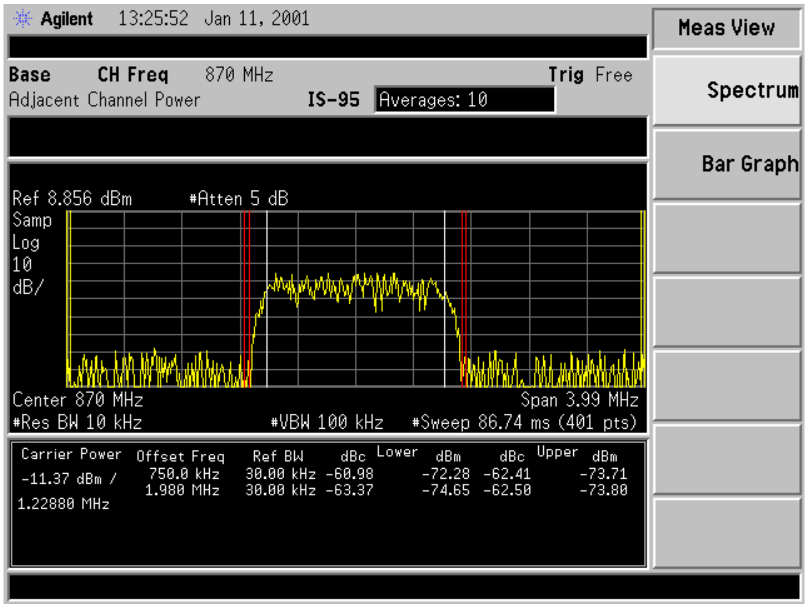
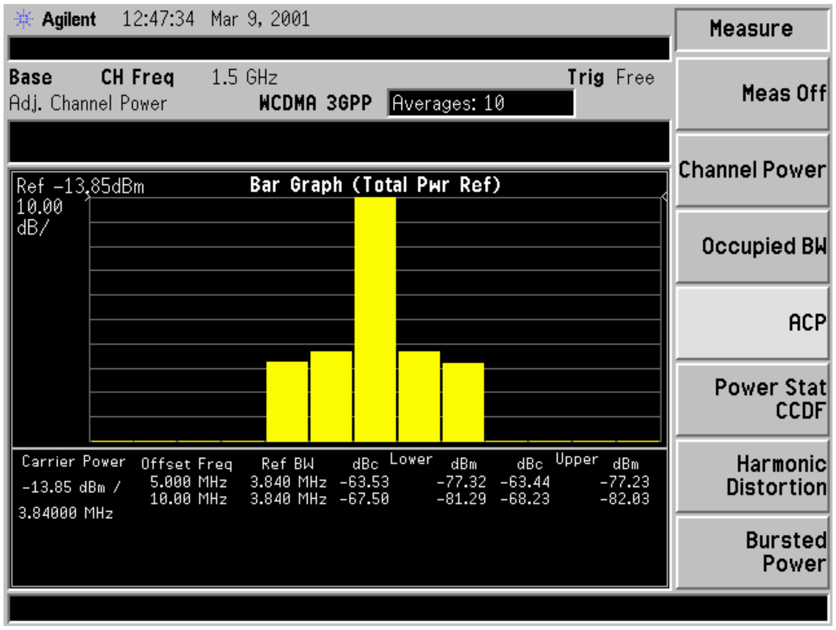


Figure 6-4 ACP Bar Graph Display



Pressing **Meas Setup** after **ACP** has been selected will access the adjacent channel power measurement setup menu. Pressing **Radio Standard** after **Mode Setup** has been selected will access all the Radio Standards available for which this measurement can be applied (GSM/EDGE and Bluetooth™, excluded). Pressing **Meas Control** after **ACP** has been selected will access the adjacent channel power measurement control menu which allows you to pause or restart your measurement, or toggle between continuous and single measurement.

Key Access: **MEASURE**

Power Stat CCDF Plots curves which characterize the signal's higher level power. It provides the distribution of peak-to-average power ratios versus probability. A CCDF curve is defined by how much time the waveform spends at or above the given power level. The percent of time the signal spends at or above the level defines the probability for that particular power level.

NOTE CCDF measurement requires the installation of Option AYX or Option B7D to ensure measurement accuracy.

For each single sweep of this measurement, the average power is defined by:

$$Pavg = \left(\sum_{1}^{n} (V^2 / Z_0) \right) / n$$

where V is the envelope voltage, Z_0 is the characteristic impedance, and n is the number of samples (32k maximum).

Pavg is used as a guideline to define the probability of the samples, which is xdB above the average power. The number of samples collected per sweep depends upon the sampling rate and the setting of the measurement interval. Multiple sweeps may be required if the sample number exceeds the number of samples collected per sweep. The results and the CCDF curve are updated after every single sweep.

Results from a 2.17 GHz W-CDMA 3GPP input signal are shown below in Figure 6-5.

NOTE It is important to set the correct center frequency before initiating this measurement.

Figure 6-5 Power Stat CCDF Measurement Results

Pressing **Meas Setup** after **Power Stat CCDF** has been selected will access the Power Stat CCDF measurement setup menu. The factory defaults provide a good starting point for this measurement. The settings are adjustable, however, to meet specific requirements. Pressing **Radio Standard** after **Mode Setup** has been selected will access all the Radio Standards available for which this measurement can be applied. Pressing **Meas Control** after **Power Stat CCDF** has been selected will access the Power Stat CCDF measurement control menu which allows you to pause or restart your measurement, or toggle between continuous and single measurement.

Key Access: **MEASURE**

Harmonic Distortion

Measures the harmonics of the strongest signal present in the span and computes the total harmonic distortion for the signal. The carrier must be the strongest peak (having a frequency > 0 Hz, a peak excursion > 6 dB on both sides, and an amplitude ≥–50 dBm) on the display at the time the measurement is started. The total harmonic distortion is then calculated from the measured harmonics and displayed as a percentage according to the following equation:

$$\%THD = 100 \times \frac{\left(\sqrt{\sum_{h=2}^{H_{max}} E_h^2}\right)}{E_f}$$

Where:

%THD = Total Harmonic Distortion as a percentage
h = harmonic number
H_{max} = Maximum Harmonic Value listed
E_h = voltage of harmonic h
E_f = voltage of fundamental signal

Refer to the *Agilent Technologies ESA Spectrum Analyzers Measurement Guide* for examples of this measurement and the calculation of Total Harmonic Distortion.

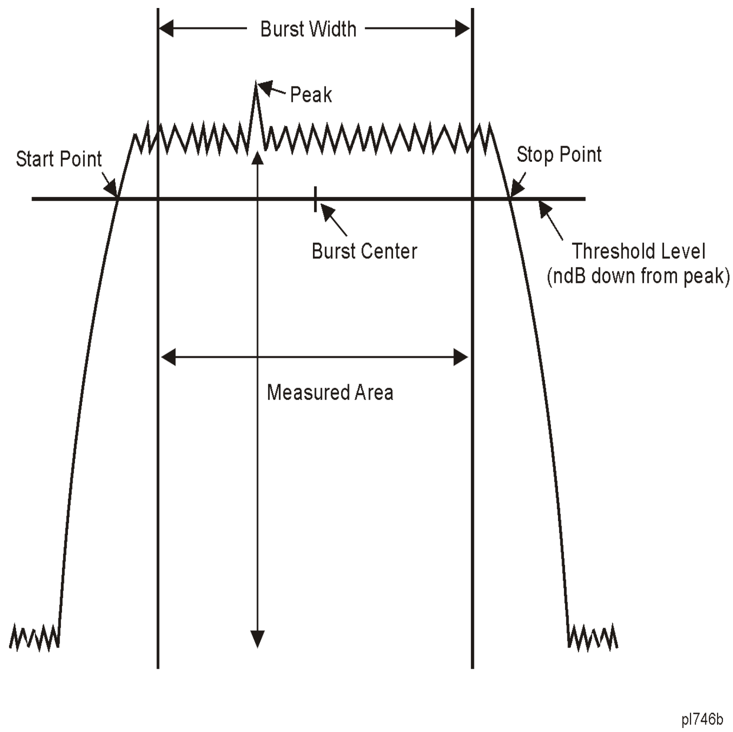
NOTE Limit the span to a bandwidth sufficient to view the modulated signal before initiating this measurement. Because resolution bandwidth is coupled to span, this provides the resolution bandwidth enough range to capture all the harmonics.

Pressing **Meas Setup** after **Harmonic Distortion** has been selected will access the harmonic distortion measurement setup menu. Pressing **Radio Standard** after **Mode Setup** has been selected will access all the Radio Standards available for which this measurement can be applied. Pressing **Meas Control** after **Harmonic Distortion** has been selected will access the harmonic distortion control menu which allows you to pause or restart your measurement, or toggle between continuous and single measurement.

Key Access: **MEASURE**

Bursted Power Measures the average power in zero-span mode for the captured burst. This measurement is primarily for use with time domain modulated signals (Bluetooth™, GSM /Edge, and NADC). The burst width, if not user defined, is determined by finding the peak in the captured data, then searching for the first place that the trace is higher than the threshold level. This is considered to be the start of the burst. The stop of the burst is the first position in the trace that falls below the threshold level. The mean carrier power is calculated based on the burst width and the threshold level. Refer to Figure 6-5 for clarification of these parameters.

Figure 6-6 Bursted Power Measurement



The bursted power measurement acquired data from the “Measured Area” above when a radio standard is chosen or when **Meas Setup**, **Meas Method**, **Measured Burst Width** is selected. When **Meas Setup**, **Meas Method**, **Above Threshold Lvl** is selected, the “Measured Area” extends the burst width delimiter lines to the start and stop points.

The mean carrier power is calculated by:

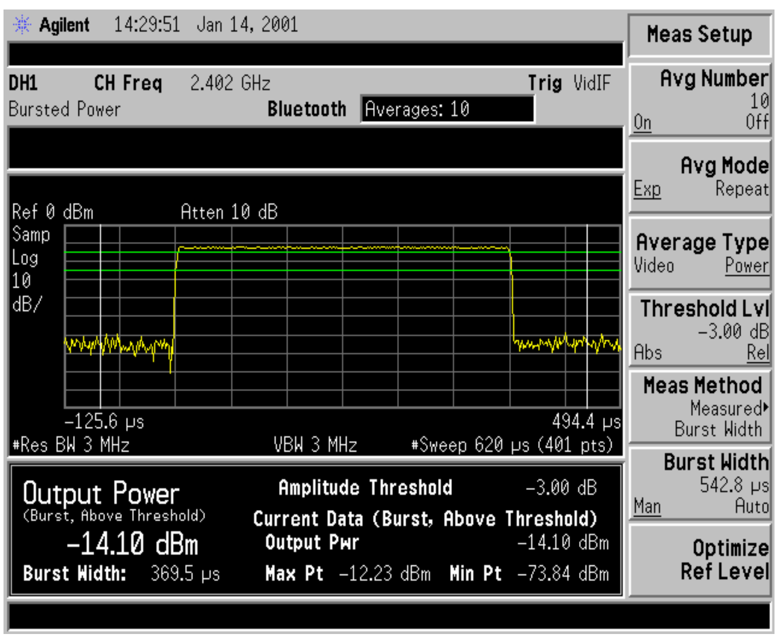
1. converting each trace point amplitude from dBm into linear power
2. Adding the above amplitudes together and dividing by the number of points included in the average.
3. This value is then displayed in logarithmic form (dBm).

$$(Pavg) = 10\log 10\left\{\frac{\left(\sum_{n}^{m}\left(10^{\frac{p}{10}}\right)\right)}{m-n}\right\}$$

where Pavg = average power, n is the start trace point, m= the stop trace point, and p= the trace point amplitude power in dBm.

The figure below shows an example of the results obtained when measuring a Bluetooth™ signal and with a user-defined burst width.

Figure 6-7 Bursted Power Measurement Results



NOTE The analyzer defaults to zero-span mode and the sweep time is set to capture at least one burst. The sweep time can be changed by pressing **Sweep**, **Sweep Time**.

Pressing **Meas Setup** after **Bursted Power** has been selected will access the bursted power measurement setup menu. Pressing **Meas Control** after **Bursted Power** has been selected will access the bursted power control menu which allows you to pause or restart your measurement, or toggle between continuous and single measurement.

Key Access: **MEASURE**

NOTE The measurements described above are those available in SA mode (see **Mode** key). Other measurements are available in other modes if an optional personality is installed.

MODE

Selects the measurement mode of your analyzer. Spectrum analyzer mode (**SA**) is the default mode. Other modes include GSM (requires Option BAH) and cdmaOne (requires Option BAC).

Mode Setup

Brings up a menu for setting up the current mode. The **SA** mode has the following mode setup functions.

Radio Standard

Accesses the radio standards key menu. Selecting a radio standard modifies spectrum analyzer settings only when one of the measurements (Channel Power, Occupied BW, ACP, Power Stat CCDF, Harmonic Distortion, Bursted Power) have been activated under the **Measure** menu.

Key Access: **Mode Setup**

None

Selects no radio standard. If **Radio Std, None** is selected when a measurement is running, essentially a “mini-preset” occurs. All instrument parameters set by the formerly active measurement (**Meas Setup** key menu) are restored to their factory default values. Analyzer parameters outside the **Measure** or **Meas Setup** key menus are not affected.

Key Access: **Mode Setup, Radio Std**

IS95

Sets the specific parameters for the selected measurement (located under the “MEASURE” key description) appropriate for industry standard IS95. All measurements are available for this standard.

Key Access: **Mode Setup, Radio Std**

J-STD-008

Sets the specific parameters for the selected measurement (located under the “MEASURE” key description) appropriate for industry standard J-STD-008. All measurements are available for this standard.

Key Access: **Mode Setup, Radio Std**

NADC

Sets the specific parameters for the selected measurement (located under the “MEASURE” key description) appropriate for industry standard NADC. The Bursted Power measurement is not available when **Device** (BTS) is selected. The Channel Power measurement is not available when **Device** (MS) is selected. All other measurements are available for this standard.

Key Access: **Mode Setup, Radio Std**

GSM/EDGE Sets the specific parameters for the selected measurement (located under the "MEASURE" key description) appropriate for industry standard GSM/EDGE. All measurements are available for this standard except Channel Power, ACP, and Occupied BW.

Key Access: **Mode Setup, Radio Std**

W-CDMA 3GPP Sets the specific parameters for the selected measurement (located under the "MEASURE" key description) appropriate for industry standard W-CDMA. All measurements are available for this standard.

Key Access: **Mode Setup, Radio Std**

cdma2000 SR1 Sets the specific parameters for the selected measurement (located under the "MEASURE" key description) appropriate for industry standard cdma2000-SR1. All measurements are available for this standard.

Key Access: **Mode Setup, Radio Std**

cdma2000 SR3-MC Sets the specific parameters for the selected measurement (located under the "MEASURE" key description) appropriate for industry standard cdma2000:SR3-MC. All measurements are available for this standard.

Key Access: **Mode Setup, Radio Std**

cdma2000 SR3-DS Sets the specific parameters for the selected measurement (located under the "MEASURE" key description) appropriate for industry standard cdma2000:SR3-DS. All measurements are available for this standard.

Key Access: **Mode Setup, Radio Std**

PDC Sets the specific parameters for the selected measurement (located under the "MEASURE" key description) appropriate for industry standard PDC. The Bursted Power measurement is not available when **Device** (BTS) is selected. The Channel Power measurement is not available when **Device** (MS) is selected. All other measurements are available for this standard.

Key Access: **Mode Setup, Radio Std**

Bluetooth™ Sets the specific parameters for the selected measurement (located under the "MEASURE" key description) appropriate for industry standard Bluetooth™. All measurements are available for this standard except Channel Power, ACP, and Occupied BW.

Key Access: **Mode Setup, Radio Std**

Standard Setup Accesses the key menu for selecting the device, packet type, or signal bandwidth to be measured.

Key Access: **Mode Setup**

Device
BTS MS Allows you to select either the base transmitter station (BTS) or the mobile station (MS) for all radio standards except Bluetooth™.

Key Access: **Mode Setup, Std Setup**

Packet Type
DH1 DH3 DH5 Allows you to select the packet type for Bluetooth™ measurement.

Key Access: **Mode Setup, Std Setup**

Signal BW
3.00000000 MHz Allows you to set the measurement bandwidth when **Radio Standard** (None) is selected.

Key Access: **Mode Setup**, **Radio Std**, **None**, **Std Setup**

Next Window

Allows you to select the active window in functions which support split-screen display modes, such as zone span. In split-screen display modes, pressing **Zoom** allows you to switch between split-screen and full-sized displays of the active window. See also “Zoom”.

NOTE The active window is indicated by a solid green box around the window.

Peak Search

Places a marker on the highest peak based on the setting of the search parameters, **Max** (default) or **Param**. Refer to **Peak Search Param Max** on page 288, for more information on the effect of setting **Peak Search** to **Max** or **Param**. When you preset the analyzer, the **Peak Search** is set to **Max** unless you save **Peak Search** (Param) as part of the user preset conditions and set **Preset** to **User**. Refer to **Preset** on page 290, for more information on presetting the analyzer.

Meas Tools Accesses the following frequently used menu keys which are replicated here for your convenience.

Peak Search Performs peak search as described above.

Key access: **Peak Search**, **Meas Tools**

Next Pk Right Refer to "Next Pk Right" on page 286.

Key access: **Peak Search**, **Meas Tools**

Next Pk Left Refer to "Next Pk Left" on page 286 of this chapter.

Key access: **Peak Search**, **Meas Tools**

Delta Refer to "Delta" on page 251.

Key access: **Peak Search**, **Meas Tools**

Mkr → CF Refer to "Mkr → CF" on page 257.

Key access: **Peak Search**, **Meas Tools**

Mkr → Ref Lvl Refer to "Mkr → Ref Lvl" on page 257.

Key access: **Peak Search**, **Meas Tools**

Function Refer to "Function" on page 253.

Key Access: **Peak Search**, **Meas Tools**

Band Power Refer to "Band Power" on page 253.

Key Access: **Peak Search**, **Meas Tools**, **Function**

Marker Noise Refer to "Marker Noise" on page 254.

Key Access: **Peak Search**, **Meas Tools**, **Function**

Off Refer to "Off" on page 256.

Key Access: **Peak Search**, **Meas Tools**, **Function**

Next Peak

Places the marker on the next highest peak. The signal peak must exceed the peak threshold value. If there is no peak, the marker will not move. (Also see the **Peak Excursn** and **Pk Threshold** key descriptions.)

Key Access: **Search**

Next Pk Right Moves the marker to the next peak to the right of the current marker. The signal peak must exceed the peak threshold value by the peak excursion value. If there is no peak to the right, the marker will not move and the No Peak Found error message will appear on the display. (Also see the **Peak Excursn** and **Pk Threshold** key descriptions.)

Key Access: **Search**

Next Pk Left Moves the marker to the next peak to the left of the current marker. The signal peak must exceed the peak threshold value by the peak excursion value. If there is no peak to the left, the marker will not move and the No Peak Found error message will appear on the display. (Also see the **Peak Excursn** and **Pk Threshold** key descriptions.)

Key Access: **Search**

Min Search Moves the active marker to the minimum detected amplitude value.

Key Access: **Search**

Pk-Pk Search Finds and displays the frequency (or time, if in zero span) and amplitude differences between the highest and lowest trace points.

Key Access: **Search**

Continuous Pk On Off When a marker is placed on a signal and **Continuous Pk** (On) is pressed, the marker will remain on the signal even if the signal changes in frequency and amplitude.

Key Access: **Search**, **More**

N dB Points On Off Activates the N dB function. Pressing **N dB Points** (On) turns on the N dB feature and activates two arrows that are N dB down from the marker. The frequency difference between the two arrows will be displayed in the upper right-hand corner of the display. If the feature is unable to find data N dB below the marker, the value of –100 Hz will be displayed in the upper right-hand corner of the display.

For example, N dB Points can be used to measure the 3 dB bandwidth of a filter in a transmission test with the tracking generator. The default value is –3 dB. Possible values range from –1.00 dB to –80.00 dB. You can enter values to a resolution of 0.01 dB using the numeric key pad, 0.1 dB using the knob, or 10 dB using the step keys.

The measured signal cannot have more than one peak that is greater than or equal to N dB. A signal must be greater than the peak excursion above the threshold to be identified. The setting for peak excursion may be increased from the –6 dB default value so that noise will not be identified as signals. Increasing the value too much may cause a smaller signal to be missed or misinterpreted as part of a larger signal. The amplitude scale may be either linear or logarithmic.

The N dB function follows the active marker. If you turn on a marker after N dB Points has been activated, the arrows will follow that marker. If the marker associated with N dB Points moves, the arrows will move with the marker unless there is no data N dB below the marker.

Key Access: **Search**, **More**

Search Param Accesses the following menu keys:

Key access: **Search**, **More**

Peak Excursn Sets the minimum amplitude variation of signals that the marker can identify as a peak. If a value of 10 dB is selected, the marker moves only to peaks that rise and fall more than 10 dB above the peak threshold value. Pressing **Preset** or turning on power resets the excursion to 6 dB and the threshold to 90 dB below the reference level.

NOTE Two signal peaks, which are so close together that the amplitude drop between them is less than the peak-excursion value, are not recognized as two peaks. A signal peak is recognized only if it has a peak excursion drop above the noise floor, on both sides of the signal.

When the peak excursion value is 6 dB or higher, the marker-peaking functions do not recognize signals less than the peak excursion value above the noise floor. To correct this, when measuring signals near the noise floor, the excursion value can be reduced even further. To prevent the marker from identifying noise as signals, reduce the noise floor variance to a value less than the peak-excursion value by reducing the video bandwidth or by using video averaging.

Key access: **Peak Search**, **More**, **Search Param**

Pk Threshold Sets the minimum amplitude of signals that the marker can identify as a peak. For example, if a value of –90 dBm is selected, the marker moves only to peaks that rise and fall more than the peak excursion value above –90 dBm. Pressing **Preset** or turning the Power on resets the excursion to 6 dB and the threshold to –90 dBm.

The value of the threshold appears in the active-function block and on the lower-left side of the display. The threshold level does not influence the trace memory or marker position. The value of the peak threshold level can be changed using the step keys, the knob, or the numeric keypad. Pressing any digit, 0 through 9, on the numeric keypad brings up the selected terminator menu.

Key access: **Peak Search**, **More**, **Search Param**

Peak Search Param Max

Sets the peak search mode. When **Peak Search** is set to **Max**, a peak search places a marker on the highest peak, excluding the LO feedthrough peak. When **Peak Search** is set to **Param**, a peak search places a marker on a peak that meets the **Peak Excursn** and **Peak Threshold** parameters. If **Peak Search** is set to **Param** and no peak satisfies the selected parameters, a marker is placed at the center of the trace, and the error message, "No Peak Found" will appear. Refer to, **Show Errors** on page 321, to remove the error message.

Key access: **Peak Search**, **More**, **Search Param**

Peak Table

Accesses the following **Peak Table** menu keys:

Key Access: **Peak Search**, **More 1 of 2**

Peak Table On Off

Displays a list of up to ten signal peaks that is updated at the end of each sweep. The peaks can be sorted in order by descending amplitude or by ascending frequency. Peaks above or below the display line can be excluded from the table. The peak table function works with trace 1 only.

Key Access: **Search**, **More**, **Peak Table**

Peak Sort Freq Amptd

Switches the peak table sorting routine between listing the peaks in order by descending amplitude or by ascending frequency.

Key Access: **Search**, **More**, **Peak Table**

Peak Readout

Accesses the following **Peak Readout** menu keys:

Key Access: **Search**, **More**, **Peak Table**

Normal

Shows up to ten signal peaks.

Key Access: **Search**, **More**, **Peak Table**, **Peak Readout**

> Display Line

Shows only peaks above the display line.

Key Access: **Search**, **More**, **Peak Table**, **Peak Readout**

< Display Line

Shows only peaks below the display line.

Key Access: **Search**, **More**, **Peak Table**, **Peak Readout**

Preset

Provides a convenient starting point for making most measurements. You can select whether a factory preset or user preset is performed. The default is factory preset, which will always set the analyzer to the same state for a given model number. The user preset is user-defined using the **Save User Preset** function (**System**, **Power On/Preset**). The Preset selection (**Factory** or **User**) can be set by pressing **System**, **Power On/Preset**, and toggling the **Preset** menu key until the desired selection is underlined.

If Factory Preset is selected:

Pressing the **Preset** front-panel key performs a factory preset, which performs the following:

- Resets the analyzer to Spectrum Analyzer (SA) mode.
- Brings up the **Freq/Channel** menu.
- Sets certain conditions to their default values.
- Performs a processor test, but does not affect alignment data.
- Clears both the input and output buffers and clears all trace data.
- Sets the amplitude values of trace 2 and 3 to the bottom of the screen.
- Amplitude-correction factors are turned off, but remain in analyzer memory.
- Limit line testing is turned off, but the limit line tables remain in analyzer memory.
- Segmented sweep is turned off, but the segmented sweep tables remain in analyzer memory.
- The status byte is set to 0.

See Table 6-5 on page -291 for the conditions established by performing a factory preset.

NOTE Input coupling is set to ac by a factory preset. For *Agilent E4402B or E4407B with Option UKB, E4404B, and E4405B* only, you can specify alternating current (ac) or direct current (dc) coupling at the analyzer input. Selecting ac coupling blocks any dc voltage at the analyzer input, but also decreases the frequency range of the analyzer. Make sure the analyzer is dc coupled when measuring below 100 kHz for Agilent E4402B, E4404B, E4405B and below 10 MHz for *Agilent E4407B*. (See "Input/Output" in this chapter for more information on this setting.)

If User Preset is selected:

Pressing the **Preset** hardkey brings up the **Factory Preset** and **User Preset** menu keys.

- If **Factory Preset** is pressed, a factory preset will be performed as described above.
- If **User Preset** is pressed, the user preset state is recalled. To set the user preset state, change the analyzer settings as desired, then press **System**, **Power On/Preset**, **Save User Preset**.

NOTE Recalling any state, including the user preset state, will affect the conditions of more parameters than are affected by a factory preset. For example, external preamp gain and input impedance correction are not affected by a factory preset but may be affected by a user preset.

NOTE If the Power On function is set to **Preset** and the Preset function is set to **Factory**, turning on the analyzer performs a factory preset. The last state of the analyzer (before it was turned off) is recalled if the **Power On** key is set to **Last** (**System**, **Power On/Preset**, **Power On**). The user preset state is recalled if the **Power On** key is set to **Preset** and **Preset** (User) is selected.

Table 6-5 Factory Preset Conditions

Amplitude correction factors	off
Amplitude Ref (Signal)	off
Amplitude units	50 Ω input – dBm log 75 Ω input – dBmV log
Annotation and graticule display	on
Attenuation	10 dB (auto-coupled)
Center frequency: E4401B and E4411B E4402B and E4403B E4404B E4405B E4407B and E4408B	 750 MHz 1.5 GHz 3.35 GHz 6.6 GHz 13.25 GHz
CF step size	10% of span
Coupled functions	all set to AUTO
Demod	Off
Detector	Peak
Display line level	–25 dBm, display off
Frequency offset	0 Hz

Table 6-5 Factory Preset Conditions (Continued)

IF Gain	Auto
Input Coupling	AC
Int Preamp	off
Limit line testing	off
Log scale	10 dB/division
Marker count	off
Marker counter resolution	auto-coupled
Markers	off
Max Mixer level	–10 dBm
Measure	Meas Off
Radio Std	None
Reference level	0 dBm in power-on units
Reference level offset	0 dB
Reference level position	top (10th) graticule
Resolution bandwidth	3 MHz (auto-coupled)
Scale Type	Log
Span	
E4401B and E4411B	1.5 GHz
E4402B and E4403B	3.0 GHz
E4404B	6.7 GHz
E4405B	13.2 GHz
E4407B and E4408B	26.5 GHz
Speaker	Off
SRQ mask	40
Start Frequency	0 Hz

Table 6-5 Factory Preset Conditions (Continued)

Stop Frequency	
E4401B and E4411B	1.5 GHz
E4402B and E4403B	3.0 GHz
E4404B	6.7 GHz
E4405B	13.2 GHz
E4407B and E4408B	26.5 GHz
State Registers	unaffected
Segmented Sweep	off
Sweep	continuous
Sweep Time	
E4401B and E4411B	4 ms (auto coupled)
E4402B and E4403B	5 ms (auto coupled)
E4404B	16.75 ms (auto coupled)
E4405B	33 ms (auto coupled)
E4407B and E4408B	265 ms (auto coupled)
Sweep Points	401
Threshold level	–90 dBm, display off
Title	cleared
Trace 1	clear-write
Trace 2	blank, at bottom of display
Trace 3	blank, at bottom of display
Trigger	free run
Trig Delay Off	1 µsec
Trig Offset Off	0 sec
VBW/RBW ratio	1.00000
Video averaging	off
Video bandwidth	3 MHz (auto-coupled)

User Preset

Loads the analyzer configuration that existed when **Save User Preset** was pressed. If **Save User Preset** has never been pressed, the factory preset state is loaded. If the user preset state has been saved but the load fails for any reason, the error message: `Unable to load user state` is displayed in the status line and the state is reset to whatever it was before the **Preset** key was pressed. This can sometimes happen if firmware has been upgraded or applications have been (un)installed after the user preset state was saved. **Save User Preset** can be accessed by pressing **System**, **Power On/Preset**.

Print

Option A4H (GPIB and Parallel) or Option 1AX (RS-232 and Parallel) only. **Print** initiates an output of the display data, without an external controller, to a previously specified graphics printer. Refer to Chapter 1 of this manual or the *Agilent ESA Spectrum Analyzers Programmer's Guide* for detailed information about printing.

Press the **Print** key to immediately print the screen to the currently-defined printer. The screen remains frozen (no further sweeps are taken) until the data transfer to the printer is complete. Refer to the **Print Setup** key description in this chapter for more information about the structure and definitions of the printer keys.

If you need to abort a print in progress, use the **ESC** (escape) key.

NOTE Printing requires an I/O optional interface. The *Agilent ESA Spectrum Analyzers Programmer's Guide*, included with the optional interfaces, provides interface details. Refer to "Printer Setup and Operation" on page 48 for more information about printing.

Print Setup

Option A4H (GPIB and Parallel) or 1AX (RS-232 and Parallel) only. Accesses the menu keys which allow you to define a printer and select printer options.

Printer Type Accesses the Printer Type menu keys. When you connect your printer and press the **Print** key, the analyzer will attempt to identify your printer. If identification is unsuccessful, **None** or **Custom** will automatically be set in the Printer Type menu.

Key Access: **Print Setup**

None The Printer Type will automatically be set to **None** when you press the **Print** key with an unsupported printer connected to your analyzer.

Key Access: **Print Setup**, **Printer Type**

Custom When you press the **Print** key and the analyzer cannot identify your printer, **Custom** will automatically be set in the Printer Type menu. Setting the Printer Type menu key to **Custom** allows you to define your printer using the **Define Custom** menu keys.

Key Access: **Print Setup**, **Printer Type**

Auto When **Auto** is selected, and the **Print** key is pressed, the analyzer will attempt to communicate with the printer and obtain its identification. If the printer is identified, the print will be successful and no message will appear on the display. If the analyzer is not able to identify the printer, the Printer Type will automatically be set to **Custom** and an error message asking you to press **Define Custom** to set up your printer will be displayed. If the printer is not supported, the Printer Type will automatically be set to **None** and an error message will inform you that your printer is unsupported.

Key Access: **Print Setup**, **Printer Type**

Define Custom Allows you to define your printer.

Key Access: **Print Setup**, **Printer Type**

Language PCL3 PCL5 Allows you to define your printer as a Hewlett-Packard PCL3. (Most DeskJets) or Hewlett-Packard PCL5 (LaserJets and DeskJets: 1100,1200,1600,2000 series) printer.

Key Access: **Print Setup**, **Define Custom**

Color Capable
Yes No

Allows you to define the color capability of your printer.

Key Access: **Print Setup**, **Define Custom**

Orientation

Allows you to select either **Portrait** or **Landscape** printing. The **Orientation** key will not function with a PCL3 (HP DeskJet) printer.

Key Access: **Print Setup**

Color
On Off

Allows you to select between color or black and white printing. This key will not function when pressed unless the connected printer supports color.

Key Access: **Print Setup**

Prints/Page
1 2

Selects the number of prints per page when orientation is set to **Portrait**. In **Landscape** printing, **Prints/Page** is always set to 1.

Key Access: **Print Setup**

Eject Page

Ejects your printed page.

Key Access: **Print Setup**

Restart

Restarts the current measurement activated in the **Measure** key menu.

When in **Average** (On) mode, (**BW/Avg**, **Average**) the averaging function is restarted (the trace is reset and the average number is reset to zero).

Return

Returns you to the previous menu. Repeated presses of this key move back through previously selected menus (including previous pages selected by the **MORE** key.

NOTE When a menu requiring a yes or no key press has been accessed, the **Return** key will not respond.

NOTE When entering an alphanumeric value (a screen title or filename), pressing **Return** terminates the entry.

Save

Executes a save operation as though you were in the **File**, **Save** menu and had pressed **Save Now**. If you have previously used the **File**, **Save**, **Save Now** keys to setup and save a file, the **Save** hardkey will save your file in the same format and to the same location using a new automatically generated filename. If you have not saved a file since power on, a state file (.STA format) will be saved to the C: drive.

For example, if you use the **File**, **Save** menu to configures the analyzer to save Trace 1 in .CVS format on the C: drive, using the automatically generated file name (TRACE001.csv), then every time the front-panel **Save** key is pressed, Trace 1 will be saved in .CSV format and the filename will be incremented (TRACE002.csv, TRACE003.csv). This provides a convenient format for saving several files with the same format quickly.

NOTE In the event that a valid save cannot be performed because a drive has not been selected, the **Save** key will report the error `No drive selected`. In this case, press **File**, **Save** and select a drive.

Single

When analyzer is in continuous sweep mode and not in a measurement (**MEASURE**, **Meas Off**), this key changes the sweep control to single sweep and executes a sweep after the trigger condition is met. If the analyzer is already in single sweep, pressing **Single** executes a new sweep after the trigger condition is met.

When analyzer is in continuous sweep mode and also in a measurement (selected under the **MEASURE** key), this key changes the measurement control to take a single measurement and executes a single measurement after the trigger condition is met. If the analyzer is already in single sweep, pressing **Single** executes a new measurement after the trigger condition is met.

If Average is on (**BW/Avg**, **Average** (On)), pressing **Single** resets the average trace and starts the average again from a count of zero. Sweeps are averaged until N sweeps are then taken (where N is the average number), and then the sweep is halted.

Source

Accesses the tracking generator key functions (Options 1DN or 1DQ only). Without Option 1DN or 1DQ, pressing **Source** will cause the error message `Option not installed` to appear on the analyzer display.

CAUTION If **Auto Align** is on, the 3 GHz tracking generator will be momentarily retuned to approximately 1.557 GHz between most sweeps. Some devices under test (for example, amplifiers with AGC) may be susceptible to damage due to this momentary retuning. To avoid this momentary retuning, turn the auto align off by pressing **System**, **Alignments**, **Auto Align**, **Off**. Refer to the appropriate "Specifications and Characteristics" chapter in the *Agilent Technologies ESA Spectrum Analyzers Specifications Guide - E Series* or *Agilent Technologies ESA Spectrum Analyzers Specifications Guide - L Series* for information on using the analyzer with Auto Align set to off.

Amplitude On Off

Activates (**On**) or deactivates (**Off**) the output power of the tracking generator. The power level can then be adjusted using the numeric keypad, step keys, or knob. Pressing any digit, 0 through 9, on the numeric keypad brings up the selected terminator menu. See the specifications chapter in the calibration guide for the available output power for your tracking generator.

Key Access: **Source**

NOTE For spectrum analyzers with Option 1DN or Option 1DQ, the tracking generator must be turned on (**Source**, **Amplitude** (On)) before you set up the segmented sweep table.

NOTE When **Amplitude** (Off) is selected, the output attenuation on the Agilent E4402B, E4403B, E4404B, E4405B, E4407B, and E4408B is set to the maximum attenuation.

Power Sweep On Off

Sets the power-sweep function to **On** or **Off**. The value of the power-sweep range is displayed in the active-function block when you press **Power Sweep** (On). The analyzer continues to sweep the specified frequency range when power sweep is on. (To do a power sweep at a fixed frequency, set the analyzer to zero span at the desired frequency.) The available power-sweep range is a function of the source attenuator setting. See the *Agilent Technologies ESA Spectrum Analyzers Specifications Guide - E Series* or *Agilent Technologies ESA Spectrum Analyzers Specifications Guide - L Series* for the available power sweep range.

The output power of the tracking generator is swept according to the sweep rate of the analyzer. The output power is always swept from the source power setting to a higher power setting (negative source power sweep values are not allowed).

Power-sweep measurements are particularly useful in making gain compression measurements or output power versus frequency measurements.

Key Access: **Source**

Attenuation Auto Man Allows you to select between automatic and manual adjustment of the tracking generator's output attenuator. The Agilent E4401B and E4411B can be manually adjusted from 0 to 60 dB in 10 dB steps. All other Agilent ESA analyzers can be manually adjusted from 0 to 56 dB in 8 dB steps. When auto-coupled, the attenuation function automatically adjusts the attenuator to yield the source amplitude level specified by the **Amplitude On Off** softkey function. For the Agilent E4401B and E4411B, press **Attenuation** (Man) for power sweeps greater than 10 dB.

Key Access: **Source**

Amptd Step Auto Man Allows you to set the step size of the power level range of the tracking generator. The default setting is one vertical scale division.

Key Access: **Source**

Amptd Offset Offsets the displayed power of the tracking generator. Using the amplitude offset capability of the tracking generator allows you to take system losses or gains into account, thereby displaying the actual power delivered to the device under test.

Key Access: **Source**

Tracking Peak *Agilent E4402B, E4403B, E4404B, E4405B, E4407B, and E4408B only*. Activates a routine that automatically adjusts fine tracking adjustments to obtain the peak response of the tracking generator on the spectrum analyzer display. Tracking Peak is performed in the active resolution bandwidth.

Key Access: **Source**

Man Track Adj *Agilent E4402B, E4403B, E4404B, E4405B, E4407B, and E4408B only*. Allows you to adjust the frequency of the tracking generator oscillator manually using the step keys, knob, or numeric keypad. The tracking adjust is tuned to maximize the amplitude of the trace.

Key Access: **Source**

NOTE When **Source** is On, resolution bandwidths less than 1 kHz are not available.

NOTE When the resolution bandwidth is less than 1 kHz, **Source** may not be turned on.

SPAN X Scale

Activates the **Span** function and accesses the menu of span functions. Pressing **SPAN X Scale** allows you to change the frequency range symmetrically about the center frequency. The frequency-span readout describes the total displayed frequency range; to determine frequency span per horizontal graticule division, divide the frequency span by 10.

Span Allows you to enter a span frequency range value.

Key Access: **SPAN Scale**

Span Zoom Finds the highest signal peak on the display. If a marker is not already on the peak, it places a marker there, turns on the signal-track function, and activates the span function. Entering new span values causes the analyzer to change the span in steps, keeping the signal centered on the screen until the desired span is reached. The analyzer is left in **Signal Track** mode. Pressing **Span Zoom** performs the routine similar to pressing the following keys: **Search**, **Frequency**, **Signal Track** (On), and **Span**.

Key Access: **SPAN Scale**

NOTE Span Zoom leaves the analyzer in Signal Track mode.

NOTE Span Zoom is not available when **Segmented** (On) is selected.

Full Span Changes the analyzer span to full span showing the full frequency range of the analyzer. In external mixing mode, pressing **Full Span** changes the analyzer span to the specified range for the selected external mixing band. Full span sets **Signal Track** (Off) and **Segmented** Off).

Key Access: **SPAN Scale**

Zero Span Changes the frequency span to zero. In this mode, the current center frequency is displayed in the time domain (the x-axis is displayed in units of time), like a conventional oscilloscope.

Sweep times faster than those in the frequency domain display mode are available if Option AYX or B7D are installed.

Resolution Bandwidths less than 1 kHz are unavailable when in zero span if the sweep time is being achieved by utilizing the Option AYX or B7D.

Key Access: **SPAN Scale**

NOTE Sweep times that would require the Option AYX or Option B7D are not available in zero span if the Resolution Bandwidth is less than 1 kHz.

NOTE Zero Span is not available when **Segmented** (On) is selected. Segments in the segmented sweep function can be set to zero span by setting the span parameter in the segmented sweep editor to 0 Hz. (**Sweep, Segmented, Modify, Edit, Span**)

NOTE The minimum number of sweep points in zero span varies with firmware revision:

Firmware Revision	Minimum # of Sweep Points in Zero Span
≤ A.03.03	401 (fixed)
A.04.xx	101
≥ A.05.00	2

NOTE Zero Span sets **Signal Track (Off)**.

Last Span Changes the analyzer frequency span to the previous span setting. If pressed after **Signal Track** is turned off, the span setting returns to the span that was in effect before **Signal Track** was turned on. This is true, even if **Signal Track** was turned on as part of **Span Zoom**. Last span sets **Segmented** (Off).

Key Access: **SPAN Scale**

Zone Accesses menu keys that allow you to control the two-window zone function. This function allows you to have an upper window with a broad display of frequency and two zone markers (vertical bars) that define the span for the lower window. This function is only available on ESA-E Series Analyzers (E4401B, E4402B, E4404B, E4405B, and E4407B).

Key Access: **SPAN Scale**

Zone On Off **Zone** (On) allows you to change from a one-window to a two-window display. The top window will display the trace with two vertical lines (Zone Markers) displayed at center frequency plus and minus 5% of the current span. (You can change the default zone frequency and zone span values using the **Zone Center** and **Zone Span** keys.) The top window will be inactive.

The bottom window will display the section of the trace in the top window that is between the Zone Markers. The span of the bottom window is 10% of the span of the top window. (You can change the default zone frequency and zone span values using the **Zone Center** and **Zone Span** keys.) Both windows have the same center frequency. The bottom window is active and the sweep time, resolution bandwidth, and video bandwidth have been coupled to the bottom window span.

There are separate annotations for frequency, bandwidth, sweep time, reference level, amplitude scale and scale/div for each window. The values for these parameters can be changed for each window independently.

To activate the top window, press the **Next Window** key located below the display. The active window is distinguished by a green border. Only the active window will have a sweep taken and updated to the display. When the active window is toggled, the state for the active window is saved, and the last state of the inactive window is recalled. When the window becomes inactive, its data invalid indicator will appear on the display. The data invalid indicator will remain until the window becomes the active window and a complete sweep has been executed. Pressing **Zoom** will change to a one-window display showing only the active window. Pressing **Zoom** again will return you to the two-window display. Pressing **Zone** (Off) will return you to a one-window display of the active window.

Key Access: **SPAN X Scale**, **Zone**

NOTE Pressing **Zoom** will set **Zone** (On), if it is off.

Zone Center Allows you to change the frequency of the zone markers without changing the zone span. The zone markers are vertical lines marking the zone in the upper window. They determine the frequency range displayed in the lower window. As the zone markers in the upper window are moved, the center frequency of the lower window is changed but the lower window will not be updated to reflect the change unless it is selected as the active window. (See **Zone On Off**.)

The center frequency for the lower window is not limited by the selected start and stop frequencies in the upper window. However, if the frequency span of the lower window is outside of the span for the upper window, the vertical span markers will be displayed at the edge of the graticule. When the lower window is active, the **FREQUENCY Channel** key will allow you to change **Zone Center**. Any change to the lower window while it is active will change the center frequency.

Key Access: **SPAN X Scale**, **Zone**

Zone Span Allows the span of the zone markers to be changed without changing the center frequency. The zone markers are vertical lines marking the zone in the upper window. They determine the frequency range displayed in the lower window. As the zone markers are moved, the span of the lower window is changed but the lower window will not be updated to reflect the change unless it is selected as the active window. (See **Zone On Off**.)

The span limit of the lower window is the same as the span limit of the analyzer. The span for the lower window is not limited to the selected span of the upper window. However, if the frequency span of the lower window is outside of the span of the upper window, the vertical span markers will not be displayed. When the lower window is active, the **SPAN X Scale** key will change **Zone Span**, and any change to **Zone Span** while the lower window is active, will change the span.

Key Access: **SPAN X Scale**, **Zone**

NOTE Zone Span is not available when **Segmented** (On) is selected.

Zone Pk Right Finds the next peak to the right of the zone center frequency on the upper window trace and then moves the zone so that it is centered around the new peak. The zone span is not changed. The center frequency of the lower window changes to reflect the new zone center frequency. The lower window will not be updated until it is made active. If no peak is found, the zone will not be moved. A signal must obey the parameters defined in **Search**, **Search Param** to be identified as a peak signal. Pressing **Zone Pk Right** will have no effect if the upper window is not the active window or if it is in zero span.

Key Access: **SPAN X Scale**, **Zone**

Zone Pk Left Finds the next peak to the left of the zone center frequency on the upper window trace and then moves the zone so that it is centered around the new peak. The zone span is not changed. The center frequency of the lower window changes to reflect the new zone center frequency. The lower window will not be updated until it is made active. If no peak is found, the zone will not be moved. A signal must obey the parameters defined in **Search**, **Search Param** to be identified as a peak signal. Pressing **Zone Pk Left** will have no effect if the upper window is not the active window or if it is in zero span.

Key Access: **SPAN X Scale**, **Zone**

Standby

Removes power from the analyzer, except for a small portion of circuitry inside the switching power supply. No internal time base circuitry, or any other function outside of the power supply is powered when the analyzer is in “standby.”

Sweep

Activates the sweep time function and accesses the following menu keys:

Sweep Time Auto Man

Selects the length of time the analyzer takes to tune across the displayed frequency span (or, in zero span, the time the analyzer takes to sweep the full screen). Reducing the sweep time increases the sweep rate. The sweep time can be changed using the step keys, the knob, or the numeric keypad.

In non-zero spans:

When the sweep time is auto-coupled, the analyzer selects the optimum (shortest) sweep time for the current settings. This selection process is influenced by several factors:

- The maximum tuning rate of the spectrum analyzer
- The selected Resolution Bandwidth and Video Bandwidth filters
- The maximum sample rate of the Analog-to-Digital converter (ADC) (Trace data are digitized and stored in memory)
- The number of trace points (**Sweep**, **Points**)

You may select a sweep time less than the auto-coupled value; however this may generate measurement errors. If this happens, the error message: `Meas Uncal` is displayed in the status line.

In zero span:

The minimum sweep time is determined by the maximum sample rate of the ADC and the number of sweep points. With Option B7D, the fastest sweep time is 2.5 microseconds (with 101 sweep points). As the number of points increases, the sweep time increases. With Option AYX, the fastest sweep time is 5 microseconds (with 101 sweep points). With neither option installed, the fastest sweep time is 1 millisecond (with 101 sweep points) and 4 milliseconds (with 401 sweep points).

The maximum sweep time is 4000 seconds for any set of conditions. Refer to the *Agilent Technologies ESA Spectrum Analyzers Specifications Guide - E Series* or *Agilent Technologies ESA Spectrum Analyzers Specifications Guide - L Series* for more information about Sweep Time and its relation to other instrument settings.

Key Access: **Sweep**

Sweep Cont Single

Switches the analyzer between the continuous-sweep mode and the single-sweep mode. Pressing **Sweep** (Single) puts the analyzer in single-sweep mode. Press **Single** on the front panel, to enable a sweep when in single-sweep mode. When **Sweep** (Cont) is selected, one sweep follows another as soon as it is triggered. Pressing **Preset**, or turning the power on, sets the sweep mode to continuous sweep.

Key Access: **Sweep**

Swp Coupling SR SA

Selects stimulus-response (SR) or spectrum-analyzer (SA) (default) auto-coupled sweep times. In stimulus-response mode, auto-coupled sweep times are usually much faster for swept-response measurements. Stimulus-response auto-coupled sweep times are typically valid in stimulus-response measurements when the system's frequency span is less than 20 times the bandwidth of the device under test.

Key Access: **Sweep**

Gate On Off

Requires Option 1D6 (Time Gate). Turns the gate function on and off. When set to **Gate** (On), the video signal that is digitized is controlled by the gate circuitry. The gate circuitry switches between two states. When the gate is "open", the normal video signal of the analyzer is passed through the video filters to the peak detectors and digitizer of the analyzer. When the gate is "closed", the video filters, peak detectors, and digitizer are given a signal at the bottom of the display.

The gate function requires that a gate trigger signal be connected to the **GATE TRIG/EXT TRIG IN (TTL)** input on the rear panel. When the gate function is on, the state of the gate appears at the **GATE/HI SWP OUT (TTL)** rear panel connector. A TTL high output indicates that the gate is open. The gate out signal is only valid while the analyzer is sweeping. Between sweeps, the gate out signal is invalid. You can adjust the gate delay and gate length using an oscilloscope to view the gate out signal. The analyzer sweep time should be set to a large value (50 sec) during the adjustment so that the gate signal is valid most of the time. When the adjustment is done you can set the analyzer back to the desired sweep time, or set it back to **Auto Couple**.

Key Access: **Sweep**

NOTE **Trig Delay** (On) and **Gate** (On) can not be active at the same time. If **Trig Delay** (On) has been previously selected, it will be reset to **Trig Delay** (Off) when **Gate** (On) is selected. Conversely, if **Gate** (On) has been previously selected, it will be reset to **Gate** (Off) when **Trig Delay** (On) is selected.

NOTE If **Gate** (On) is selected without an external trigger signal present, operating other functions, such as: tracking, frequency count, or preselector centering, may cause the analyzer to stop functioning until it is powered on again.

Gate Setup

Requires Option 1D6 (Time Gate). Accesses the following menu keys that allow you to setup various gate parameters:

Key Access: **Sweep**

Trig Type

Edge Level Allows you to select between **Edge** and **Level** triggering of the gate. **Trig Type** (Edge) opens the gate in response to an edge trigger on the trigger input after a delay set in **Gate Delay**. The gate stays open for the selected **Gate Length**. When **Trig Type** (Level) is selected, the gate is open as long as the trigger input is true, as defined under the **Level Setup** key.

Key Access: **Sweep**, **Gate Setup**

Edge Setup Accesses menu keys that allow you to set up edge triggering.

Key Access: **Sweep**, **Gate Setup**

Edge Pos Neg Sets the polarity for edge triggering of the gate. When **Edge** (Pos) is pressed, a positive-going edge will trigger the opening of the gate, after the delay set with the **Gate Delay** key. When **Edge** (Neg) is pressed, a negative-going edge will trigger the opening of the gate after the set delay.

Key Access: **Sweep**, **Gate Setup**, **Edge Setup**

Gate Delay Controls the length of time from the trigger until the gate is turned on. Requires Option 1D6.

Key Access: **Sweep**, **Gate Setup**, **Edge Setup**

Gate Length Controls the length of time that the gate is on when using edge triggering to control the gate. Requires Option 1D6.

Key Access: **Sweep**, **Gate Setup**, **Edge Setup**

Level Setup Sets up level polarity that will open the gate. Requires Option 1D6.

Key Access: **Sweep**, **Gate Setup**

High Selects a high TTL level to open the gate. Requires Option 1D6.

Key Access: **Sweep**, **Gate Setup**, **Level Setup**

Low Selects a low TTL level to open the gate. Requires Option 1D6.

Key Access: **Sweep**, **Gate Setup**, **Level Setup**

Points Allows you to set the number of points per sweep, from 101 to 8192 in non-zero span and 2 to 8192 in zero span (firmware revision A.05.00 and greater). Use the knob, step keys, or numeric keypad to set this value. When the sweep time is limited by the Analog to Digital Converter (ADC) sample rate, the sweep time changes with the number of points selected. The greater the number of points, the longer the sweep time becomes. If **Preset** is pressed, or the analyzer power is cycled, the number of points per sweep will default to 401. The current value of points is displayed next to the sweep time (refer to "Display Annotation" on page 24).

Changing the number of points has several effects on the analyzer. Since markers are read at the point location, the marker reading may change. Press **Peak Search**, again for greater accuracy in the marker reading. All trace data for the current window is cleared. If in continuous sweep mode, (Sweep, **Sweep** (Cont)), a new sweep begins immediately. If average is on (BW/Avg, **Average** (On)), the averaging starts over with a count of 0. If Limit Lines are on (**Display**, **Limits**, **Modify**, **Limit 1 or 2** (On)), they are turned off.

Key Access: **Sweep**

NOTE By selecting a number of sweep points greater than 401, you are optimizing frequency resolution and accuracy while accepting a reduced measurement speed. In addition to sweep points, the span, resolution bandwidth, video bandwidth, and center frequency will also affect measurement speed.

This function is not available when signal identification is on **(Input/Output, Input Mixer, Signal Ident (On)).**

When zone span is on (Span, Zone. **Zone** (On)), each window has its own value for points.

This feature is not available in the E4403B, E4408B, or E4411B (ESA-L Series). The number of points per sweep for these models is always set to 401.

Segmented Accesses the segmented sweep function and its editor.

Segmented sweep is a method in which you can select multiple frequency bands (a maximum of 32), specify their parameters individually, and display them as a single trace. This function of the analyzer results in faster measurements and provides greater detail and resolution in particular bands of interest. To set the parameters of individual segments, go to the editor (**Sweep, Segmented, Modify, Edit**) and refer to the parameter key descriptions below. For measurement examples of the segmented sweep function, refer to the *Agilent ESA Spectrum Analyzers Measurement Guide.*

Key Access: **Sweep**

NOTE This feature is only available on ESA-E series analyzers (E4401B, E4402B, E4404B, E4405B, E4407B) with firmware revision ≥ A.05.00.

Displaying the Trace

Turning segmented sweep on (**Sweep**, **Segmented**, **Segmented** (On), displays each sweep segment from left to right in order of increasing start frequency. When segments have the same start frequency, the segments are displayed in order of increasing stop frequency. Overlapping segments are acceptable. (Note however; the reference marker for a marker delta will be displayed in the first segment).

Segments are demarcated by vertical lines. The width of a given segment is determined by the ratio of the number of sweep points in the segment to the number of sweep points in the total trace. For example, if there are five segments with 101 sweep points each (505 total points), each segment occupies 20% of trace. If you increase the number of points in one of the segments to 404 (808 total points), that segment will occupy half of the trace; the other four segments, 12.5% each. You can define up to 32 segments with a total maximum number of sweep points equal to 8192.

Segmented Sweep Editor

When the editor is entered (**Sweep, Segmented, Modify, Edit**), the segmented sweep mode is turned on, and a dual-display appears. The upper window shows the trace, displayed as described above. The lower window shows the editor data in tabular form: one segment per row with segment number and parameter values occupying the seven columns. The paramenters that can be set are:

- Center Freq
- Span
- Resolution BW
- Video BW
- Points
- Sweep Time (Zero Span only)

The trace is updated after each segment has a complete row of data entered. Although thirty-two segments are possible, only 8 rows of data are shown in the table at a time.

Use the tab keys or softkey menu to navigate the editor. When defining a new segment, you may use the numeric keypad to set values. Pressing **Enter** places the value in the table and highlights the next parameter available for modification.

NOTE The order of the segments may change when you enter center frequency or span because the sequence is based upon increasing start frequency.

Various parameters are coupled to ensure accurate measurements. You will not be able to enter a value that would result in a measurement that is uncalibrated.

Amplitude parameters are common to all segments and are defined via the amplitude softkey menu. Refer to "AMPLITUDE Y Scale" on page 203 for more information.

The data in the segmented sweep table is retained through a power cycle. Table values can only be deleted by the **Delete** keys described below.

To exit the editor press any key except **Print**, **Help,** and the viewing angle adjustments.

NOTE Exiting the editor does not turn off segmented sweep. **Segmented** (Off) must be selected.

Interaction with Other Analyzer Functions

Certain conditions prevent segmented sweep from being activated, while others cause this mode to be turned off. For analyzers with Option AYZ, the mixer frequency range (**Input**, **Input Mixer** (Ext), **Ext Mix Band**) must be set to include the frequencies of interest in the segmented sweep table. If the mixer range is not the same, segmented sweep will not turn on. If the mixer range is changed, segmented sweep will be turned off.

Segmented sweep is not available when the following analyzer functions are turned on: Demod, Signal ID, and Signal Track. In addition, keys which access these functions are grayed out if segmented sweep is on. This is also true for the following functions: Mkr→CF, Mkr→CF Step, Mkr→CF Start, Mkr→CF Stop, MkrΔ→Span, Span Zoom, Zone Span, and Zero Span.

Confining marker pairs (marker delta, band pair, and span pair) to one segment facilitates interpretation of marker readings. However, marker pairs can provide useful information across segments. Amplitude readings are straightforward because the y-axis is consistent over all segments. Frequency or time readings require consideration of differences in sweep time, number of points, and span when interpreting measurements across segments.

Marker delta functions differently depending upon the type of segment in which it is activated. If you turn on marker delta in a segment set to 0 Hz span, it remains in that segment and provides amplitude and time difference measurements. If you initiate a marker delta in a non-zero span segment, it will function across segments and continue to display frequency and amplitude information.

Band pair and span pair function similarly to marker delta in segmented sweep with some characteristics which need to be noted. When a band or span pair is initiated in segmented sweep, the analyzer defaults to the frequency domain. If you wish to make time measurements in a zero-span segment, the domain must be set to time (**Marker**, **More**, **Readout**, **Time**). The band or span pair can traverse all segments without regard to the type of segment in which they were initiated.

NOTE Turn markers off (**Marker**, **Off**) when entering or exiting segmented sweep (**Segmented**, **Segmented** (Off)).

Performing a factory preset will turn segmented sweep off. This is also true if you select full span or last span.

Functions which are parameters of segmented sweep are not available when accessed by pressing the following front-panel keys: **Auto Couple**, **BW/Avg** (**Resolution BW** and **Video BW**), **Frequency** (the entire softkey menu), **Span** (see above), and **Sweep** (**Sweep Time** and **Points**).

When the sweep trigger is set to any of the trigger selections other than free run, no sweep occurs until the trigger condition is met. Once the trigger occurs, all segments are swept, completing the entire trace.

NOTE For spectrum analyzers with Option 1DN or Option 1DQ, the tracking generator must be turned on (**Source**, **Amplitude** (On)) before you set up the segmented sweep table.

The on/off state of the segmented sweep mode and the segmented sweep table can be saved as a “state” type file (see “Save” on page 300) or as part of the power on/preset function (see “Power On/Preset” on page 321).

NOTE When loading a “state” type file, segmented sweep will not turn on if any of the parameters in the file contain optional instrument settings not currently loaded on the analyzer or frequency settings outside the current range of the analyzer.

Edit Accesses the segmented sweep editor, where a maximum of thirty-two segments can be defined by the segment number and the six parameters described below. Use the data control keys described on page 14 to enter the setting as each parameter is highlighted. Refer to the “Editor” section above for more information.

Key Access: **Sweep**, **Segmented**

Segment Allows you to select a previously defined segment or the next segment for modification. Use the numeric keypad to select a specific segment or press the **Tab** keys to access adjacent segments.

Key Access: **Sweep, Segmented, Modify**, **Edit**

Center Freq Allows you to specify the center frequency for a particular segment using the data control keys. For more information on this function, refer to “Center Freq” on page 243.

Key Access: **Sweep, Segmented, Modify**, **Edit**

Span Allows you to select a frequency range symmetrically about the center frequency for the current segment using the data control keys.

NOTE The order of the segments may change when you enter center frequency or span because the sequence is based upon increasing start frequency. Refer to the “Displaying the Trace” section above, for clarification.

Zero span is available for any or all segments. It must be set by pressing **Span**, **0**, **Hz**. For more information on this function, refer to “Span X Scale” on page 305.

Key Access: **Sweep, Segmented, Modify, Edit**

Resolution BW Allows you to select the resolution bandwidth to a value between 1 kHz and 5 MHz for the current segment using the data control keys. For more information on this function, refer to "BW/Avg" on page 213.

Key Access: **Sweep, Segmented, Modify, Edit**

Video BW Allows you to set the video bandwidth for the current segment to a value between 30 Hz and 3 MHz. For more information, refer to "Video BW Auto Man" on page 213.

Key Access: **Sweep, Segmented, Modify, Edit**

Points Allows you to set the number of points for the current segment. The minimum number of points in a zero span segment is 2; in a non-zero-span segment, 101. The maximum number of points in the total sweep is 8192. If you exceed the number of points available in one segment, the message: `Too much data; total sweep points limited` will be displayed in the status line (yellow on color displays). Refer to "Points" on page 314 for more information on this parameter.

Key Access: **Sweep, Segmented, Modify, Edit**

Sweep Time Allows you to set the sweep time for the current zero span segment. For a non-zero span segment, the sweep time is auto-coupled to Span, Resolution Bandwidth, and Video Bandwidth and cannot be manually defined. The minimum sweep time is displayed. Refer to "Sweep Time Auto Man" on page 311 for more information.

Key Access: **Sweep, Segmented, Modify**, **Edit, More**

NOTE The parameters for each segment are limited to ensure the occurrence of only calibrated measurements.

Delete Segment Deletes the highlighted segment.

Key Access: **Sweep, Segmented, Modify**, **Edit, More**

Delete Initiates the deletion of all segments. After pressing this key once, the message: `If you are sure, press key again to delete` will be displayed. Pressing **Delete** again will complete the process.

Key Access: **Sweep, Segmented, Modify**

System (Local)

Accesses the System menu keys. Pressing **System** (Local) after the analyzer has been placed in the remote mode, places the analyzer in the local mode and enables front-panel control. During remote operation, R appears in the upper-right corner of the screen. A, T, L, or S may appear during remote operation, indicating talk, listen, or service request. Pressing the **System** (Local) key removes the R symbol in the upper-right corner.

Show Errors

Accesses a display of the last 11 errors reported. The most recent error will appear at the top of the list. The first error listed will be the first error removed if the error list is longer than 11 entries. If the same error message occurs several times the error message will be incremented rather than added to the list as a new error message.

The date and time identify the first time and the last time (if there is more than one of the same type error) an error occurred. The number of identical errors is also shown.

Key Access: **System**

Next Page

Allows you to access the next page of error messages. It is grayed out if you are on the last page or only one page exists.

Key Access: **System**, **Show Errors**

Prev Page

Allows you to access the previous page of error messages. It is grayed out if you are on the first page or only one page exists.

Key Access: **System**, **Show Errors**

Clear Error Queue

Clears the error queue in the **Show Errors** display.

Key Access: **System**, **Show Errors**

Power On/Preset

Accesses the following menu keys.

Key Access: **System**

Power On Last Preset

Determines the state of the analyzer when the analyzer is powered on. If the Power On function is set to **Preset**, the state of the analyzer is the same as it is after **Preset** is pressed, when the analyzer is powered on. If the Power On function is set to **Last**, then the state that the analyzer was in when it was powered off is recalled.

The setting (Last or Preset) of the Power On function is not changed by pressing **Preset**. Use the **Power On/Preset** menu key function to change the setting of the analyzer state that is recalled at power on. Limit lines are not recalled when the analyzer is powered on. Refer to "Preset" in this chapter for more information.

Key Access: **System**, **Power On/Preset**

Preset Factory User Pressing **Preset** (Factory) presets the analyzer to the configuration originally set at the factory. Refer to the "Preset" key description for the default factory-configuration settings.

Pressing **Preset** (User) sets the analyzer to the settings defined by the **Save User Preset** key. Refer to "Preset" in this chapter for more information.

Key Access: **System**, **Power On/Preset**

Save User Preset Saves the active state of the analyzer into the User Preset register for recall on **Preset** if **Preset** (User) is selected. Refer to "Preset" in this chapter for more information.

Key Access: **System**, **Power On/Preset**

Time/Date Accesses the following **Time/Date** menu keys used to set and display the real-time clock:

Key Access: **System**

Time/Date On Off Turns the display of the real-time clock on or off.

Key Access: **System**, **Time/Date**

Date Format MDY DMY Changes the display of the date from a month-day-year format to a day-month-year format.

Key Access: **System**, **Time/Date**

Set Time Allows you to set the time of the real-time clock. Enter the time in 24 hour HHMMSS format, using the numeric keypad and pressing **Enter**. Valid hour (HH) values are from 00 to 23. Valid minute (MM) and second (SS) values are from 00 to 59.

Key Access: **System**, **Time/Date**

Set Date Allows you to set the date of the real-time clock. Enter the date in the YYYYMMDD format using the numeric keypad and press **Enter**. Valid year (YYYY) values are 0000 through 9999. Valid month (MM) values are from 01 to 12, and valid day values are from 01 to 31.

Key Access: **System**, **Time/Date**

Alignments Accesses the following **Alignments** menu keys which align the internal circuitry of the analyzer, load default values for the alignment system, and adjust the 10 MHz reference.

Key Access: **System**

Auto Align Accesses the **Auto Align** menu keys.

All Turns on the automatic alignment of all measurement systems. When **Auto Align**, **All** is selected, "**AA**" appears along the left edge of the display.

Key Access: **System**, **Alignments**

All but RF Turns on the automatic alignment of all measurement systems except the RF section. (Eliminating automatic alignment of the RF prevents changes in the input impedance between sweeps, which could cause input device instability.) When **Auto Align**, **All but RF** is selected, "**AB**" appears.

Key Access: **System**, **Alignments**

Off Turns off automatic alignment.

Key Access: **System**, **Alignments**

NOTE It is normal to hear clicking sounds when the Auto Alignment function is On. During retrace, a small portion of the analyzer circuitry is realigned. Some of the switching of the analyzer circuitry is done using relays. It is the rapid switching of these relays during retrace that causes the clicking sounds. To eliminate the clicking sounds, turn the auto alignment off by pressing **System**, **Alignments**, **Auto Align**, **Off**. When this is done, the **Align Now**, **All** function should be performed periodically. Refer to the appropriate "Specifications and Characteristics" chapter in the *Agilent Technologies ESA Spectrum Analyzers Specifications Guide - E Series* or *Agilent Technologies ESA Spectrum Analyzers Specifications Guide - L Series* for more information on how often to perform **Align Now**, **All** when the auto alignment is off

Align Now Accesses the **Align Now** menu keys and immediately executes an alignment cycle of the selected system(s). Menu key selections include:

Key Access: **System**, **Alignments**

All Initiates the alignment of all systems. Except the Option 1DN Tracking Generator for models E4402B, E4403B, E4404B, E4405B, E4407B, and E4408B.

Key Access: **System**, **Alignments, Align Now**

RF (Ext Cable) Initiates the alignment of the RF system with a cable connected from AMPTD REF OUT to INPUT 50 Ω. *Models E4402B, E4403B, E4404B, E4405B, E4407B, and E4408B*. This Alignment uses an Internal Signal Source.

Key Access: **System**, **Alignments, Align Now**

RF Initiates the alignment of the RF system. *Models E4401B and E4411B only*. This Alignment uses an Internal Signal Source.

Key Access: **System**, **Alignments, Align Now**

TG (Ext Cable) Initiates the alignment of the tracking generator only when the Option 1DN is installed in Agilent E4402B, E4403B, E4404B, E4405B, E4407B, and E4408B. You must connect a cable from RF OUT 50 Ω to INPUT 50 Ω

Key Access: **System**, **Alignments, Align Now**

FM Demod Initiates an alignment of the FM demodulation system only when Option BAA or Option 106 is installed.

Key Access: **System**, **Alignments, Align Now**

After a five minute warm-up, **Align Now**, **All** (with a cable connected from AMPTD REF OUT to INPUT 50 Ω) should be performed on Agilent E4402B, E4403B, E4404B, E4405B, E4407B, and E4408B. Refer to the appropriate “Specifications and Characteristics” chapter in the *Agilent Technologies ESA Spectrum Analyzers Specifications Guide - E Series* or *Agilent Technologies ESA Spectrum Analyzers Specifications Guide - L Series* for details on using **Align Now** when **Auto Align** is **Off**.

Freq Correct On Off Controls use of some of the correction factors. When On is underlined, frequency correction factors are used. When Off is underlined, frequency correction factors are not used, and `Freq Corr Off` appears on the display. Turning the correction factors off degrades frequency accuracy.

Key Access: **System**, **Alignments**

NOTE Frequency correction factors must be on for the analyzer to meet its specified performance.

Time Base Accesses the **Fine** and **Coarse** Time Base menu keys, which allow control of the 10 MHz time base frequency. This function is used to verify the settability of the 10 MHz reference and to adjust for changed operating conditions, such as temperature. Pressing **Load Defaults** or cycling power, resets the time base to its original value.

Key Access: **System**, **Alignments**

Load Defaults Loads the default values for the alignment system, turns on the frequency corrections, and resets the time base to the factory values. **Align Now**, **All** must be executed 3 times after pressing **Load Defaults**.

Key Access: **System**, **Alignments**

Remote Port *With Option A4H (GPIB and Parallel) only*. Selects the remote port to allow programming from an external controller over GPIB. Also, it allows the GPIB address to be entered. The default address is 18.

With Option 1AX (RS-232 and Parallel) only. Selects the remote port to allow programming from an external controller over a serial communication link. Also, it allows the baud rate to be set. The available baud rate values are as follows: 110, 300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200. The default baud rate is 9600.

Key Access: **System**

Show System Displays the number and description of the options installed in your analyzer. It also displays the instrument model number, product number, serial number, firmware revision number, Host ID (for licensing), bootrom revision, and amount of RAM and ROM.

Key Access: **System**, **More**

Next Page Allows you to access the next page of show system. It is grayed out if you are on the last page or only one page exists.

Key Access: **System**, **Show System**

Prev Page Allows you to access the previous page of show system. It is grayed out if you are on the first page or only one page exists.

Key Access: **System**, **Show System**

Show Hdwr Gives detailed information about the hardware installed on your analyzer.

Key Access: **System**, **More**

Next Page Allows you to access the next page of show hardware. It is grayed out if you are on the last page or only one page exists.

Key Access: **System**, **Show Hdwr**

Prev Page Allows you to access the previous page of show hardware. It is grayed out if you are on the first page or only one page exists.

Key Access: **System**, **Show Hdwr**

Color Palette Agilent ESA-E Series only (E4401B, E4402B, E4404B, E4405B and E4407B). Accesses the **Color Palette** menu keys. These keys are only available with analyzers having a color display.

Key Access: **System**, **More**

Default Sets all the display screen attributes to the factory defined colors.

Key Access: **System**, **More**, **Color Palette**

Vision Impair 1 and **Vision Impair 2** The special colors built into the **Vision Impair 1** and **Vision Impair 2** keys accommodate most color-deficient vision problems.

Key Access: **System**, **More**, **Color Palette**

Optical Filter Accommodates the use of protective goggles while viewing lasers.

Key Access: **System**, **More**, **Color Palette**

Monochrome Sets the display screen to green monochrome. The monochrome display uses different shades of green for each green value. This is especially useful for driving external monochrome monitors.

Key Access: **System**, **More**, **Color Palette**

Diagnostics Accesses the **Front Panel Test** menu key.

Key Access: **System**, **More**

Front Panel Test Allows you to verify the functionality of each front-panel key (except **Preset**). The number next to each key name increments once each time the key is pressed. Rotating the knobs causes the number of pulses to be counted. Press **ESC** to exit.

Key Access: **System**, **More**, **Diagnostics**

Restore Sys Defaults Resets the “persistent” state variables to their defaults. These are values, such as the GPIB address, that are unaffected by a power cycle or a preset.

Key Access: **System**, **More**

Table 6-6 System Default Settings

Feature	Default Setting
Power On Last/Preset	Preset
Preset Factory/User	Factory
RS-232 DTR Control	On (hardware pacing)
RS-232 RTS Control	IBFULL (hardware pacing)
RS-232 Receive Pacing	None (data pacing)
RS-232 Transmit Pacing	None (data pacing)
RS-232 Baud Rate	9600
Instrument Color Palette	Default palette
Print Format	Print screen mode
Printer Selection	Auto
Print Orientation	Portrait
Custom Printer, Language	PCL3

Table 6-6 System Default Settings (Continued)

Feature	Default Setting
Custom Printer, Color Capability	No
Color Printing	On
Prints/ Page	1
Date Format	MDY
Time Date Display	On
GPIB Address	18
Display Viewing Angle	4
Speaker Volume	0
Manual Tracking Adjustment	2048
External Amplifier Gain	0 dBm
Input Impedance	50 (Ohm)[1]

1. This value may be 75 ohms, depending upon the analyzer hardware configuration.

Licensing Accesses the security system to enable licensing for individual options. For information on how to use this system, see the installation information for individual options in the measurement personalities' user's guides.

NOTE Not all options can be enabled using this system and there is no way to turn *off* an option through this system. Once an option has been licensed for a given analyzer, it cannot be transferred to a different analyzer.

Key Access: **System**, **More, More**

Option Accesses the Alpha Editor allowing you to enter a three character option number. To terminate the entry, press **Enter** or **Return**. An external keyboard may also be used for this entry. The option number will appear on the second line of the **Option** key. Key

Access: **System**, **More**, **Licensing**

License Key Accesses the Alpha Editor allowing you to enter the license key number. To terminate the entry, press **Enter** or **Return**. An external keyboard may also be used for this entry. The license key number will appear on the second line of the **License Key** menu key.

Key Access: **System**, **More**, **Licensing**

Activate Allows you to activate the option. When a valid option key number and license key number have been entered, press **Activate**. If your entry was correct, the option will be enabled and the message: `Option activated` will appear in the status line of your display. The option number and license key number will also be cleared from the **License Key** and **Option** key.

If your entry was incorrect, the error message `License key invalid` will appear in the status line of your display. The option number and license key number can be edited until they are correct.

Key Access: **System**, **More**, **Licensing**

NOTE It is possible to enable an option for which the analyzer is not yet configured. Therefore, the message `Option activated` does not mean that the option will immediately function. For a display of options that are enabled and for which the analyzer is properly configured, press **System**, **More**, **Show System**.

Personalities Accesses a display listing the personalities that are currently installed in the analyzer. Information about the personalities are under the column headings **Opt** (option number), **Name** (option name), **Version** (personality version), **Licensed** (whether or not the personality is licensed), and **Size** (personality memory). At the bottom of the display is a line showing the available memory for installing personalities.

Key Access: **System**, **More**, **More**

NOTE Some files are shared between personalities. If shared files are installed, a personality may require less room than is indicated on the display. The **Uninstall** key will not delete any shared file unless the personality being deleted is the last personality to use the shared file.

Next Page Allows you to view the next page of installed personalities. It is grayed out if you are on the last page or only one page exists.

Key Access: **System**, **More**, **Personalities**

Prev Page Allows you to view a previous page of installed personalities. It is grayed out if you are on the first page or only one page exists.

Key Access: **System**, **More**, **Personalities**

Install Allows you to install personalities in the analyzer. For more information on this key, see the documentation that accompanies the personalities software.

Key Access: **System**, **More**, **Personalities**

Uninstall Allows you to uninstall a personality. Highlight the appropriate personality and press **Uninstall**, **Uninstall Now**. You will be prompted with the displayed message `If you are sure you want to uninstall, press Uninstall Now again`.

Some personalities may not be deleted. If the attempt is made to do so, the message `Can't uninstall this program` will appear on the display.

Key Access: **System**, **More**, **Personalities**

Service Accesses the **Service** menu keys. You must have a password to access this menu. For information, refer to the troubleshooting chapter in the *Agilent ESA Spectrum Analyzers Service Guide*.

Key Access: **System**, **More**, **More**

Tab Keys

The Tab keys are located below the display and are used to move between fields in the tables and forms.

Trig

Accesses the menu of keys that allow you to select the sweep mode and trigger mode of the analyzer.

Free Run

New sweep starts as soon as possible after the current sweep ends.

Key Access: **Trig**

Video

Activates the trigger condition that allows the next sweep to start if the detected RF envelope voltage rises to a level set by the video trigger level. When **Video** is pressed, a line appears on the display. The analyzer triggers when the input signal exceeds the trigger level at the left edge of the display. You can change the trigger level using the step keys, the knob, or the numeric keypad

Key Access: **Trig**

NOTE This function is not available when the Resolution Bandwidth is less than 1 kHz. If a Resolution Bandwidth less than 1 kHz is selected while in Video Trigger mode, the Trigger mode changes to Free Run.

Line

Activates the trigger condition that allows the next sweep to be synchronized with the next cycle of the line voltage.

Key Access: **Trig**

NOTE Line trigger is not available when operating from a dc power source.

External Pos Neg

Activates the trigger condition that allows the next sweep to start when the external voltage (connected to **GATE TRIG/EXT TRIG IN** on the rear panel) passes through approximately 1.5 volts. The external trigger signal must be a 0 V to +5 V TTL signal. This function also controls the trigger polarity (for positive or negative-going signals).

Key Access: **Trig**

TV

Option B7B (TV Trigger and Picture on Screen) only. Activates the trigger condition that allows the next sweep to be synchronized with the next occurrence of the synchronizing pulse of a selected TV line.

Line number range is dependent on the settings of the **Standard** and **Field** menus within the **TV Trig Setup** menu. When the line number is incremented beyond the upper limit, the value will change to the lower limit and continue incrementing from there. When the line number is decremented below the lower limit, the value will change to the upper limit and continue decrementing from there.

Key Access: **Trig**

TV Trig Setup

Option B7B (TV Trigger and Picture on Screen) only. Accesses the setup functions for TV Trigger.

Key Access: **Trig**

Field

Allows you to determine how the fields of the TV picture signal will be affected by the trigger system. One complete TV image consists of one frame of 525 or 625 horizontal lines depending on the TV standard being used. Each frame is composed of two fields of interlacing lines, each consisting of 262 1/2 lines (or 312 1/2 lines). The fields are called Field One and Field Two. Field One is viewed as having 263 lines (or 313 lines) and Field Two is viewed as having 262 lines (or 312 lines).

For the 525 line NTSC video standard, we refer to TV lines as follows (these are the Field Modes):

Entire Frame, lines 1 to 525
Field One, lines 1 to 263
Field Two, lines 1 to 262 (note that this really refers to “actual” lines 264 to 525)

For the 625 line PAL and SECAM video standards, we refer to TV lines as follows:

Entire Frame, lines 1 to 625
Field One, lines 1 to 313
Field Two, lines 314 to 625

As the Field is changed, the appropriate value for Line is chosen to keep triggering on the same line as before, or if this is not possible, the corresponding line in the new Field. For example, suppose line 264 is selected while in the NTSC-M standard and the Entire Frame mode. This is the first line in Field Two. If Field Two is then selected, the Line number changes to Line 1, the same actual line in the TV signal. If Field One is then selected, the line number stays at 1, but now we are triggering in the first line in Field One. The only exception to this is if we are on the last line of Field One and change to Field Two. In this case, we go to the last line in Field Two.

Key Access: **Trig**, **TV Trig Setup**

Entire Frame

Causes the selected line number to be viewed as an offset into the entire frame starting with line 1, the first line in Field One.

Key Access: **Trig**, **TV Trig Setup**, **Field**

Field One Causes the selected line number to be viewed as an offset into the first field starting with Line 1, the first line in Field One.

Key Access: **Trig**, **TV Trig Setup**, **Field**

Field Two Causes the selected line number to be viewed as an offset into the second field. If Line 1 is selected, it is the 264th line of the frame (NTSC-M, NTSC-Japan, PAL-M) or the 314th line of the frame (PAL-B,D,G,H,I, PAL-N-Combin, SECAM-L).

Key Access: **Trig**, **TV Trig Setup**, **Field**

Sync Pos Neg Refers to the nature of the video waveform. Normal baseband video has a TV line sync pulse on the bottom of the waveform (more negative voltage). This is referred to as "negative" (**Sync Neg**). When the analyzer is used as a TV receiver to produce baseband video, the detected video is "upside down" with the sync pulse on the top of the waveform (this is true only for NTSC and PAL transmission standards, not for SECAM). This orientation is referred to as "positive" (**Sync Pos**).

Key Access: **Trig**, **TV Trig Setup**

Standard Accesses the Standard menu keys which allow you to select from the following TV standards: **NTSC-M**, **NTSC-Japan**, **PAL-M**, **PAL-B,D,G,H,I**, **PAL-N**, **PAL-N-Combin**, **SECAM-L**.

Key Access: **Trig**, **TV Trig Setup**

TV Source Allows you to select between the internal analyzer path (**SA**) or the EXT VIDEO IN connector on the rear panel (**Ext Video In**) as the source for the TV Trigger and TV Monitor functions. Note that this does not affect the signal viewed on the analyzer.

Key Access: **Trig**, **TV Trig Setup**

TV Monitor When **TV Monitor** is pressed, the selected Standard is used to determine the proper setup of the analyzer hardware for presentation of the TV picture. When the TV picture is active and on the display, pressing a key that normally accesses a menu, instead restores the original ESA graphical display with the selected menu enabled. The active function remains active and can be adjusted while the picture is displayed.

Key Access: **Trig**, **TV Trig Setup**

NOTE The color decoding circuitry is always enabled, even for weak and monochrome signals.

Trig Delay On Off

Allows you to set and turn on or off a delay, during which the analyzer will wait to begin a sweep after receiving an external trigger signal. This function is not available when **Gate** is on. **Trig Delay** is active when **External** is selected.

Key Access: **Trig**

NOTE This function is not available in Free Run or Video Trigger modes.

Trig Offset On Off

Allows you to set and turn on or off an offset value from the trigger point of the sweep at which to begin storing data in the trace of the analyzer. The offset is specified as a function of time, and permits positive (pre trigger) and negative (post trigger) values to be specified.

Key Access: **Trig**

NOTE This function is only available when in Zero Span. (It is grayed out when in swept span.) If this key is pressed in swept spans, the error message: `Trigger Offset unavailable in swept spans` is displayed in the status line. The value and state of Trigger Offset is remembered if Zero Span is exited and restored when Zero Span is reselected.

NOTE This function is only available with Resolution Bandwidths of 1 kHz or greater. If this key is pressed when the Resolution Bandwidths is less than 1 kHz, the error message: `Trigger Offset unavailable in bandwidths < 1 kHz` is displayed in the status line. While Trigger Offset is on, it is not possible for the instrument to be set to a Resolution Bandwidth less than 1 kHz. Any attempt to do so will cause the error message: `Bandwidths <1 kHz unavailable with Trigger Offset on` to be displayed in the status line.

⇑ (UP) and ⇓ (DOWN) Arrow Keys

The ⇑ (UP) and ⇓ (DOWN) arrow keys can be used to adjust the analyzer parameters incrementally. The arrow keys are also used to select between files or points on a list. These keys are also called step keys.

Viewing Angle

Controls the optimum viewing angle of the display. The viewing angle keys are located next to each other at the upper left-hand corner of the analyzer, bordering the display. These two keys allow you to adjust the intensity of the objects on the display so that it can be optimally viewed from different angles.

The **Viewing Angle** keys automatically repeat when they are held down.

View/Trace

Accesses the trace keys that allow you to store and manipulate trace information. Each trace is comprised of a series of data points in which amplitude information is stored. The analyzer updates the information for any active trace with each sweep.

Trace 1 2 3

Selects the menu keys used for trace 1, trace 2, or trace 3 functions. Press **Trace 1 2 3** until the number of the desired trace is underlined.

Key Access: **View/Trace**

CAUTION When using normalization, the mode of traces 2 and 3 should not be changed.

Clear Write

Erases any data previously stored in the selected trace and continuously displays any signals during the sweep of the analyzer. This function is activated for trace 1 at power-on and by pressing **Preset**.

Key Access: **View/Trace**

Max Hold

Maintains the maximum level for each trace point of the selected trace (1, 2 or 3), and updates each trace point if a new maximum level is detected in successive sweeps.

Key Access: **View/Trace**

NOTE Changing the vertical scale (**Amplitude**, **Scale Type**, Log or Lin), pressing **Restart**, turning averaging on (**BW/Avg**, **Average, On**), or switching window in Zone Span (**Span**, **Zone**) restarts the held trace.

Min Hold

Maintains the minimum level for each trace point of the selected trace (1, 2 or 3), and updates each trace point if a new minimum level is detected in successive sweeps.

Key Access: **View/Trace**

NOTE Changing the vertical scale (**Amplitude**, **Scale Type**, Log or Lin), pressing **Restart**, turning averaging on (**BW/Avg**, **Average, On**), or switching window in Zone Span (**Span**, **Zone**) restarts the held trace.

View

Holds and displays the amplitude data of the selected trace. The trace register is not updated as the analyzer sweeps. If a trace is deactivated by pressing **Blank,** the stored trace data can be retrieved by pressing **View**.

Key Access: **View/Trace**

Blank Stores the amplitude data for the selected trace, and removes it from the display. The selected trace register will not be updated as the analyzer sweeps. This function is activated for traces 2 and 3 at power-on and by pressing **Preset**.

Key Access: **View/Trace**

Operations Accesses the following **Operations** menu keys:

Key Access: **View/Trace**, **More**

1↔2 Exchanges the contents of the trace 1 register with the trace 2 register and puts trace 1 and 2 in view mode.

Key Access: **View/Trace**, **More**, **Operations**

2 – DL → 2 Subtracts the display line from trace 2 and places the result in trace 2 and puts trace 2 in view mode. The **2 – DL → 2** function is a math operation.

Key Access: **View/Trace**, **More**, **Operations**

2 ↔ 3 Exchanges the contents of trace 2 with trace 3 and puts trace 2 and 3 in view mode.

Key Access: **View/Trace**, **More**, **Operations**

1 → 3 Copies trace 1 into trace 3 and puts trace 3 in view mode.

Key Access: **View/Trace**, **More**, **Operations**

2 → 3 Copies trace 2 into trace 3 and puts trace 3 in view mode.

Key Access: **View/Trace**, **More**, **Operations**

Normalize Accesses the following **Normalize** menu keys:

Key Access: **View/Trace**, **More**

Store Ref (1→ 3) Copies trace 1 into trace 3. **Store Ref (1→ 3)** must be pressed before pressing **Normalize** (On). If **Normalize** (On) is pressed before **Store Ref (1→ 3)**, the error message: `Store reference trace before turning on Normalize` is displayed in the status line, however Normalize has been activated.

Key Access: **View/Trac**, **More**, **Normalize**

Normalize On Off **Normalize** (On) Activates the normalize function. On each sweep, the normalized trace (Trace 3) is subtracted from Trace 1 and the result is added to the normalized reference level. The display shows the result of the following calculation:

Trace 1 – Normalized Trace + Normalized Reference Level

The trace data is normalized with respect to the normalized reference level, even if the value of the normalized reference level is changed. This function remains in effect on all subsequent sweeps until it is turned off.

NOTE Segmented sweep is not available when **Normalize** (On) is selected.

CAUTION Trace 1 should be in clear write mode prior to setting normalize to on.

The normalize function is most useful for applying correction data to a trace while making a stimulus response measurement with a tracking generator. For example, connect the cables and a thru line, in place of the device to be measured, between the tracking generator and the analyzer input. Notice that the frequency response is not perfectly flat, showing the response of the cables, as well as the flatness of both the tracking generator and the analyzer.

Now press **Store Ref (1→ 3)**, **Normalize On**. Notice that the displayed trace is now flat, or normalized. The position of the normalized trace can now be moved to a different position on the display by changing the normalized reference position. This may be useful if the device to be tested has positive gain, such as an amplifier. Now replace the thru line with the device under test, and an accurate measurement of the gain or loss can be made.

Key Access: **View/Trace**, **More**, **Normalize**

Norm Ref Lvl Sets the level (in dB) of the normalized reference.

Key Access: **View/Trace**, **More**, **Normalize**

Norm Ref Posn Offsets the displayed trace without affecting the instrument gain or attenuation settings. This allows the displayed trace to be moved without decreasing measurement accuracy. The normalized reference position is indicated with a (>) character on the left side of the display and a (<) character on the right side of the display.

Key Access: **View/Trace**, **More**, **Normalize**

Zoom

Allows you to switch between the split-screen and full-sized display of the active window in zone span and other functions which support split-screen display modes. The active window is indicated by a solid green line surrounding the window.

If **Zoom** is pressed while in a non-split-screen display mode, it will activate the zone span mode. (See **Span**, **Zone**, and also **Next Window**.) If **Zoom** is pressed when zone markers are off, it will turn on zone markers and put the display in split-screen mode. (See **Span**, **Zone.**)

7 Options and Accessories

This chapter lists the options and accessories that can be ordered along with your analyzer. The Option Table on the following page shows which options are available for your particular product.

Table 7-1 ESA Option Table

Option		E4411B	E4401B	E4402B	E4403B	E4404B	E4405B	E4407B	E4408B
042	Gray Backpack carrying case	•	•	•	•	•	•	•	•
044	Yellow Backpack carrying case	•	•	•	•	•	•	•	•
060	Low Emission[1,2]		•	•		•	•	•	
106	Bluetooth™ FM Demodulation[3]			•		•	•	•	
120	ACPR Dynamic Range Extension			•		•	•	•	
225	Cable Fault Personality		•	•		•	•	•	
226	Phase Noise Measurement Personality		•	•		•	•	•	
227	Cable TV Measurement Personality		•	•		•	•	•	
228	Bluetooth™ Measurement Personality			•		•	•	•	
230	Benchlink Web Remote Control Software[4]	•	•	•	•	•	•	•	•
290	8590 - Series Programming Code[4] Compatibility	•	•	•	•	•	•	•	•
303	Bluetooth™ General Purpose Bundle			•		•	•	•	
304	Bluetooth™ Premium Bundle			•		•	•	•	
0B0	Delete Manual Set	•	•	•	•	•	•	•	•
0B1	Add Manual Set	•	•	•	•	•	•	•	•
0BV	Service Documentation, Component Level	•	•	•	•	•	•	•	•
0BW	Service Documentation, Assembly Level	•	•	•	•	•	•	•	•
1AX	RS-232 and Parallel Interface[5]	•	•	•	•	•	•	•	•
1CP	Rack Mount with Handles	•	•	•	•	•	•	•	•
1D5	High Stability Frequency Reference		•	•		•	•	•	
1D6	Time-Gated Spectrum Analysis		•	•		•	•	•	
1D7	50 to 75 Ohm Matching Pad	•	•	•	•	•	•	•	•
1DN	50 Ohm Tracking Generator	•	•	•	•	•	•	•	•
1DP	75 Ohm input[6]	•	•						
1DR	Narrow Resolution Bandwidths		•	•		•	•	•	
1DQ	75 Ohm Tracking Generator[7]	•	•						
1DS	RF Preamplifier		•	•		•	•	•	

Table 7-1 ESA Option Table (Continued)

Option		E4411B	E4401B	E4402B	E4403B	E4404B	E4405B	E4407B	E4408B
A4H	GPIB and Parallel Interface[8]	•	•	•	•	•	•	•	•
A4J	IF, Video and Sweep Ports	•	•	•	•	•	•	•	•
A5D	DC Power Cable	•	•	•	•	•	•	•	•
AXT	Transit Case	•	•	•	•	•	•	•	•
AYT	Gray Soft Carrying/Operating Case	•	•	•	•	•	•	•	•
AYU	Yellow Carrying/Operating Case	•	•	•	•	•	•	•	•
AYX	Fast Time Domain Sweeps		•	•		•	•	•	
AYZ	External Mixing							•	
B70	Benchlink Spectrum Analyzer	•	•	•	•	•	•	•	•
B72	Enhanced Memory Upgrade		•	•		•	•	•	
B74	RF and Digital Communications Hardware			•		•	•	•	
B75	Performance Bundle[6]		•	•		•	•	•	
B7B	TV Trigger and Picture on Screen[9]		•	•		•	•	•	
B7D	Digital Signal Processing and Fast ADC			•		•	•	•	
B7E	RF Communications Hardware			•		•	•	•	
B7K	Distance to Fault Accessory Kit			•		•	•	•	
BAA	FM Demodulation[10]		•	•		•	•	•	
BAB	APC 3.5 Input Connector							•	•
BAC	cdmaOne Measurement Personality			•		•	•	•	
BAH	GSM Measurement Personality			•		•	•	•	
UE2	Firmware Upgrade Kit	•	•	•	•	•	•	•	•
UKB	Low Frequency Extension[11]			•		•	•	•	
UK6	Commercial Calibration[6]	•	•	•	•	•	•	•	•
UK9	Front Panel Cover	•	•	•	•	•	•	•	•
W32	3 Year Calibration Contract	•	•	•	•	•	•	•	•
W50	5 Year Service Support	•	•	•	•	•	•	•	•
W52	5 Year Calibration Contract	•	•	•	•	•	•	•	•

1. This option is incompatible with Option B7B.
2. This option operates only with ac input power. Battery or dc power will not enable this option on the analyzer.
3. Option 106 is incompatible with Option BAA.
4. This option requires Option A4H or 1AX.
5. Option 1AX is incompatible with Option A4H.
6. This option is only available at time of purchase.
7. This option has a 75 Ohm output impedance, and is only available with Option 1DP.
8. Option A4H is incompatible with Option 1AX.
9. Option B7B requires Option BAA.
10. Option BAA is incompatible with Option 106
11. Option UKB requires Option 1DR.

Options

Options can be ordered by option number when you order your analyzer. Some of the options are also available as kits that can be ordered and installed after you have received your spectrum analyzer. Refer to Table 7-1 on page 344 to determine which options are available for your particular product.

How to Order Options

At the time of instrument purchase, options can be ordered using your product number and the number of the option you are ordering. For example, if you are ordering Option 1D6 for an Agilent E4401B, you would order E4401B 1D6.

If you are ordering an option after the purchase of your analyzer, you will need to add a U (for upgrade) to the product number and then specify which option you are ordering.

The options are listed in alphabetical order by name below for your review. If you know the option you wish to order, refer to Table 7-1 on page 344 which is in ascending order by option number.

12 Vdc Power Cable (Option A5D)

Option A5D provides a 12 Vdc power cable that allows your analyzer to be powered from 12 V automotive or truck batteries.

3 Year Calibration Contract (Option W32)

Option W32 provides your analyzer with a 3 year instrument calibration contract.

5 Year Calibration Contract (Option W52)

Option W52 provides your analyzer with a 5 year instrument calibration contract.

5 Year Service Support (Option W50)

Option W50 provides your analyzer with a total of 5 years of service support. This adds a 2 year service contract to the analyzer's base 3 year warranty.

50 Ω to 75 Ω Matching Pad (Option 1D7)

This option provides a 50 Ω to 75 Ω matching pad with dc block to be used on the analyzer input. The pad has a frequency range of 9 MHz to 2 GHz. It adapts your standard 50 Ω analyzer to be compatible with a 75 Ω system under test. Connector types are 50 Ω Type-N (m) to 75 Ω BNC (f).

50 Ω Tracking Generator (Option 1DN)

Option 1DN provides a 9 kHz to 1.5 GHz built-in tracking generator for the Agilent E4401B and the Agilent E4411B. Option 1DN provides a 9 kHz to 3 GHz built-in tracking generator for the Agilent E4402B, E4403B, E4404B, E4405B, E4407B and E4408B. This source creates a source-receiver combination that allows insertion-loss, frequency response, and return-loss measurements. The tracking generator has a wide distortion-free dynamic range, plus good sensitivity and selectivity.

75 ohm Input Impedance (Option 1DP)

This option provides a 75 Ω input impedance instead of the standard 50 Ω impedance. Analyzers with this option use cables, circuit boards, and front panels that are different from the standard units. Option 1DP is only available on the Agilent E4401B and E4411B.

Option 1DP is not available after the purchase of your analyzer.

75 ohm Tracking Generator (Option 1DQ)

Option 1DQ provides a 1 MHz to 1.5 GHz built-in tracking generator for the Agilent E4401B and the Agilent E4411B. Option 1DQ provides a 1 MHz to 3 GHz built-in tracking generator for the Agilent E4402B, E4403B, E4404B, E4405B, and E4407B. This source creates a source-receiver combination that allows insertion-loss, frequency response, and return-loss measurements. The tracking generator has a wide distortion-free dynamic range, plus good sensitivity and selectivity.

Option 1DQ has a 75 Ω output impedance, and is only available with Option 1DP.

8590 - Series Programming Code Compatibility (Option 290)

Option 290 allows use of a limited set of 8590 Series programming commands to control the ESA Series analyzers. When this option is installed on an ESA analyzer, remote programming using SCPI commands is not possible. This option must be uninstalled to restore SCPI programming functionality.

ACPR Dynamic Range Extension (Option 120)

Option 120 provides extended dynamic range for ACPR measurements by improving phase noise at offsets 800 kHz to 8 MHz.

Additional Manual Set (Option 0B1)

Option 0B1 provides an additional copy of the *Agilent ESA Spectrum Analyzers User's Guide, Agilent ESA Spectrum Analyzers Calibration Guide, Agilent ESA Spectrum Analyzers Specifications Guide - E Series* or *Agilent ESA Spectrum Analyzers Specifications Guide - L Series*, and the *Agilent ESA Spectrum Analyzers Reference Guide*.

APC 3.5 Input Connector (Option BAB)

The type-N female connector is replaced with an APC 3.5 mm male connector. An APC 3.5 (f) to APC 3.5 (f), and BNC (f) to SMA (m) adapters are included for alignment purposes.

Backpack Operating and Carrying Cases (Option 042/044)

Options 042 and 044 are protective soft operating and backpack carrying cases. Option 042 is made of gray rip-stop nylon and Option 044 is made of yellow rip-stop nylon. An outside pocket holds manuals or other accessories. Reinforced adjustable padded shoulder straps provides ergonomic distribution between your shoulder. The front and rear panel soft covers adjust to be compatible with the front panel protective hard cover (Option UK9) and snap on battery pack (HP/Agilent E1779A). Side ventilation allows for operation without removal, but the maximum operating temperature is reduced to 45 °C.

Benchlink Web Remote Control Software (Option 230)

Option 230 provides software which can be used to control the analyzer remotely over the web. When the analyzer is connected via GP-IB to one personal computer (PC), access to the analyzer is available through any internet connection by specifying the IP address of the physically connected PC. The following analyzer functions are available through remote web access:

- front panel control
- capture screen images
- capture trace data
- remote programming commands (SCPI)

Benchlink Spectrum Analyzer (Option B70)

Option B70 provides the Benchlink Spectrum Analyzer software which can be used to capture screen images and trace data using a personal computer (PC). The captured information can then be used in other PC applications, including word processing and spread sheets.

Bluetooth™ FM Demodulation (Option 106)

Option 106 is required to perform FM demodulation on signals measured with the Bluetooth™ Measurement Personality (Option 228).

Option 106 allows you to demodulate, display and measure deviation on Bluetooth™ FM modulated signals. You can listen to audio signals on a built-in speaker or with an earphone.

Option 106 provides the following additional port:

EXT VIDEO OUT - provides a detected video output (before the analog-to-digital conversion) proportional to the vertical deflection of the trace (75 Ω).

Bluetooth™ General Purpose Bundle (Option 303)

Option 303 provides

- Bluetooth™ FM Demodulation (Option 106)
- Bluetooth™ Measurement Personality (Option 228)
- Fast Digitized Time Domain Sweeps (Option AYX)
- Enhanced Memory Upgrade (Option B72)

Bluetooth™ Measurement Personality (Option 228)

Option 228 provides transmitter and receiver measurements required to test Bluetooth™ devices. The set of Bluetooth™ measurements includes:

- Modulation Overview
- Output Power
- Carrier Frequency Drift
- Monitor Band/Channel
- Initial Carrier Frequency Tolerance
- Modulation Characteristics

Option 228 includes: Bluetooth™ user's guide, Bluetooth™ quick reference card, Bluetooth™ measurement guide, and Bluetooth™ programming commands manual.

Bluetooth™ FM Demodulation (Option 106) is required for full functionality of this personality.

Bluetooth™ Premium Bundle (Option 304)

Option 304 provides the following:

- Bluetooth™ demodulator board (Option 106)
- Bluetooth™ measurement personality (Option 228)
- high stability frequency reference (Option 1D5)
- digital signal processing and fast ADC (Option B7D)
- RF communications hardware (Option B7E)

- enhanced memory upgrade (Option B72)
- RF preamplifier (Option 1DS)

Cable Fault Location Personality (Option 225)

Option 225 performs a Fast Fourier Transform to calculate the distance to a cable fault. This option must be ordered with 50 Ω Tracking Generator (Option 1DN). This measurement includes on-screen instructional dialog to guide set up and calibration. Velocity factor and cable loss can be user-defined or selected from several different pre-defined cable types.

Cable TV Measurement Personality (Option 227)

Option 227 provides measurement capabilities necessary for installation and service of cable TV.

cdmaOne Measurement Personality (Option BAC)

Option BAC provides transmitter and receiver measurements that comply with various international digital communications standards, including TIA/EIA/IS-95-A, TIA/EIA-95-B, TIA/EIA/IS-97-A, TIA/EIA-97-B, TIA/EIA/IS-98-A, TIA/EIA-98-B, J-STD-008, J-STD-018, J-STD-019, ARIB STD-T53, CKOR, and PKOR. The set of cdmaOne measurements includes:

- channel power
- receiver channel power
- modulation accuracy (RHO)
- code domain power
- receiver spurious
- out-of-band spurious
- harmonics
- occupied bandwidth
- monitor channel/band
- close-in spur

Option BAC includes a cdmaOne user's guide, cdmaOne quick reference card, cdmaOne measurement guide and cdmaOne programming commands manual.

NOTE For optimum performance of this personality, installation of "RF and Digital Communications Hardware (Option B74)" is recommended.

Commercial Calibration with Test Data (Option UK6)

Option UK6 provides the factory calibration test data and the standard commercial calibration certificate on the initial analyzer shipment.

Option UK6 is only available at time of purchase.

Component Level Service Documentation (Option 0BV)

Option 0BV provides a copy of the *Agilent ESA Spectrum Analyzers Component-Level Information*. The component-level information includes parts lists, component-location diagrams, and schematic diagrams for selected repairable assemblies.

Delete Manual Set (Option 0B0)

Option 0B0 deletes copies of the *Agilent ESA Spectrum Analyzers User's Guide*, *Agilent ESA Spectrum Analyzers Calibration Guide*, and the *Agilent ESA Spectrum Analyzers Reference Guide*.

Digital Signal Processing and Fast ADC (Option B7D)

Option B7D provides digital signal processing and fast ADC. This option is required for many of the mobile communication measurements in the GSM and cdmaOne measurement personalities. Option B7D must be ordered with Option B7E (RF communications hardware) and Option 1D5 (high stability frequency reference).

For A.07.00 firmware revisions and later, either this option or Option AYX (Fast Digitized Time Domain Sweeps) is required to perform the PowerStat Complementary Cumulative Distribution Function (PowerStat CCDF) for all radio standards. It is also required to perform the ACP measurement when the NADC radio standard is selected.

Distance to Fault Accessory Kit (Option B7K)

Option B7K includes the 86205A (RF bridge), 11636A (power divider), 909A (coax termination), 11512A (coax short), 8120-8687 (coax cable), and 9211-0050 (padded case).

Enhanced Memory Upgrade (Option B72)

Option B72 provides 2 SIMMS which increases the analyzer's RAM to 32 MBytes and its flash or data storage memory to 16 MBytes (10 MBytes of which are available to the user for data storage).

External Mixing (Option AYZ)

Option AYZ allows the use of HP/Agilent 11970 Series, and HP/Agilent 11974 external mixers with the Agilent E4407B analyzer to extend the frequency range to 110 GHz. Operation to 325 GHz is also possible with non-HP/Agilent mixers.

Fast Digitized Time Domain Sweeps (Option AYX)

Option AYX allows fast digitized sweep times as fast as 20 μsec in spans of 0 Hz. Refer to the **Sweep** key description in Chapter 6 , “Front-Panel Key Reference.” for information about possible sweep times. It also provides the following additional inputs and outputs:

Option AYX - provides the analyzer with additional inputs and outputs. They are as follows: SWP OUT, HI SWP OUT (TTL), HI SWP IN (TTL), AUX VIDEO OUT, and AUX IF OUT.

SWP OUT - sweep ramp output, provides a voltage ramp proportional to the sweep of the analyzer (0 V to 10 V).

HI SWP OUT (TTL) - provides the HI SWP TTL signal as an output (TTL high during a sweep, TTL low during a retrace). It indicates when the analyzer is sweeping

HI SWP IN (TTL) - allows external sweep control. It can be grounded to stop and reset the sweep.

AUX VIDEO OUT - provides detected video output (before the analog-to-digital conversion) proportional to vertical deflection of the trace.

AUX IF OUT - provides a 50 Ω, 21.4 MHz IF output that is the down-converted signal of the RF input of the analyzer.

For A.07.00 firmware revisions and later, either this option or Option B7D (Digital Signal Processing and Fast ADC) is required to perform the PowerStat Complementary Cumulative Distribution Function (PowerStat CCDF) for all radio standards. It is also required to perform the ACP measurement when the NADC radio standard is selected.

Firmware Upgrade Kit (Option UE2)

Option UE2 provides the most current ESA spectrum analyzer firmware on 3-1/2 inch floppy disks.

FM Demodulation (Option BAA)

Option BAA allows you to demodulate, display and measure deviation on FM modulated signals. You can listen to audio signals on a built-in speaker or with an earphone.

Option BAA provides the following additional port:

EXT VIDEO OUT - provides a detected video output (before the analog-to-digital conversion) proportional to the vertical deflection of the trace (75 Ω).

Front Panel Protective Cover (Option UK9)

The cover assembly snaps onto the front of your analyzer to protect the front panel during travel and when the unit is not in use. The front panel protective cover includes a storage compartment to house small accessories or cables.

GPIB and Parallel Interface (Option A4H)

Option A4H allows you to control your analyzer from a computer that uses a general purpose interface bus (GPIB). Option A4H includes an GPIB connector, a parallel interface connector for printers, a CD-ROM containing Benchlink XL software[1], and the *Agilent ESA Spectrum Analyzers Programmer's Guide*.

Option A4H allows the analyzer to copy its display to a printer.

GSM Measurement Personality (Option BAH)

Option BAH provides transmitter and receiver measurements that comply with various international digital communications standards, including ETS 300 607-1, ETS 300 609-1, ETS 300 910, and J-STD-007. The set of GSM measurements includes, transmit power, power steps, power versus time, spurious emissions suite, intermodulation attenuation suite, phase and frequency error, cable fault location suite, slow frequency hopping cycle verification, monitor suite, and output RF spectrum suite. Option BAH includes a GSM user's guide, GSM quick reference card, GSM measurement guide, and programming commands manual.

Hard Transit Case (Option AXT)

Option AXT provides a hard transit case. The hard transit case will survive commercial transportation. This rugged case has two wheels and an extendible handle for easy transport. The case can also accommodate two battery packs and ac adapters.

1. This program allows you to download spectrum analyzer display or data files to a personal computer using Microsoft® Word or Microsoft® Excel. Benchlink installation instructions are included with the CD-ROM.

High Stability Frequency Reference (Option 1D5)

Option 1D5 improves the frequency reference accuracy. The analyzer's synthesizer is phase locked to an oven controlled crystal oscillator (OCXO), instead of the standard VCXO.

IF, Sweep and Video Ports (Option A4J)

Option A4J provides the analyzer with additional inputs and outputs. They are as follows: SWP OUT, HI SWP OUT (TTL), HI SWP IN (TTL), AUX VIDEO OUT, and AUX IF OUT.

SWP OUT - sweep ramp output, provides a voltage ramp proportional to the sweep of the analyzer (0 V to 10 V).

HI SWP OUT (TTL) - provides the HI SWP TTL signal as an output (TTL high during a sweep, TTL low during a retrace). It indicates when the analyzer is sweeping.

HI SWP IN (TTL) - allows external sweep control. It can be grounded to stop sweeping.

AUX VIDEO OUT - provides detected video output (before the analog-to-digital conversion) proportional to vertical deflection of the trace.

AUX IF OUT - provides a 50 Ω, 21.4 MHz IF output that is the down-converted signal of the RF input of the analyzer.

Low Emission (Option 060)

Option 060 provides reduced radiated and conducted emissions to comply with EN55011 Class B requirements. This option applies during ac operation only.

Option 060 is incompatible with TV Trigger (Option B7B).

Low Frequency Extension (Option UKB)

Option UKB extends the frequency range of the analyzer on the low end to 100 Hz when DC coupling is selected. This option requires installation of "Narrow Resolution Bandwidth (Option 1DR)" on ESA models E4402B, E4404B, E4405B, and E4407B.

Narrow Resolution Bandwidth (Option 1DR)

This option provides additional narrow resolution bandwidths of 10 Hz, 30 Hz, 100 Hz, and 300 Hz. These bandwidths improve the analyzer sensitivity and allow you to resolve closely spaced signals.

Operating and Carrying Cases (Option AYT/AYU)

Options AYT and AYU are protective soft operating and carrying cases. Option AYT is made of gray rip-stop nylon and Option ATU is made of yellow rip-stop nylon. An outside pocket holds manuals or other accessories. A reinforced adjustable padded shoulder strap provides ergonomic distribution between your hand and shoulder. The front and rear panel soft covers adjust to be compatible with the front panel protective hard cover (Option UK9) and snap on battery pack (HP/Agilent E1779A). Side ventilation allows for operation without removal, but the maximum operating temperature is reduced to 45 °C.

Performance Bundle (Option B75)

Option B75 provides the pre-amplifier, narrow resolution bandwidths, and high stability frequency reference. Refer to Options 1DS, 1DR, and 1D5 for details.

This option is only available at time of purchase.

Phase Noise Measurement Personality (Option 226)

Option 226 provides an automatic log plot display of phase noise (dBc/Hz) versus log offset frequency. It includes spot frequency and RMS noise. High Stability Frequency Reference (*Option 1D5*) is recommended.

Pre-amplifier (Option 1DS)

The pre-amplifier improves the analyzer’s sensitivity (lowers the noise floor) by approximately 16 dB.

Rack Mount Kit With Handles (Option 1CP)

Option 1CP provides the parts necessary to mount the analyzer in an HP/Agilent System II cabinet or in a standard 19 inch (482.6 mm) equipment rack. It includes front handles and rack slides for added convenience.

RF and Digital Communications Hardware (Option B74)

Option B74 includes the RF Communications Hardware (*Option B7E*), Digital Signal Processing and Fast ADC (*Option B7D*), Time-Gated Spectrum Analysis (*Option 1D6*), Memory Extension (*Option B72*), High Stability Frequency Reference (*Option 1D5*), Preamplifier (*Option 1DS*), and Narrow Resolution Bandwidth (*Option 1DR*) assemblies. These assemblies are required for optimum performance of the cdmaOne (*Option BAC*) or GSM measurement personality (*Option BAH*).

RF Communications Hardware (Option B7E)

Option B7E provides the communications hardware required for many digital communication measurements. Option B7E must be ordered with Option B7D (digital signal processing and fast ADC) and Option 1D5 (high stability frequency reference).

RS-232 and Parallel Interface (Option 1AX)

Option 1AX allows you to control your analyzer from a computer that uses an RS-232 interface. It includes an RS-232 9-pin connector (HP/Agilent 5182-4794), a parallel interface connector for printers, a CD-ROM containing Benchlink XL software[1], and the *Agilent ESA Spectrum Analyzers Programmer's Guide*.

Option 1AX allows the analyzer to copy its display to a printer.

Service Documentation and Adjustment Software (Option 0BW)

Option 0BW provides a copy of the *Agilent ESA Spectrum Analyzers Service Guide* and PC-based adjustment software on CD-ROM. The service guide describes assembly level troubleshooting procedures, provides a parts list, and documents the adjustment procedures.

Time-Gated Spectrum Analysis (Option 1D6)

Option 1D6 allows you to selectively measure the spectrum of signals that may overlap in the frequency domain, but are separated in the time domain. By adjusting a time gate based on a user-supplied trigger signal, you can significantly increase the diagnostic capability of your spectrum analyzer for time-interleaved signals.

TV Trigger and Picture on Screen (Option B7B)

Option B7B requires Option BAA.

Option B7B allows you to trigger the analyzer sweep on a TV line of a demodulated TV waveform and view TV images in NTSC, PAL and SECAM standards on the analyzer display.

Option B7B provides the following additional ports:

EXT VIDEO IN/TV TRIG OUT - provides a shared baseband video input and a TTL output for the TV trigger (output through 75 Ω source impedance).

1. This program allows you to download spectrum analyzer display or data files to a personal computer using Microsoft® Word or Microsoft® Excel. Benchlink installation instructions are included with the CD-ROM.

EXT VIDEO OUT - provides a detected video output (before the analog-to-digital conversion) proportional to the vertical deflection of the trace (similar to Option BAA alone), and provides passthrough of the signal at EXT VIDEO IN/TV TRIG OUT, if selected (75 Ω).

Accessories

A number of accessories are available from Agilent Technologies to help you configure your analyzer for your specific applications. They can be ordered through your local Agilent Sales and Service Office and are listed below in alphabetical order by name. Refer to Table 4-1 on page 110 for a list of Agilent Sales and Service Offices.

50 Ω/75 Ω Minimum Loss Pad

The HP/Agilent 11852B is a low VSWR minimum loss pad that allows you to make measurements on 75 Ω devices using an analyzer with a 50 Ω input. It is effective over a frequency range of dc to 2 GHz.

75 Ω Matching Transformer

The HP/Agilent 11694A allows you to make measurements in 75 Ω systems using an analyzer with a 50 Ω input. It is effective over a frequency range of 3 to 500 MHz.

AC Probe

The HP/Agilent 85024A high frequency probe performs in-circuit measurements without adversely loading the circuit under test. The probe has an input capacitance of 0.7 pF shunted by 1 MΩ of resistance and operates over a frequency range of 300 kHz to 3 GHz. High probe sensitivity and low distortion levels allow measurements to be made while taking advantage of the full dynamic range of the spectrum analyzer.

The HP/Agilent 41800A low frequency probe has a low input capacitance and a frequency range of 5 Hz to 500 MHz.

Broadband Preamplifiers and Power Amplifiers

Preamplifiers and power amplifiers can be used with your spectrum analyzer to enhance measurements of very low-level signals.

The HP/Agilent 10855A preamplifier provides a minimum of 22 dB gain from 2 MHz to 1300 MHz. (Power is supplied by the probe power output of the analyzer.)

The HP/Agilent 8447D preamplifier provides a minimum of 25 dB gain from 100 kHz to 1.3 GHz.

The HP/Agilent 87405A preamplifier provides a minimum of 22 dB gain from 10 MHz to 3 GHz. (Power is supplied by the probe power output of the analyzer.)

The Agilent 85905A CATV 75 ohm preamplifier provides a minimum of 18 dB gain from 45 MHz to 1 GHz. (Power is supplied by the probe power output of the analyzer.)

The 11909A low noise preamplifier provides a minimum of 32 dB gain from 9 kHz to 1 GHz and a typical noise figure of 1.8 dB.

Carrying Strap (Part Number E4411-60028)

This carrying strap comes with Options AYT and AYU. It can also be ordered separately and used with Agilent ESA spectrum analyzers.

External Keyboard

The HP C1405B keyboard is an IBM AT compatible keyboard that can be connected to the external keyboard connector on the front panel of the analyzer. You may use any IBM AT compatible keyboard with a mini DIN connector. Screen titles and filenames can be entered with the external keyboard.

GPIB Cable

For use with Option A4H. The Agilent 10833 Series GPIB cables interconnect GPIB devices and are available in four different lengths. GPIB cables are used to connect controllers to a spectrum analyzer.

HP/Agilent 11970 Series Harmonic Mixers

The 11970 Series harmonic mixers are available to extend the frequency range of analyzers with Option AYZ (external mixing) up to 110 GHz. The following six models are available:

Table 7-2

HP/Agilent Model Number	Frequency Range
11970K	18.0 to 26.5 GHz
11970A	26.5 to 40.0 GHz
11970Q	33.0 to 50.0 GHz
11970U	40.0 to 60.0 GHz
11970V	50.0 to 75.0 GHz
11970W	75.0 to 110 GHz

HP/Agilent 11974 Series Preselected Millimeter Mixers

11974 Series preselected millimeter mixers are available to extend the frequency range of analyzers with Option AYZ (external mixing) up to 75 GHz. Preselection reduces mixer overload from broadband signals, reduces radiation of local oscillator harmonics back to the device under test, and reduces the level of image and multiple responses displayed. The following four models are available:

Table 7-3

HP/Agilent Model Number	Frequency Range
11974A	26.5 to 40.0 GHz
11974Q	33.0 to 50.0 GHz
11974U	40.0 to 60.0 GHz
11974V	50.0 to 75.0 GHz

HP/Agilent E1779A Battery Pack

The E1779A is a battery pack that will power an Agilent ESA spectrum analyzer for 80 to 114 minutes, depending on the options installed in the analyzer. Refer to the *E1779A Battery Pack User's Guide* for more information.

HP/Agilent N2717A Performance Verification Software

The N2717A provides automated performance verification software, adjustment software, and the calibration guide on CD-ROM.

Parallel Interface Cable

For use with Option A4H and 1AX. The HP C2950A parallel interface cable is a 36-pin to 25-pin male-to-male 2 meter cable used to connect supported printers to a spectrum analyzer. This cable is IEEE-1284 compliant.

Printer

For use with Option A4H or 1AX. The DeskJet personal printers provide black and white or color printing for another form of permanent records of your test results. The HP LaserJet series printers are also compatible. The printers connect to the parallel interface installed on the spectrum analyzer with either Option A4Hor 1AX.

RF and Transient Limiters

The HP/Agilent 11867A and 11693A RF Limiters protect the spectrum analyzer input circuits from damage due to high power levels. The HP 11867A operates over a frequency range of dc to 1800 MHz and begins reflecting signal levels over 1 mW up to 10 W average power and 100 watts peak power. The 11693A microwave limiter (0.1 to 12.4 GHz, usable to 18 GHz) guards against input signals over 1 milliwatt up to 1 watt average power and 10 watts peak power.

The 11947A Transient Limiter protects the spectrum analyzer input circuits from damage due to signal transients. It specifically is needed for use with a line impedance stabilization network (LISN). It operates over a frequency range of 9 kHz to 200 MHz, with 10 dB of insertion loss.

RF Bridges

The HP/Agilent 86205A 50 Ω RF bridge and 86207A 75 Ω RF bridge can be used to make reflection measurements using an analyzer with tracking generator Option 1DN or 1DQ or with an external signal generator. These external directional bridges offer high directivity and excellent port match. The 86205A operates over a frequency range of 300 kHz to 6 GHz. The 86207A operates over a frequency range of 300 kHz to 3 GHz.

RS-232 Cable

For use with Option 1AX. The HP 24542G is a 3 meter 9-pin (f) to 25-pin (m) RS-232 cable. The HP 24542U is a 3 meter 9-pin (f) to 9-pin (f) RS-232 cable for serial 9-pin PC connection to an analyzer. The modem cable required is HP 24542M 9-pin (f) to 25-pin (m), and the PC cable is HP 24542U. The Agilent 5182-4794 is a 2.5 meter 9-pin (f) to 9-pin (f) RS-232 cable for serial 9-pin PC connection to an analyzer (included with Option 1AX).

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