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User's Guide

Agilent Technologies 8560 E-Series and EC-Series Spectrum Analyzers

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The following safety notes are used throughout this manual. Familiarize yourself with these notes 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 Always use the three-prong AC power cord supplied with this product. Failure to ensure adequate grounding may cause product damage.

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.

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

WARNING **Before this instrument is switched on, make sure it has been properly grounded through the protective conductor of the ac power cable to a socket outlet provided with protective earth contact.**

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1 Quick Start Guide

What You'll Find in This Chapter

- How to Use This Guide
- Differences between 8560 E-Series and EC-Series Instruments
- Initial Inspection
- Turning the Spectrum Analyzer On for the First Time
- Making a Basic Measurement
- Setting Reference Level Calibration
- Front Panel Overview
- Rear Panel Overview
- Cleaning the Instrument
- Safety Considerations
- Documentation Description

How to Use This Guide

Where to Start

If you are familiar with spectrum analyzers:

- Briefly review the front and rear panel overview sections in Chapter 1 for a short introduction to the 8560E/EC, 8561E/EC, 8563E/EC, 8564E/EC, and 8565E/EC spectrum analyzers.
- If you want more information about a particular spectrum analyzer function, refer to Chapter 4.

If you are not familiar with spectrum analyzers:

- Read Chapter 1, "Quick Start Guide," which introduces you to the spectrum analyzer.
- Continue on to Chapter 2, "Making Measurements," to gain experience with spectrum analyzer measurements.

This manual uses the following conventions:

Front-Panel Key	This font represents either a hard key, which is physically located on the instrument, or a softkey, whose label is determined by the instrument's firmware.
`Screen Text`	This font indicates text displayed on the instrument's screen.

Differences between 8560 EC-Series and E-Series Spectrum Analyzers

Features	8560 EC-Series	8560 E-Series
Display	— LCD display — color — display not adjustable — backlight bulbs are replacable (replace both bulbs when display is dim) — requires A17 LCD driver board	— CRT display — monochrome — display adjustable for focus, intensity, and quadrature — requires high voltage module (HVM), which is located in the A6 power supply — requires A17 CRT driver board
Fast ADC sweep times (FADC) enables sweep times of 30 ms to 50 µs	— FADC is standard — FADC circuitry integrated into A2 controller board	— FADC is available as an option (Option 007) — separate A16 FADC board required
VGA port	— located on rear panel — always active — does not require user interface	Not available

In all other operational respects the EC-series and E-series are identical. Unless otherwise noted, the information in this manual applies to all EC-series and E-series instruments.

Introducing Your New Spectrum Analyzer

Table 1-1 Spectrum Analyzer Operating Range

Spectrum Analyzer	Amplitude Range	Frequency Range
8560E/EC	–145 dBm to +30 dBm	30 Hz to 2.9 GHz
8561E/EC	–145 dBm to +30 dBm	30 Hz to 6.5 GHz
8562E/EC	–148 dBm to +30 dBm	30 Hz to 13.2 GHz
8563E/EC	–148 dBm to +30 dBm	9 kHz to 26.5 GHz 30 Hz to 26.5 GHz (with Option 006)
8564E/EC	–147 dBm to +30 dBm	9 kHz to 40 GHz 30 Hz to 40 GHz (with Option 006)
8565E/EC	–147 dBm to +30 dBm	9 kHz to 50 GHz 30 Hz to 50 GHz (with Option 006)

Initial Inspection

Inspect the shipping container upon receipt. Retain it and the cushioning materials. If the container or cushioning material is damaged, verify that the contents are complete and that the analyzer functions correctly mechanically and electrically.

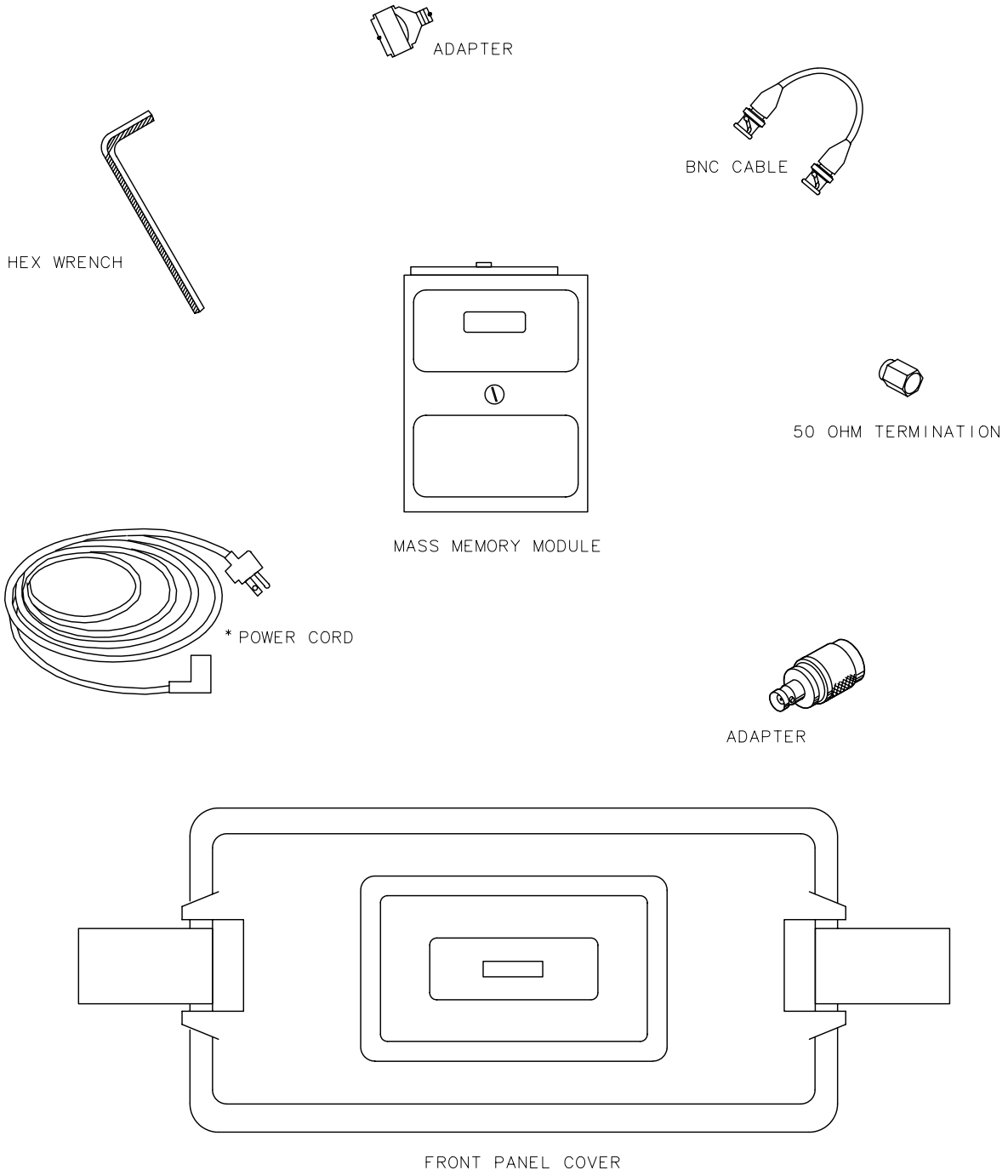
If the contents are incomplete or the analyzer fails the verification tests in the calibration guide, notify one of the Agilent Technologies Sales and Service Offices listed in Table 9-2 on page 672. Show any container or cushioning materials damages to the carrier. The Sales and Service Office will arrange for repair or replacement without waiting for a claim settlement.

The shipping container and cushioning materials are shown in the "If You Have A Problem" chapter, Figure 9-4 on page 679. Instructions for repackaging the analyzer are included in that chapter.

Part Numbers of Accessories Supplied

Item	Part Number
Front cover	5063-0274
Mass memory module	85620A
(not included with Option 104)	
BNC cable, 23 cm (9 in.)	10502A
4 mm hex (Allen) wrench	8710-1755
Power cord	see Figure 9-2 on page 672
Fuse: 5 A, 250 V (supplied in fuse holder)	2110-0709
Adapter, Type-N (m) to SMA (f) (8563E/EC only)	1250-1250
Adapter, Type-N (m) to BNC (f)	1250-0780
(not included with Option 026)	
(2 per Option 002)	
Adapter, SMA (m) to BNC (f)	1250-1200
(Option 026, 8564E/EC or 8565E/EC only)	
Adapter, APC 3.5 (f) to APC 3.5 (f)	5061-5311
(Option 026 only)	
Adapter, K (f) to 2.4 mm (f)	1250-2187
(8564E/EC or 8565E/EC only)	
Adapter, 2.4 mm (f) to 2.4 mm (f)	1250-2188
(8564E/EC or 8565E/EC only)	
Termination, 50 Ω SMA (m)	1810-0118
Power holes will occur when using adapters and cables beyond their specified range.	

Figure 1-1 Accessories Supplied



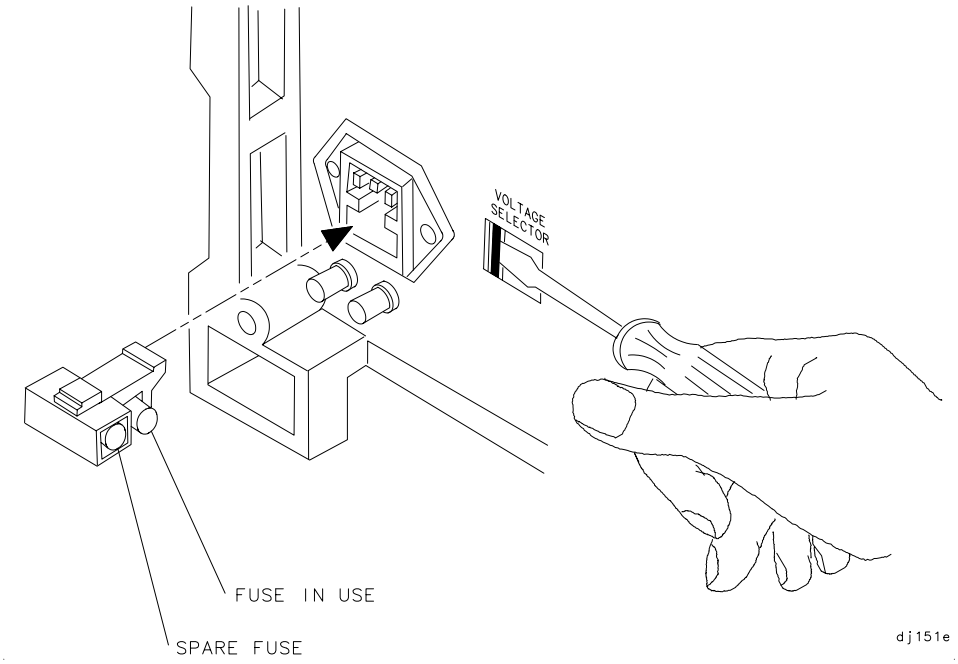
* See Figure 9-2 on page 672 for part numbers.

Turning the Spectrum Analyzer On for the First Time

The spectrum analyzer requires no installation other than connection to an ac power source. If you want to install your spectrum analyzer into an System II cabinet or a standard 19 inch (486.2 mm) equipment rack, complete instructions are provided with the Option 908 and Option 909 Rack mounting Kits.

CAUTION *Do not* connect the analyzer to an ac power source before verifying that the line voltage is correct, the line-voltage selector switch located on the analyzer rear panel is set to the correct voltage, and the proper fuse is installed. Failure to verify that these items are correct could result in equipment damage.

Figure 1-2 Selecting the Correct Line Voltage



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

1. Press **LINE** to turn the analyzer on.
2. The analyzer takes about half a minute to perform a series of self-diagnostic and adjustment routines. At completion, the screen displays the analyzer model number and the firmware date (for example, 890802 indicates August 2, 1989). If you should ever need to call Agilent Technologies for service or have any questions regarding your analyzer, it is helpful to know the firmware date to get the most accurate information.
3. Allow the analyzer a 5-minute warmup. Refer to the warmup specification in the calibration guide.
4. The reference level calibration adjustment procedure in this chapter should be performed before checking the specifications.
5. The trace alignment procedure can be performed to optimize the display location.
6. The GPIB address may need to be changed for remote operation.

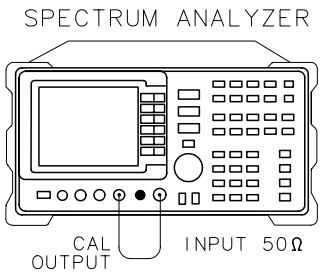
Making a Basic Measurement

A basic measurement involves tuning the spectrum analyzer to place a signal on the screen, then measuring the frequency and amplitude of the signal with a marker. We can measure an input signal in four simple steps.

1. Set the center **frequency**.
2. Set the frequency **span**.
3. Activate the **marker**.
4. Set the **amplitude**.

As an example, we will measure the front panel 300 MHz calibration signal. First, switch on the spectrum analyzer. (For maximum accuracy, if the analyzer has just been powered up, allow for a 5-minute warmup.)

Figure 1-3 300 MHz Calibration Signal Connection



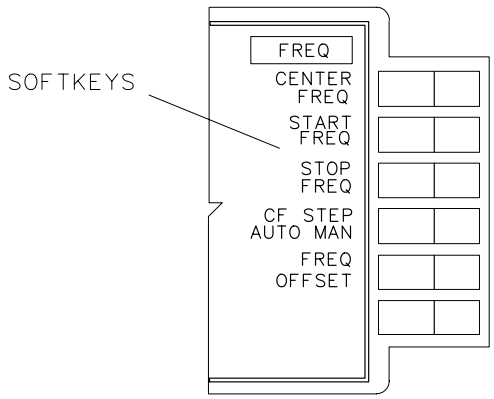
Connect a short cable from the analyzer CAL OUTPUT connector to the INPUT 50 Ω connector (both connectors are on the front panel of the spectrum analyzer). Then perform the following steps:

1. Set the center frequency.

   a. Press **FREQUENCY**. This activates the center frequency function, indicated by CENTER appearing in the active function block on the left side of the display (see Figure 1-5 on page 32). It also brings up a menu of other frequency functions. See Figure 1-4 on page 31.

      These functions are called softkeys and are designated in the manual by shading. (e.g. **CENTER FREQ**) Most front panel keys access menus of softkey functions.

Figure 1-4 Softkey Menu

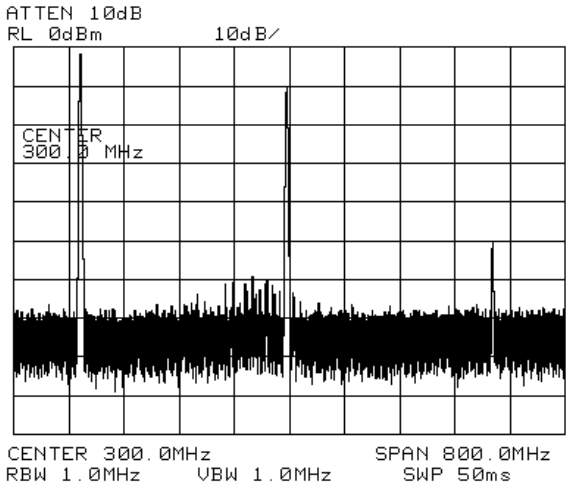


aj13e

   b. To set the center frequency to 300 MHz, use the keys in the DATA section of the front panel and enter 300 MHz. These data keys allow you to select the exact numeric value of the active function, which, in this case, is the center frequency. The step keys and knob also allow you to select values for the function.

NOTE When entering some data values, such as unitless entries, **ENTER** must be used to terminate the data entry. **ENTER** is located in the lower right corner of the spectrum analyzer front panel. It is also labeled **Hz/μV/μs**.

Figure 1-5 300 MHz Center Frequency



2. Set the frequency span.

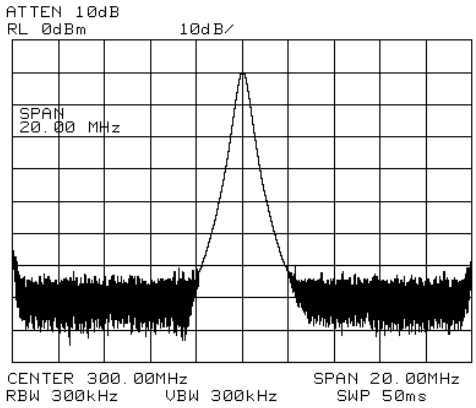
   a. Press **SPAN**. Note that SPAN is now displayed in the active function block, identifying it as the current active function.

   b. To reduce the frequency span—for example, to 20 MHz—either press 20 MHz on the data keypad, or use the ⇓ key to "step down" to this value. (Like data keys, step keys can also be used to change the numeric value of the active function.)

      The resulting display is shown in Figure 1-6. Note that the resolution and video bandwidths are coupled to the frequency span; they are automatically adjusted to appropriate values for a given span. Sweeptime is also a coupled function.

   c. Press **SWEEP** and notice the **SWP TIME AUTO MAN** softkey. The softkey can be used to make the sweeptime be auto-coupled or manually controlled; the underline indicates which part of the function is enabled. For example, the **SWP TIME AUTO MAN** function is auto-coupled when AUTO is underlined.

Figure 1-6 20 MHz Frequency Span



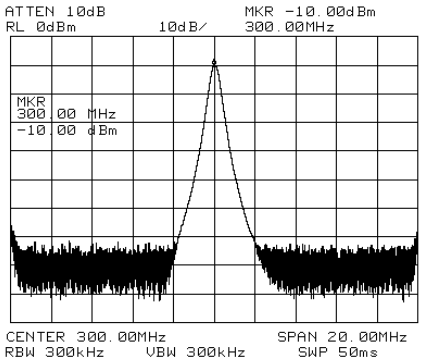
3. Activate the marker.

   a. Press **MKR**, which is located in the MARKER section of the front panel. This activates the normal marker and places it at the center of the trace (in this case, at or near the peak of the signal).

      The marker reads both the frequency and the amplitude, and displays these values in the active function block. In this case, the marker reads 300.00 MHz and –10.00 dBm, as shown in Figure 1-7 on page 33.

   b. If the marker is not on the peak of the signal, it can be placed on the highest point by pressing **PEAK SEARCH**, or by using the knob to move the marker manually.

Figure 1-7 Activated Normal Marker



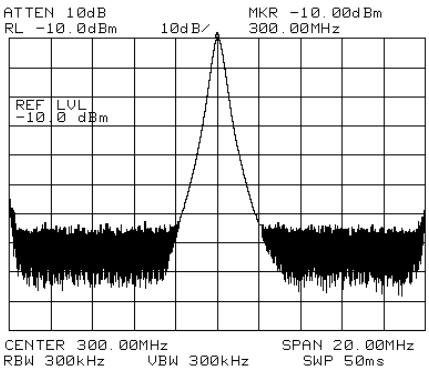
4. Set the amplitude.

   a. Generally, placing the signal peak at the reference level provides the best measurement accuracy. To adjust the signal peak to the reference level (Figure 1-8), press **AMPLITUDE**. Then key in –10 dBm, or use either the step keys or the knob.

      Using the knob is the easiest way to fine-tune the signal peak to the reference level, which is located at the top of the graticule.

   b. Because the marker is active, a faster method to fine-tune the signal peak to the reference level is to press **MARKER** → **REF LVL**, which is located under the **MKR** → key. This function sets the reference level equal to the marker amplitude value.

Figure 1-8 –10 dBm Reference Level



Reference Level Calibration

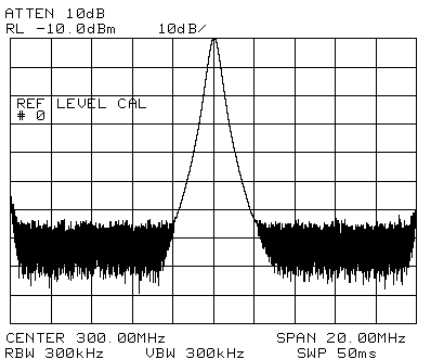
Recalibrating the reference level is usually necessary only when the ambient temperature changes more than 10 degrees Celsius. Because the spectrum analyzer continually monitors and reduces any IF errors, executing the reference-level calibration is seldom necessary.

The reference-level calibration function **REF LVL ADJ** allows the analyzer internal gain to be adjusted. When the calibrator signal is connected to the input, selecting a reference level equal to the calibrator amplitude will display the signal at top-screen.

1. Turn the markers off by pressing **MKR**, then **MARKERS OFF**.
2. Press **CAL**. This accesses a menu of calibration routines. The fifth function on this new list, labeled **REF LVL ADJ**, allows you to calibrate the amplitude of the instrument.
3. Press **REF LVL ADJ** to activate the function.
4. To calibrate the spectrum analyzer, use the knob on the front panel and adjust the peak of the signal to the reference level as shown in Figure 1-9. Note the number that appears in the active function block (number 0 in this example). This number ranges from –528 to +528 (–33 to +33 in earlier instruments). It is a relative value indicating how much amplitude correction was required to calibrate the spectrum analyzer. The number is usually around 0.

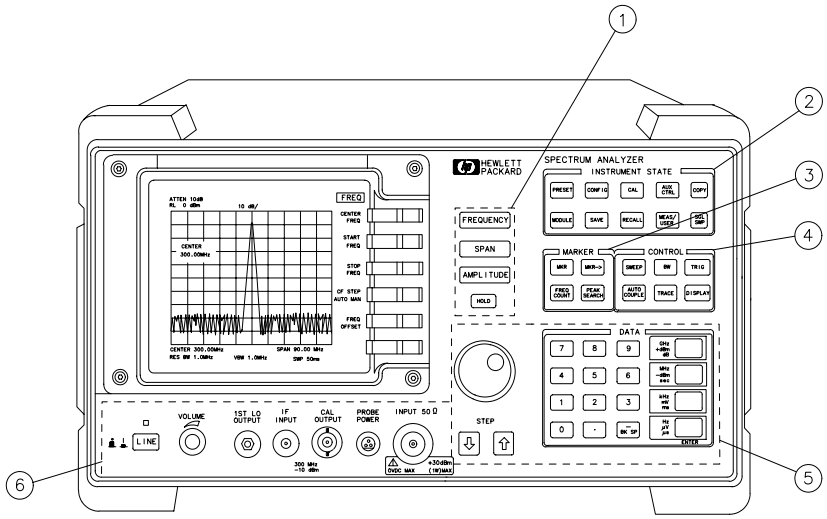
   If the amplitude is at either end of the range, or if it cannot be adjusted to a value within this range, consult the calibration guide.
5. To store the value, press the **STORE REF LVL** softkey. When entering or storing a value using the data keys, the entry must be terminated with the **ENTER** key, located in the lower-right corner of the analyzer.

Figure 1-9 Peaked Signal to Reference Level



Front Panel Overview

Figure 1-10 **Front Panel of an 8560 E-Series or EC- Series Spectrum Analyzer**



1. **FREQUENCY, SPAN, and AMPLITUDE** are the fundamental functions for most measurements. The HOLD key freezes the active function and holds it at the current value until a function key is pressed.
2. **INSTRUMENT STATE** functions affect the state of the entire spectrum analyzer, not just the state of a single function.
3. **MARKER** functions read out frequencies and amplitudes on the spectrum analyzer trace, let you make relative measurements, automatically locate the signal of highest amplitude on a trace, and tune the spectrum analyzer to track a signal automatically.
4. **CONTROL** functions allow you to adjust the resolution and video bandwidths, the sweep time, the display, and other functions that control spectrum analyzer measurement capabilities.
5. **DATA** keys, STEP keys, and the knob allow you to change the numeric value of the active function. Use the data keys to enter an exact value or to move quickly from one value to another. The step keys vary a value in predefined increments or, for some functions, in increments that you choose. The knob allows you to fine-tune most numeric values.

6. The front-panel connectors include an RF input, an active-probe power, a 300 MHz calibrator signal, a 310.7 MHz IF input, and a first LO output. Table 1-2 has a short specification summary of these connectors. The IF input is not available with the 8560E/EC, Option 002. A volume knob is provided for making adjustments to the volume of the built-in speaker. The LINE button turns the spectrum analyzer on and off.

CAUTION

The maximum input level to the INPUT 50 Ω is +30 dBm with a minimum of 10 dB input attenuation.

For the 8560E/EC, 8561E/EC, or 8562E/EC only: When ac coupled, the maximum dc voltage to the RF input is ±50 V. When dc coupled, the maximum dc voltage is ±0.2 V. Default power-up mode is ac coupled. It is best to leave the analyzer in ac coupled mode for maximum protection. Exceeding the maximum safe input levels can damage the input attenuator and the input mixer.

For the 8563E/EC, 8564E/EC, or 8565E/EC only: The maximum dc voltage to the RF input is ±0.2 V. Exceeding this voltage can damage the input attenuator and the input mixer. Option 006 extends the frequency range down to 30 Hz and is more susceptible to damage from dc voltages.

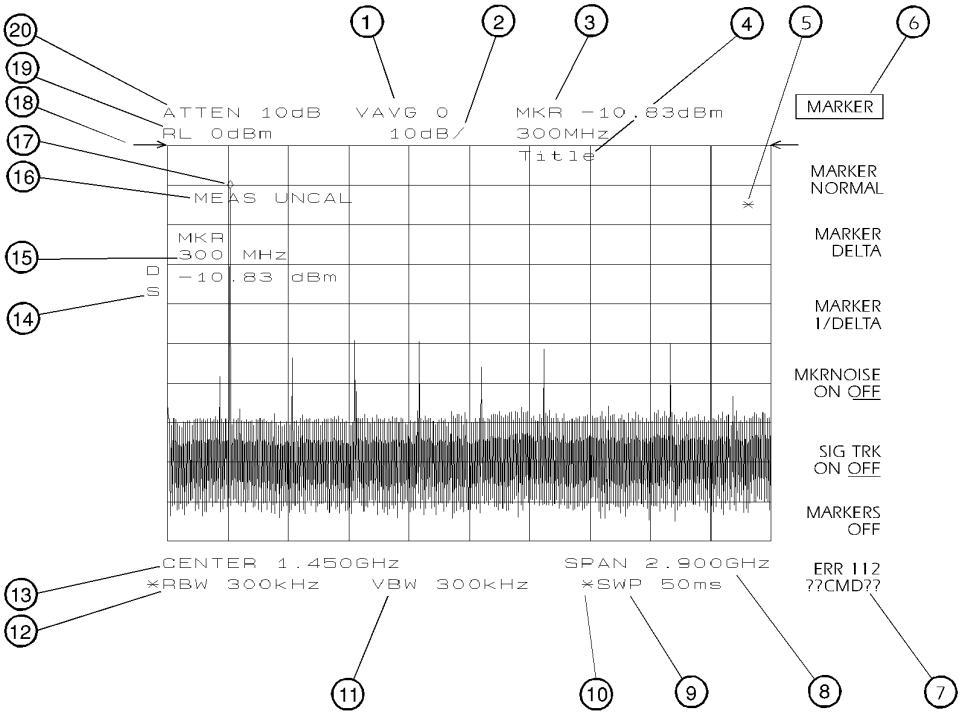
Table 1-2

Connector	Frequency Range	Amplitude/ Voltage Limits
INPUT 50 Ω	8560E/EC: 30 Hz–2.9 GHz (dc coupled) 100 kHz–2.9 GHz (ac coupled) 8561E/EC: 30 Hz–6.5 GHz (dc coupled) 100 kHz–6.5 GHz (ac coupled) 8562E/EC: 30 Hz–13.2 GHz (dc coupled) 100 kHz–13.2 GHz (ac coupled) 8563E/EC: 9 kHz–26.5 GHz (dc coupled) 30 Hz–26.5 GHz (Option 006) 8564E/EC: 9 kHz–40 GHz (dc coupled) 30 Hz–40 GHz (Option 006) 8565E/EC: 9 kHz–50 GHz (dc coupled) 30 Hz–50 GHz (Option 006)	+30 dBm Max ±0.2 V dc Max (dc coupled) ±50 V dc Max (ac coupled) +30 dBm Max ±0.2 V dc Max (dc coupled) ±50 V dc Max (ac coupled) +30 dBm Max ±0.2 V dc Max (dc coupled) ±50 V dc Max (ac coupled) +30 dBm Max ±0.2 V dc Max (dc coupled) +30 dBm Max ±0.2 V dc Max (dc coupled) +30 dBm Max ±0.2 V dc Max (dc coupled)
PROBE POWER	——	+15 V, –12.6 V (150 mA max)
CAL OUTPUT	300 MHz	–10 dBm
IF INPUT* (for use with external mixers)	310.7 MHz	0 V dc Max
1ST LO OUTPUT	3.00 GHz–6.81 GHz	+16.5 dBm ±2.0 dB +14.5 dBm ± 3.0 dB‡
RF OUT 50 Ω† (tracking generator output)	300 kHz–2.9 GHz	–10 dBm to +1 dBm

* Not available with an 8560E/EC Option 002 or Option 327.
† Available only with an 8560E/EC Option 002.
‡ LO output of an 8560E/EC Option 002.

Display Annotation

Figure 1-11 Display Annotation



1. Number of video averages.
2. Logarithmic or linear amplitude scale per division.
3. Marker amplitude and frequency.
4. Title area.
5. Data invalid indicator, displayed when analyzer settings are changed before completion of a full sweep.
6. Menu title and softkey menu.
7. Error message area.
8. Frequency span or stop frequency.
9. Sweep time.
10. Indicator of uncoupled function for sweep time, resolution bandwidth, video bandwidth, or input attenuation.
11. Video bandwidth.
12. Resolution bandwidth.
13. Center or start frequency.

14.Active special functions: the following characters appear in a vertical line alongside the graticule. This information is also available by pressing **DISPLAY**, then **ANNOT HELP**.

Table 1-3

A =	IF adjust turned OFF
C =	DC coupling selected (The 8563E/EC, 8564E/EC, and 8565E/EC are always dc coupled. AC coupling is available only for an 8560E/EC, 8561E/EC or 8562E/EC spectrum analyzers. The default setting for an 8560E/EC, 8561E/EC or 8562E/EC is ac coupling.)
D =	Detector mode set to sample, negative peak, or positive peak
E =	Special sweep-time equations in use (refer to tracking generator menus)
F =	Frequency offset is less than or greater than 0 Hz
G =	Internal tracking generator is ON
K =	Signal track is ON
M =	Trace math is ON
N =	Normalization is ON
R =	Reference level offset is less than or greater than 0 dB
S =	Single-sweep mode
T =	Trigger mode set to line, video, or external
W =	Amplitude correction (ampcor) is on
X =	10 MHz reference is external
+ =	External mixer bias is greater than 0 mA
– =	External mixer bias is less than 0 mA

15.Active function area

16.Message area (for example, messages such as `MEAS UNCAL`, `PEAKING`, and `Sampling` are displayed in the message area)

17.Marker indicator

18.Indicator of reference-level position when in normalized mode

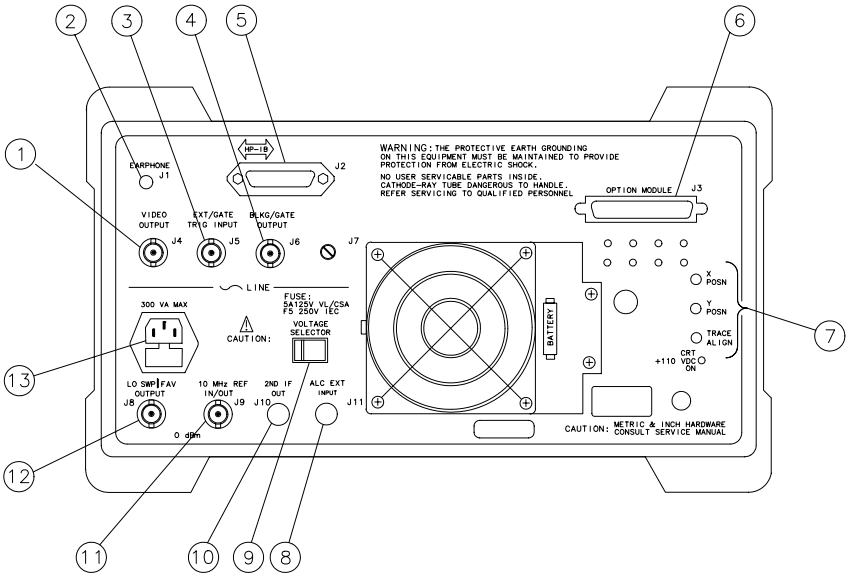
19.Reference level

20.Input attenuator value (internal mixing) or conversion loss (external mixing)

Rear Panel Overview

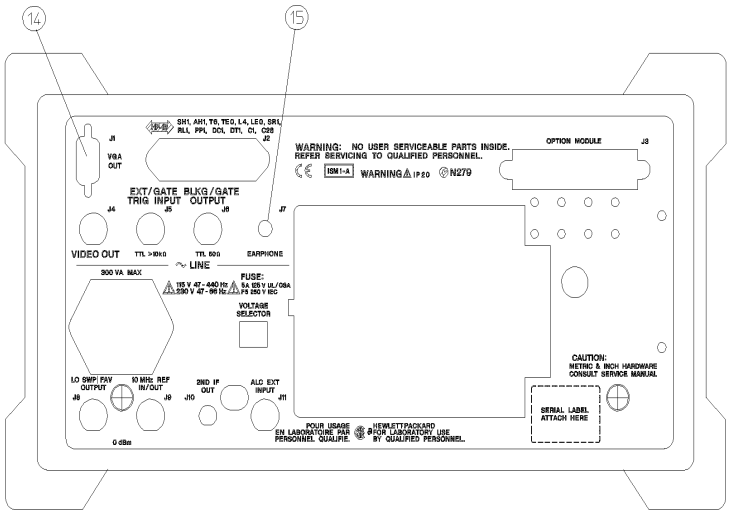
The rear panels of the E-series and EC-series are identical except the earjack on the E-series instruments is located at J1 (see 2, Figure 1-12) while on EC-series instruments, the earjack is located at J7 (see 15, Figure 1-13). EC-series instruments have a VGA port at J1, while E-series instruments do not have a VGA port. Three CRT display adjustment pots are accessed through the rear of E-series instruments (see 7, Figure 1-12), which are not present on EC-series instruments.

Figure 1-12 Rear Panel Functions - 8560 E-series



aj12e

Figure 1-13 Rear Panel Functions - 8560 EC-series



pj12c

CAUTION To prevent damage to the instrument, be sure to set the voltage selector to the appropriate value for your local line-voltage output. For more information, refer to the "If You Have A Problem" chapter.

1. J4 **VIDEO OUTPUT** provides a detected video signal that is proportional to the vertical deflection of the trace on the display. The output range is 0 V to 1 V when terminated in 50 Ω. It can be used when the display is in 10 dB/div or LINEAR mode. For resolution bandwidth settings less than 300 Hz, a 4.8 kHz IF signal with a dc offset is present at J4. The VIDEO OUTPUT connector is not available with Option 327.
2. J1 on 8560 E-series instruments (see 14 for information on J1 in EC-series instruments) **EARPHONE** provides a 4 Ω impedance earphone jack .
3. J5 **EXT/GATE TRIG INPUT** accepts a TTL signal as an external trigger, or as a trigger for gated video. The input signal range is 0 V to 5 V (TTL). For external triggering, the instrument sweep triggers on the rising or falling edge (as determined by **TRIG POL POS NEG**) of the signal (about +1.5 V).

For gated video triggering, the instrument sweep trigger depends upon the setting of **GATE CTL EDGE LVL**. If **GATE CTL EDGE LVL** is set to EDGE, either the positive or negative edge of the trigger input signal initiates the gate delay. (Set **EDGE POL POS NEG**.) If **GATE CTL EDGE LVL** is set to level (LVL), either the TTL high level or TTL low level opens the gate. (Set **LVL POL POS NEG**.) The gate control functions can be accessed by pressing **SWEEP**.

4. J6 **BLKG/GATE OUTPUT** provides either a blanking output or a gate output.

   The blanking output is a 0 V to 5 V (TTL) signal that is low (0 V) during spectrum analyzer sweeps. The output is high (5 V) during retrace and when the instrument is between bands in multiband sweeps. Use this output for pen lift when plotting with nondigital plotters. It is also useful for synchronizing instruments.

   The gate output provides a TTL signal that indicates the status of the gate when the gate is in edge trigger mode. A high TTL signal indicates the gate is on; a low TTL signal indicates the gate is off. The gate output is not active in level mode.
5. J2 **GPIB** is the General Purpose Interface Bus connector.
6. J3 **OPTION MODULE** allows connection of option modules such as the 85620A mass memory module or the 85629B test and adjustment module.

7. **X POSN, Y POSN, and TRACE ALIGN** on 8560 E-series instruments allow you to align the spectrum analyzer display of using a special CRT pattern. Refer to the softkey **CRT ADJ PATTERN** under the **CAL** menu, or consult the service guide for your model of spectrum analyzer. 8560 EC-Series instruments are not adjustable.

8. J11 **ALC EXT INPUT** provides either an external leveling input or an alternate sweep output that corresponds to the sweep ramp that tunes the local oscillator.

   For an 8560E/EC, Option 002 (which has a built-in tracking generator), J11 provides an external leveling input. For an Option 005, J11 provides a 0 V to 10 V ramp that corresponds to the sweep ramp that tunes the local oscillator (the same local oscillator sweep ramp that J8 provides).

9. **VOLTAGE SELECTOR** switch adapts the spectrum analyzer to the power source: either 115 V or 230 V.

10. J10 **2ND IF OUT** is the Option 001, 310.7 MHz IF output.

11. J9 **10 MHz REF IN/OUT** provides a 10 MHz, 0 dBm minimum, time-base reference signal. This connector can be switched to an input, to use an external reference. An external reference must be 10 MHz at a minimum of –2 dBm. To select the external reference mode, press **AUX CTRL**, **REAR PANEL**, **10 MHZ EXT INT**.

12. J8 **LO SWP | FAV OUTPUT** provides different signals at connector J8: a 0 V to 10 V ramp corresponding to the local oscillator tune ramp, or a sweeping dc output of 0.5 V per GHz of tuned frequency (and 0.25 V for the 8564E/EC and 8565E/EC). The voltage range of the sweeping dc output depends on the spectrum analyzer frequency range. Select the output with the softkeys that are accessed when you press **AUX CTRL**, **REAR PANEL**.

    The 0.25 V/GHz output is needed for frequency ranges above 26 GHz. External tracking generators, such as the 85640A, 85644A, or 85645A use the 0.5 V/GHz output. When you have selected preselected external mixers, the 0.5 V/GHz output provides approximately 1.5 V per GHz of LO frequency, to control the preselected mixer.

13. The LINE input operates at nominally 115 V (47 to 440 Hz) or at nominally 230 V (47 to 66 Hz).

14. J1 **VGA OUT** port on 8560 EC-series instruments provides a VGA port. The VGA port is always active and does not require user interface.

15. J7 **EARPHONE** provides a 4 Ω impedance earphone jack on 8560 EC-series instruments.

Assistance

Product maintenance agreements and other customer assistance agreements are available for Agilent Technologies products.

For any assistance, contact your nearest Agilent Technologies Sales and Service Office.

Cleaning

The instrument front and rear panels should be cleaned using a soft cloth with water or a mild soap and water mixture.

Safety Symbols

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

CAUTION

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

WARNING

The *warning* sign 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* until the indicated conditions are fully understood and met.

Instruction Documentation	The product is marked with this symbol when it is necessary for you to refer to the instructions in the documentation.

General Safety Considerations

WARNING

Before this instrument is switched on, **make sure it has been properly grounded through the protective conductor of the ac power cable to a socket outlet provided with protective earth contact.**

Any interruption of the protective (grounding) conductor, inside or outside the instrument, or disconnection of the protective earth terminal can result in personal injury.

If this instrument is used in a manner not specified by Agilent Technologies, the protection provided by the instrument may be impaired.

There are many points in the instrument which can, if contacted, cause personal injury. Be extremely careful. Any adjustments or service procedures that require operation of the instrument with protective covers removed should be performed only by trained service personnel.

CAUTION

Before this instrument is switched on, make sure its primary power circuitry has been adapted to the voltage of the ac power source.

Failure to set the ac power input to the correct voltage could cause damage to the instrument when the ac power cable is plugged in.

This product conforms to Enclosure Protection IP 2 0 according to IEC-529. The enclosure protects against finger access to hazardous parts within the enclosure; the enclosure does not protect against the entrance of water.

8560 E-Series and EC-Series Spectrum Analyzer Documentation Description

User's Guide

The *8560 E-Series and EC-Series User's Guide* applies to the 8560E/EC, 8561E/EC, 8562E/EC, 8563E/EC, 8564E/EC, and 8565E/EC spectrum analyzers. The *8560 E-Series and EC-Series User's Guide* includes information about preparing the spectrum analyzer for use, spectrum analyzer functions, common spectrum analyzer measurements, programming fundamentals, and definitions for remote programming commands.

In addition to the user's guide, the following manuals are shipped with your spectrum analyzer:

Calibration Guide

The *Agilent Technologies 8560 E-Series and EC-Series Calibration Guide* includes the specifications and characteristics, and information about how to test your spectrum analyzer to determine if the spectrum analyzer meets its specifications.

Quick Reference Guide

The *Agilent Technologies 8560 E-Series and EC-Series Quick Reference Guide* applies to the 8560E/EC, 8561E/EC, 8562E/EC, 8563E/EC, 8564E/EC, and 8565E/EC spectrum analyzers. The *8560 E-Series and EC-Series Quick Reference Guide* includes information about how to make a simple measurement with your spectrum analyzer, briefly describes the spectrum analyzer functions, and lists all the programming commands.

Manuals Available Separately

Service Guide

The service guide provides information for servicing an instrument to the assembly level. The manual includes instrument adjustments, troubleshooting, major assembly replaceable parts lists, and replacement procedures. For ordering information, contact a Agilent Technologies Sales and Service Office. This manual is not always immediately available for new products.

Component-Level Information

The component-level information manual provides component level information for the assemblies used in the instrument. Schematic drawings, component locators and assembly parts list are provided for the current vintage of assemblies. Component-level information is not always immediately available for new assemblies.

How to Order Manuals

Each of the manuals listed above can be ordered individually. To order, contact your local Agilent Technologies Sales and Service Office. See Table 9-3 on page 681 for a listing of Agilent Technologies sales and service offices.

2 Making Measurements

Making Measurements

This chapter demonstrates spectrum analyzer measurement techniques with examples of typical applications. Each application focuses on different features of the Agilent 8560 E-Series and EC-Series spectrum analyzers. The measurement application and procedures covered in this chapter are:

- Resolving Closely Spaced Signals (with Resolution Bandwidth)
- Improving Amplitude Measurements with Ampcor
- Modulation
- Harmonic Distortion
- Third-Order Intermodulation Distortion
- AM and FM Demodulation
- Stimulus-Response Measurements
- External Millimeter Mixers
- Adjacent Channel Power Measurement
- Power Measurements Functions
- Time-gated Measurement
- Making Time-Domain Measurements Using Sweep Delay
- Making Pulsed RF Measurements

Example 1: Resolving Closely Spaced Signals (with Resolution Bandwidth)

What Is Resolution Bandwidth?

Signal resolution is determined by the intermediate frequency (IF) filter bandwidth. The spectrum analyzer traces the shape of its IF filter as it tunes past a signal. Thus, if two equal-amplitude signals are close enough in frequency, the filter shapes for the two signals can fall on top of one another and appear as a single response. If two signals are not equal in amplitude but are still close together, the smaller signal can be hidden under the response of the larger one.

Spectrum Analyzer Function Used

The resolution bandwidth function (RES BW) selects the appropriate IF bandwidth for a measurement. (Agilent Technologies specifies resolution bandwidth as the 3 dB bandwidth of a filter.) The following guidelines can help you determine the appropriate resolution bandwidth to choose.

Stepping Through a Measurement of Two Equal Amplitude Signals

Generally, to resolve two signals of equal amplitude, the resolution bandwidth must be less than or equal to the frequency separation of the two signals. For example, to resolve two signals of equal amplitude with a frequency separation of 1 kHz, a resolution bandwidth of 1 kHz or less should be used.

1. Connect two signal sources to the spectrum analyzer INPUT 50 Ω. Set the frequency of one source to 499.5 kHz and the other source to 500.5 kHz. Set both sources to the same amplitude.
2. Press **PRESET** on the spectrum analyzer to start the procedure from a preset state, and set the spectrum analyzer center frequency to 500 kHz.
3. Set the span to 10 kHz.
4. Set the resolution bandwidth to 1 kHz. See Figure 2-1.
5. Change the resolution bandwidth to a wider value and notice that you can no longer see that there are two signals present.
6. Change the two source frequencies to 499 kHz and 501 kHz.

To resolve two signals with a frequency separation of 2 kHz, a 1 kHz resolution bandwidth again must be used (see Figure 2-2). Since the spectrum analyzer uses bandwidths in a 1, 3, 10 sequence, the next larger filter, 3 kHz, would exceed the 2 kHz separation and thus would not resolve the signals.

Keep in mind that noise sidebands (phase noise) can also affect resolution.

Figure 2-1 1 kHz Signal Separation

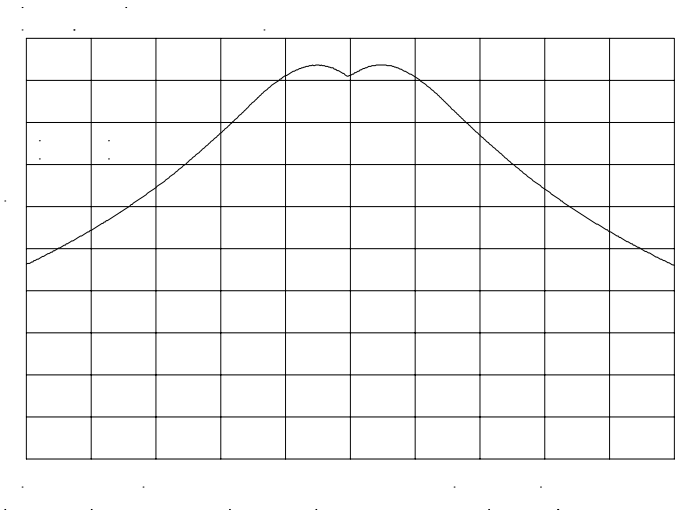
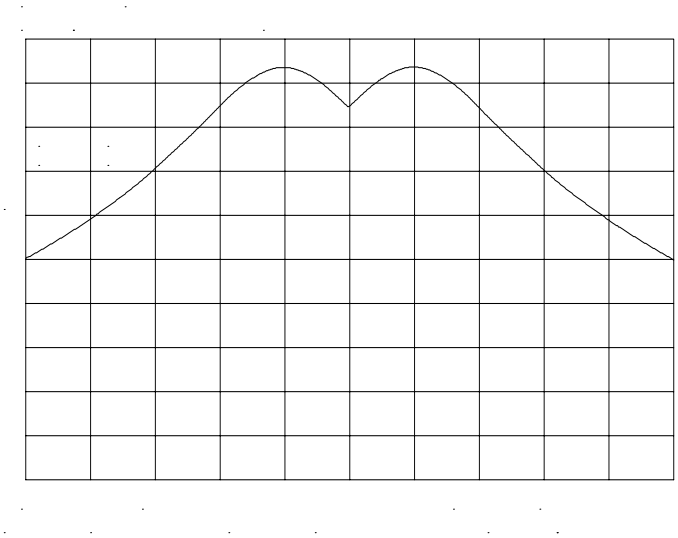


Figure 2-2 2 kHz Signal Separation



Stepping Through a Measurement of Two Signals of Unequal Amplitude

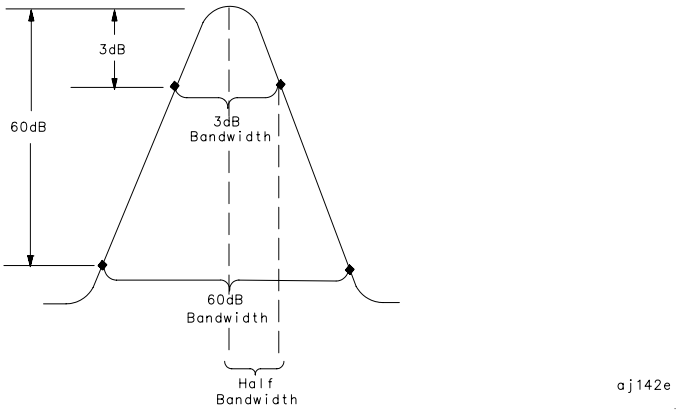
This example resolves a third-order intermodulation distortion product with a frequency separation of 700 kHz and an amplitude separation of about 60 dB.

1. Connect two signal sources to the spectrum analyzer INPUT 50 Ω. Set the frequency of one source to 10 MHz and the other source to 10.7 MHz. Set both sources to an amplitude of about –10 dBm.
2. Press **PRESET** on the spectrum analyzer to start the procedure from a preset state and set the spectrum analyzer center frequency to 10.35 MHz.
3. Set the span to 5 MHz.
4. Set the resolution bandwidth to 100 kHz and the video bandwidth to 1 kHz. See Figure 2-4 on page 55.

To resolve two signals of unequal amplitude, the resolution bandwidth must be less than or equal to the frequency separation of the two signals (the same as resolving two equal amplitude signals). However, in this case the largest resolution bandwidth that will resolve the two unequal signals is determined primarily by the shape factor of the IF filter, rather than by the 3 dB bandwidth. Shape factor is defined as the ratio of the 60 dB bandwidth to the 3 dB bandwidth of the IF filter, as in Figure 2-3.

The wider IF filters in this spectrum analyzer have shape factors of 15:1 or better. The IF filters less than or equal to 100 Hz have a better shape factor of 5:1 or better. Therefore, to resolve two signals of unequal amplitude, the half-bandwidth of a filter at the point equal to the amplitude separation of the two signals must be less than the frequency separation of the two signals.

Figure 2-3 Bandwidth Shape Factor



Use a 100 kHz resolution bandwidth filter to resolve this third-order intermodulation distortion product. The 100 kHz filter has a typical shape factor of 12:1, a 60 dB bandwidth of 1.2 MHz, and a half-bandwidth value of 600 kHz. This half-bandwidth is narrower than the frequency separation, so the two input signals will be resolved. See Figure 2-4.

However, using a 300 kHz filter, the 60 dB bandwidth is 3.6 MHz and the half-bandwidth value is 1.8 MHz. Since this half-bandwidth is wider than the frequency separation, the signals most likely would not be resolved

- Change the resolution bandwidth to 300 kHz and notice that you can no longer see that the distortion product is present. See Figure 2-5 on page 55.

Figure 2-4 100 kHz Bandwidth Resolution

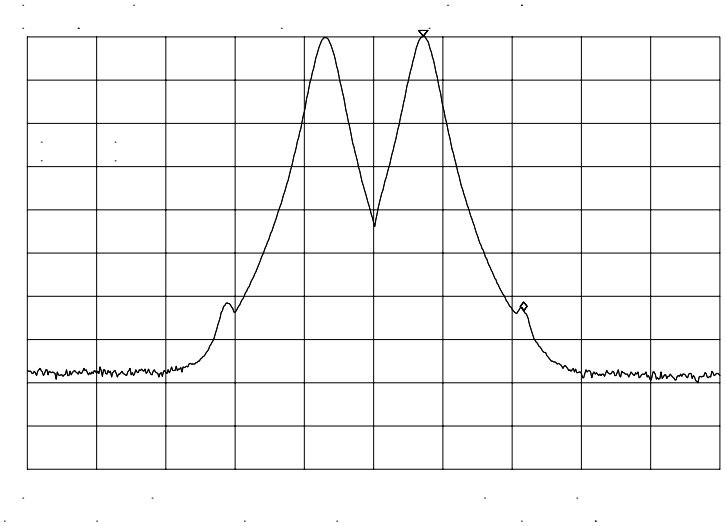
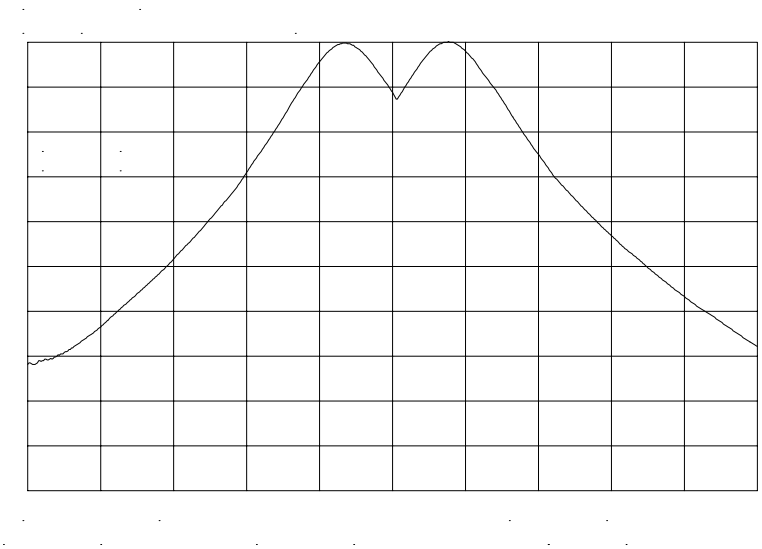


Figure 2-5 300 kHz Bandwidth Resolution



NOTE Spectrum analyzer sweep time is inversely proportional to the square of the resolution bandwidth, for bandwidths greater than or equal 300 Hz. So, if the resolution bandwidth is reduced by a factor of ten, the sweep time is increased by a factor of 100. For fastest measurement times, use the widest resolution bandwidth that still permits resolution of all desired signals.

Example 2: Improving Amplitude Measurements with Ampcor

What Is Ampcor?

The amplitude correction function is used to improve the amplitude accuracy of your measurement system. System flatness is often degraded by many things including cable and adapter losses. Additional systematic amplitude errors such as IF gain uncertainty, resolution bandwidth switching uncertainty, and attenuator switching uncertainty can also be corrected. These system effects can be normalized out of the displayed measurement results using the ampcor function. Pairs of frequency/amplitude correction points are entered into the spectrum analyzer. Turning on the ampcor function causes real-time correction of the measurement data using these points. This real-time correction is updated as the frequency and amplitude parameters of the spectrum analyzer are changed.

Spectrum Analyzer Functions Used

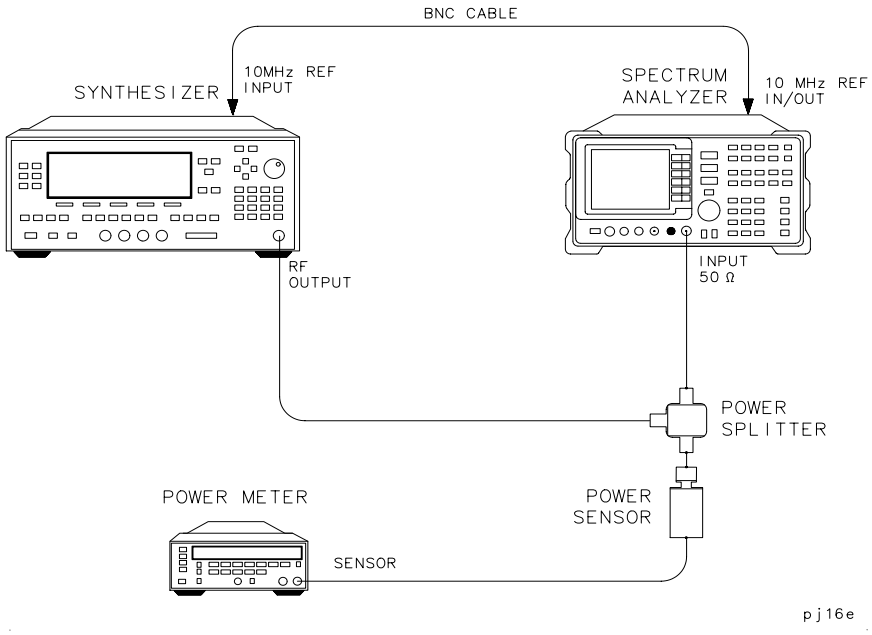
This example uses the amplitude correction function, ampcor. It illustrates the use of some of the ampcor data entry and editing functions that help with the entry of the frequency-amplitude correction pairs. Once you have entered a set of correction values, they can be saved and recalled for later use.

Stepping Through an Ampcor Measurement

The ampcor function will be used to correct for variations in the flatness of a measurement system. Suppose we want to make measurements on a personal digital cellular system (PDC). The PDC frequency range is 1 GHz to 1.6 GHz, and in this frequency range the spectrum analyzer frequency response has a small amount of ripple. The ampcor function will be used to correct for this and for some cable losses.

Substitute a source and power meter for the PDC signal and set up the measurement with the system cable. The flatness correction values are identified, and then entered and saved.

Figure 2-6 Ampcor Measurement Setup



Set up the measurement.

1. Zero and calibrate the power meter and power sensor.
2. Connect the source output to the power splitter input. Connect the system cable from the spectrum analyzer input to one of the power splitter outputs. Connect the power sensor to the other power splitter output. See Figure 2-6.
3. Set the source output to:

   CW .....1.0 GHz
   Amplitude ..... 0 dBm

4. On the power meter, enter the 1 GHz power sensor calibration factor.
5. The correction values should be determined using the same measurement setup as the intended measurement will use. For the purpose of this example, we will use the following spectrum analyzer setup:

   Center frequency .....1.0 GHz
   Frequency span ..... 5 MHz
   Resolution bandwidth ..... 300 kHz
   Log scale ..... 1 dB/division

6. On the spectrum analyzer, press **CAL**, **MORE 1 OF 2**, **AMPCOR MENU**, and **EDIT AMPCOR**. If there is a correction already loaded, purge it by pressing **MORE 1 OF 2**, **DONE EDIT**, **PURGE CORR**, **PURGE DATA**. (Or you can save the correction first and then purge it. Refer to the procedures that follow.) If data was purged, press **EDIT AMPCOR** again before continuing.

Enter the correction points.

1. On the spectrum analyzer, press **MORE 1 OF 2**, **PEAK SEARCH**, **MORE 2 OF 2**.
2. Enter the marker frequency.
3. Use the knob to adjust AMPL until the marker amplitude reads the same as the power meter. The ampcor function will be automatically turned on after the first point is entered. Note the "W" along the left edge of the display.
4. Set the source CW frequency to the next frequency to be corrected.
5. Enter the power sensor calibration factor for this frequency into the power meter.
6. On the spectrum analyzer, press **FREQUENCY** and enter the next frequency to be corrected.
7. Press **CAL**, **MORE 1 OF 2**, **AMPCOR MENU**, **EDIT AMPCOR**, **MORE 1 OF 2**, **PEAK SEARCH**, **MORE 2 OF 2**, **NEW CORR PT**.
8. Use the knob to adjust AMPL until the marker amplitude reads the same as the power meter.
9. Repeat steps 4 through 8 for each additional correction point.

Storing the ampcor data.

1. Press **MORE 1 OF 2**, **DONE EDIT**, **SAVE AMPCOR**. Select a convenient register number.
2. If you would like to create a softkey label under which the correction data will be saved, press **DISPLAY** and enter a screen title. Return to the ampcor menu, press **SAVE AMPCOR** and select a correction register number. The first 16 characters of the screen title will be used as a softkey label.

You have now completed the process for entering amplitude correction points. At this point you can disconnect the source from the spectrum analyzer input and connect the test signal, using the same system cable. You can recall the correction points and begin to make measurements.

Using the ampcor data.

1. With ampcor on, the amplitude measured by the analyzer at the correction-point frequencies should agree with the power meter reading ±0.2 dB. This error is due primarily to the spectrum analyzer marker amplitude resolution, which ranges from 0.017 dB to 0.17 dB, depending upon the log scale selected.
2. If you want to turn off ampcor, press **AMPCOR ON OFF** so that OFF is selected. The correction to the trace is now turned off, but the correction values remain in memory.
3. If you want to purge the ampcor correction data, press **PURGE CORR** and purge the correction data. The correction values are now gone from active memory.

Ampcor Limitations

When using the ampcor function consider the following:

Trace data above or below the graticule

If any of the uncorrected trace data is above or below the graticule, the ampcor function will not properly correct it. The spectrum analyzer amplitude accuracy is not specified above or below the graticule. Anytime ampcor applies a correction such that data outside the graticule is moved to within the graticule, an error (error number 921 or 922) is generated. In order to avoid these errors, make sure that the trace data which is being corrected is within the graticule before the correction is applied.

Measurements near the bottom of the graticule

If you are using 10 dB/division and the measurements occur in the bottom division of the display, imperfect log fidelity will cause errors in the correction.

Flatness correction and temperature drift

If the factors that contribute to poor flatness are temperature dependent, the corrections will not be as effective.

Example 3: Modulation

What Is Modulation?

Modulation is the act of translating some low frequency or baseband signal (voice, music, data) to a higher frequency. In the modulation process, some characteristic of a carrier signal (usually amplitude or frequency) is changed in direct proportion to the instantaneous amplitude of the baseband signal.

More information about amplitude and frequency modulation can be found in Agilent Technologies Application Note 150-1, literature number 5954-9130.

Spectrum Analyzer Functions Used

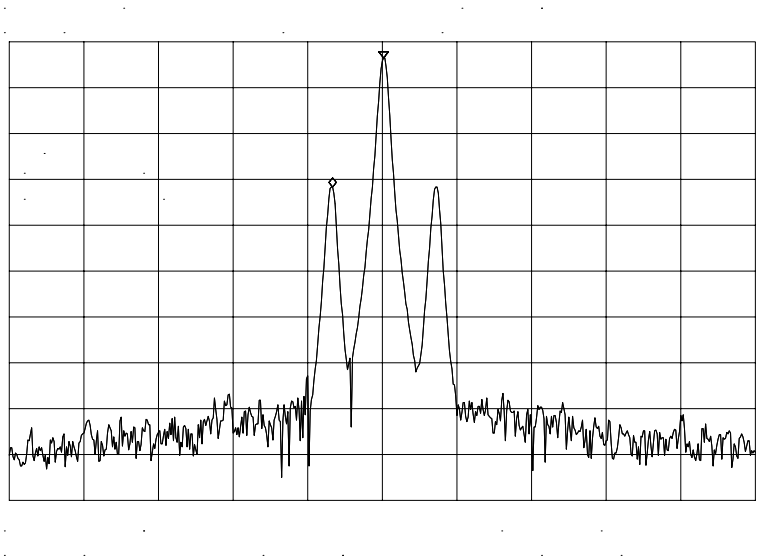
The following procedure describes how to measure signals with AM and FM types of modulation on them. It shows how to tune the signal onto the spectrum analyzer display. It demonstrates using the frequency count function and several marker functions to make measurements.

Stepping Through Modulation Measurements

Amplitude Modulation

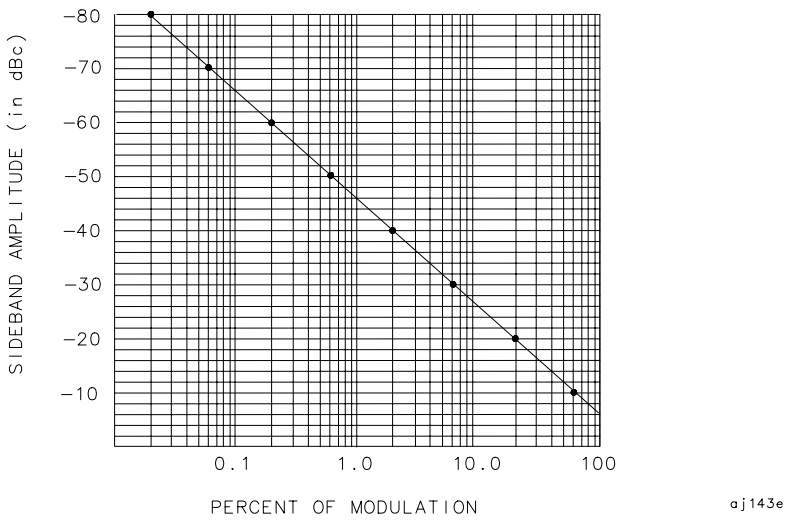
1. Connect the signal source to the spectrum analyzer INPUT 50Ω.
2. Set the source to a carrier frequency of 100 MHz with amplitude modulation of about 34 kHz.
3. Set the spectrum analyzer center frequency to 100 MHz. Set the span to 500 kHz.
4. Figure 2-7 on page 61 illustrates the amplitude-modulated signal as seen on the spectrum analyzer display. Note the carrier signal. To determine its frequency, simply press **PEAK SEARCH**.
5. Additional modulation information can be easily determined from the carrier signal and a sideband. For example, the difference between the carrier frequency and the sideband frequency can be found by pressing **PEAK SEARCH**, **MARKER DELTA**, and **NEXT PEAK**. The markers read the frequency difference between the two signals, which is equal to the modulating frequency. The marker also reads the difference in amplitude. This difference in amplitude between the two signals can be used to determine percentage of modulation (refer to Figure 2-8 on page 61).

Figure 2-7 An Amplitude-Modulated Signal



NOTE Unequal amplitudes of the lower and upper sidebands indicate incidental FM on the input signal. Incidental FM can reduce the accuracy of percentage-of-modulation measurements.

Figure 2-8 Percentage of Modulation



The following equation also determines percentage of modulation using amplitude units in volts:

$$M = \frac{2A_s \times 100}{A_c}$$

where A_s = sideband amplitude, in volts

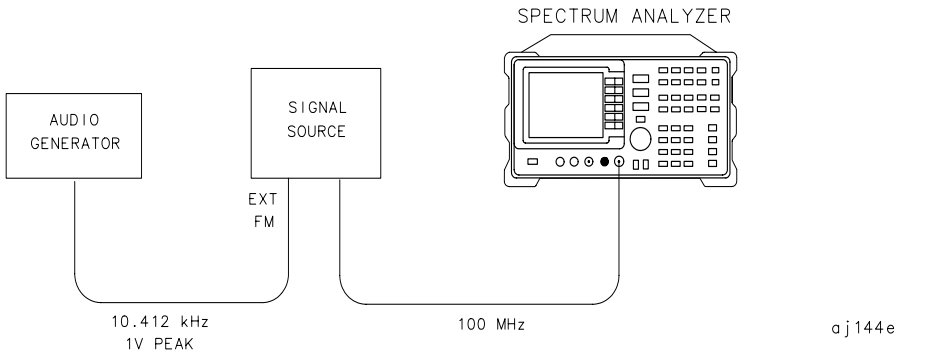
A_c = carrier amplitude, in volts

Frequency Modulation

This section contains general information about frequency modulation, as well as a procedure for calculating FM deviation using a spectrum analyzer.

For sinusoidal modulation where either the modulation frequency or the FM deviation can be varied, the spectrum analyzer can be used to accurately set up a modulation index corresponding to a Bessel null. The following example illustrates how to verify the FM deviation accuracy of a signal generator with FM capability. We will use a carrier frequency of 100 MHz and test for FM deviation accuracy at a 25 kHz rate using the modulation index for the first carrier null (2.401). Figure 2-9 illustrates how to set up the equipment for this measurement.

Figure 2-9 FM Deviation Test Setup



1. Connect the signal source to the spectrum analyzer INPUT 50Ω. Set the source to 100 MHz.
2. Press **PRESET** to begin with the spectrum analyzer in a preset state and change the settings as follows:
   a. Set center frequency to 100 MHz.
   b. Set span to 100 kHz.
   c. Set resolution bandwidth to 1 kHz.
   d. Set video bandwidth to 1 kHz.

3. Figure 2-10 contains Bessel functions for determining modulation. (Table 2-1 and Table 2-2 on page 63 also contain modulation index numbers for carrier nulls and first sideband nulls.)

Figure 2-10 Bessel Functions for Determining Modulation Index

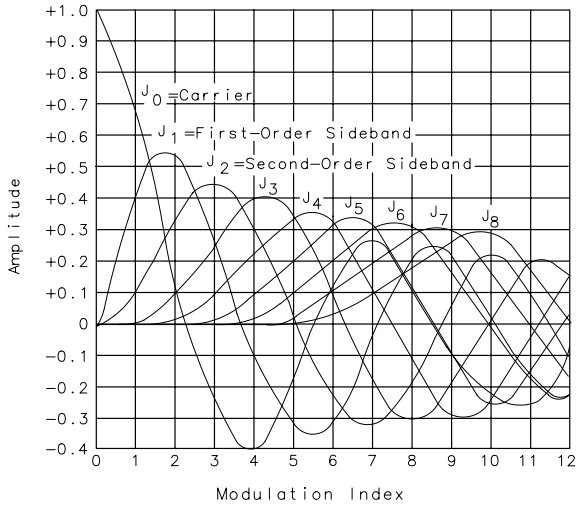


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Table 2-1 Carrier Nulls and Modulation Indexes

Order of Carrier Null	Modulation Index
1	2.401
2	5.520
3	8.653
4	11.791
5	14.931
6	18.071
n (n > 6)	18.071 + π(n – 6)

Table 2-2 Sideband Nulls and Modulation Indexes

Order of First Sideband Null	Modulation Index
1	3.83
2	7.02
3	10.17
4	13.32
5	16.47
6	19.62

4. Knowing that the desired deviation is 25 kHz, and choosing the modulation index of the first carrier null, calculate the modulating frequency as follows:

$$\text{Modulating Frequency} = \frac{25\text{kHz}}{2.401}$$

$$\text{Modulating Frequency} = 10.412\text{kHz}$$

5. Set the modulation rate on the signal generator to 10.412 kHz. If the signal source doesn't have an accurate internal modulation source, use an external source. You can use the delta count mode of the analyzer to accurately set the audio source frequency as follows:

Table 2-3

a. Press **FREQ COUNT** to activate the counter function, then press **COUNTER RES** and set the counter resolution.

b. Press **COUNTER ON OFF** so that ON is underlined, and use the delta count mode to read the difference between two sideband peaks (see Figure 2-11).

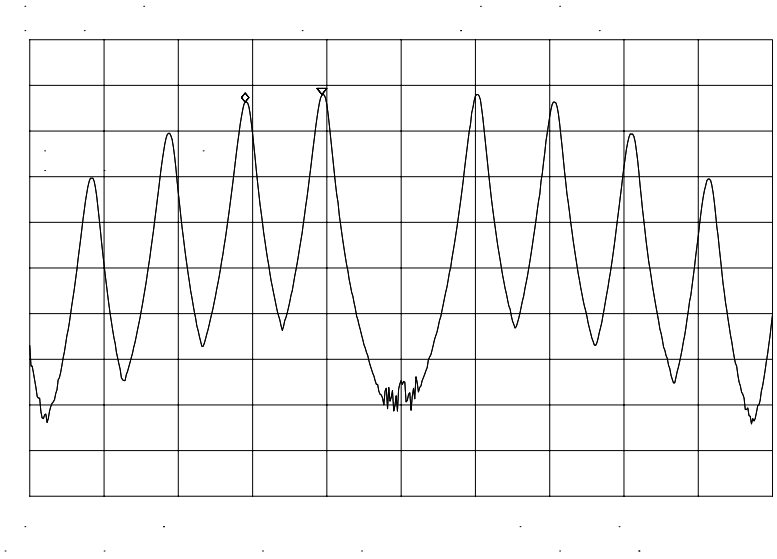
c. Now adjust the frequency deviation for a maximum null of the carrier.

d. Calculate the FM deviation by multiplying the modulation index (from Table 2-10) by the modulation rate:

e. FM Deviation = 10.39 kHz × 2.401

f. FM Deviation = 24.95 kHz

Figure 2-11 Markers Show Modulating Frequency



- Gradually change the modulation frequency (or change the amplitude of the modulation signal) and observe the changes in the displayed nulls. Figure 2-12 illustrates a frequency-modulated signal with a small modulation index (modulation index of about 0.2) as it appears on a spectrum analyzer. Figure 2-13 on page 66 and Figure 2-14 on page 66 illustrate larger modulation index values. In the first figure the null is at the carrier. In the second figure the null is at the first sideband.

Figure 2-12 A Frequency-Modulated Signal

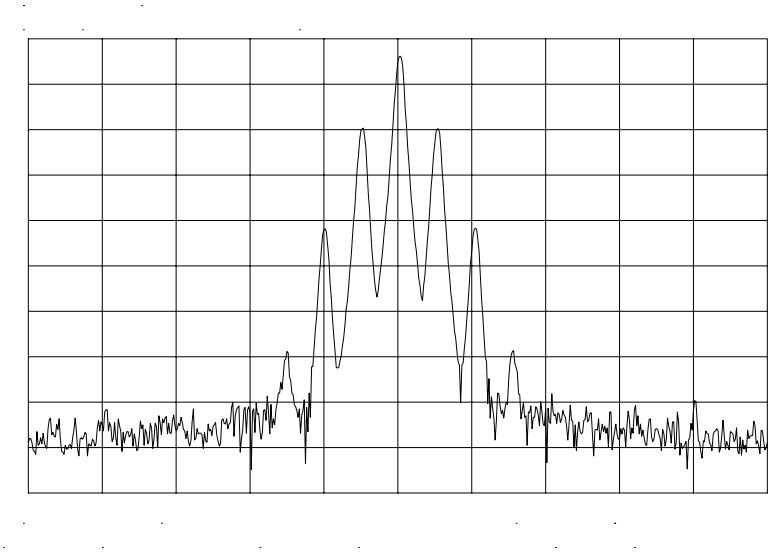


Figure 2-13 FM Signal with Carrier at a Null

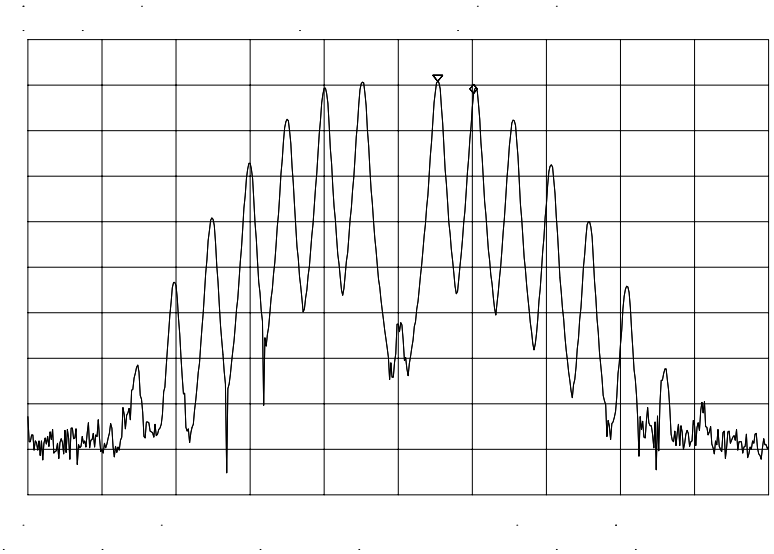
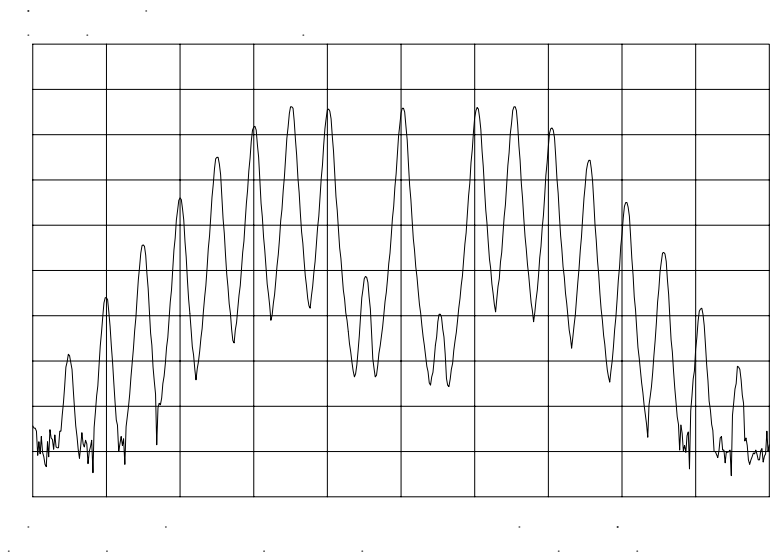


Figure 2-14 FM Signal with First Sidebands at a Null



NOTE Incidental AM from a source signal can cause the frequency null to shift, resulting in errors to the procedure above. Incidental AM is very low for most RF signal generators, but can be significant in microwave signal generators. Nonsymmetrical side lobes indicate the presence of incidental AM. In such cases, the best technique for measuring FM is to down-convert and use a modulation analyzer such as the Agilent 8901A/B.

Example 4: Harmonic Distortion

What Is Harmonic Distortion?

Most transmitting devices and signal sources contain harmonics. Measuring the harmonic content of such sources is frequently required. In fact, measuring harmonic distortion is one of the most common uses of a spectrum analyzer. Harmonic distortion can be checked very quickly by using the measurement routine described below. This measurement routine measures harmonic amplitudes relative to the source frequency.

Spectrum Analyzer Functions Used

The following harmonic distortion measurement applies an important group of spectrum analyzer operating skills: setting the frequency span using start and stop frequencies; setting the video bandwidth; and making relative measurements using two markers. It also demonstrates setting a signal to center frequency using a marker, and setting the frequency step size to the value of the center frequency.

There are two common ways to measure harmonic distortion using a spectrum analyzer. Procedure A illustrates the faster method, which permits a simultaneous display of the fundamental and its harmonics. Procedure B takes longer to perform but provides a better measurement of harmonics closer to the noise floor.

Stepping through the Fast Harmonic Measurements: Procedure A

This example measures the harmonic content of a 1 MHz signal provided by a signal generator. You may use the 300 MHz calibrator signal of the spectrum analyzer, but be sure to adjust the spectrum analyzer start and stop frequencies to accommodate the source frequency and its harmonics.

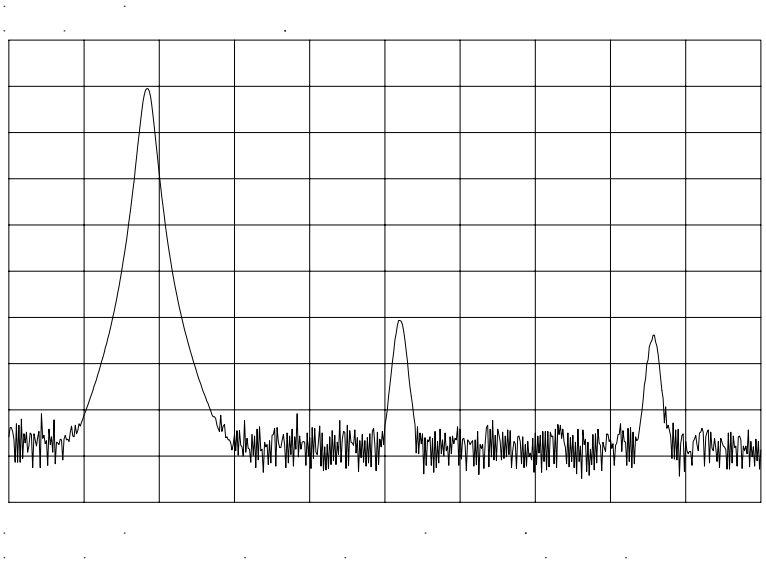
1. Connect the signal source to the spectrum analyzer INPUT 50 Ω
   Press **PRESET** to start the procedure from a preset state.

Measure the 1 MHz fundamental and its first two harmonics

1. Set the start frequency to 450 kHz.
2. Set the stop frequency to 3.5 MHz.

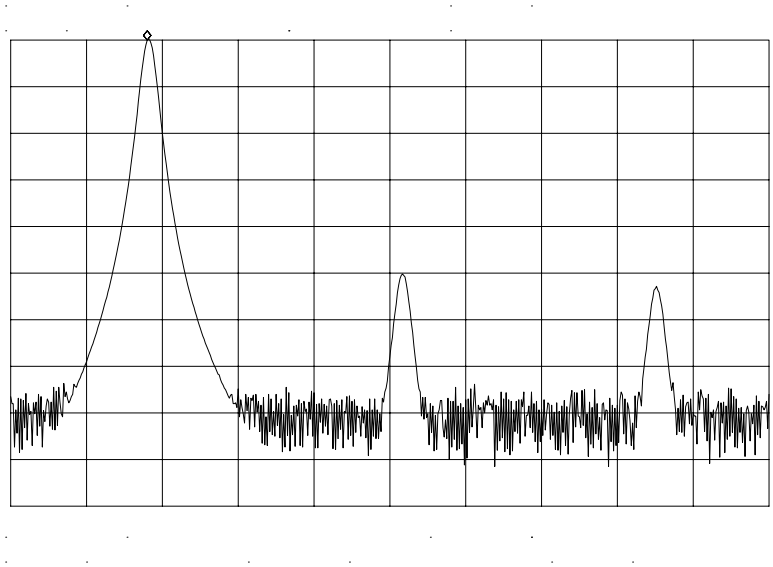
This displays the fundamental frequency and the second and third harmonics as shown in Figure 2-15 on page 68.

Figure 2-15 Input Signal and Harmonics



1. Set the video bandwidth to improve visibility by smoothing the noise:
   a. Press **BW**.
   b. Press **VIDEO BW AUTO MAN** until MAN is selected.
   c. Use the step down ⇓ key to select the video bandwidth.
2. For measurement accuracy, raise the peak of the fundamental to the reference level:
   a. Press **PEAK SEARCH**, **MKR** →, **MARKER** → **REF LVL**. The result is shown in Figure 2-16.

Figure 2-16 Peak of Signal is Positioned at Reference Level for Maximum Accuracy

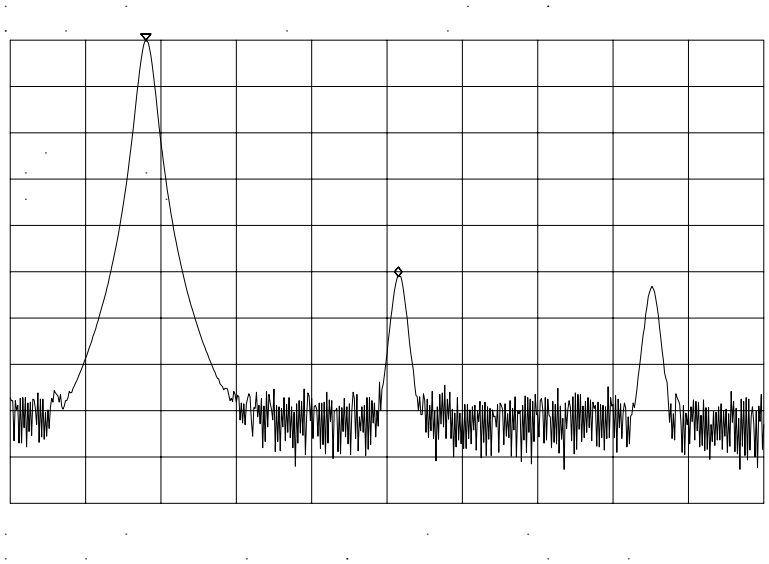


Place a second marker on the second harmonic

1. Set the peak threshold above the noise:
   a. Press **PEAK SEARCH**, **MORE 1 OF 2**, **PEAK THRESHLD**.
   b. Adjust the dashed line to a level above the noise using either the step keys or the knob.
2. Activate the second marker:
   a. Press **PEAK SEARCH**, **MARKER DELTA**, **NEXT PK RIGHT**.

This places the anchor marker on the fundamental, and a second marker on the peak of the second harmonic, as shown in Figure 2-17 on page 70.

Figure 2-17 Harmonic Distortion in dBc (marker threshold set to –70 dB)



Find the harmonic distortion (method 1)

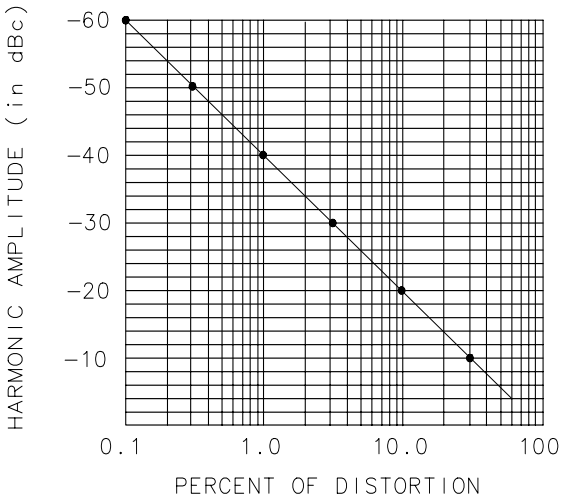
The difference in amplitude between the fundamental and second harmonic shown in the figure is about –50 dB, or 0.33 percent harmonic distortion (see Figure 2-18).

1. To measure the third harmonic, press **NEXT PK RIGHT** again.

Measure additional harmonics

1. Continue reading amplitudes and comparing them to Figure 2-18 for each additional harmonic you want to measure. **PEAK EXCURSN** defines what is and what is not a peak; the next-peak routines find the corresponding peak.

Figure 2-18 Percentage of Distortion versus Harmonic Amplitude



Find the harmonic distortion (method 2)

1. Another easy way of determining the percent of distortion is to change the units to volts:
   a. Press **AMPLITUDE**, **MORE 1 OF 3**, **AMPTD UNITS**, **VOLTS**. The marker readout automatically changes to voltage units.
   b. To determine the percentage of distortion, use the ratio given by the marker and move the decimal point of this value two places to the right. However, the displayed ratio is limited to a minimum of 0.01, or 1 percent, before reaching zero.

Plot the display

1. You may want to plot the display for hard-copy documentation:
   a. Connect a graphics plotter (such as an Agilent 7440A ColorPro) to the analyzer via GPIB.
   b. Set the plotter address to 5.
   c. On the spectrum analyzer, press **CONFIG**, then **COPY DEV PRNT PLT** until PLT is selected.
   d. Press **PLOTTER CONFIG** to view available plot functions.
   e. Press **COPY** to transfer the entire display to the plotter.

Other plotter functions let you select certain traces or parts of the display for plotting. The **PLOT ORG DSP GRAT** function lets you choose the plotter reference points to correlate to the display (DSP) or to the display graticule (GRAT).

An Alternative Harmonic Measurement Method: Procedure B

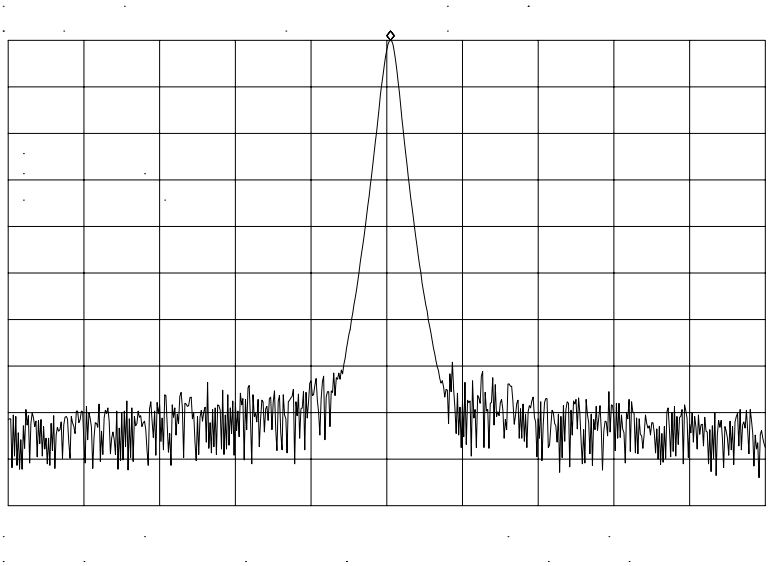
This method is somewhat longer, but because each signal is measured in a narrower span and resolution bandwidth, the signal-to-noise ratio is improved, making the results more accurate.

1. Using the present setup, clear the markers from the screen by pressing **MKR**, **MARKERS OFF**. Notice that when **MARKERS OFF** or **HOLD** is pressed, the display expands to the full size of the screen, for easier viewing.

Measure the 1 MHz fundamental

1. Reduce the frequency span:
   a. Press **PEAK SEARCH**, which activates a marker on the highest-level signal on-screen.
   b. Reduce the frequency span to 1 MHz by pressing **SPAN**, **SPAN ZOOM**.
   c. Enter 1 MHz. The span zoom function lets you quickly "zoom" to a narrower frequency span without losing the signal from the screen (because signal track is activated).
   d. After the frequency span is reduced, turn off the signal-track function by pressing **MKR**, and setting **SIG TRK ON OFF** to OFF.
2. Set the center-frequency step-size to the frequency of the fundamental:
   a. Press **MKR** →, **MARKER** → **CF STEP**
3. For better amplitude accuracy, move the signal to the top of the graticule:
   a. Press **MARKER** → **REF LVL**. The resulting display should resemble Figure 2-19 on page 73.

Figure 2-19 Input Signal Displayed in a 1 MHz Span



Measure the second harmonic

1. Press **MKR**, **MARKER DELTA**, **FREQUENCY**, and the step up **›** key. This step retunes the spectrum analyzer center frequency to the second harmonic.
2. Adjust the harmonic to the reference level. (Note that the **MARKER →** **REF LVL** function is not available in marker-delta mode.) This displays the amplitude of the second harmonic as shown in Figure 2-20 on page 74.

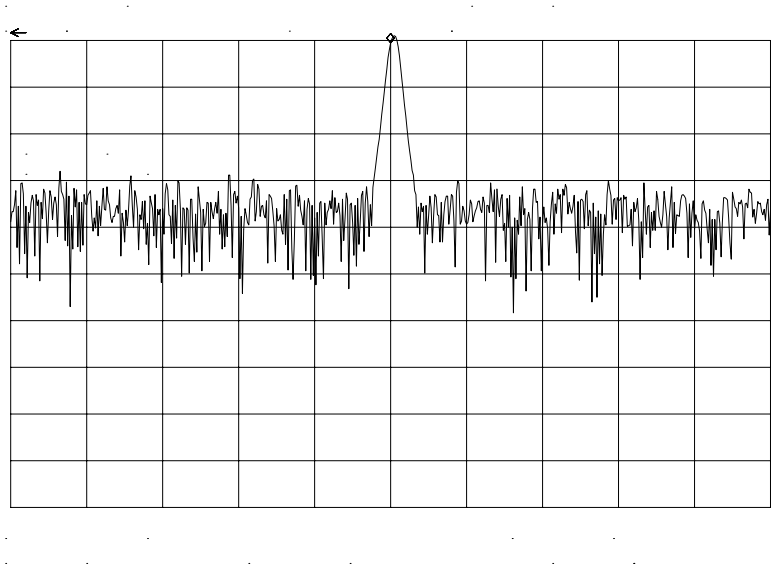
Find the harmonic distortion

1. Use Figure 2-18 on page 71 to convert the difference between the second harmonic and the fundamental to a percentage of distortion. Again, units can be changed to volts in order to read the voltage ratio of the two signals.

Measure additional harmonics

1. For each additional harmonic you wish to measure, press the step up **›** key and adjust the reference level. Note the arrow in the upper-left corner of the graticule indicates that the anchor marker is off-screen. However, the results are still valid.

Figure 2-20 Second Harmonic Displayed in dBc



Percent of Harmonic Distortion

The total percent of harmonic distortion of a signal is also measured frequently. For this measurement, the amplitude of each harmonic must be measured in linear units (for example, volts) instead of dBc. To display amplitude units in volts, press **AMPLITUDE**, **MORE 1 OF 3**, **AMPTD UNITS**, and **VOLTS**. The amplitude values of these signals are used in the equation below to compute total harmonic distortion:

$$\frac{\sqrt{(A_2)^2 + (A_3)^2 + (A_4)^2 .... + (A_n)^2} \times 100}{A_1}$$

1. Where:

   A_1 = the amplitude of the fundamental frequency, in volts

   A_2 = the amplitude of the second harmonic, in volts

   A_3 = the amplitude of the third harmonic, in volts

   A_4 = the amplitude of the fourth harmonic, in volts

   A_n = the amplitude of the *nth* harmonic, in volts

If the signal amplitudes are measured carefully, as in the previous example, this procedure measures percent-of-harmonic distortion very accurately.

Example 5: Third-Order Intermodulation Distortion

What Is Intermodulation Distortion?

In crowded communication systems, signal interference of one device with another is a common problem. For example, two-tone, third-order intermodulation often is a problem in narrow-band systems. When two signals (F_1 and F_2) are present in a system, they can mix with the second-order harmonics that are generated ($2F_1$ and $2F_2$), creating third-order intermodulation distortion products, which are located close to the original signals at $2F_2–F_1$ and $2F_1–F_2$. Higher order intermodulation distortion can also occur. These distortion products are generated by such system components as amplifiers and mixers.

Spectrum Analyzer Functions Used

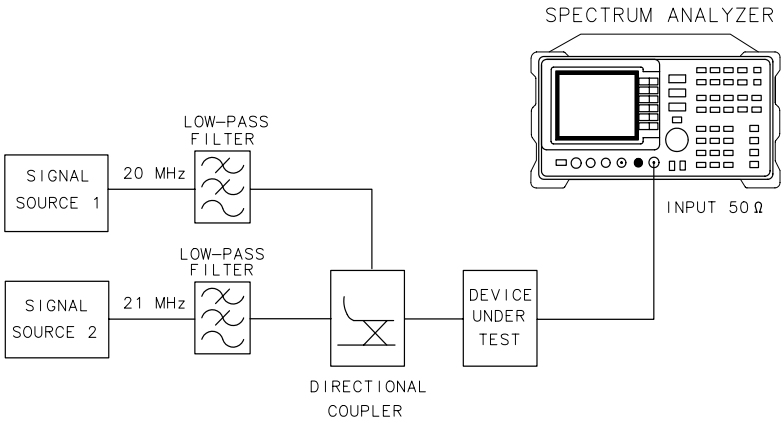
The following procedure describes how to measure third-order intermodulation distortion. It shows how to tune two signals onto the spectrum analyzer display and demonstrates setting the resolution bandwidth, mixer level, and reference level. It also incorporates several marker functions.

Stepping through the Measurement

Set up the test

1. To test a device for third-order intermodulation, connect the equipment as shown in Figure 2-21 on page 76. This example uses a 6 dB directional coupler, and two sources set to 20 MHz and 21 MHz. You may substitute other source frequencies, but for this example, maintain a frequency separation of about 1 MHz. The device under test is a 26 dB preamplifier. The low-pass filters are required to stop the signal from the two sources from causing distortion due to reflecting the signal. If you are performing this procedure only for practice using the instrument, you don't need the low-pass filters.

Figure 2-21 Third-Order Intermodulation Test Setup



2. Set one source to 20 MHz and the other source to 21 MHz, for a frequency separation of 1 MHz.
3. Set the sources equal in amplitude (for this example, we have set the sources to –30 dBm).

Reduce the frequency span

4. Tune both signals onto the display by setting the center frequency to 20.5 MHz.
5. Reduce the frequency span to 5 MHz for a span wide enough to include the distortion products on the display. For frequency separations other than those used in this example, choose a span greater than three times the separation of the source signals.

NOTE

A quick way to get to a smaller frequency span is to use **SPAN ZOOM**. **SPAN ZOOM** activates a highest-peak marker, turns signal track on, and zooms down to the span selected by the user.

To activate the span zoom function, press **SPAN**, **SPAN ZOOM**, and enter 5 MHz. Be sure to turn signal track off before changing other spectrum analyzer settings.

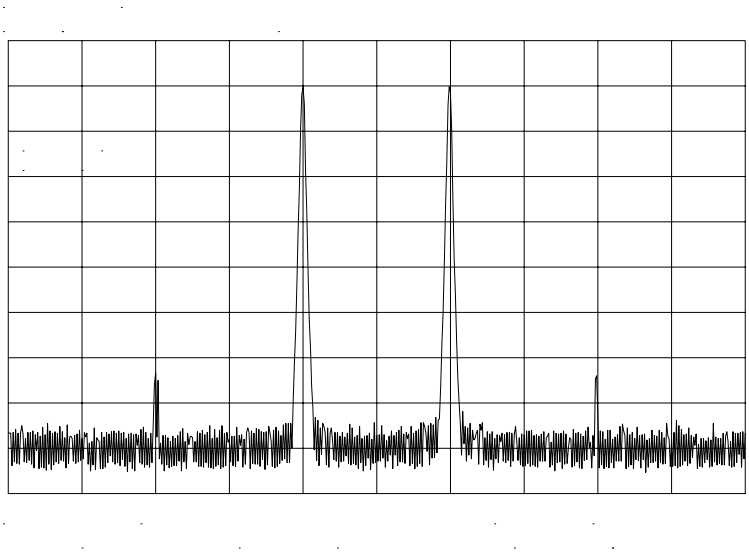
Center and adjust the signals on the display

6. Press **FREQUENCY**.
7. Using the knob, center the two signals on the display, as shown in Figure 2-22 on page 77.

8. To resolve the distortion products, reduce the resolution bandwidth until the distortion products are visible:
   a. Press **BW**.
   b. Use the step down ⇓ key to reduce the resolution bandwidth.
9. Reduce the video bandwidth, if necessary.
10. To make sure the input signals are equal in amplitude:
   a. Press **PEAK SEARCH**, **MARKER DELTA**, and **NEXT PEAK**.
   b. Adjust the signal source with the corresponding marker on it until the difference in amplitude reads zero.

NOTE If you need to choose a specific resolution bandwidth to verify that the distortion products are at a certain level below the source signal, refer to Example 1 in this chapter.

Figure 2-22 Signals Centered on Spectrum Analyzer Display

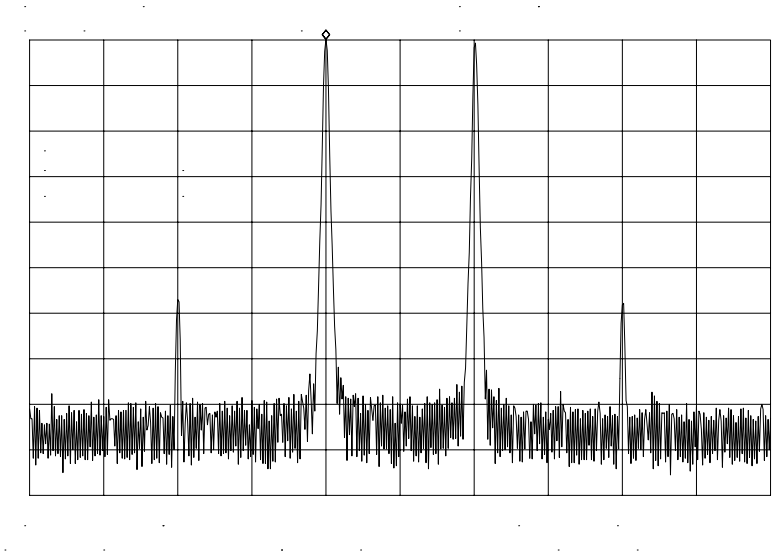


Set the reference level

11. For greatest measurement accuracy, position the peaks of the source signals at the reference level. The spectrum analyzer function **MARKER → REF LVL** lets you set the reference level using a marker:
   a. Place a marker on the source signal of highest amplitude by pressing **PEAK SEARCH**, **MARKER NORMAL**.

b. Set the reference level to this value by pressing **MKR →**, **MARKER → REF LVL**. Figure 2-23 on page 78 illustrates the resulting display.

Figure 2-23 Signal Peak Set to Reference Level



Maximize dynamic range

12. Distortion-free dynamic range is important for this type of measurement. To maximize such dynamic range:

    a. Set the mixer input level to –30 dBm by pressing **AMPLITUDE**, **MORE 1 OF 3**, **MAX MXR LEVEL**.

    b. Enter –30 dBm.

The spectrum analyzer automatically sets the attenuation so the maximum signal level is –30 dBm at the input mixer when the signal is at or below the reference level (see Example 1). You will hear the input attenuator click; notice that the value of the attenuator is now 20 dB (see Figure 2-24 on page 79).

This change to the maximum mixer level can affect the noise, so you may need to adjustment the resolution and video bandwidths.

Set a second marker and measure the distortion product

Once a marker is activated, the marker delta function activates a second marker and displays the difference between the two markers. Relative measurements can then be performed easily.

13.To measure a distortion product:

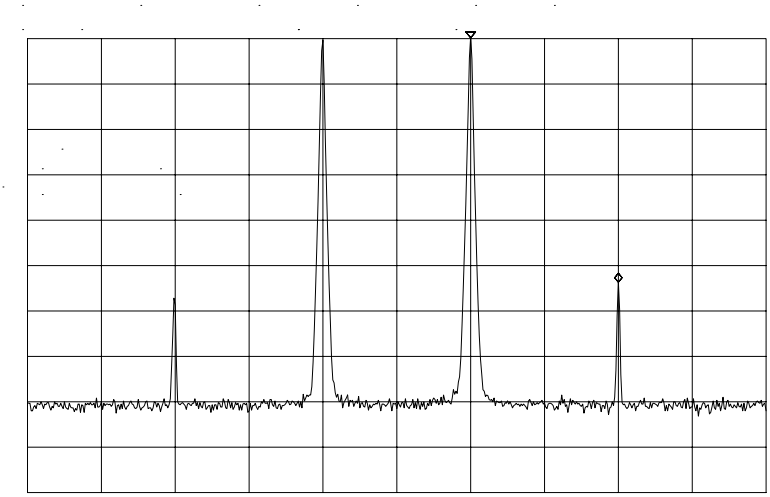
a. Press **PEAK SEARCH** to place a marker on a source signal.

b. To activate a second marker, press **MARKER DELTA**.

c. Press **NEXT PK LEFT** or **NEXT PK RIGHT** to set the second marker on the peak of the distortion product that is beside the signal source (see Figure 2-24).

The difference in frequency and amplitude between the two markers is displayed in the active function block.

Figure 2-24 Intermodulation Distortion Measured in dBc



Create a title for the measurement

The screen title function lets you create a title on the screen, and a label for the recall menu.

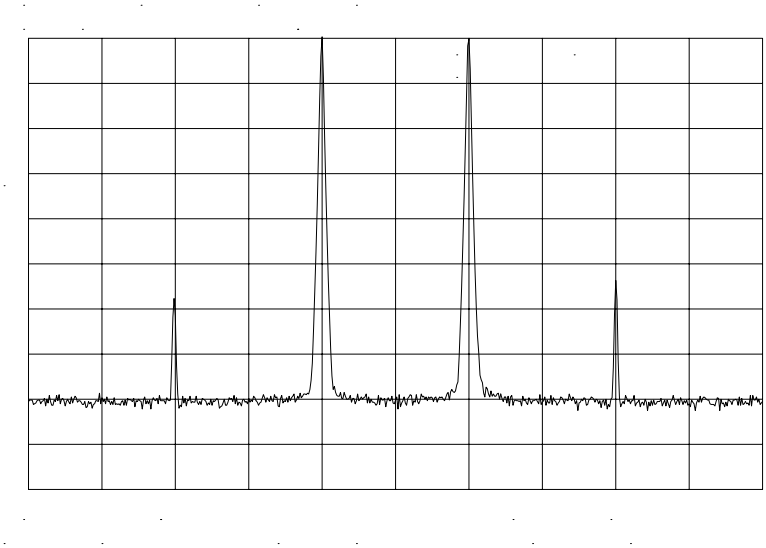
14.To create a title:

a. Press **DISPLAY**, **SCREEN TITLE**.

b. Use the softkeys from the screen-title menu and the knob (to choose the letters) to create a title. The title appears in the upper-right corner of the graticule; it can be up to two rows of 16 characters each (see Figure 2-25).

c. Press **TITLE DONE** when the title is complete.

Figure 2-25 Display with Title



Save the measurement information

The save and recall functions allow you to store data for later viewing.

15.To save the instrument state:

a. Press **SAVE**, **SAVE STATE**.

b. Press a softkey to enter the instrument state data into the register (0 to 9) you select. The first 16 characters of the title are used to label the register on the recall menu.

16.To view this menu, press **RECALL**, **RECALL STATE**. If a stored state has not been titled, the menu reads STATE followed by the register number chosen.

Example 6: AM and FM Demodulation

What is AM and FM Demodulation?

Amplitude modulation (AM) and frequency modulation (FM) are common modulation techniques used to broadcast information. In the United States and Canada, the AM broadcast band is 535 kHz to 1605 kHz, while the FM broadcast band covers 88 MHz to 108 MHz.

Demodulation of AM and FM signals can be done with any spectrum analyzer with zero span capability and with a wide enough bandwidth to fully encompass the modulated signal. An easier method of examining a demodulated signal is to use the built-in AM and FM demodulator and speaker in the 8560 E-Series and EC-Series spectrum analyzers.

For simplicity, in our example we will demodulate only an FM signal. To demodulate and listen to an AM signal, repeat the same steps, but activate **AM DEMOD ON OFF** instead of **FM DEMOD ON OFF**.

Spectrum Analyzer Functions Used

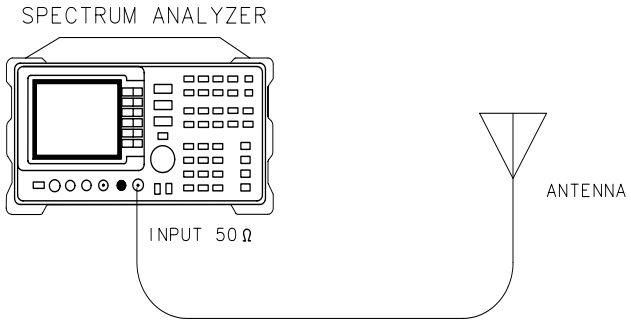
The following procedure illustrates the use of the built-in AM and FM demodulator and speaker. The example includes tuning the spectrum analyzer to a band of interest, activating and moving a marker to the signal that is to be demodulated, and demodulating and listening to the signal with the built-in demodulator and speaker.

Stepping through the Measurement

Set up the test

1. Provide a signal to the spectrum analyzer by connecting an antenna to the input port of the spectrum analyzer.

Figure 2-26 AM and FM Demodulation Test Setup



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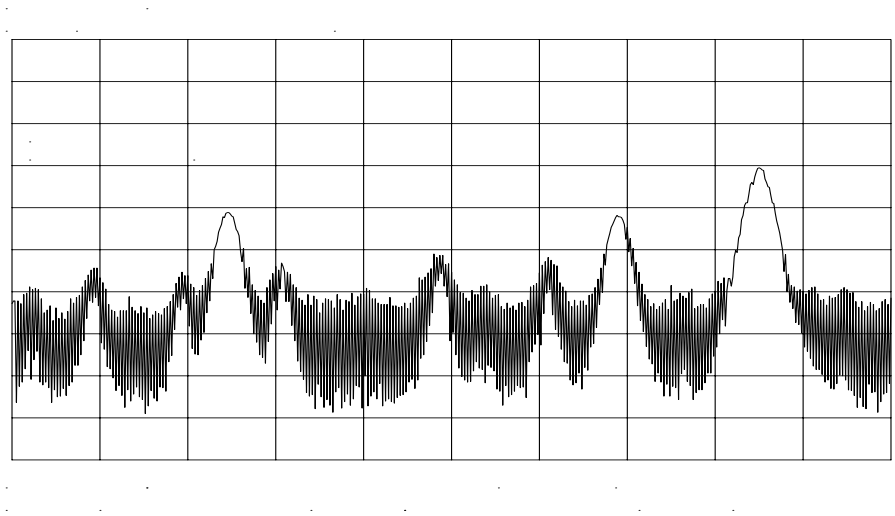
Set the start and stop frequencies

2. Tune to the FM band by setting the start frequency of the spectrum analyzer to 88 MHz, and the stop frequency to 108 MHz:
   a. Press **FREQUENCY**.
   b. Press **START FREQ**; enter 88 MHz.
   c. Press **STOP FREQ**; enter 108 MHz (see Figure 2-27).

Figure 2-27 FM Band



Set a marker

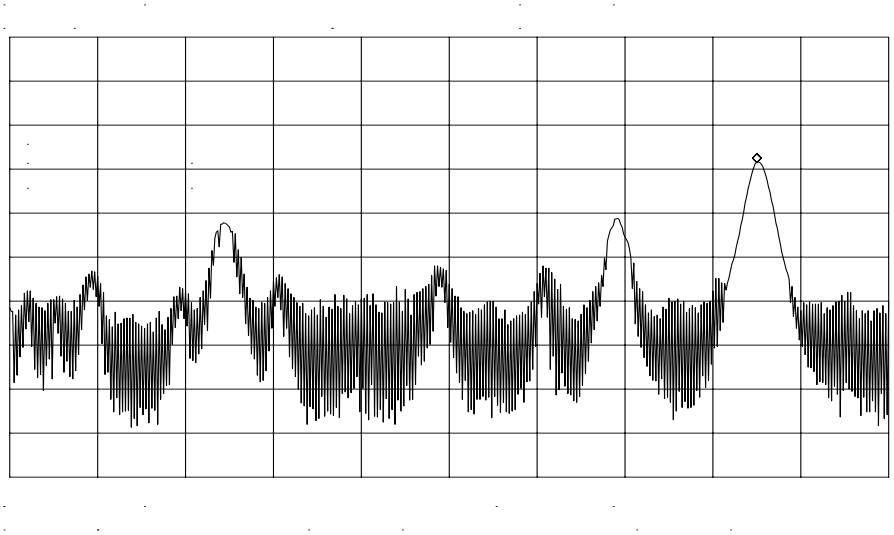
3. To demodulate an FM signal, you must activate a marker before you turn on the demodulator. For your convenience, the AM and FM demodulation menu contains the marker functions.

a. Press **AUX CTRL AM/FM DEMOD** to access the demodulation menu.

b. Activate a marker by pressing **MARKER NORMAL**.

c. Position the marker on the signal of interest. If the signal of interest is the highest in amplitude, press **PEAK SEARCH** directly, as in Figure 2-28 on page 83.

Figure 2-28 Place a marker on the signal of interest, then demodulate.



Set the time

4. For this example, before demodulating the signal, set the demodulation time to 30 seconds:

   a. pressing **MORE 1 OF 2**, **DEMOD TIME**.

   b. Enter 30 seconds. This sets the actual time that the built-in demodulator will demodulate the signals so you may listen to it.

Demodulate the signal

5. Press **MORE 2 OF 2**, then set **FM DEMOD ON OFF** to ON. You may have to adjust the volume of the speaker using the volume knob located on the front panel, under the display.

NOTE You also can use AM or FM demodulation when the frequency span of the spectrum analyzer is zero. To obtain continuous demodulation in zero span, set the trigger mode to external by pressing **TRIG**, **EXTERNAL**. Setting the spectrum analyzer to the external trigger mode (without actually supplying a trigger) gives you an uninterrupted signal. Otherwise, demodulation will occur only during the spectrum analyzer sweep.

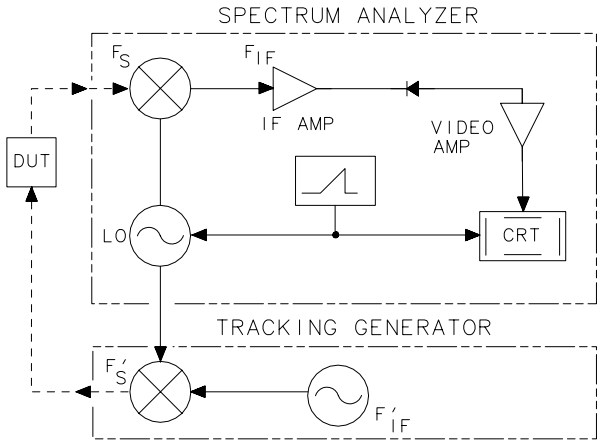
Example 7: Stimulus-Response Measurements

What Are Stimulus-Response Measurements?

Stimulus-response measurements require a source to stimulate a device under test (DUT), and a receiver to analyze the frequency-response characteristics of the DUT. Characterization of a DUT can be made in terms of its transmission or reflection parameters. Ripple, flatness, and rejection are examples of transmission measurements. A typical reflection measurement is return loss.

A spectrum analyzer combined with a tracking generator forms a stimulus-response measurement system. With the tracking generator as the swept source and the spectrum analyzer as the receiver, operation is analogous to a single-channel scalar network analyzer. Because the tracking generator is a narrow-band system, its output frequency must be made to track the spectrum analyzer input frequency precisely, resulting in a wide dynamic range. This wide dynamic range will be illustrated in the following example.

Figure 2-29 **Block Diagram of a Spectrum Analyzer and Tracking Generator System**



Spectrum Analyzer Functions Used

The following procedure describes how to use the 8560E/EC Option 002 spectrum analyzer with built-in tracking generator system to measure the rejection range of a bandpass filter, which is a type of transmission measurement.

The same measurement can be made using an 8560E/EC (without Option 002), Agilent 8561E/EC, Agilent 8562E/EC, Agilent 8563E/EC, Agilent 8564E/EC or Agilent 8565E/EC spectrum analyzer with an Agilent 85640A, Agilent 85644A, or Agilent 85645A tracking generator. This example illustrates several functions in the 8560E/EC Option 002 tracking-generator menu: adjusting the tracking-generator output power, source calibration, and normalization.

Because the procedure for conducting a reflection measurement is similar, use this example as your guide. You may also refer to the *Agilent Technologies Spectrum Analyzer Seminar*, *Application Note 150-7*, or *Applicaton Note 1212* for more information about reflection measurements.

Stepping through the Measurement

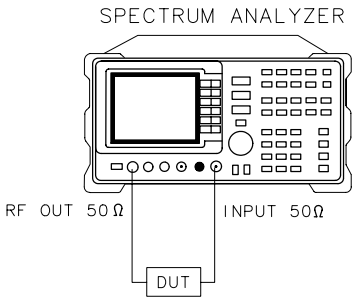
There are four basic steps for performing any stimulus-response measurement (either transmission or reflection):

1. Set up the spectrum analyzer settings
2. Calibrate
3. Normalize
4. Measure

Set up the test

1. To measure the rejection of a bandpass filter, connect the equipment as shown in Figure 2-30. This example uses a bandpass filter with a center frequency of 321.4 MHz and a specified rejection of –85 dB, as the device under test (DUT).

Figure 2-30 Transmission Measurement Test Setup



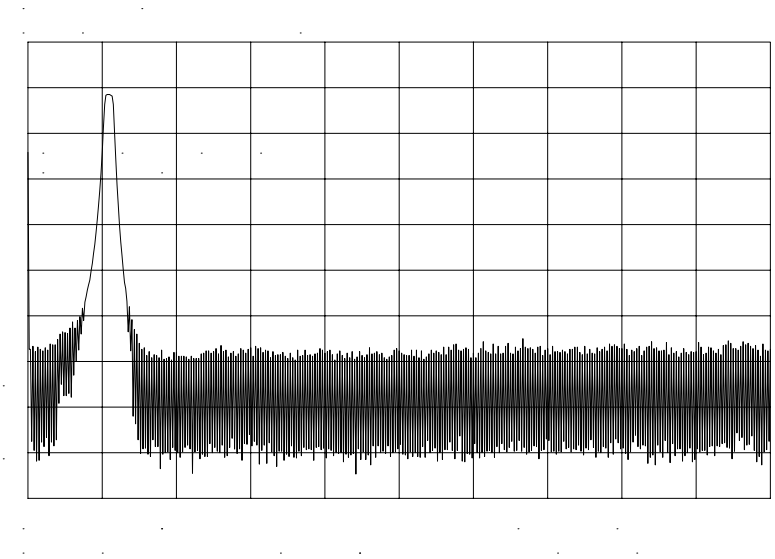
aj150e

Set the spectrum analyzer

2. To activate the tracking generator menu, press **AUX CTRL**, **TRACKING GENRATOR**. The tracking-generator output power is displayed in the active function block. Because the filter (DUT) is not particularly sensitive, an output power of –10 dBm should not damage it.
3. Activate the tracking-generator power level by pressing **SRC PWR ON OFF** until ON is selected.

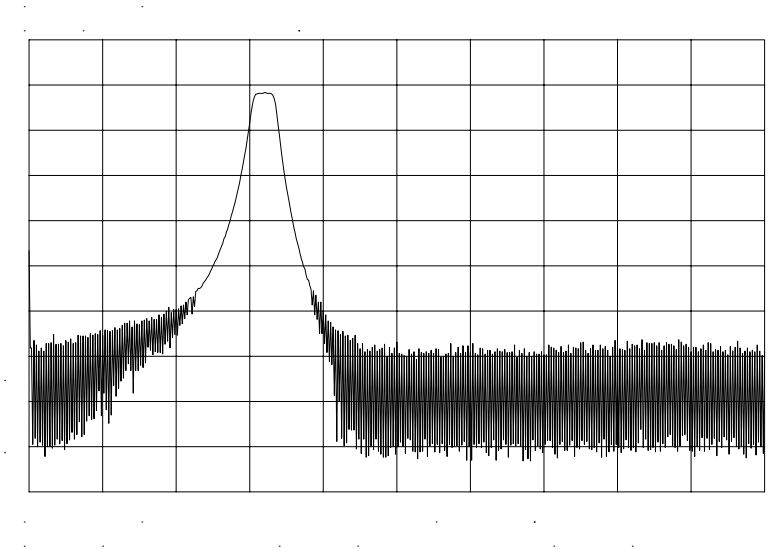
   If `ERR 901 TGFrqLmt` appears in the error message area, set the start frequency to 300 kHz. (Stimulus-response measurements using an 8560E/EC Option 002 are specified from 300 kHz to 2.9 Ghz.) Due to the current resolution of the annotation, changing the start frequency to 300 kHz will be denoted only in smaller spans.
4. Put the sweep time of the analyzer into stimulus-response auto-coupled mode by pressing **MORE 1 OF 3**, then **SWP CPL SR SA** until SR is selected. In stimulus-response mode, the auto-coupled sweep times usually are much faster for swept-response measurements (see Figure 2-31).

Figure 2-31 Tracking-Generator Output Power Activated



5. Because we are interested only in bandpass-filter rejection, tune the center frequency so the filter roll off takes up most of the trace on the display (see Figure 2-32).

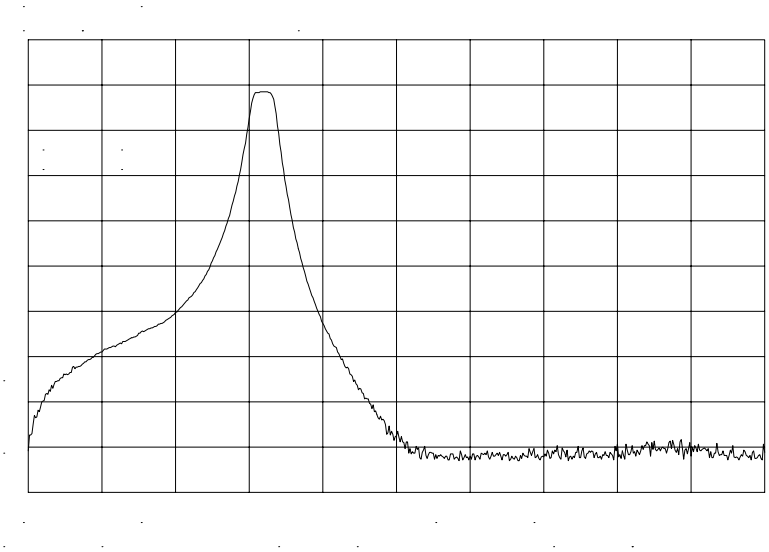
Figure 2-32 Adjust analyzer settings according to the measurement requirement.



6. Decrease the resolution bandwidth to increase sensitivity, and narrow the video bandwidth to smooth the noise. In Figure 2-33, the resolution bandwidth has been decreased to 3 kHz.

NOTE The minimum resolution bandwidth supported in stimulus-response measurements is 300 Hz.

Figure 2-33 Decrease the resolution bandwidth to improve sensitivity.



NOTE

Tracking Error

Adjusting the resolution bandwidth may result in a decrease in amplitude of the signal. This is known as a tracking error. Tracking errors occur when the tracking generator output frequency does not exactly match the input frequency of the spectrum analyzer. The resulting product from the spectrum analyzer input mixer is not at the center of the IF bandwidth. Tracking errors are most notable when using narrow resolution bandwidths.

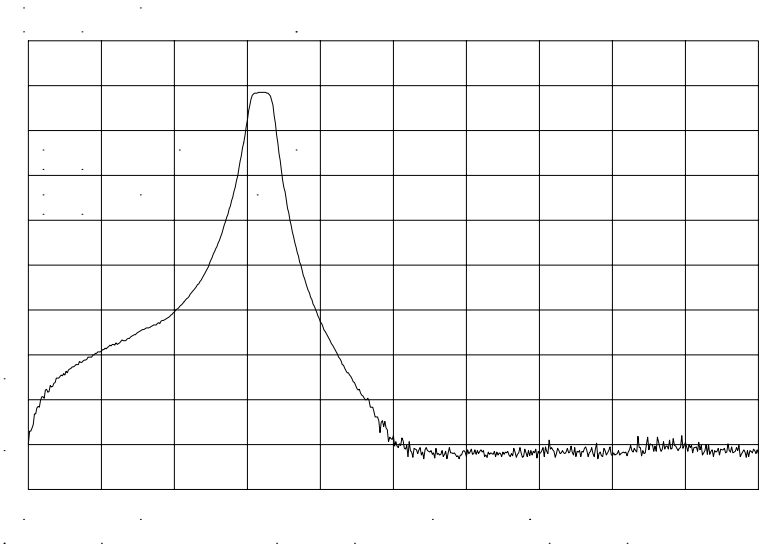
Compensate for the tracking error, by using either the manual or the automatic tracking adjustment. These keys are on the second softkey menu page of **TRACKING GENRATOR** under the **AUX CTRL** key.

Automatic Tracking

Once the automatic tracking routine is activated in a wide resolution bandwidth, it is not necessary to use the tracking adjust again when decreasing the resolution bandwidth. The automatic tracking routine uses the 300 Hz resolution bandwidth to perform the tracking adjustment.

To activate the automatic tracking routine, press **TRACKING PEAK**, then press **MAN TRK ADJ** to display the DAC values of the coarse- and fine-tracking adjustments. In this example, the automatic tracking routine was performed, and the resolution bandwidth was decreased to 300 Hz, without encountering any tracking error (see Figure 2-34).

Figure 2-34 Manual tracking adjustment compensates for tracking error.



Calibrate

Calibration in a transmission measurement is done using a through (thru). A thru essentially is a conductor that is connected in place of the device under test.

7. To calibrate using a thru:

   a. Press **AUX CTRL**, **TRACKING GENRATOR**, **SOURCE CAL MENU**, **CAL THRU**.

   b. The guided calibration routine prompts you to connect the thru, as illustrated in Figure 2-35. Connect the thru, then press **STORE THRU** to store the thru trace in trace B and in an internal memory location in the analyzer.

      The state information of the thru-calibration trace is stored in state register number 9. This trace can be recalled for future use. Figure 2-36 shows what appears on-screen after the thru trace is stored.

Figure 2-35 Guided calibration routines prompt the user.

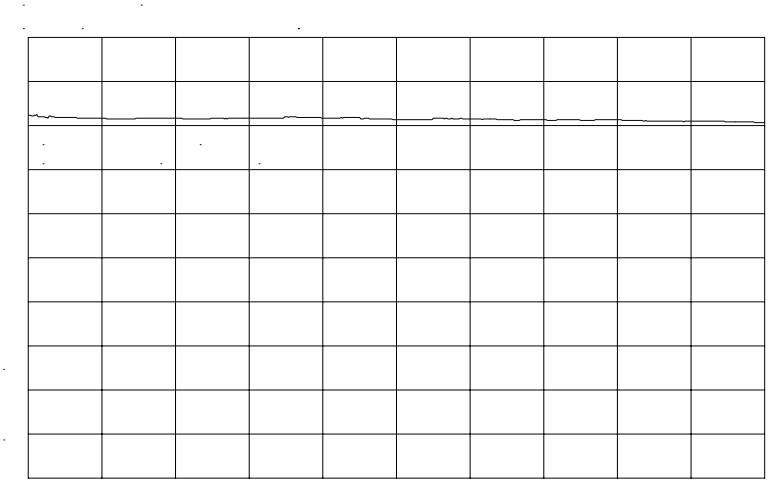
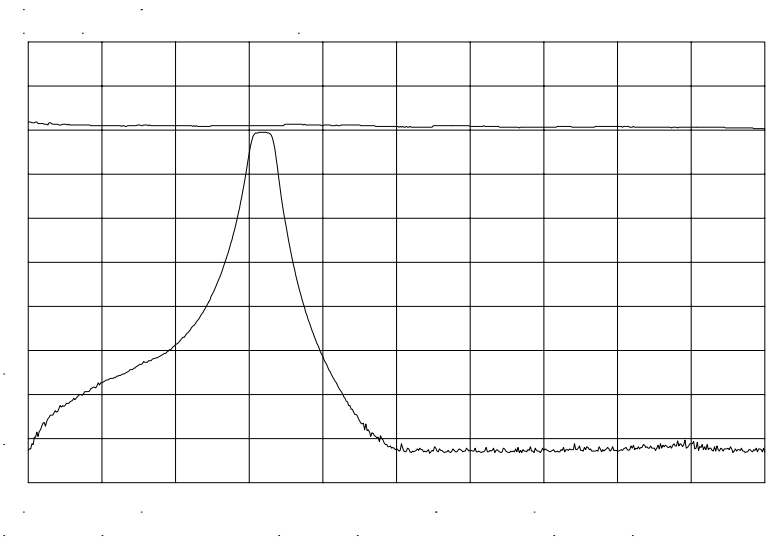


Figure 2-36 The thru trace is displayed in trace B.



Normalize

Normalization eliminates the frequency response error in the test setup. When normalization is on, trace math is performed on the active trace:

$$A - B + NRP \rightarrow A$$

1. where:

   A is the active trace.

   B is the stored thru calibration trace.

   NRP is the normalized reference position.

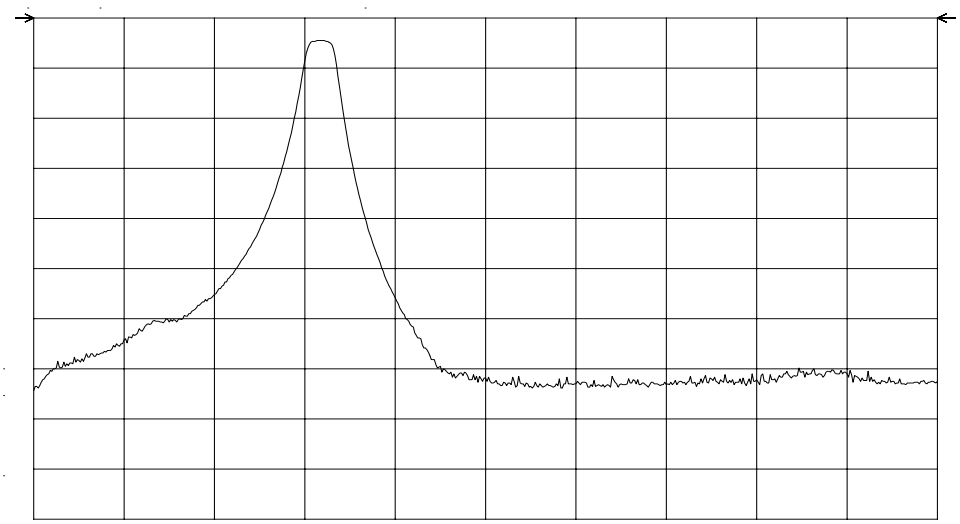
The units of the reference level, dB, reflect this relative measurement (see Figure 2-37).

- To normalize, press **NORMLIZE ON OFF** until ON is selected. (This softkey is located on the first page of the tracking-generator menu.)

An arrow appears on each side of the graticule when normalization is activated. These two arrows mark the normalized reference position, or the position where 0 dB insertion loss (transmission measurements) or 0 dB return loss (reflection measurements) will normally reside.

You can set the dB value of the normalized reference position using the **NORM REF LVL** adjustment under the **AMPLITUDE** key. Changing **NORM REF POSN** changes the position of the normalized trace, within the range of the graticule.

Figure 2-37 Normalized Trace

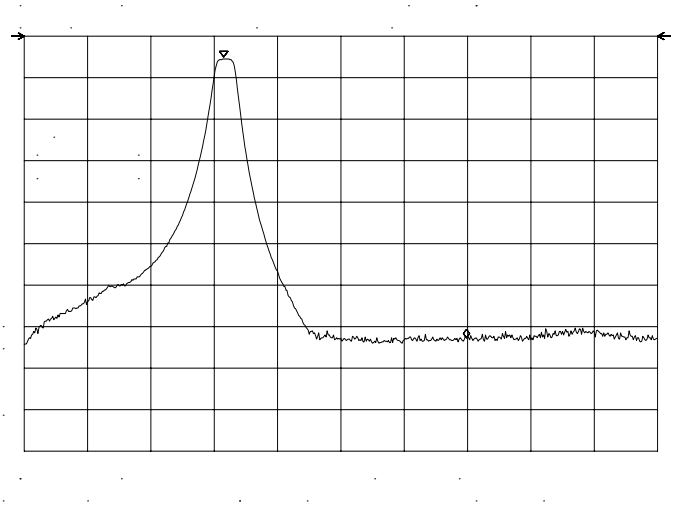


Measure

Measure the range using the delta markers:

1. Press **PEAK SEARCH**, **MARKER DELTA**.
2. Use the knob to position the second marker in the rejection area of the bandpass filter as shown in Figure 2-38.

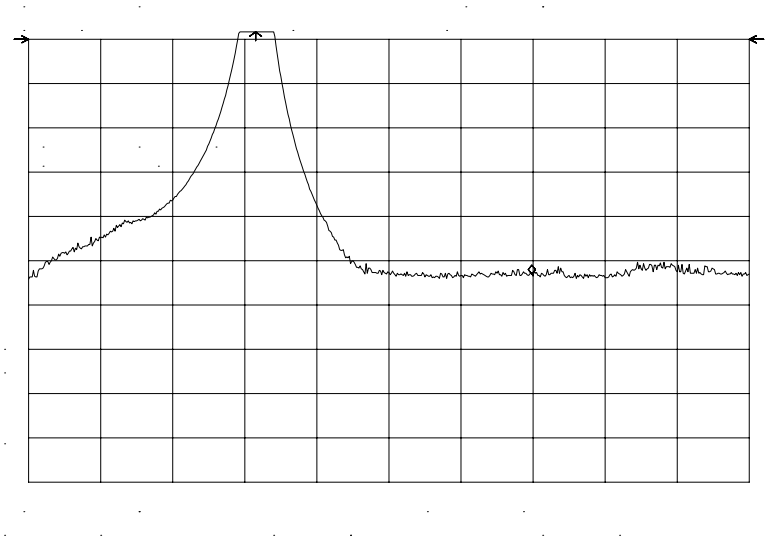
Figure 2-38 Measure the rejection range with delta markers.



Activating normalization changes the softkeys that appear in the amplitude menu: **RANGE LVL** appears, and **REF LVL** is replaced by **NORM REF LV**L. Although both these functions reposition the trace on the display, **RANGE LVL** adjusts attenuation and gain, while **NORM REF LVL** does not change the spectrum analyzer settings.

NORM REF LVL, like **NORM REF POSN**, is a trace math function that lets you change the position of the normalized trace within the range of the graticule, without changing spectrum analyzer settings. See Figure 2-39. As a result, your measurement remains calibrated. However, using these two trace math functions may mean that the top of the screen does not represent the gain-compression limit.

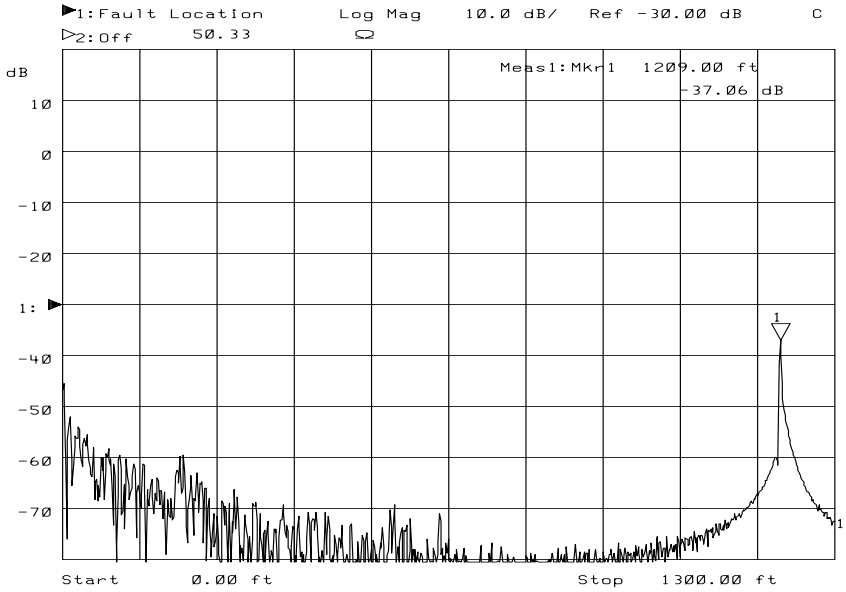
Figure 2-39 **NORM REF LVL adjusts the trace without changing analyzer settings.**



RANGE LVL increases the dynamic range of the measurement by changing the input attenuator and IF gain. It is equivalent to **REF LVL** used in signal analysis measurements. Both **RANGE LVL** and **REF LVL** ensure that the input signal is not in gain compression.

To increase the dynamic range of the measurement, press **RANGE LVL**. Note that while increasing the dynamic range, more errors are introduced into the measurement, such as attenuator switching. However, as Figure 2-40 shows, the dynamic range level has increased by 18 dB, when using **RANGE LVL**.

Figure 2-40 Increase the dynamic measurement range by using RANGE LVL.



If the actual measured signal is beyond the gain-compression limit, or below the bottom graticule of the display, an error message will appear in the lower right corner of the display. In the case shown here, the passband information is adjusted off-screen in order to view the rejection range with better resolution. Changing the analyzer settings to raise the passband information above the top of the screen results in an ERR 903
A>DLMT.

In normalized mode, ERR 904 B>DLMT also may appear if:

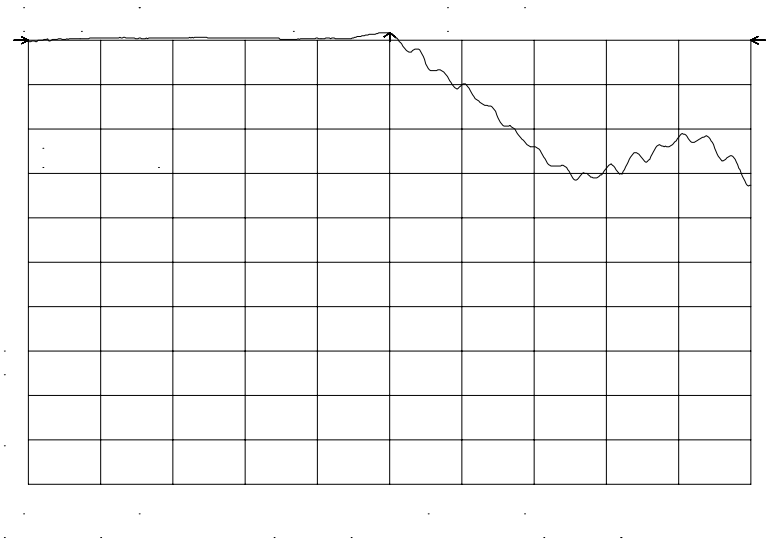
- The calibration trace is off-screen, or
- No calibration has been performed after a preset, or
- Trace B is blank.

To clear this error and ensure a calibrated measurement, recalibrate and perform a store-thru operation.

Using Range Level versus Using Normalized Reference Level

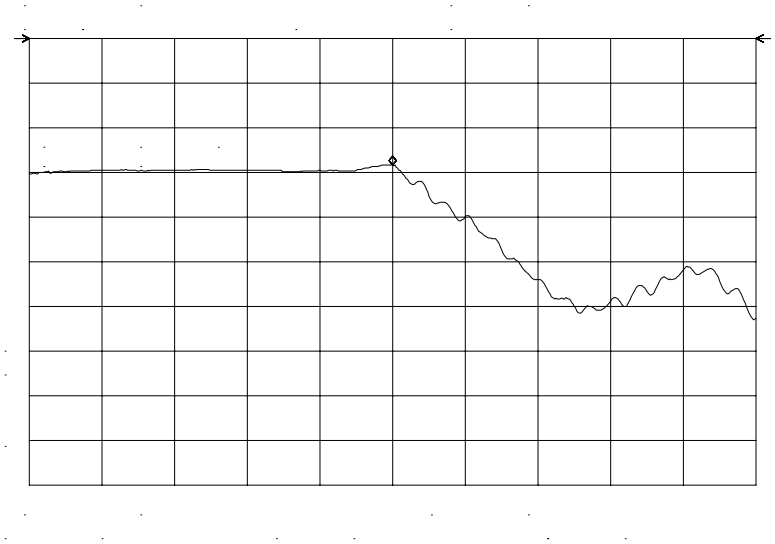
The following example illustrates the difference between **RANGE LVL** and **NORM REF LVL**. The normalized frequency response of a preamplifier is shown in Figure 2-41. The normalized trace is cut off at the top of the graticule. This is confirmed by the step up ⇓ key when a marker is activated, and the `ERR 903 A>DLMT` error message appears in the error message block.

Figure 2-41 Normalized Frequency Response Trace of a Preamplifier



By increasing **NORM REF LVL** to 30 dB, as shown in Figure 2-42, the trace moves down on the screen. Note that (1) the input attenuator value remains at 10 dB, (2) the marker-amplitude readout displays 13.2 dB, and (3) the `ERR 903 A>DLMT` error message is still displayed, even though the signal appears to be fully within the graticule.

Figure 2-42 **NORM REF LVL is a trace function.**



After returning **NORM REF LVL** to 0 dB, increase **RANGE LVL** to 30 dB. As shown in Figure 2-43, the trace moves fully within the graticule. Compare the settings: (1) input attenuator value has changed to 40 dB, (2) the marker-amplitude readout displays –6.3 dB, and (3) the `ERR 903 A>DLMT` error message no longer appears.

Figure 2-43 **RANGE LVL adjusts analyzer for compression-free measurements.**

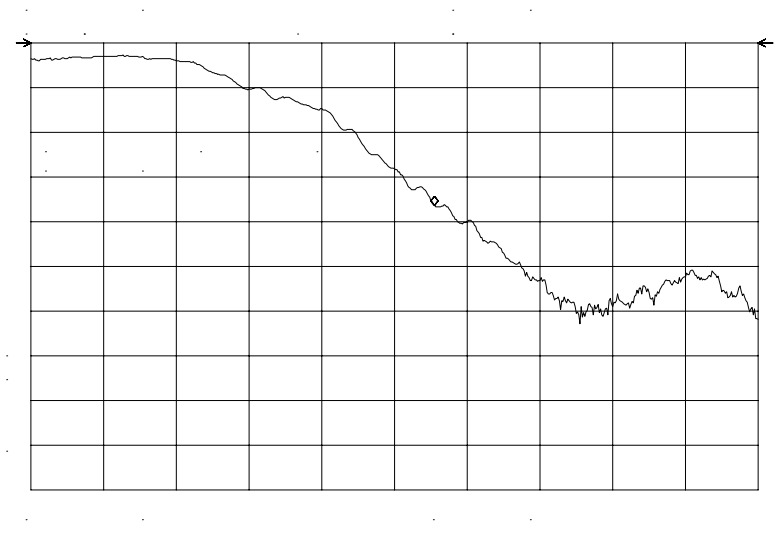


Figure 2-42 shows that **NORM REF LVL** is a trace function that can position the active trace without changing analyzer settings. The ERR 903 A>DLMT error message is an indicator that the actual measured trace may fall outside of the analyzer measurement range with the current settings. Compression-free measurements are assured by adjusting **RANGE LVL** and changing the input attenuator and IF gain.

Example 8: External Millimeter Mixers (Unpreselected)

External millimeter mixers can be used to extend the frequency coverage of the 8560 E-Series and EC-Series spectrum analyzers. (The 8560E/EC Option 002 and Option 327 do not have external mixing capability.) Agilent Technologies manufactures external mixers that do not require biasing and cover frequency ranges from 18 GHz to 110 GHz. Other manufacturers sell mixers that extend the range to 325 GHz, but may require biasing. The 8560 E-Series and EC-Series spectrum analyzers support both types of mixers.

Spectrum Analyzer Functions Used

The 8560 E-Series and EC-Series spectrum analyzers contain an extensive menu of functions that help with millimeter measurements. This example explains how to connect external mixers to the spectrum analyzer, how to choose the band of interest, how to store conversion-loss factors, and how to use the optional automatic signal-identification functions.

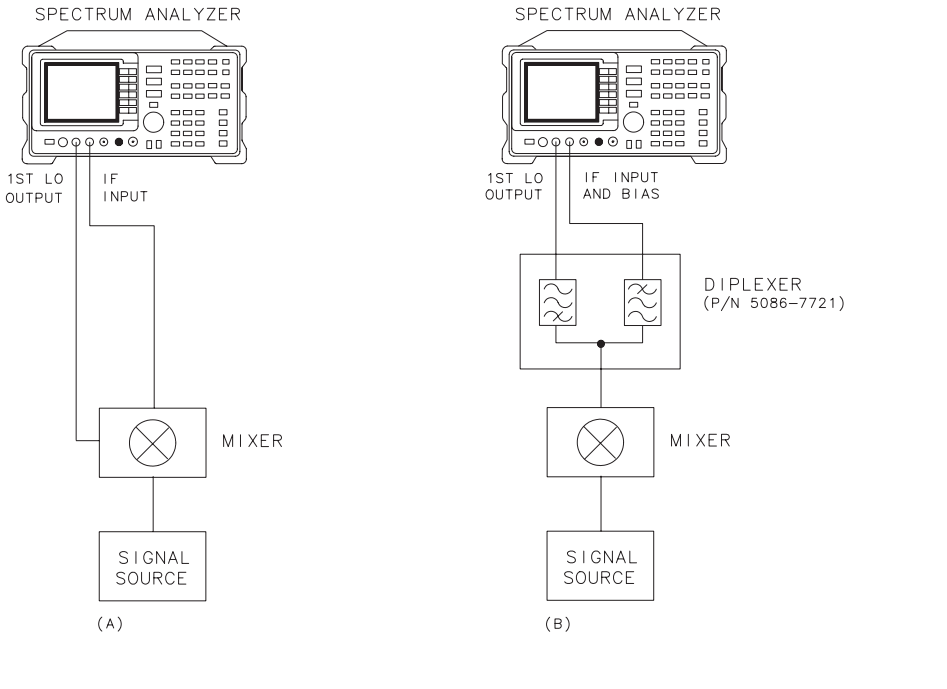
Stepping through the Measurement

Set up the equipment

1. Figure 2-44 illustrates how to connect an external harmonic mixer to the spectrum analyzer.

CAUTION The spectrum analyzer local-oscillator output power is +16.5 dBm. Be sure that your external harmonic mixer can accommodate this power level before connecting it to the analyzer.

Figure 2-44 External Mixer Setup (a) without Bias; (b) with Bias



NOTE Good-quality shielded SMA-type cables should be used to connect the mixer to the spectrum analyzer to ensure that no signal attenuation occurs. Agilent 5061-5458 SMA-type cables may be used. Do not over-tighten the cables; the maximum torque should not exceed 112 N-cm (10 in-lb).

Select the Frequency Band

2. Specify unpreselected external mixing by pressing **CONFIG**, then **EXT MXR PRE UNPR** until UNPR is selected.
3. To select a frequency above 18 GHz:
   a. Press **AUX CTRL, EXTERNAL MIXER** to set the analyzer to external mixer mode.
   b. Enter the desired frequency directly using the center-frequency function.
   c. Notice in Table that some frequencies overlap and fall into two bands. To be sure that the desired band is selected, refer to Table and select the desired frequency band, then use the full band function to enter this band.

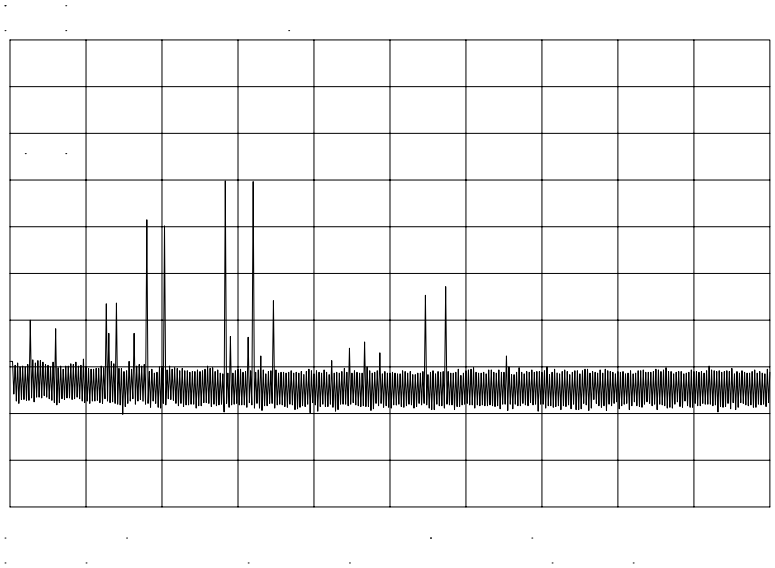
d. In the external mixer menu, press **FULL BAND**, then press the step up **›** key until the letter preceding BAND in the active function area corresponds to the desired frequency band.

In this example, we'll look at U-band, which ranges from 40 GHz to 60 GHz, as shown in Figure 2-45. The **LOCK HARMONIC** function "locks" the spectrum analyzer in that band, ensuring that the spectrum analyzer sweeps only the chosen band. **LOCK ON OFF** is automatically set to ON when **FULL BAND** is pressed.

Table 2-4 External Mixer Frequency Ranges

Frequency Band	Frequency Range (GHz)	Mixing Harmonic	Conversion Loss
K	18.0 to 26.5	6–	30 dB
A	26.5 to 40.0	8–	30 dB
Q	33.0 to 50.0	10–	30 dB
U	40.0 to 60.0	10–	30 dB
V	50.0 to 75.0	14–	30 dB
E	60.0 to 90.0	16–	30 dB
W	75.0 to 110.0	18–	30 dB
F	90.0 to 140.0	24–	30 dB
D	110.0 to 170.0	30–	30 dB
G	140.0 to 220.0	36–	30 dB
Y	170.0 to 260.0	44–	30 dB
J	220.0 to 325.0	54–	30 dB

Figure 2-45 Select the band of interest.



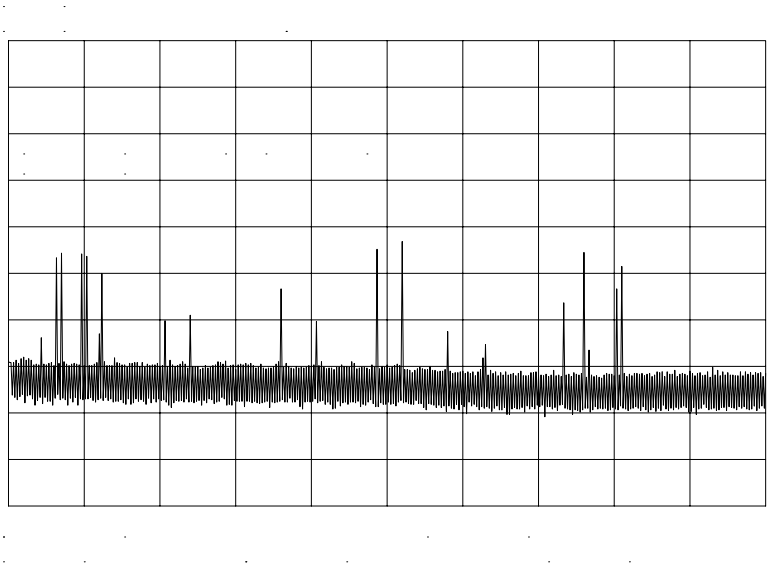
Save the average conversion-loss value

4. Table lists default conversion-loss values that are stored in the analyzer for each frequency band. These values approximate the values for the Agilent 11970 series mixers. Other conversion-loss values may be entered into the spectrum analyzer in two ways. The first method lets you to save the average conversion-loss value for the entire band using **AVERAGE CNV LOSS**. To activate this function:

   a. Press **AUX CTRL**, **EXTERNAL MIXER**, **AMPTD CORRECT**, **AVERAGE CNV LOSS**.

   b. Enter the appropriate average conversion-loss value. On Agilent 11970 Series harmonic mixers, these values are charted on the mixer. The U-band mixer used for this example had an average conversion loss of 23.5 dB, as shown in Figure 2-46.

Figure 2-46 Store and correct for conversion loss.



The second method for storing conversion-loss information lets you save individual conversion-loss data points at specific intervals across the harmonic band, using **CNV LOSS VS FREQ**.

To view or enter a conversion-loss data point:

a. Press **CNV LOSS VS FREQ**.

b. Enter the conversion-loss data at the frequency shown.

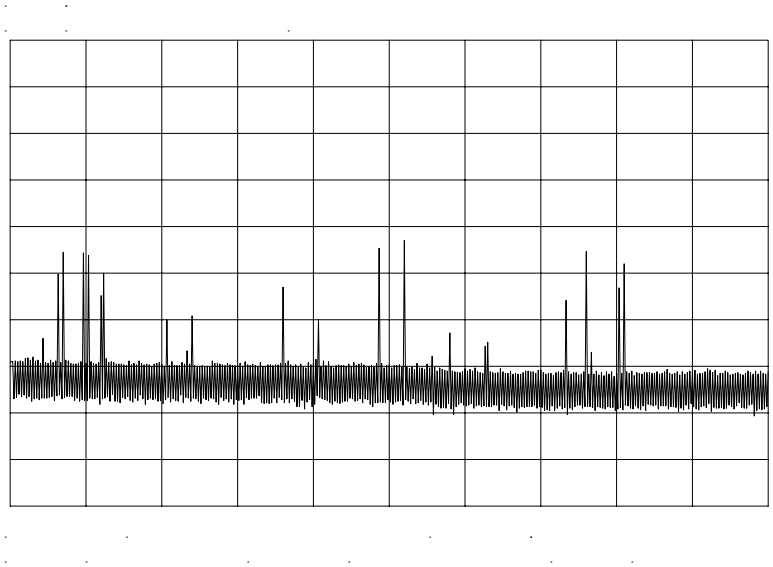
c. Use the step up › key to step through the band, entering the conversion loss at each step.

Signal Identification (unpreselected mixers only)

5. The IF output of a harmonic mixer contains many mixer products (frequencies of LO ± source, 2LO ± source, 3LO ± source…nLO ± source). As a result, within a single harmonic band, a single input signal can produce many responses, only one of which is valid.

   These responses come in pairs, where the members of the valid pair are spaced 621.4 MHz apart (see Figure 2-47) and the right-most member for the pair is the correct response (for this analyzer, the left member of a pair is not valid).

Figure 2-47 Signal Responses Produced by a 50 GHz Signal in U Band



Identify signals with the frequency-shift method

6. Signal-identification routines that identify the signal and images are available on instruments with firmware revisions ≤920528, or with Option 008. The frequency-shift method of identifying valid signals uses the spectrum-analyzer function **SIG ID ON OFF**. When using this function, smaller spans will yield more accurate measurements.

   a. Span down to 50 MHz.

   b. Press **AUX CTRL**, **EXTERNAL MIXER**, **SIGNAL IDENT**.

   c. Press **SIG ID ON OFF** until ON is selected.

   Any signal not produced by the currently selected harmonic will be shifted horizontally on alternate sweeps (see Figure 2-48). Therefore, when viewing the display, on alternate sweeps the signal will appear, then not appear, at the frequency of interest. The correct signal produced by the selected harmonic will be shifted in a vertical direction only, as in Figure 2-49.

Figure 2-48 Response for Invalid Signals

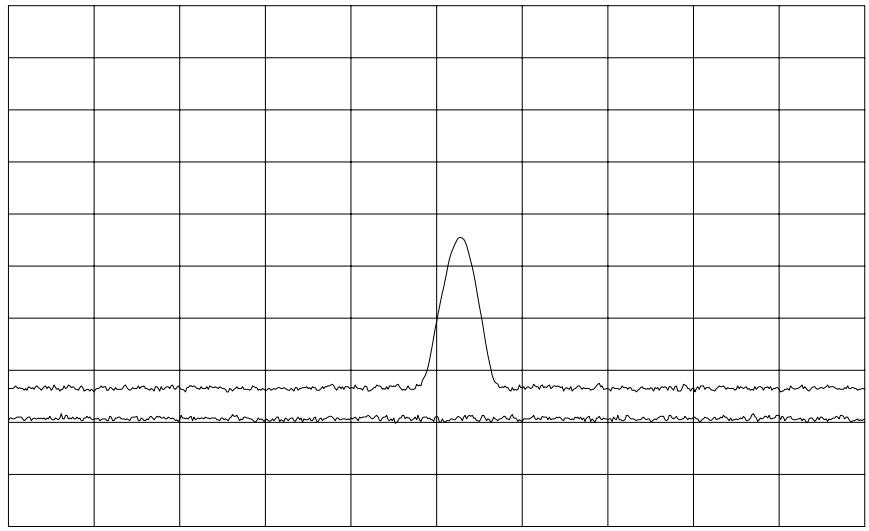
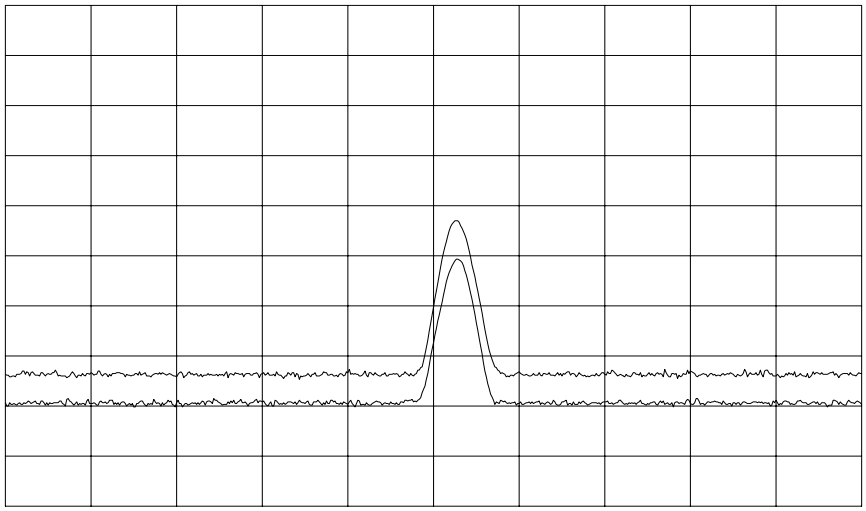


Figure 2-49 Response for Valid Signals



Identify signals in wide frequency spans

7. **SIG ID AT MKR** identifies signals in wide frequency spans, using harmonic search. **SIG ID AT MKR** automatically determines the proper frequency of a signal and displays its value on the spectrum analyzer.

   Activating **SIG ID AT MKR** on an image of the signal will yield a reading in the active block, as shown in Figure 2-50. The true signal frequency is given with an identifier that the marker resides on an image. If the marker is placed on a true signal, and **SIG ID AT MKR** is activated, the signal frequency will appear without the IMAGE notation, as shown in Figure 2-51. To activate **SIG ID AT MKR**:

   a. Place a marker on a signal.

   b. Press **AUX CTRL**, **EXTERNAL MIXER**, **SIGNAL IDENT**, **SIG ID AT MKR**.

8. To exit the external mixer mode, press **AUX CTRL**, then **INTERNAL MIXER**.

Figure 2-50 **SIG ID AT MKR Performed on an Image Signal**

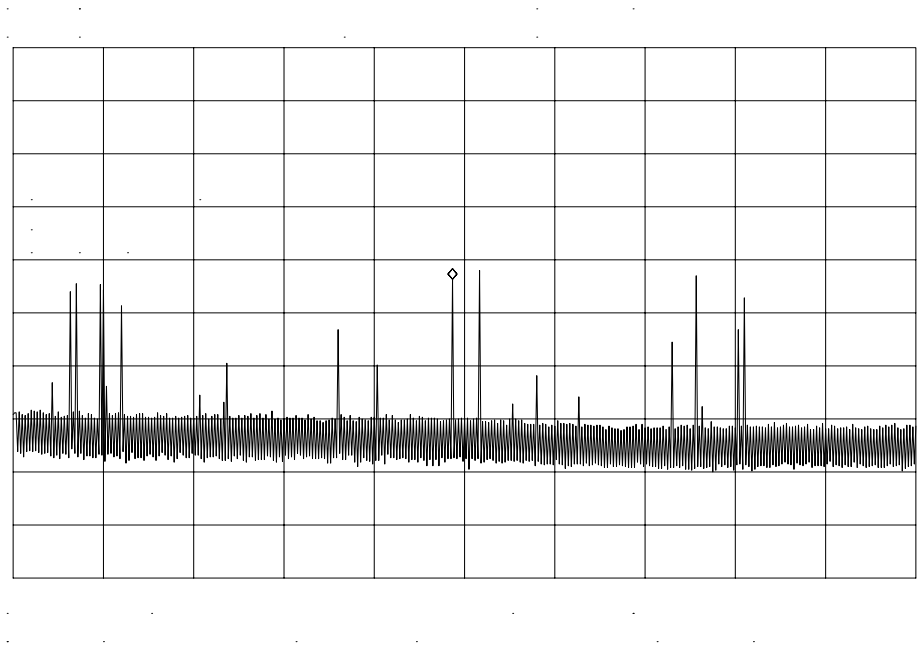
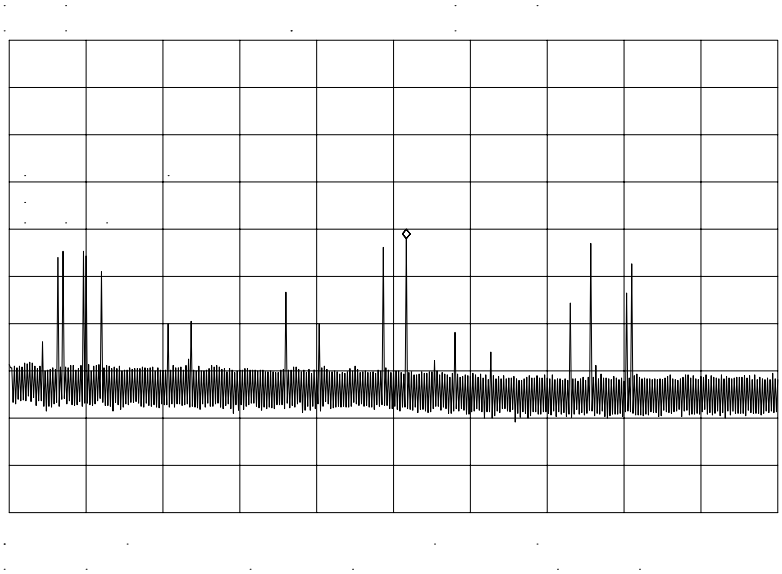


Figure 2-51 SIG ID AT MKR Performed on a True Signal



Bias

The Agilent 11970A Series harmonic mixers mentioned in the previous section do not require bias. Mixers requiring bias can also be used with the 8560 E-Series and EC-Series. Bias minimizes the conversion loss of these mixers; however, the bias must be adjusted for every frequency where a measurement is made. Mixers requiring bias are connected as shown in Figure 2-44 (with mixer bias supplied via the IF line).

To measure a signal, access a band as described above.

To activate the bias:

1. Press **AUX CTRL**, **EXTERNAL MIXER**, **BIAS**.
2. Press the softkey corresponding to the bias polarity (positive or negative) that your mixer requires.
3. Use the knob on the spectrum analyzer to adjust the bias and to peak the signal for maximum amplitude.
4. If your spectrum analyzer has Option 008 or a firmware revision ≤920528, activate the signal identification method that you desire.
5. On most mixers, the optimum bias varies with frequency, so the bias should be adjusted for every signal measured.

WARNING **The open-circuit bias voltage can be as great as +3.5 V through a source resistance of 300 ohms. Such voltage levels may appear when recalling an instrument state in which an active bias has been stored.**

NOTE The bias value that appears on the spectrum analyzer display is expressed in terms of short-circuit current (that is, the amount of current that would flow if the IF line were shorted to ground). The actual amount of current flowing into the mixer will be less.

Example 9: Adjacent Channel Power Measurement

What Is Adjacent Channel Power (ACP)?

Adjacent channel power measures the modulation that leaks from the intended channel of a communication device, such as a cellular radio, into an adjacent channel. That leakage may degrade communication among users of the adjacent channels. Therefore, regulatory bodies specify the amount of power that is allowed to leak into the adjacent channels. (Regulations can also specify the leakage into the first and second alternate channels.)

Adjacent channel power may be measured directly for continuously modulated carriers, as in the many analog FM systems. There are many complex standards for measuring ACP in systems that use burst carriers like TDMA (time-division multiple access) cordless phones and cellular systems. These signals can also be measured with a spectrum analyzer.

Spectrum Analyzer Functions Used

The ACP examples are applicable to spectrum analyzers with firmware revisions >930809. Earlier firmware revisions do include a limited amount of ACP functionality. Its operation is similar to the **ACP AUTO MEASURE** function which is documented in "Stepping Through a Basic ACP Measurement".

Two examples of adjacent channel power measurements are shown, a basic measurement using the analog measurement method and a measurement of a burst signal using the two-bandwidth method. Calculations are made for measurements such as the ACP leakage ratio and the total transmitted power. The channel spacing and channel bandwidth with which the measurement was made are also displayed.

The following topics are covered in this example:

- Stepping Through a Basic ACP Measurement
- ACP Analog Method Information
- Stepping Through a Burst Signal ACP Measurement
- PDC Measurements of Mobiles According to the RCR-27B Standard
- PHS Measurements of Mobiles According to the RCR-28 Standard
- NADC Measurements of Mobiles According to the IS-54 Standard

Stepping Through a Basic ACP Measurement

In this example, we will be using a transmitter with a carrier frequency of 300 MHz. We will define the signal that we examine has having a channel bandwidth of 14.0 kHz and a channel spacing requirement of 20.0 kHz, as shown in Figure 2-53. For this example we will use the calibrator as the signal source. You would normally provide a signal to the spectrum analyzer either by connecting a radio directly, or by coupling a signal from the radio via an antenna.

CAUTION The maximum input to the spectrum analyzer should not exceed +30 dBm (1 W) with greater than or equal to 10 dB attenuation.

Figure 2-52 Adjacent Channel Power Measurement Test Setup

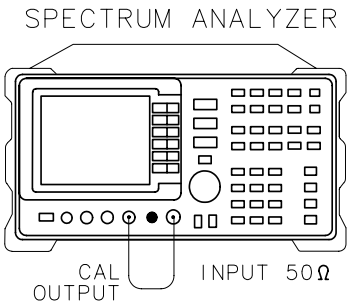
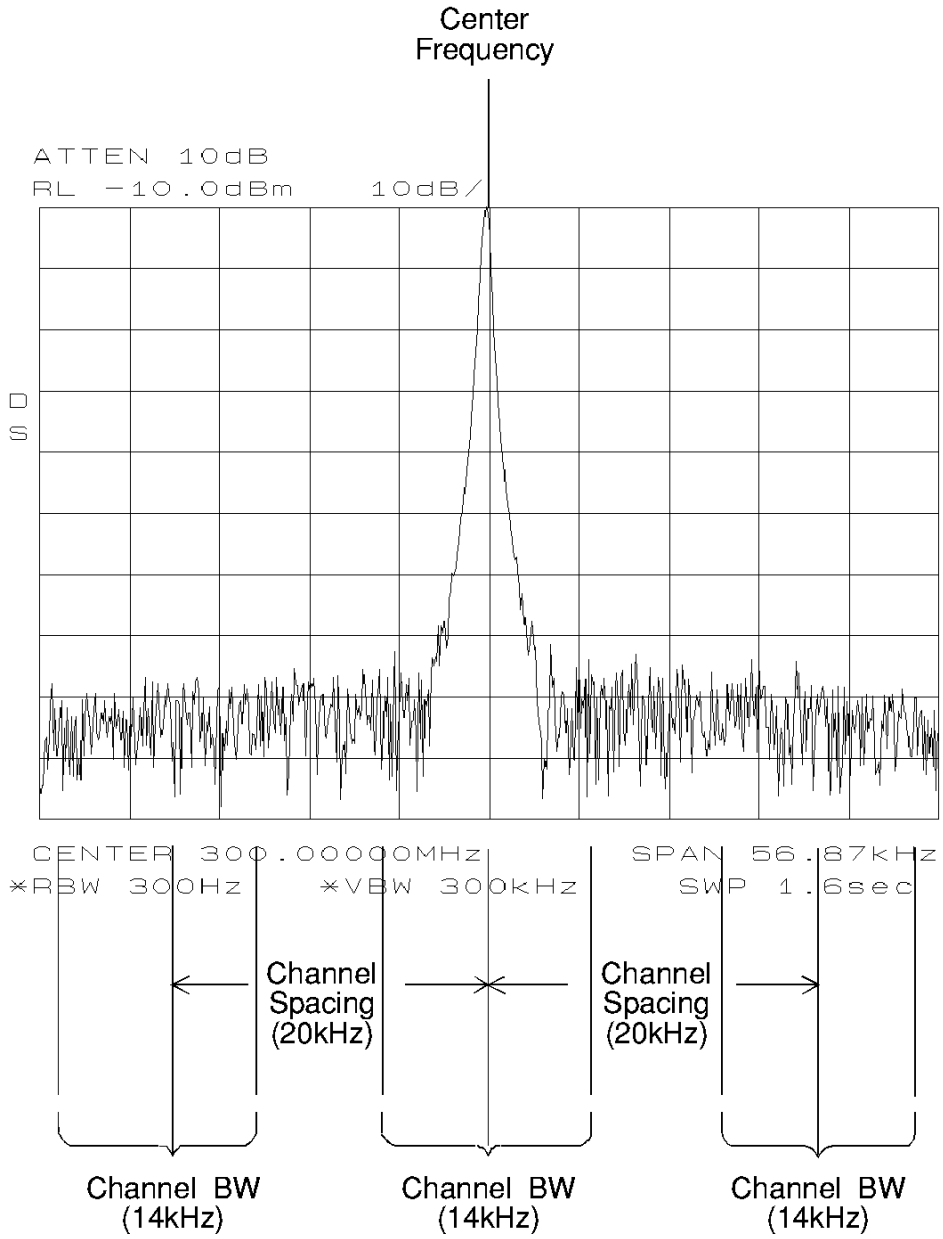


Figure 2-53 Adjacent Channel Power Parameters



The first step is to set the spectrum analyzer to display the signal under test.

1. Press **PRESET** on the spectrum analyzer to start the measurement from a defined preset state.
2. Input the frequency of the transmitted carrier by pressing **FREQUENCY**, **CENTER FREQ**, and entering the center frequency of the carrier signal (in this case, 300 MHz for the calibrator signal).
3. Press **AMPLITUDE**, then the step down ⇓ key once to set the signal reference level to –10 dBm.

Access the adjacent channel power (ACP) softkey functions and set up the measurement parameters.

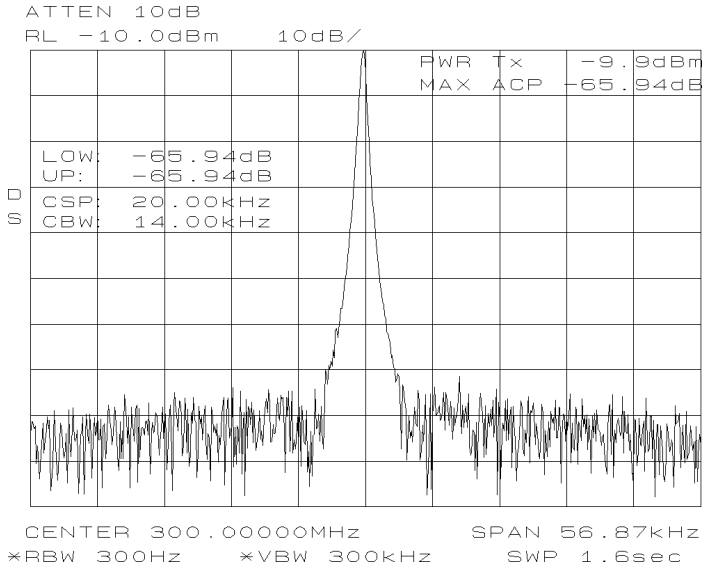
1. Press **MEAS/USER**, then **ACP MENU** to access the adjacent channel power menu of softkeys.
2. Press **ACP SETUP** and **METHODS** to select the measurement method that will be used to make the measurement. Press **ANALOG METHOD** if it is not already selected. The analog method is the most common measurement method and is described in more detail following this example. Press **PREV MENU**.
3. Press **SPACING/BANDWDTH** to access the channel spacing and channel bandwidth softkeys. Press **CHANNEL SPACING** and enter 20.0 kHz. Press **CHANNEL BANDWDTH** and enter 14.0 kHz. Press **PREV MENU** to return to the setup menu.
4. Then press **PREV MENU** to return to the adjacent channel power menu of functions.

Now that the setup is complete, you can activate the measurement.

5. Press **ACP AUTO MEASURE** to activate the automatic adjacent channel power measurement. **ACP AUTO MEASURE** reconfigures the measurement parameters, optimizing the frequency span, resolution bandwidth, video bandwidth, and detector of the spectrum analyzer.

   Numerical results for the ACP leakage ratio in the upper and lower adjacent channels are listed in the active function area, along with the channel spacing and channel bandwidth. The total transmitted power measured, and the maximum ACP ratio (of the upper and lower adjacent channels) are listed in the title area in the upper-right corner of the display.

Figure 2-54 Adjacent Channel Power Measurement Results



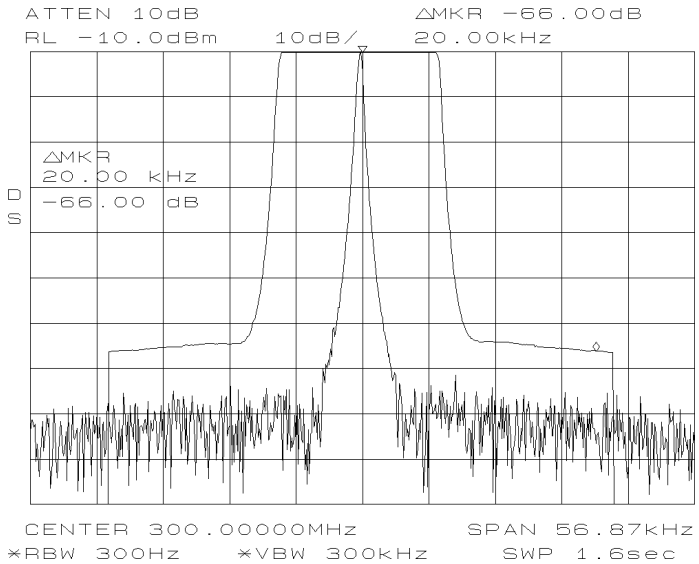
NOTE

The adjacent channel power measurement also can be performed with the spectrum analyzer settings that you choose. For example, if you want to perform the ACP measurement with a specific resolution bandwidth, or in a particular span, set the spectrum analyzer up in the state that you want, then use **ACP COMPUTE**. **ACP COMPUTE** performs the adjacent channel power measurement without changing the instrument state. The ACP compute function is only available when using the analog or peak method.

6. Press **EXIT & RESTORE** and set **ACPGRAPH ON OFF** to ON. This shows a graphical display of the adjacent channel power ratio, for the selected channel bandwidth, as a function of the channel spacing. The ACP graph function is only available when using the analog or peak method.

   A delta marker is activated, with the reference marker at the center frequency, and the marker spacing equal to the channel spacing.

Figure 2-55 ACP Graph Display



The ACP graph lets you see how rapidly the ACP ratio changes with channel spacing. The ACP graph is not defined for channel spacings where the graph is drawn at the bottom graticule line. For these points, the channel bandwidth would include frequencies beyond the edges of the screen, where no data was taken.

7. Press **EXIT ACP MENU** when you are finished with the adjacent channel power measurement, to restore the instrument state to its condition before making an ACP measurement.

ACP Analog Method Definition

When using the analog method and the ACP auto measurement function for making adjacent channel power measurements, the spectrum analyzer center frequency should be set to the transmitter intended center frequency. The reference level should be set to optimize the displayed range to minimize the number of data points above the top or below the bottom of the range of the chosen display scale. The display scale should be set to LOG 10 dB/division. The input attenuator should be set to optimize the tradeoff between analyzer-induced third-order intermodulation distortions and noise.

When **ACP AUTO MEASURE** is used with the analog method selected and the number of alternate channel pairs is set to zero, the display reflects the following:

- ACP ratio results in the lower channel (LOW) and upper channel (UP), located in the active function area,
- channel spacing (CSP) and channel bandwidth (CBW) parameters, located in the active function area, and
- total power transmitted (PWR Tx) and maximum adjacent channel power (MAX ACP), located in the display title area.

Figure 2-53 illustrates how the channel bandwidth and channel spacing parameters are defined. For more detailed information regarding how an ACP measurement is determined, refer to "Adjacent Channel Power (ACP) Computations" below.

The adjacent channel power measurement, as performed by the spectrum analyzer using the analog method from the **ACP AUTO MEASURE** softkey, responds to signals in an rms fashion. This means that the total power transmitted and adjacent channel power ratios are accurately reported, whether or not the transmitted signal contains tones, noise, or both. If the instrument state violates any of the following constraints, the response of **ACP COMPUTE** to signals is no longer rms, and errors of up to –2.51 dB can occur for noise-like signals:

- Video bandwidth is at least 10 times the resolution bandwidth.
- Detector mode is SAMPLE.
- Resolution bandwidth is less than or equal to 100 kHz.
- Video averaging is OFF.
- Neither MAX HOLD nor MIN HOLD trace mode is selected.

When **ACP AUTO MEASURE** is pressed and the measurement setup is suitable for rms detection, the following adjacent channel power message is briefly displayed in the active function area immediately before the measurement is made.

```
       DETECTION:
       RMS VOLTAGE
(POWER DETECTOR)
```

NOTE Power detection is invoked during adjacent channel power calculations but is not available as a detector mode.

In addition to the warning message, the instrument-state parameter that is causing the warning will be displayed. The instrument-state messages that may be displayed are:

- RBW ≥ 300 kHz
- VBW < 10 × RBW
- DETECTOR MODE
- MIN HOLD
- MAX HOLD
- VIDEO AVERAGE

Even though a warning message with an invalid instrument-state parameter was indicated, the measurement is still made and the results are displayed in the active function area. If an invalid instrument-state parameter is suspected, the warning message can be viewed briefly by pressing **ACP COMPUTE** repeatedly. Computation results without rms detection can be accurate if the signals in the adjacent channels are similar to continuous wave (CW) signals, but not if the signals are noise-like. Also, some international standards for ACP measurements require the video bandwidth to be equal to the resolution bandwidth, which prohibits rms detection, while requiring the measurement to respond to the rms sum of all signals in the passband. If the video bandwidth is set according to this standard, the warning message will be displayed.

In addition to the warning messages for invalid instrument-state parameters listed above, the following three error messages may be observed in the lower right corner of the display:

- ERR 908 BW>>SPCG indicates that the channel bandwidth is too wide, compared to the channel spacing, for a valid computation.
- ERR 909 SPAN<ACP indicates that the frequency span is too narrow to obtain a valid measurement.
- ERR 910 SPAN>ACP indicates that the frequency span is too wide, compared to the channel bandwidth, to obtain an accurate measurement.

If any of the three errors occur, the measurement is not completed. To correct the measurement, adjust your instrument state settings depending on the error that has occurred.

Adjacent Channel Power (ACP) Instrument Setup

Settings of the reference level, input attenuation, and display scale are not changed by the ACP auto measurement function. They must be set for optimum dynamic range to optimize accuracy.

Although linear and other logarithmic scales are supported, only the log 10 dB per division scale has adequate dynamic range for ACP measurements; thus, it should always be used. The reference level (RL) should be chosen so that the signal exceeds neither the top nor the bottom of the fidelity-specified range of the chosen (10 dB per division) scale. When the signals in the channel are CW-like, the optimum RL is that for which the largest signal is at the RL.

When the signals in the channel are noise-like, as is the case for most digital modulations, the optimum RL depends on the range of the logarithmic amplifier and other parameters. The difference between the transmitter power and the optimum reference level is given by:

$$(10\text{dB})\log\left[\frac{RL}{P_{TX}}\right] = (10\text{dB})\log\left[\frac{1.85RBW}{ChBW}\right] + 0.439(\text{logrange} + ACP_{range})$$

1. where:

   P_{TX} is the total transmitted power.

   RBW is the spectrum analyzer resolution bandwidth.

   ChBW is the channel bandwidth.

   RL is the reference level power (note that the units must be power units, for example, mW, and match those of P_{TX}).

   logrange is the specified range of the log amplifier, a positive number (100 dB for the 8560 Series and EC-Series Spectrum Analyzers).

   ACP_{ratio} is the ratio of the adjacent channel power to the transmitter power, expressed in dB, and is always a negative number.

The setting of the input attenuator of the spectrum analyzer determines the tradeoff between the distortion errors and noise errors. The following equation expresses the optimum choice of input attenuation for a spectrum analyzer.

$$ATTN_{opt} = PdB_{TX} - (3.84\text{dB}) - \frac{1}{3}\left\{DANL_{Ref} + 2ML_{Ref} + TODdB_{Ref} + (10\text{dB})\log\left[\frac{ChBW}{NBW_{Ref}}\right] - (20\text{dB})\log\left[2 - \frac{ChSpacing}{ChBW}\right]\right\}$$

where:

$ATTN_{opt}$ is the optimum choice of attenuation.

ATTN is the attenuator setting chosen within 10 dB increments.

PdB_{TX} is the transmitter power in units of dBm.

$DANL_{Ref}$ is the displayed average noise level specification for the analyzer, in dBm, with no input attenuation.

ML_{Ref} is the mixer level for which third-order distortion is specified in the spectrum analyzer.

$TODdB_{Ref}$ is the ratio of the signal power to the distortion component power for the third-order distortion specification, in dB, a positive number.

ChBW and ChSpacing are the channel bandwidth and channel spacing parameters NBWRef is the noise bandwidth for the resolution bandwidth in which DANL is specified; the NBW is 1.055 times the resolution bandwidth for RBW less than or equal to 100 Hz.

Given this optimum attenuation, and a 10 dB step-size in the input attenuator, choose the input attenuator in the range:

$$ATTN < ATTN_{opt} + 5.80\text{dB}$$

$$ATTN > ATTN_{opt} - 4.20\text{dB}$$

Adjacent Channel Power (ACP) Computations

The analog method calculates ratios for the upper and lower adjacent channels of the power within these channels to the total transmitter power. The total transmitter power is computed as follows:

$$PWRT_x = (10\text{dB})\log_{10}\left[\sum_{x1}^{x4} P(x)\frac{\left(\frac{SPAN}{600}\right)}{NBW}\right] + RL$$

where:

$x1$ and $x4$ are positions of the trace data points at the left edge of the lower adjacent channel and the right edge of the upper adjacent channel, respectively.

P(x) is the power ratio of the indicated trace data at point x to the reference level. For example, if the trace data is –60 dB, P(x) is 0.000001.

SPAN/600 is the spacing of trace data points.

NBW is the effective noise bandwidth of the resolution bandwidth used for the measurement. It depends on the shape of the resolution bandwidth filter, the scale, and the detector mode. For the ACP function, for most resolution bandwidths, the noise bandwidth is approximately:

1.128 × 3 dB BW for RBW ≥ 300 Hz

1.055 × 3 dB BW for RBW ≤ 100 Hz

RL is the reference level in dB units.

The power in the lower adjacent channel is given by the same expression, except that the upper summation limit is *x*2, the right edge of the lower channel, instead of *x*4. Likewise, the power in the upper channel includes summation limits from *x*3, the left edge of the upper channel, to *x*4.

The ACP leakage ratio displayed as LOW (lower channel) is given in decibels as the dB difference between the total power transmitted (PWR Tx) and the power in the lower channel. UP is computed similarly for the upper channel.

The edges of the adjacent channels, *x*1 through *x*4, are given by:

$$x1 = F_c - ChSp - \left(\left(\frac{1}{2}\right)ChBW\right) + 0.307RBW + \left(\left(\frac{1}{2}\right)\left(\frac{1}{600}\right)SPAN\right)$$

$$x2 = F_c - ChSp + \left(\left(\frac{1}{2}\right)ChBW\right) - 0.307RBW - \left(\left(\frac{1}{2}\right)\left(\frac{1}{600}\right)SPAN\right)$$

$$x3 = F_c + ChSp - \left(\left(\frac{1}{2}\right)ChBW\right) + 0.307RBW + \left(\left(\frac{1}{2}\right)\left(\frac{1}{600}\right)SPAN\right)$$

$$x4 = F_c + ChSp + \left(\left(\frac{1}{2}\right)ChBW\right) - 0.307RBW - \left(\left(\frac{1}{2}\right)\left(\frac{1}{600}\right)SPAN\right)$$

where:

Fc is the center frequency.

ChSp and ChBW are channel spacing and channel bandwidth.

RBW is the resolution bandwidth.

1/2 × 1/600 × SPAN is one-half of the spacing of trace data.

0.307 × RBW is a term that changes the effective passband shape for the power measurement to a shape with a response that is –6 dB at the channel edges compared to the channel center.

This correction to *x*1 through *x*4 will help the spectrum analyzer results agree with measuring receiver results, because a measuring receiver is specified to have a –6 dB response at the channel edges.

The ACP leakage ratio displayed as MAX ACP is for either the lower or upper adjacent channel, whichever has the higher power. In other words, MAX ACP is the least negative of the dB numbers displayed as LOW and UP.

Stepping Through a Burst Signal ACP Measurement

In this example, we will be making a measurement on a PDC (personal digital cellular) mobile transmitter. You will need to provide a signal to the spectrum analyzer either by connecting a radio directly, or by coupling a signal from the radio via an antenna. The MKK method is one of the standards used for PDC radios, the two bandwidth method (specified in the RCR-27 document) is another. We will use the two bandwidth method in this example.

Signal transmission formats are measured using different standards and parameter settings. Table shows the relationship between some of the formats and their measurement requirements.

Table 2-5

Format	Specification	Meas Method		Channel Spacing	Channel Bandwidth	# Alt Chnls	Burst Period	Burst Width	Weighting
		Mobile	Base						
NADC	IS-54	Gated	Analog	30 kHz	33 kHz	2	20 ms	6.43 ms	√COS*
PDC	RCR-27B	2 BW‡	Analog	50 kHz	21 kHz	1	20 ms	6.52 ms	OFF†
PDC	MKK	Peak	Analog	50 kHz	21 kHz	1	20 ms	6.52 ms	OFF†
PHS	RCR-28**	Peak	Peak	300 kHz	192 kHz	2§	5 ms	625 µs	OFF†
Analog	FM/25 kHz	Analog	Analog	25 kHz	16 kHz	0	n/a	n/a	OFF†
Analog	FM/12.5 kHz	Analog	Analog	12.5 kHz	8.5 kHz	0	n/a	n/a	OFF†

* When making NADC measurements, use root-raised-cosine frequency weighting with T=41 µs and α=0.35. T=42 µs is specified for NADC measurements, but 41 µs is used due to number rounding limitations of the spectrum analyzer.

† The weighting function is turned off, therefore T and α are not applicable.

‡ The 2BW method is described in the following section about PDC measurements.

§ The 8560 E-Series and EC-Series documentation refers to the channels that are offset by 300 kHz,600 kHz, and 900 kHz as the adjacent channels, first alternate channels and second alternate channels. The RCR-28 standard does not have a name for the channels at 300 kHz offset, and it calls the 600 kHz and 900 kHz offsets the adjacent channels and the first alternate channels, respectively.

** The RCR-28 standard is discussed further in the following section about PHS measurements.

CAUTION The maximum input to the spectrum analyzer should not exceed +30 dBm (1 W) with greater than or equal to 10 dB attenuation.

Set up the spectrum analyzer to display the signal before going to the adjacent channel power softkeys.

1. Press **PRESET** on the spectrum analyzer to start the measurement from a defined preset state.
2. Press **AMPLITUDE** and set the reference level to the value of the transmitter power that is being input to the spectrum analyzer. (You may need to use an external attenuator.)
3. Press **FREQUENCY** and set the center frequency to the center frequency of the transmission channel that you want to measure.

Now the signal is displayed. Set up the ACP measurement before executing it.

1. Press **MEAS/USER**, **ACP MENU** and **SETUP ACP** to access the ACP setup functions.
2. Press **METHODS** and **2BW METHOD** to select the two bandwidth measurement method. Press **PREV MENU**.
3. Press **ACCELERAT**. Check that the **ACCELERAT NORMAL** function is selected. The normal setting is required to measure to the standard. You can use faster measurement methods, but the results would not agree completely with the standards. Press **PREV MENU**.
4. Press **SPACING/BANDWDTH** and **CHANNEL SPACING**, and set the spacing to 50 kHz. (Table 2-5 on page 118 shows the settings for some other formats.)
5. Press **CHANNEL BANDWDTH** and set the bandwidth to 21 kHz.
6. Press **# ALT CHANNELS** and set it to 1. This will give you measurement results for the adjacent channels and for the first alternate channel pair. Press **PREV MENU**.
7. Press the **BURST/WEIGHTNG** softkey. Press **BURST PERIOD** and set the period to 20 ms. Press **BURST WIDTH** and set the width to 6.43 ms.
8. Press **WEIGHTNG √COS OFF** so that off is selected. This turns off the root-raised-cosine weighting function. Press **PREV MENU**.
9. Press **ACPSTATE DFL CURR** so that the default state (DFL) is selected. This allows the spectrum analyzer to default to the parameters considered best for the measurement. In this example, and any in the table, the defaults are compatible with the standard. Press **PREV MENU**.

Now that the parameters are set, you can activate the measurement.

1. Press **AUTO ACP MEASURE** to activate the measurement. The measured values are displayed in the upper left part of the graticule.
2. Press **VIEW TBL TRAC** so that table (TBL) is selected. The display will change from showing the signal trace to showing a table of the ACP measurements.

PDC Measurements of Mobiles According to the RCR-27B Standard

The following information is applicable as of September 1993. The two-bandwidth method, as described in standard RCR-27B, was not strictly followed by Agilent Technologies in the development of the built-in adjacent channel power functions (ACP). We believe that following the standard exactly as written will not make the intended measurements. If you are not familiar with the standard, you may want to skip over the following paragraph and proceed to the final paragraph in this section.

One example of the differences between the standard and the Agilent Technologies implementation is that the standard calls for 10 kHz/3 kHz resolution bandwidths and the implementation uses 3 kHz/1 kHz resolution bandwidths. This is because a 10 kHz resolution bandwidth is not adequately selective for measurements. Another difference is that the ratio M_r in the implementation is compensated to account for the fact that the peak response to noise exceeds the average response to noise by an amount that depends on the product of the noise bandwidth and the observation time (the burst width). Without this compensation, the two-bandwidth method did not effectively separate impulsive from noise-like power. There are other minor differences between the standard and the implementation as well.

The most significant difference is the way that the standard calls for measuring the ratio of the power in the adjacent channels to the main channel. The standard measures the power in the adjacent channels using a peak detector, and computes its ratio to the average power in the main channel when "on," measured with a power meter. The Agilent Technologies implementation takes the ratio with the power in the main channel measured in the same way as the power in the adjacent channels. We believe that this latter method provides a more meaningful ratio and meets the intention of the standard. However, the Agilent Technologies implementation results in an ACP ratio that is 7.25 dB more negative than the standard method. This is due to the difference between measuring power of a noise-like signal with a peak detector versus using a true averaging power detector.

The user may want to add +7.25 dB to the (negative) ACP ratios measured, to compensate for the difference between the standard and the Agilent Technologies interpretation of its intent. The 8560 E-Series and EC-Series implementation is consistent with that used in the Agilent 85720A JDC/TDMA Measurement Personality.

PHS Measurements of Mobiles According to the RCR-28 Standard

The following information is applicable as of September 1993. The RCR-28 standard does not specify a ratio for adjacent channel power, but rather an absolute power. The standard specifies that the power be computed as follows:

$$P_{adjS} = \frac{P_{adj}}{P_{main}} \times P_{xmit}$$

where:

P_{adjS} is the (absolute) adjacent channel power according to the definition of standard RCR-28.

P_{adj} is the power measured in the adjacent channel using the peak method.

P_{main} is the power measured in the main channel, within the channel bandwidth, using the peak method.

P_{xmit} is the total power measured in the transmitted burst. That is the average power measured in a wide bandwidth, while the burst is "on."

Because the transmitter is specified to have at least 99% of its power within a 288 kHz bandwidth, P_{main}, being measured in a 192 kHz bandwidth, must be accurately measured.

To find P_{adjS} according to the standard, we can make the following measurements and computations:

$$P_{adjS} = ACP_{adj} \times \frac{P_{wide}}{P_{center}} \times P_{carr}$$

where:

ACP_{adj} is the ACP ratio in the adjacent channel (or alternate channel). This result should be in decimal form, converted from decibels by the equation:

$$ACP_{adj} = 10^{0.1 \times ACP_{dB}}$$

where ACPdB is the ACP ratio in decibels (it is always negative).

P_{wide} is measured with the channel power function, using the same trace data as was used by the ACP measurement. That means with the channel power bandwidth set to (2×channel spacing + channel bandwidth), or 792 kHz. The units should be W, mW, or a similar unit.

P_{center} is the same as P_{wide} except the channel power bandwidth should be equal to the channel bandwidth. Use the same units as P_{wide}.

P_{carr} is measured in zero span with:

Resolution bandwidth..... ≥300 kHz
Video bandwidth ..... 3 MHz
Sweep time ..... 30 ms

Use the units you would like for the final answer, such as nW.

For many users, the built-in ACP function without all the computations gives useful information. To measure according to the standard requires the computations shown above.

NADC Measurements of Mobiles According to the IS-54 Standard

The following information is applicable as of February 1995. The IS-54 standard requires a measurement method that we call the gated method. In order to make time-selective measurements, an external TTL-type trigger input is required when using the gated method. If the device under test does not have a trigger output, you can use the Agilent 85902A burst trigger adapter to provide a trigger. This accessory is connected to the signal directly (see Figure 2-56); it may be more convenient for some users to connect the Agilent 85902A to the second IF output (310.7 MHz) of a spectrum analyzer equipped with Option 001. See Figure 2-57.

The IS-54 standard also requires that the received spectrum be weighted in the same manner as it would be in a receiver. The weighting function used is the root-raised-cosine weighting, with parameters T and α. W is the weighting in dB. It is a function of Δf, the offset of the frequency of the spectral component from the center of the channel. The relationship is as follows:

$$\text{for } |\Delta f| \le \frac{1-\alpha}{2T},\ W(\Delta f) = 0\text{dB}$$

$$\text{for } |\Delta f| \ge \frac{1+\alpha}{2T},\ W(\Delta f) = -\infty\text{dB}$$

$$\text{for all other } \Delta f,\ W(\Delta f) = 10\text{dB} \times \log_{10}\left(\frac{1}{2}\right)\left[1 - \sin\left(\frac{\pi(2|\Delta f|T - 1)}{2\alpha}\right)\right]$$

In this implementation , α and the edge of the –∞ dB region are compensated for the effects of a non-zero resolution bandwidth filter on the effective weighting function.

Figure 2-56 Trigger Configuration for Gated Method, Non-Option 001

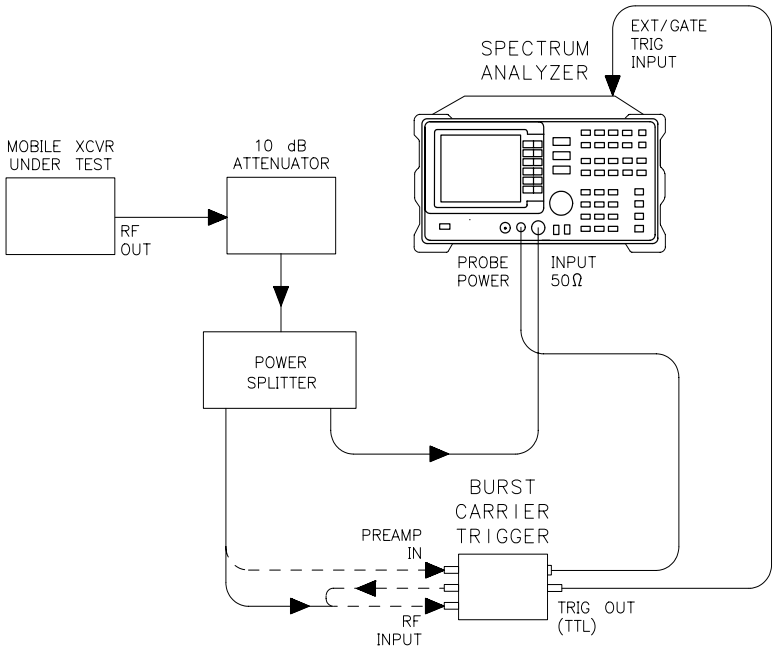
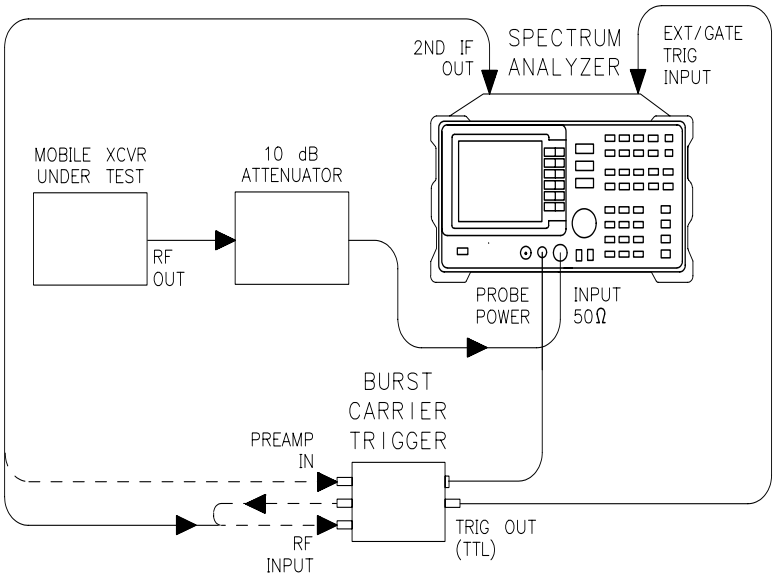


Figure 2-57 Trigger Configuration for Gated Method, Option 001



Example 10: Power Measurement Functions

What are the Power Measurement Functions?

The spectrum analyzer can make several different types of power measurements on complex communication signals. These are in addition to the adjacent channel power measurements discussed in Example 9. These measurements are available as built-in functions in the spectrum analyzer **MEAS/USER** menu. These measurements include the following:

- The occupied bandwidth of a modulated signal is the bandwidth that contains the specified (usually 99.00%) portion of the total transmitted power.
- The channel power within a frequency range, such as a communications channel, is a calculation of the total power of the signal from its spectrum.
- The carrier power of a burst communications signal can be computed while the burst is on and the carrier leakage can be computed while the burst is off. The measurement is made in zero span with a wide resolution bandwidth (compared to the modulation, when on).

Using Power Measurement Functions

RMS Detection

For most power measurements, it is desireable to respond to signals in an RMS fasion. This means that the power measured is accurately reported, whether the signal contains tones, noise, or other signals. If the spectrum analyzer is not configured for RMS detection (also known as power detection), CW-like signals (tones) will be measured correctly, but noise-like signals (including most digitally-modulated signals) will not be correctly measured.

The power measurement functions compute the RMS of all the applicable measurement cells (display buckets). If the data in those cells is unbiased, RMS detection occurs. To keep the data unbiased requires:

- The detection mode must be SAMPLE. Other modes, such as POSitive PEAK, are biased differently for noise-like signals than for CW-like signals.
- The video bandwidth (VBW) should be at least 10 times the resolution bandwidth (RBW). If it is not, video filtering of a noise-like signal on a logarithmic (dB) display scale biases the measurement.

- The resolution bandwidth may not exceed 100 kHz in the 8560 E-Series and EC-Series spectrum analyzers. A wider resolution bandwidth would cause the video filtering problem mentioned above because the internal video bandwidth in the SAMPLE detection mode is limited by the analyzer hardware to about 450 kHz. At 4.5 times the resolution bandwidth, noise power is underestimated by 0.02 dB.
- Video averaging and other display functions such as MAX HOLD must be turned off. Video averaging, like video bandwidth filtering, averages the log of the signal before RMS detection, biasing noise-like signals.

It is not necessary to be concerned about power detection in all cases. In occupied bandwidth measurements, which are ratiometric, power detection is only necessary if the signals beyond the edge of the occupied bandwidth have different statistical parameters from those in the center (ie. for those with tones in the center and noise at the edges). In channel power measurements, power detection is only necessary if significant amounts of the power are noise-like signals; if all signals are CW-like, power detection is unnecessary. In carrier power measurements, the "On" power usually acts like a constant power because the phase is modulated, not the amplitude. So power detection is not required. But if the "On" power shows considerable modulation, such as with a QAM signal, power detection is necessary. The "Off" power is usually noise-like, thus requiring power detection.

Making Carrier "On" Power Measurements

The carrier power measurement computes the average power during the time that a burst is on. The result will be accurate if the power indicated is accurate, and if the time over which it is averaged is representative.

In order for the indicated power to be accurate, the resolution bandwidth must be much wider than the spectrum of the signal while the burst is on. The spectrum for most burst signals is about as wide as the symbol rate; a resolution bandwidth greater than 3 times this rate is recommended. The recommended video bandwidth is at least twice the symbol rate.

The time over which the power is averaged depends on the time between the rising and falling transitions. The threshold is 20 dB below the peak level. The averaging zone is moved in from these thresholds by 1% of the sweep time plus the reciprocal of the resolution bandwidth (1/RBW).

If this automatic choice of the averaging zone is undesirable, it may be possible to fill in the screen with the section of the burst of interest. Use the desired averaging time as the sweep time, and set up the desired video trigger (or other trigger) source and delay.

Making Carrier "Off" Power Measurements

Carrier "Off" power measurements are usually made under the same conditions as are the "On" power measurements. Power-indicated accuracy and time-averaged representativeness issues apply here also.

RMS detection is usually very important for carrier "Off" measurements because the power tends to be noise-like. The ideal resolution bandwidth for "Off" power measurements may be only about the width of the spectrum of the signal to minimise the addition of noise from the spectrum analyzer or other system noise generators. If noise is not a consideration, a wide resolution bandwidth, such as that used for the "On" power measurement, is preferred.

The averaging zone is like that of the "On" power measurement averaging zone, dependent on the time between threshold crossings. The starting point after the falling edge is delayed by 1% of the sweep time plus about 1.2/RBW. The ending point preceeds the threshold by 1% of the sweep time plus about 0.6/RBW.

Unlike the "On" power measurement case, changing the averaging zone using triggering is not practical. Some control may be exercised by changing the sweep time or resolution bandwidth.

Making CHAN PWR OVER BW Measurements

The channel power function cumputes the sum of the power across the bandwidth (centered at the center frequency) specified by the CHPWR BW parameter. RMS detection is usually important, as previously discussed.

The CHPWR BW parameter is the 6 dB bandwidth. This means that a sine wave at the edge of the band (for example, a frequency given by the center frequency plus half of the CHPWR BW) will cause a response in the channel power measured 6 dB below the response to a sine wave at the center frequency. Sine waves outside the CHPWR BW are rejected by the selectivity of the chosen resolution bandwidth.

The 3 dB bandwidth of the channel power function is narrower than the CHPWR BW by 0.6 times the resolution bandwidth. The user can compute the desired CHPWR BW to program by adding 0.6 RBW to the desired 3 dB bandwidth.

Spectrum Analyzer Functions Used

The carrier power measurement functions, including the on-power and the off-power (carrier leakage), will be used to measure a burst RF signal.

Stepping through a Carrier Power Measurement

A carrier power measurement will be made on a typical cellular radio signal. The signal should be a burst RF signal with about a 20 ms burst period.

1. Connect the burst RF signal to the input of the spectrum analyzer.
2. Press **FREQUENCY** and set the spectrum analyzer center frequency to the carrier frequency of the signal.
3. Press **AMPLITUDE** and set the reference level a few dB higher than the expected carrier level.
4. On the spectrum analyzer, set:

   Resolution bandwidth ..... 100 kHz
   Video bandwidth..... 3 MHz
   Span .....0 Hz
   Sweep time .....40 ms (for typical 20 ms burst period)

5. Press **MEAS/USER**, **CARRIER PWR MENU** and **AVG "ON" POWER**. Notice the carrier power value on the display. Press **PREV MENU**.
6. Press **AVG "OFF" POWER** and notice the carrier power value on the display. This is the leakage power present when the burst is off.

Example 11: Time-Gated Measurement

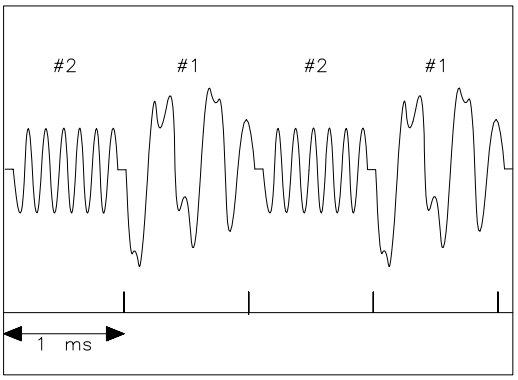
What Is Time-Gating?

Traditional frequency-domain spectrum analysis provides only limited information for certain signals. Examples of these difficult-to-analyze signal include the following signal types:

- Pulsed RF
- Time multiplexed
- Time domain multiple access (TDMA)
- Interleaved or intermittent
- Burst modulated

In some cases, time-gating capability enables you to perform measurements that would otherwise be very difficult, if not impossible. For example, consider Figure 2-58, which shows a simplified digital mobile-radio signal in which two radios, number 1 and number 2, are time-sharing a single frequency channel. Each radio transmits for 1 ms.

Figure 2-58 Simplified Digital Mobile-Radio Signal in Time Domain



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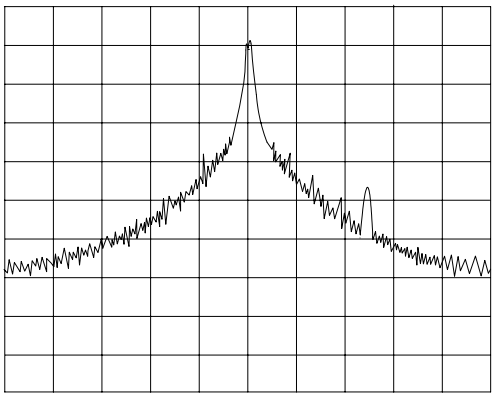
What if you wanted to measure the unique frequency spectrum of each transmitter? Unfortunately, a traditional spectrum analyzer cannot perform that measurement. By the time the spectrum analyzer has completed its measurement sweep, which lasts about 50 ms, the radio transmissions will have switched back and forth 25 times. Because the radios are both transmitting at the same frequency, their frequency spectra will overlap, as shown in Figure 2-59. The spectrum analyzer shows the combined spectrum; you will not be able to tell which part of the spectrum results from which signal.

Figure 2-59 Frequency of the Combined Signals of the Radios



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Using the time-gate capability and an external trigger signal, you can see the separate spectrum of radio number one (or radio number 2 if you wish) and identify it as the source of the spurious signal shown as in Figure 2-60 and Figure 2-61.

Figure 2-60 Time-Gated Spectrum of Signal Number 1

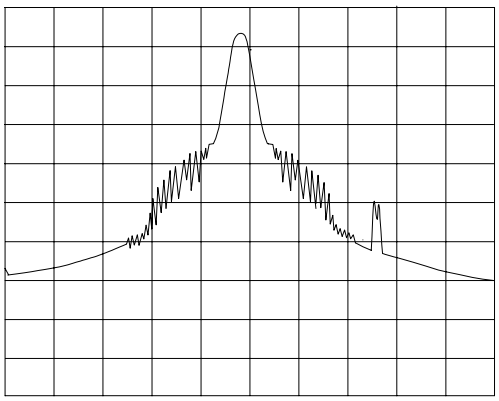

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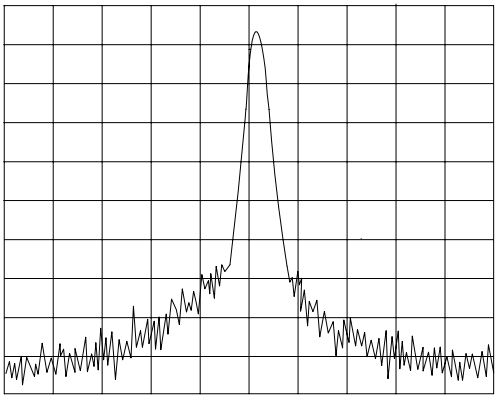
Figure 2-61 Time-Gated Spectrum of Signal Number 2



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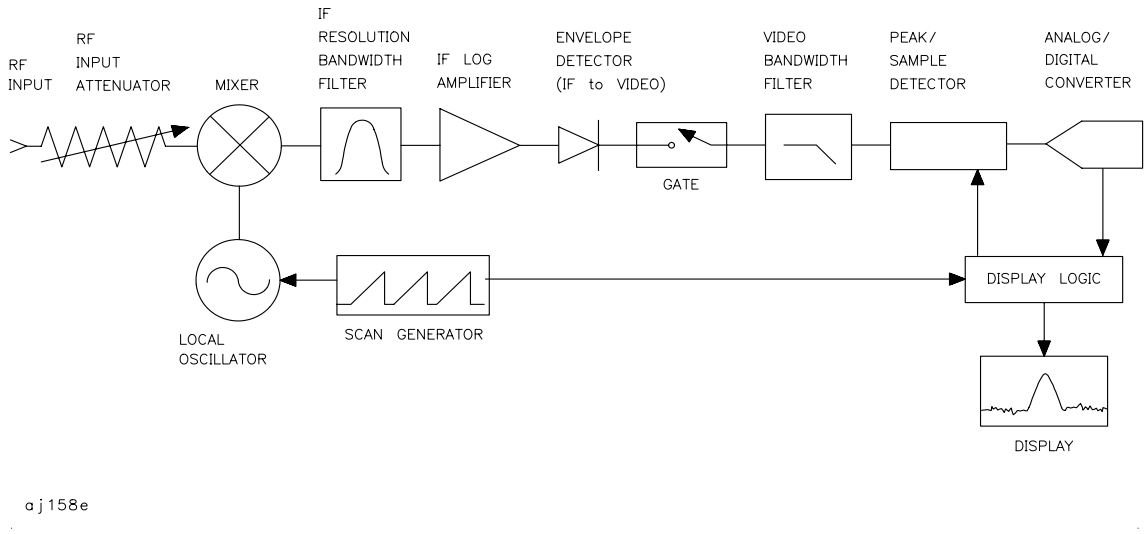
Time-gating lets you define a time window, or time gate, during which a measurement will be performed. This permits you to specify the part of a signal that you want to measure, and exclude or mask out other signals that might interfere.

How Time-Gating Works

Time-gating is achieved because the spectrum analyzer selectively interrupts the path of the detected signal, as shown in Figure 2-62. By opening and closing a switch relative to an externally supplied trigger signal, the analyzer controls the times at which it captures measurement data. Under the right conditions, the only signals that the analyzer measures are those present at the input to the analyzer when the gate is on. With the correct spectrum analyzer settings, all other signals are masked out.

The RF section of the spectrum analyzer is responding to the full signal. The selective gating occurs only before the video processing. This means that there are some limitations on the gate settings because of signal response times in the RF signal path.

Figure 2-62 Block Diagram of the Spectrum Analyzer with Time Gate



The gate within the analyzer is opened and closed based on four factors:

- An externally supplied transistor-transistor logic (TTL) signal.
- The gate control, or trigger mode (positive or negative edge triggering, or positive or negative level triggering).
- The gate delay setting, which determines how long after the trigger signal the gate actually becomes active for the edge trigger mode.
- The gate length setting, which determines how long the gate is on for the edge trigger mode.

To understand time-gating better, consider a spectrum measurement performed on two pulsed-RF signals. You need to consider the timing interaction of three key signals that are present during this measurement. The three signals are:

- The pulsed-RF signal under test.
- The gate trigger signal, supplied from the signal source.
- The gate output signal, available from a BNC connector on the rear panel of the spectrum analyzer. This transistor-transistor logic (TTL) signal is low when the gate is "off" (masking) and high when the gate is "on" (measuring).

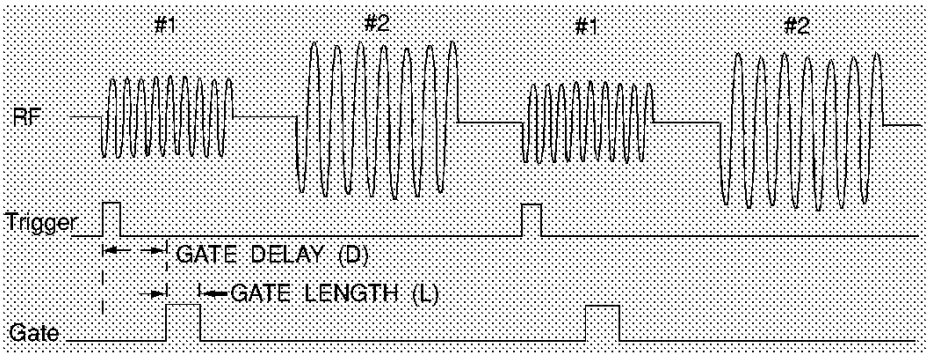
The timing interactions between the three key signals are best understood if you observe them first on a oscilloscope. Figure 2-63 shows each of the signals as the would appear on the oscilloscope.

Keep in mind the main goal: to measure the spectrum of pulse train number 1 and determine if it has any low-level modulation or spurious signals.

Because the pulse trains of signal number 1 and signal number 2 have almost the same carrier frequency, their frequency-domain spectra overlap. Further, the spectrum of pulse train number 2 dominates because signal number 2 has greater amplitude. Without gating, you won't see the spectrum of pulse train number 1; it is masked by pulse train number 2.

To measure pulse train number 1, the gate must be on only during those pulses. The gate will be off at all other times, thus excluding all other signals. To position the gate, set the gate delay and gate length, as shown in Figure 2-63, so that the gate is on only during some central part of the pulse. Carefully avoid positioning the gate over the rising or falling pulse edges. When gating is activated, the gate output signal will indicate actual gate position in time, as shown in the line labeled "Gate."

Figure 2-63 Timing Relationship of Signals During Gating



Now that you've set up the spectrum analyzer to perform the gate measurement, you'll see, as shown if Figure 2-65, the spectrum within the pulses of pulse train number 1 only; the spectrum of pulse train number 2 is excluded. In addition, when viewing pulse train number 1, you also will have eliminated the pulse spectrum generated from the pulse edges. Gating has allowed you to view spectral components that otherwise would be hidden. (See the following section, “Stepping through a Time-Gated Measurement” for the detailed measurement procedure.)

Figure 2-64 Spectrum within pulse #1

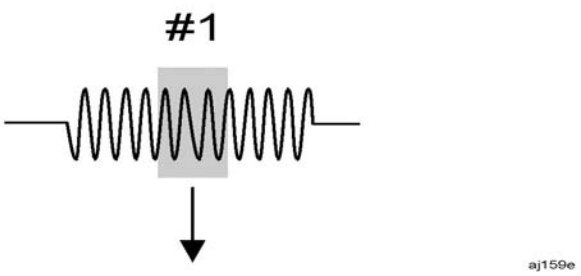
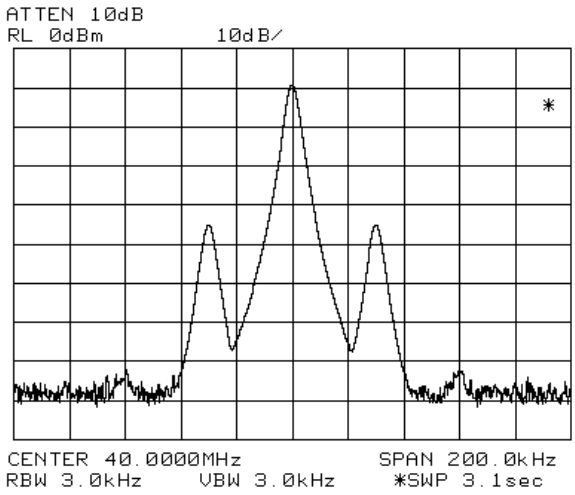


Figure 2-65 Using Time-Gating to View Signal 1



Moving the gate so that it is positioned over the middle of pulse train number 2 produces a result such as that shown in Figure 2-67. Here, you see only the spectrum within the pulses of signal number 2; both signal number 1 and the pulse spectrum of signal number 2 are excluded.

Figure 2-66 Spectrum within pulse #2

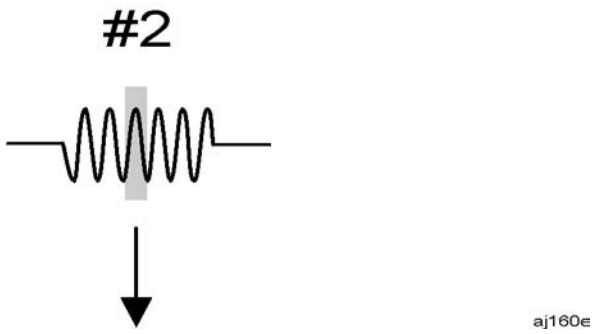
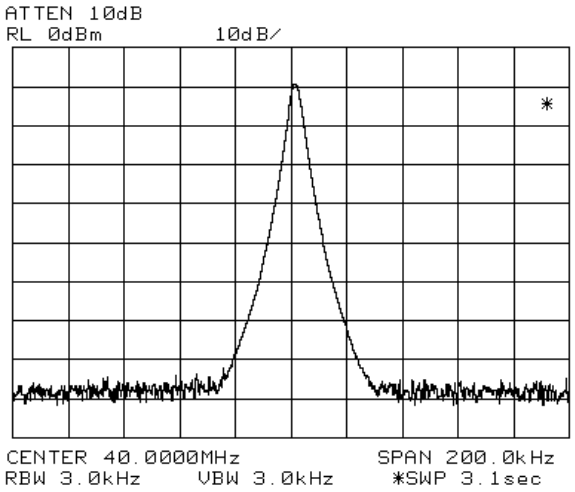


Figure 2-67 Using Time-Gating to View Signal 2



Time-gating serves as a useful measurement tool for many different types of signals. However, the signal must be repetitive and have a TTL timing trigger signal available to synchronize the gate.

Making Noise Measurements Noise measurements made using a gated measurement technique will vary from the value measured without gating. A typical measurement made without gating uses sample detection mode and has some errors caused by the instrumentation. The errors come from the differences between the filter shape of the resolution bandwidth filters compared with ideal filters, and from the spectrum analyzer internal block diagram which takes the logarithm of the noise first and than averages it.

A gated measurement is also affected by these considerations, and it uses peak detection rather than sample detection. This adds additional inaccuracy because the peak value of the noise during some time interval will give a higher result than the average power (using sample detection). The resulting value increases as the time interval increases, because the probability of finding the statistically rarer larger peaks increases. For very accurate noise measurements using the gated function, the impact of these considerations must be calculated based on the current spectrum analyzer settings.

The equation below can be used to calculate a correction value for the measured noise. Subtract the correction from the measured value.

$$Correction = 10\text{db}\log_{10}[\ln(2\pi\gamma BW_i + e)]$$

where:

BW_i is the impulse bandwidth which is 1.62 × resolution bandwidth, for resolution bandwidths ≥300 Hz.

τ is the time interval over which the peak detection occurs and is equal to the sweeptime/600.

Refer to Agilent Technologies Application Note 1303, page 18, for more details.

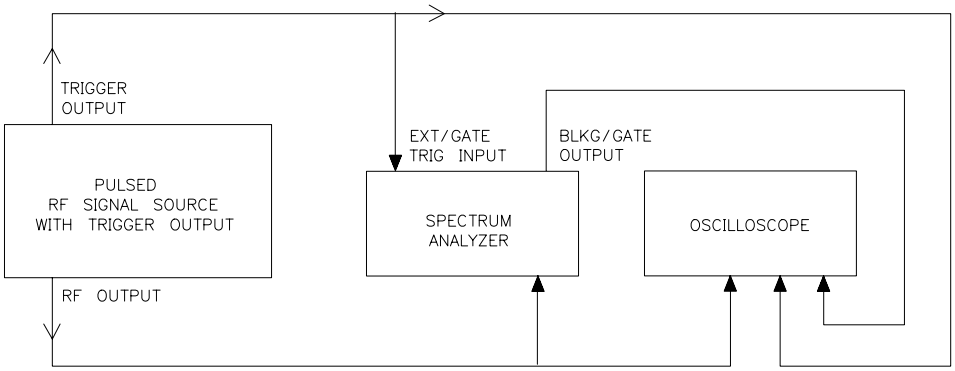
Test Setup and Connection Diagram

Figure 2-68 shows a block diagram of the test setup. In Figure 2-68, the signal source is treated as one block. The source produces a signal RF-pulse train from one port and a TTL trigger signal from the other port. The other blocks represent a spectrum analyzer with time-gating capability and a multi-channel oscilloscope. As shown in the previous section, the oscilloscope is very useful for illustrating the timing interactions of the signals.

Instrument	Connections
Spectrum analyzer	RF input (the RF-pulse train from the signal source)
	Gate trigger input (the TTL timing trigger signal from the signal source)
	Gate output (the TTL voltage output indicating whether the gate is on or off)
Oscilloscope	Gate trigger input (the TTL timing trigger signal from the signal source; this is same signal as the analyzer gate trigger input.)
	Gate output (This is the signal from the spectrum analyzer BLKG/GATE OUTPUT connector. The gate output graphically shows the gate status versus time.)
	RF signal under test (the same signal that is input to the spectrum analyzer input)

Using this measurement setup will allow you to view all signal spectra on the spectrum analyzer and all timing signals on the oscilloscope. The setup will prove to be very helpful when you perform gated measurements on unknown signals.

Figure 2-68 Connection Diagram for Time-Gated Spectrum Measurements

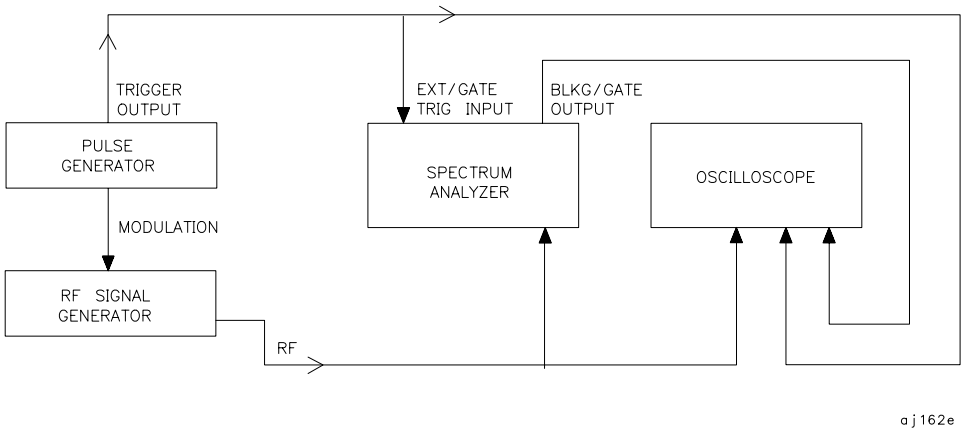


Stepping through the Measurement of a Single RF-Pulse Train

This measurement example will give you a closer look at time-gating and will show even more clearly the advantages of this measurement capability. Because the example uses a simple pulsed-RF signal with specific parameters and shows specific control settings, you can duplicate the measurement using your own equipment.

The objective of this measurement is to eliminate the pulse spectrum and then view the spectrum of the carrier as if it were continually on, rather than pulsed. This will reveal low-level modulation components that were hidden by the pulse spectrum.

Figure 2-69 Connection Diagram for Example



Instrument configurations for the measurement are:

Pulse Generator: Agilent 8112A or equivalent

Instrument Connections

Pulse period	5 ms (or pulse frequency equal to 200 Hz)
Mode	norm
Pulse width	4 ms
High level (HIL)	5 V
Waveform	pulse
Low level (LOL)	0 V
Delay	0 or minimum
Amplitude	5 V
Offset	2.5 V

Signal Generator: Agilent 8642A or equivalent

Instrument Connections

Frequency	40 MHz
Amplitude	0 dBm
AM	OFF
PULSE	ON, modulation source set to EXT DC
FM	ON, 1 kHz deviation
FM MOD SOURCE	INT
MOD FREQUENCY	100 kHz
RF	ON

Spectrum Analyzer Settings

Instrument Connections

Center frequency	40 MHz
Span	500 kHz
Reference level	0 dBm
Sweep time	3.1 s
Resolution bandwidth	3 kHz

Video bandwidth	3 kHz
Gate	OFF (Press **SWEEP**, then **GATE ON OFF** so that OFF is underlined.)
Gate delay	2 ms (Press **GATE DLY [ ]**, use the data keys to enter in a 2, then press **ms**.)
Gate length	1ms (Press **GATED VIDEO**, **GATE LEN [ ]**, use the data keys to enter in a 1, then press **ms**.)
Gate control	EDGE (Press **GATE CTL EDGE LVL** so that EDGE is underlined.)
Gate polarity	POS (Press **EDGE POL POS NEG** so that POS is underlined.)

Oscilloscope: Agilent 54503A or equivalent with 3 or more input channels

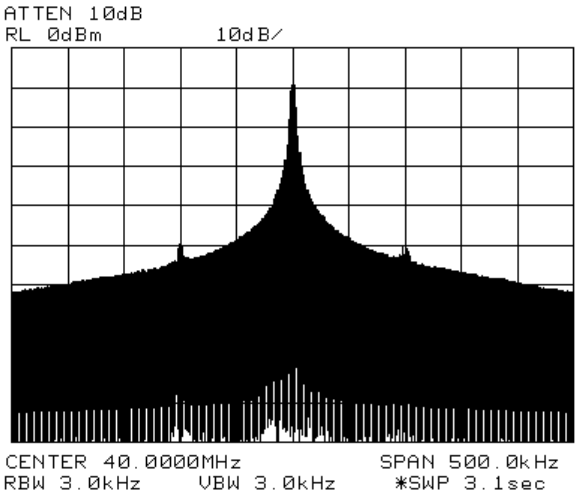
Instrument Connections

Timebase	1 ms/div
Display	Normal
Number of screens	4
Persistence	Minimum
Channel 1	ON, 4 V/div, OFFSET = 2 V, DC coupled, 1 M Ω input, connect to external trigger signal. Adjust channel 1 settings as necessary.
Channel 2	ON, 400 mV/div, OFFSET = 0 V, DC coupled, 50 Ω input, connect to the pulsed-RF signal. Adjust channel 2 settings as necessary.
Channel 3	ON, 4 V/div, OFFSET = 2 V, DC coupled, 1 M Ω input, connect to the BLKG/GATE OUTPUT connector on the spectrum analyzer. Adjust channel 3 settings as needed when gate is active.
Channel 4	OFF
Trigger	TRIG'D, channel 1, level = 3.5 V, or as needed
System control	running

Measurement Results

Without time-gating, the signals appear as shown in Figure 2-70.

Figure 2-70 Frequency Spectrum of Signal without Gating



To see the effect of time-gating:

1. Press **SWEEP**.
2. Press **GATE ON OFF** so that ON is underlined.
3. Check the oscilloscope display and ensure that the gate is positioned under the pulse. The gate should be set to be on around the third quarter of the pulse. If necessary, adjust gate length and gate delay. See Figure 2-71 and Figure 2-72 for displays of the oscilloscope display and spectrum analyzer display when the gate is positioned correctly.

Figure 2-71 Oscilloscope Display

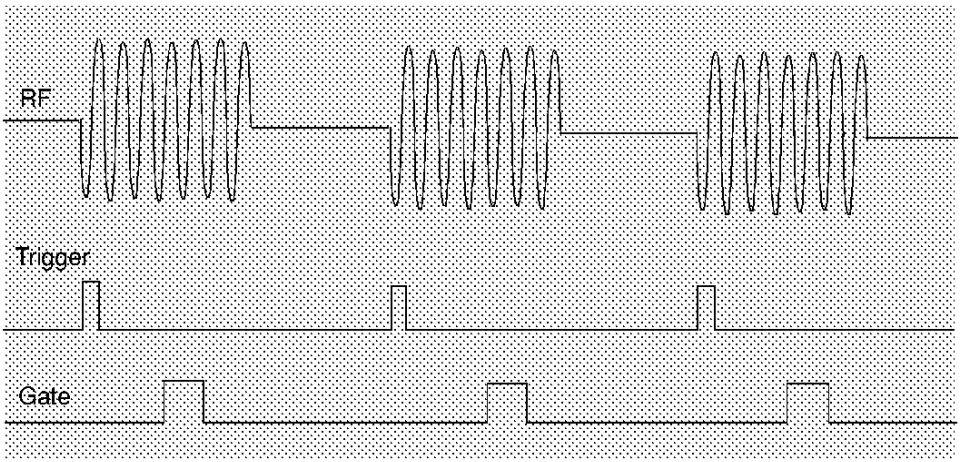
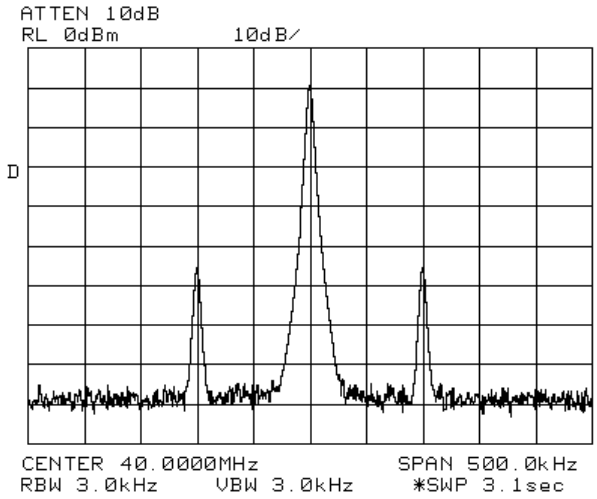


Figure 2-72 Spectrum Analyzer Display



Notice that the gated spectrum is much cleaner than the ungated spectrum. The spectrum you see is the same as would be seen if the signal were on continually. To prove this, turn off the pulse modulation in the signal generator by pressing **SHIFT PULSE OFF**; the spectrum does not change. In both cases, you can see the two low-level modulation sidebands caused by the narrow-band FM. Without gating, these sidebands had been obscured by the pulse spectrum.

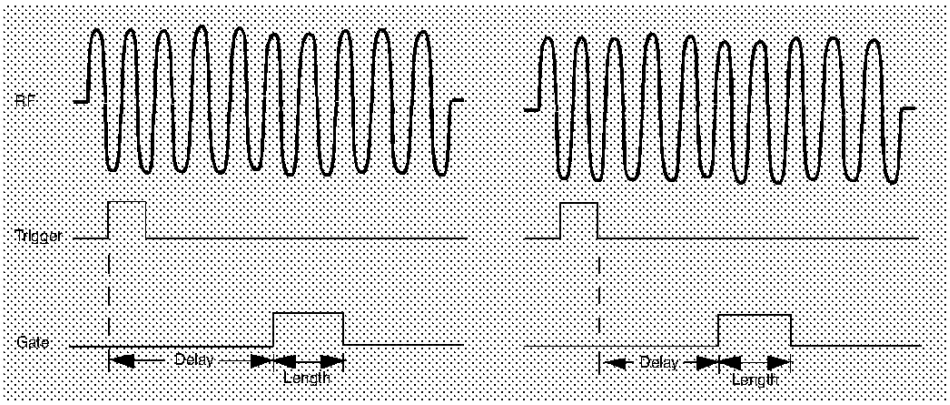
Using the Edge Mode and the Level Mode for Triggering

Depending on the trigger signal that you are working with, you can trigger the gate in one of two separate modes: edge or level. This gate-trigger function is separate from the normal external trigger capability of the spectrum analyzer, which initiates a sweep of a measurement trace based on an external TTL signal.

Edge Mode

Edge mode lets you position the gate relative to either the rising or falling edge of a TTL trigger signal. To trigger on the rising edge, press **SWEEP**, **GATED VIDEO**, **GATE CTL LVL EDGE** so that EDGE is underlined, **EDGE POL POS NEG** so that POS is underlined. With the equipment set up as in the previous example, the oscilloscope screen should appear as shown in Figure 2-73. By activating **EDGE POL POS NEG** so that NEG is underlined and decreasing the gate delay, the oscilloscope should appear as shown in Figure 2-73, where the falling edge initiates the gate delay.

Figure 2-73 Using Positive or Negative Triggering



Level Mode

In level gate-control mode, an external trigger signal opens and closes the gate directly, without any programmed gate delay or gate length. Either the TTL high level or TTL low level opens the gate, depending on the setting of **LVL POL POS NEG**. Therefore, the gate delay and gate length control functions are not active. Level mode is useful when you trigger signal occurs at exactly the same time as does the portion of the signal you want to measure.

When using level or edge mode, you must set the sweep time, resolution bandwidth, and video bandwidth as described in “Summary of Time-Gated Measurement Procedure”.

Stepping through a Time-Gated Measurement

The previous example showed you how to use time-gating to measure a very specific signal. But most signals requiring time-gating are fairly complex, so some extra steps are required when performing measurements. Once you understand the basic steps of time-gated measurements and the reasons for taking these steps, you will be able to set up your instruments using just the summary of "rules" or the recommended control setting tables presented at the end of this example.

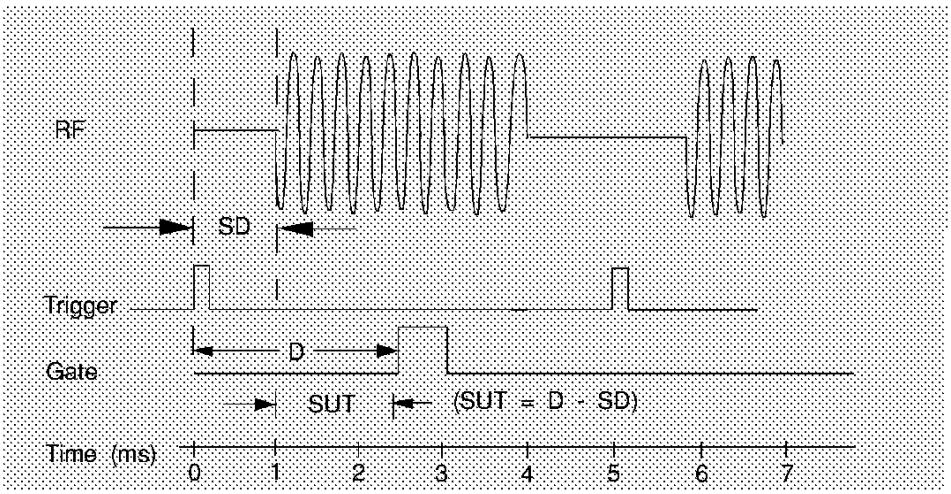
To make a time-gated measurement:

1. Determine how your signal under test appears in the time domain and how it is synchronized to the trigger signal.

   You need to do this to position the time gate by setting the delay relative to the trigger signal. To set the delay, you need to know the timing relationship between the trigger and the signal under test. Unless you already have a good idea of how the two signals look in the time domain, you will want to examine the signals with an oscilloscope to determine the following parameters:

   - Trigger type (positive or negative edge of a TTL signal).
   - Pulse repetition interval (PRI), which is the length of time between trigger events.
   - Pulse width, or τ. If your signal is not pulsed as in this example, τ could be as large as the PRI.
   - Signal delay (SD), which is the length of time occurring between the trigger event and when the signal is present and stable. If your trigger occurs at the same time as the signal, signal delay will be zero.

Figure 2-74 Time-domain Parameters



In Figure 2-75, the parameters are:

- PRI is 5 ms long.
- Pulse width (τ) is 3 ms long.
- If EDGE POL POS NEG is set to POS, the signal delay is 1 ms long. (If EDGE POL POS NEG is set to NEG, the signal delay is 0.8 ms long.)
- Gate delay is 2.5 ms long.
- Setup time is 1.5 ms long.

2. Set analyzer sweep time greater than 601 times PRI (pulse repetition interval), or longer if MEAS UNCAL appears on the screen.

   To ensure that the gate is on at least once during each of the 601 digital trace points on the spectrum analyzer, you may need to increase the sweep time of the analyzer. In Figure 2-74, the PRI is 5 ms, so you should set the sweep time to at least 601 times 5 ms, or 3005 ms (3.1 s). Because the next-higher available sweep time setting is 3.1 s, the sweep time should be set to 3.1 s in this example. If the sweep time is too fast, some trace points may show values of zero or other incorrectly low readings. If the signal has an intermittent or variable repetition interval, use the longest PRI for calculating sweep time. If the trace seems incomplete or erratic, try a longer sweep time. You should leave the **SWEEP AUTO MAN** set to MAN, so that the sweep time that you have selected will be retained.

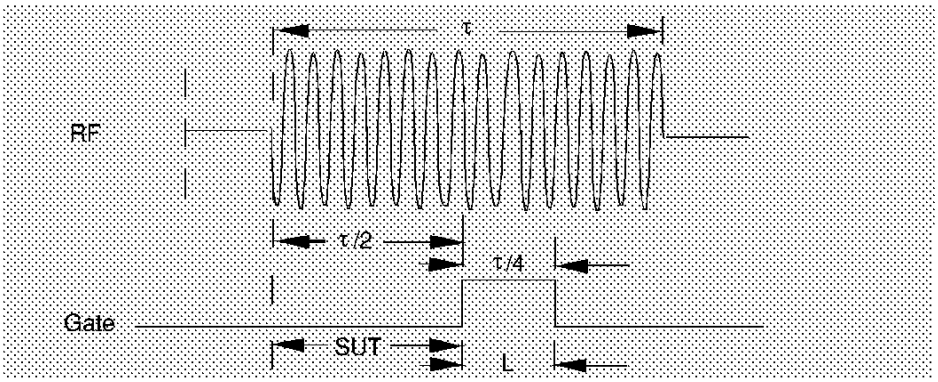
3. Locate the signal under test on the display of the spectrum analyzer. Set **CENTER FREQ** and **SPAN** so that you can view the signal characteristics that you are interested in measuring. Although the analyzer is not yet configured for correct gated measurements, you will want to determine the approximate frequency and span in which to display the signal of interest. If the signal is erratic or intermittent, you may want to press **TRACE**, **MAX HOLD A** to determine the frequency of peak energy.

   Set SPAN narrow enough to show the signal characteristics that you want to measure. For example, if you wanted to look for spurious signals within a 200 kHz frequency range, you might set the frequency span to just over 200 kHz, or if you just wanted to measure peak amplitude during the gate, you could leave the span wider.

4. Turn on the gate pressing **GATE ON OFF** so that ON is underlined. Adjust EDGE POL POS NEG, GATE DLY, and GATE LEN as necessary. Determine the setup time and signal delay for time-gating.

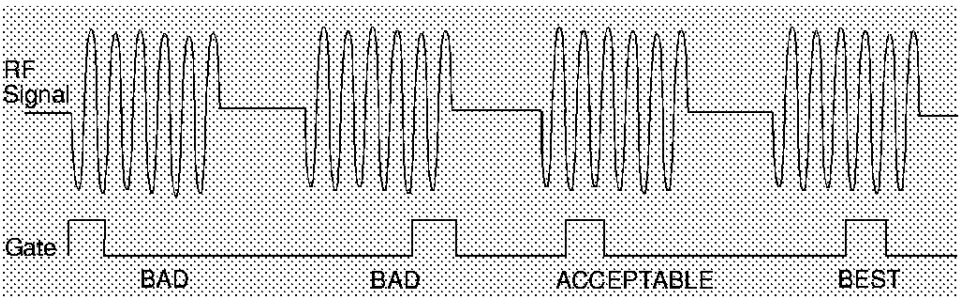
   Generally, you should position the gate over a part of the signal that is stable, not over a pulse edge or other transition that might disturb the spectrum. Starting the gate at the center of the pulse gives a setup time of about half the pulse width. Setup time describes the length of time during which that signal is present and stable before the gate comes on. Generally, you should maximize the setup time (SUT). Signal delay (SD) is the delay inherent in the signal; that is, SD is the length of time after the trigger, but before the signal of interest occurs and becomes stable. If the trigger occurs simultaneously with the signal of interest, SD is equal to zero, and SUT is equal to the gate delay. Otherwise, SUT is equal to the gate delay minus SD. See Figure 2-75.

Figure 2-75 Positioning the Gate



You have flexibility in positioning the gate, but some positions offer a wider choice of resolution bandwidths. A good rule of thumb is to start the gate in the middle of the pulse and have it remain on for one-fourth the pulse duration. Doing so provides a reasonable compromise between setup time and gate length, but it is only a starting point—you can actually position the gate almost anywhere you wish.

Figure 2-76 Best Position for Gate



As a general rule, you will obtain the best measurement results if you position the gate relatively late within the signal of interest, but without extending the gate over the trailing pulse edge or signal transition. Doing so maximizes setup time and provides the resolution bandwidth filters of the spectrum analyzer the most time to settle before a gated measurement is made. "Relatively late," in this case, means allowing a setup time of greater than 2 divided by the resolution bandwidth.

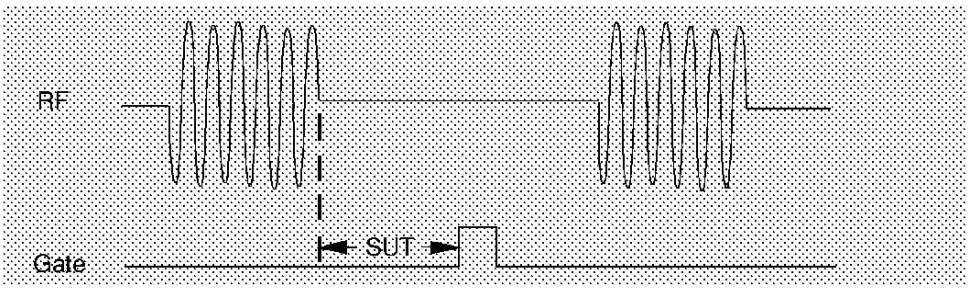
As an example, if you want to use a 1 kHz resolution bandwidth for measurements, you will need to allow a setup time of at least 2 ms. Or, if you want to turn on the gate as early as possible, you could use the widest specified resolution bandwidth in the analyzer, which is 2 MHz. Minimum setup time (2 divided by 2 MHz), equals 1.0 µs, so you could have a setup time as short as 1 µs, although the minimum gate delay that can be set is 3 µs.

You can set the gate length to any value you desire that lets you select the proper portion of the signal of interest to measure. Choosing a narrower gate length forces you to select a wider video bandwidth, as will be discussed in step 5.

Note that the signal need not be an RF pulse. It could be simply a particular period of modulation in a signal that is continuously operating at full power, or it could even be during the off time between pulses. Depending on your specific application, adjust the gate position to allow for progressively longer setup times (ensuring that the gate is not left on over another signal change such as a pulse edge or transient), and select the gate delay and length that offer the best signal-to-noise ratio on the display.

If you were measuring the spectrum occurring between pulses, you should use the same (or longer) setup time after the pulse goes away, but before the gate goes on. This lets the resolution-bandwidth filters fully discharge the large pulse before the measurement is made on the low-level interpulse signal.

Figure 2-77 Setup Time for Interpulse Measurement

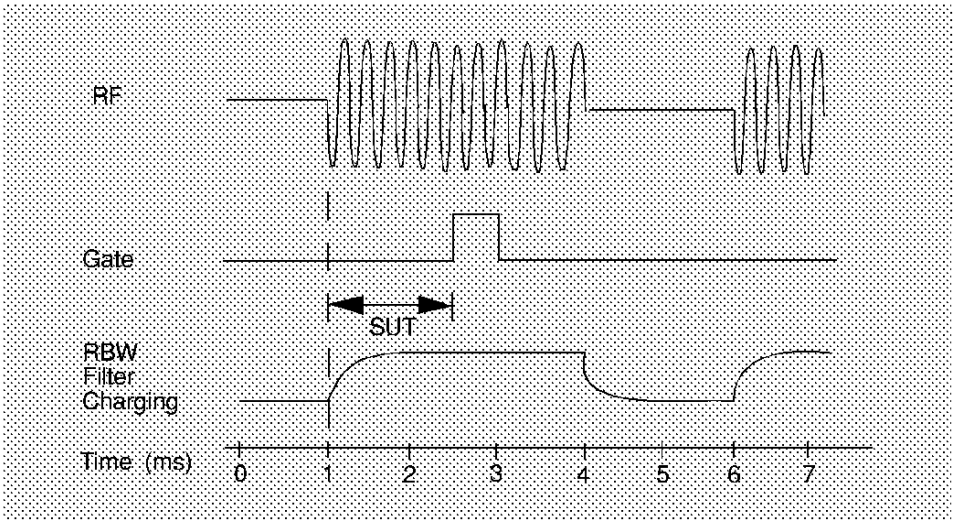


5. Adjust the resolution bandwidth and video bandwidth. Adjust the resolution bandwidth to greater than two divided by the setup time. If you want to use a narrower bandwidth, you can increase the setup time. See the previous step for more information. Adjust the video bandwidth to greater than one divided by the gate length.

   Resolution Bandwidth

   The resolution bandwidth you can choose is determined by the gate position, so you can trade off longer setup times for narrower resolution bandwidths. This trade-off is due to the time required for the resolution-bandwidth filters to fully charge before the gate comes on. Setup time, as mentioned, is the length of time that the signal is present and stable before the gate comes on.

Figure 2-78 Resolution Bandwidth Filter Charge-Up Effects



Because the resolution-bandwidth filters are band-limited devices, they require a finite amount of time to react to changing conditions. Specifically, the filters take time to charge fully after the analyzer is exposed to a pulsed signal. Although the charge-up is asymptotic, you can consider it to be complete after the length of time defined by two divided by resolution bandwidth, where the resolution bandwidth is the –3 dB resolution bandwidth being used.

Because setup time should be greater than filter charge times, be sure that:

$$SUT > \frac{2}{RBW}$$

or

$$RBW > \frac{2}{SUT}$$

where, in this example, RBW is greater than 2/1.5 ms; that is, RBW is greater than 1333 Hz. The resolution bandwidth should be set to the next larger value, 3 kHz.

Video Bandwidth

Just as the resolution-bandwidth filter needs a finite amount of time to charge and discharge, so does the video filter, which is a post-detection filter used mainly to smooth the measurement trace. Regardless of the length of the real RF pulse, the video filter sees a pulse no longer than the gate length, and the filter will spend part of that time charging up. To ensure that a true peak value is obtained before the gate goes off, the video filter must have a charge time of less than the gate length. For this purpose, you can approximate the charge time of the video filter as 1/VBW, where VBW is the –3 dB bandwidth of the video filter. Therefore, you will want to be sure that:

$$\text{gate length} \geq \frac{1}{VBW}$$

or

$$VBW > \frac{1}{\text{gate length}}$$

For example, if you use a 1 kHz video bandwidth for noise smoothing, you need a gate length greater than 1 ms. Alternatively, if you use a gate as narrow as 1 µs, you should use a video filter of 1 MHz.

Reducing the video-bandwidth filter too fast causes the signal to appear to drop in amplitude on the screen.

If you are in doubt about the proper video bandwidth to choose, set it to 1 MHz and reduce it gradually until the detected signal level drops slightly. Then reset it to the value it was at just before the signal dropped.

Leave both RBW and VBW in MANUAL mode, not AUTO; this is important so that they will not change if SPAN is changed. Press the BW front-panel key, then press RES BW or VID BW once or twice until MAN is underlined. The setting readout on the bottom line of the analyzer screen should show a "" sign next to the function names (for example, RES BW, VBW, and SWP), indicating that they have been set manually.

6. Adjust span as necessary, and perform your measurement.

   Now your spectrum analyzer is set up to perform accurate measurements. Freeze the trace data by either activating single sweep (press **SGL SWP**), or by placing you active trace in view mode (press **TRACE**, **VIEW A**). Use the markers to measure the signal parameters you chose in step 1. If necessary, adjust SPAN, but do not decrease resolution bandwidth, video bandwidth, or sweeptime. IF MEAS UNCAL is displayed after increasing span, you must increase the sweeptime further. Most normal trace functions are still available with time-gating. Most marker functions are also available, except marker noise.

Summary of Time-Gated Measurement Procedure

The following is a description of the steps required to perform a time-gated spectrum measurement.

1. Determine how your signal under test appears in the time domain and how it is synchronized to the trigger signal. You need to determine the following:
   - Trigger type (positive or negative)
   - Pulse repetition interval (PRI)
   - Pulse width (τ)
   - Signal delay (SD)
   - The parameters of the signal that you want to measurement and the resolution bandwidth required to measure those parameters.
2. Set the analyzer sweep time to greater than 601 times PRI (pulse repetition interval), or longer if MEAS UNCAL appears on the screen. Leave sweep time in the manual mode (not autocoupled).
3. Locate the signal under test on the display of the spectrum analyzer. Set the center frequency and span so that you can view the signal characteristics in which you are interested.
4. Activate the gate (turn the gate on), and position the gate over the part of the signal that you want to measure by adjusting gate control, gate delay, gate length, and sweep delay. Determine the setup time (SUT). (You will need to use an oscilloscope to view and position the gate.) Do not read the measurement results yet; you must adjust the resolution bandwidth for the gate settings.
5. Adjust the spectrum analyzer settings:

   Resolution bandwidth: Adjust to greater than 2 divided by the setup time. If you want to use a narrower bandwidth, you can increase the setup time. See the previous step for more information.

   Video bandwidth: Adjust to greater than 1 divided by the gate length. Leave both resolution bandwidth and video bandwidth in manual mode, not autocoupled.
6. Adjust the span and reference level as necessary, and perform your measurement.

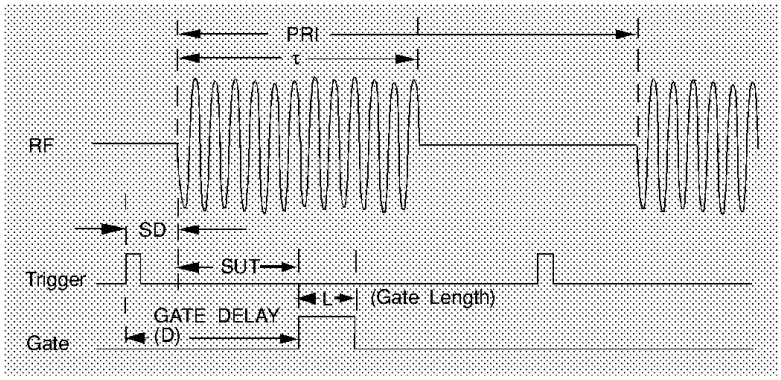
"Rules" for Making a Time-Gated Spectrum Measurement

This section summarizes the rules described in the previous sections.

Table 2-6 Determining Spectrum Analyzer Settings for Viewing a Pulsed RF Signal

Spectrum Analyzer Function	Spectrum Analyzer Setting	Comments
Sweep Time	Set the sweep time to be 601 times greater than the pulse repetition interval (PRI): Sweep time > 601 × PRI	Because the gate must be on at least once per trace point, the sweep time has to be set to the pulse repetition interval times for every point of the trace. (Each trace has 601 points.)
Gate Delay	The gate delay is equal to the signal delay plus half of the pulse width: Gate Delay = Signal Delay + $\tau/2$	The gate delay must be set so that the gating captures the pulse. If the gate delay is too short or too long, the gating can miss the pulse or include resolution bandwidth transient responses.
Gate Length	The gate length is equal to one-fourth the pulse width: Gate Length = $\tau/4$	If the gate length is too long, the signal display can include transients caused by the spectrum analyzer filters.
Video Bandwidth	Set the video bandwidth to a value greater than 1 divided by the gate length: Video Bandwidth >1/gate length	The video bandwidth must be wide enough so that the rise times of the video bandwidth do not attenuate the signal. The maximum video bandwidth for time-gate measurements is 1 MHz.
Resolution Bandwidth	Set the resolution bandwidth to a value greater than 2 divided by the gate delay minus the signal delay: Resolution Bandwidth > 2/(Gate Delay - Signal Delay)	The resolution bandwidth must be wide enough so that the charging time for the resolution bandwidth filters is less than the pulse width of the signal.

Figure 2-79 Gate Positioning Parameters



Most control settings are determined by two key parameters of the signal under test: the pulse repetition interval (PRI) and the pulse width (τ). If you know these parameters, you can begin by picking some standard settings. Table and Table summarize the parameters for a signal whose trigger event occurs at the same time as the beginning of the pulse (for example, SD is 0). If your signal has a non-zero delay, just add it to the recommended gate delay.

Table 2-7 Suggested Initial Settings for Known Pulse Width (τ) and Zero Signal Delay

Pulse width (τ)	Gate Delay (SD + τ/2)	Resolution Bandwidth (2>SUT)	Gate Length (τ/4)	Video Bandwidth (1/gate length)
4 µs	3 µs	1 MHz	1 µs	1 MHz
10 µs	5 µs	1 MHz	3 µs	1 MHz
50 µs	25 µs	100 kHz	13 µs	100 kHz
63.5 µs	32 µs	100 kHz	16 µs	100 kHz
100 µs	50 µs	100 kHz	25 µs	100 kHz
500 µs	250 µs	10 kHz	125 µs	10 kHz
1 ms	500 µs	10 kHz	250 µs	10 kHz
5 ms	2.5 ms	1 kHz	1.25 ms	1 kHz
10 ms	5 ms	1 kHz	2.5 ms	1 kHz
16.6 ms	8.3 ms	1 kHz	4 ms	1 kHz
33 ms	16.5 ms	1 kHz	8 ms	1 kHz
50 ms	25 ms	1 kHz	13 ms	1 kHz
100 ms	50 ms	1 kHz	25 ms	1 kHz
≥130 ms	65 ms	1 kHz	33 ms	1 kHz
When using the short gate delays, you may notice the gate delay time jitter by ±1 µs. This jitter is due to the spectrum analyzer 1 MHz gate clock, and it does not indicate a problem.				

Table 2-8 Suggested Sweep Times for a Known Pulse Repetition Interval (PRI) or Pulse Repetition Frequency (PRF)

Pulse Repetition Interval (PRI)	Pulse Repetition Frequency (PRF)	Sweep Time (minimum)
≤50 µs	≥20 kHz	50 ms
100 µs	10 kHz	61 ms
500 µs	2 kHz	301 ms
1 ms	1 kHz	601 ms
5 ms	200 Hz	3.01 s
10 ms	100 Hz	6.01 s
16.7 ms	60 Hz	20 s
33.3 ms	30 Hz	30 s
50 ms	20 Hz	40 s
100 ms	10 Hz	60 s
>170 ms	Use the MAX HOLD trace function and take several measurement sweeps.	

Table 2-9 If You Have a Problem with the Time-Gated Measurement

Symptom	Possible Cause	Suggested Solution
Erratic analyzer trace with random vertical lines or dropouts extending below the peak trace amplitude.	Sweep rate too fast to ensure at least one gate occurrence per trace point.	Increase sweep time until dropouts disappear.
Erratic analyzer trace with dropouts that are not removed by increasing analyzer sweep time; oscilloscope view of gate output signal jumps erratically in time domain.	GATE DLY may be greater than trigger repetition interval.	Reduce GATE DLY until it is less than trigger interval.
Gate does not trigger.	Gate trigger voltage may be too low, or gate may not be activated.	Ensure gate trigger reaches 5.0 volts. Check to see if other connections to trigger signal may be reducing voltage. If using oscilloscope, check that all inputs are high impedance, not 50 Ω
Display spectrum does not change when the gate is turned on.	Insufficient setup time.	Increase setup time for the current resolution bandwidth, or increase resolution bandwidth.

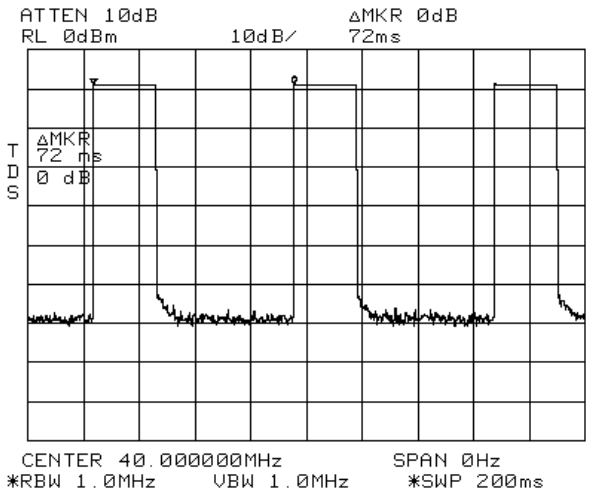
Table 2-9 If You Have a Problem with the Time-Gated Measurement

Symptom	Possible Cause	Suggested Solution
Displayed spectrum too low in amplitude.	Resolution bandwidth or video bandwidth filters not charging fully.	Widen resolution bandwidth or video bandwidth, or both.
Display changed drastically during operation.	Gate functions have been turned off by changing detector path. For example, activating the marker noise function (MKRNOISE ON OFF) changes the detector path.	Do not change the detector path during the measurement.

Example 12: Making Time-Domain Measurements with Sweep Delay

Although spectrum analyzers are primarily frequency-domain devices, they can also show signals in the time domain. The simplest way to do this is to set the SPAN of the analyzer to 0 Hz so that it becomes a fixed-tuned receiver. The display of the analyzer then shows received power versus time, which lets you determine the shape of the envelope of an RF or microwave signal, as shown in Figure 2-80. The zero-span display represents the power detected at the center frequency of the analyzer, within the bandwidth of the resolution-bandwidth filter.

Figure 2-80 Pulsed-RF Signal in Time Domain

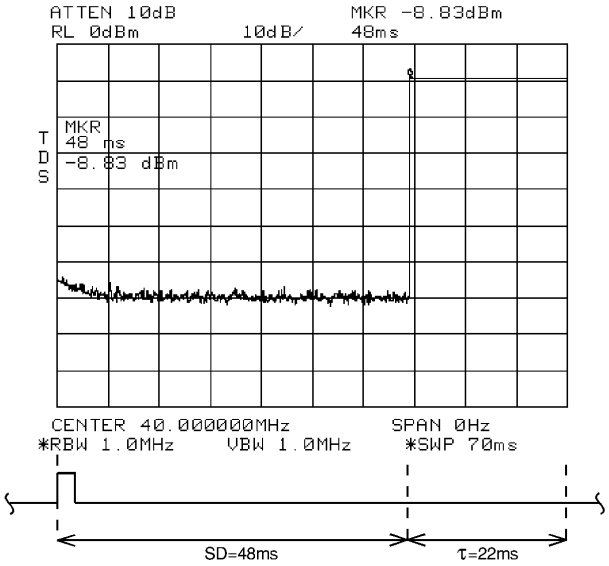


In both the time and frequency domains, the measurement sweep is initiated following a valid sweep-trigger condition. The sweep trigger can be set by pressing **TRIG**, and the selecting between the following choices:

FREE RUN	Sweep initiated as soon as the analyzer is ready to start another sweep.
VIDEO	Sweep initiated when the signal reaches a variable level.
LINE	Sweep initiated by the AC power cycle.
EXTERNAL	Sweep initiated by an external TTL signal.

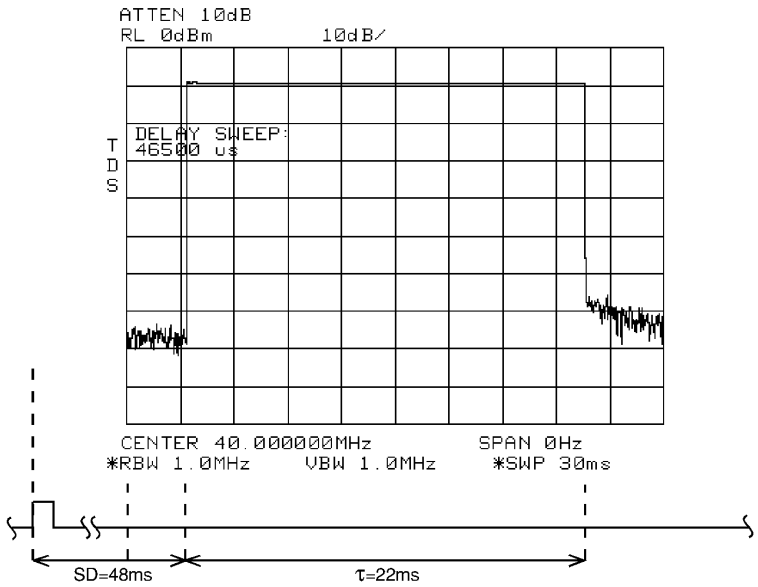
Unless the delay sweep function is used, the sweep starts immediately after a valid trigger and lasts as long as the sweep time setting indicates, and the only adjustment that can be made is to increase or decrease the length of the sweep. A spectrum analyzer can show a zero-span display, but if the spectrum analyzer is not using a sweep delay, the amount of detail that can be seen for events that do not occur immediately after the trigger event is limited. See Figure 2-81 for an example of a zero-span display of an RF pulse that occurs 48 ms after the external sweep trigger signal.

Figure 2-81 Display of Zero-Span without Sweep Delay



The sweep delay functions **DLY SWP [ ]** and **DLY SWP ON OFF** allow you to delay the start of a measurement sweep by up to 65 ms after a trigger signal is received. This lets you zoom in on the event of interest, as shown in Figure 2-82.

Figure 2-82 Display of Zero-Span with Sweep Delay



The following procedure shows how you can use the sweep delay functions in zero span.

1. Set the center frequency of the spectrum analyzer to the signal of interest.
2. Set the resolution bandwidth and video bandwidth wider than the spectral width of the signal of interest. If possible, choose a value wide enough so that the resolution bandwidth filter is fairly flat over the width of you signal. (The resolution bandwidth setting indicates the –3 dB width of the filter.)
3. Set the frequency span to 0 Hz.
4. Connect the TTL trigger signal from the device under test to the BNC connector labeled EXT/GATE TRIG INPUT.
5. Press **TRIG**, and then press **EXTERNAL**.
6. Press **SWEEP**.
7. Press **DLY SWP [ ]**, and then use the data keys or knob to enter the sweep delay.
8. Press **DLY SWP ON OFF** so that ON is underlined.
9. Set the sweep time so that the duration of the signal is less than the sweep time.

The sweep delay functions allow you to see the full pulse width. See Figure 2-82. The sweep delay functions can be used for non-zero spans, as well as time-gated measurements. When the sweep delay is used during a time-gated measurement, the sweep delay and the gate delay are not summed together. For example, if the pulse occurred 60 ms after the trigger signal, you would set the sweep delay to 58 ms and the gate delay to 60 ms.

Example 13: Making Pulsed RF Measurements

What Is Pulsed RF?

A pulsed RF signal is a train of RF pulses with a constant repetition rate, constant pulse width and shape, and constant amplitude. Several procedures for measuring characteristics of a pulsed-RF signal are included in this example. The procedures explain how to measure center frequency, pulse width, and pulse repetition frequency. Peak pulse power and desensitization are also discussed.

Spectrum Analyzer Functions Used

The resolution bandwidth used to measure a pulsed RF signal greatly affects the measurement. The relationship between the resolution bandwidth and the pulse repetition frequency must be understood. When the resolution bandwidth is narrow compared to the pulse repetition frequency, the display will show the individual frequency components making up the pulsed RF signal. This is called the narrow band mode. When the resolution bandwidth is wide compared to the pulse repetition frequency, it is the broadband mode. The envelope of the spectrum can be seen traced out by pulse lines which are separated by the pulse repetition frequency.

Stepping Through Pulsed RF Measurements

Broadband Mode

1. Connect a signal source to the spectrum analyzer INPUT 50 Ω and input a pulse modulated signal.
   a. Set the carrier frequency to 1 GHz.
   b. Set the pulse repetition frequency to 1 kHz.
   c. Set the pulse width to 900 nsec.
2. Press **PRESET** on the spectrum analyzer to start the procedure from a preset state.
3. Pulsed RF measurements are generally made in the broadband mode. To set the spectrum analyzer for pulse-mode measurements, begin by setting the video bandwidth to 3 MHz.
4. Activate the positive peak detector by pressing **TRACE**, **MORE**, **DETECTOR MODES**, and **DETECTOR POS PEAK**.
5. Select the center frequency function, then adjust the span until the center lobe and at least one pair of side lobes appear on the display. See Figure 2-83.

6. Increase the sweep time (that is, the sweep becomes slower) until the display fills in and becomes a solid line (see Figure 2-84). If this line does not fill in, the instrument is not in broadband mode, in which case the following procedures for side lobe ratio, pulse width, and peak pulse power do not apply. For further reference, consult Agilent Technologies Application Note 150-2, entitled "Pulsed RF" (literature number 5954-2705).

Figure 2-83 Main Lobe and Side Lobes

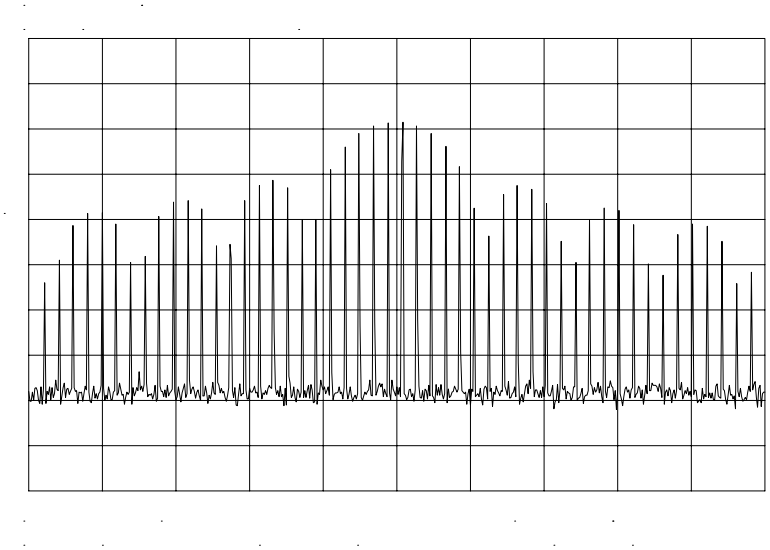
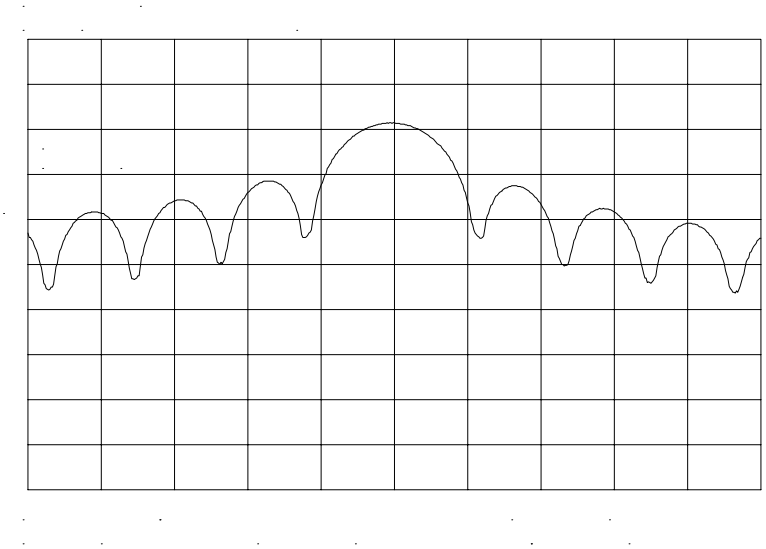


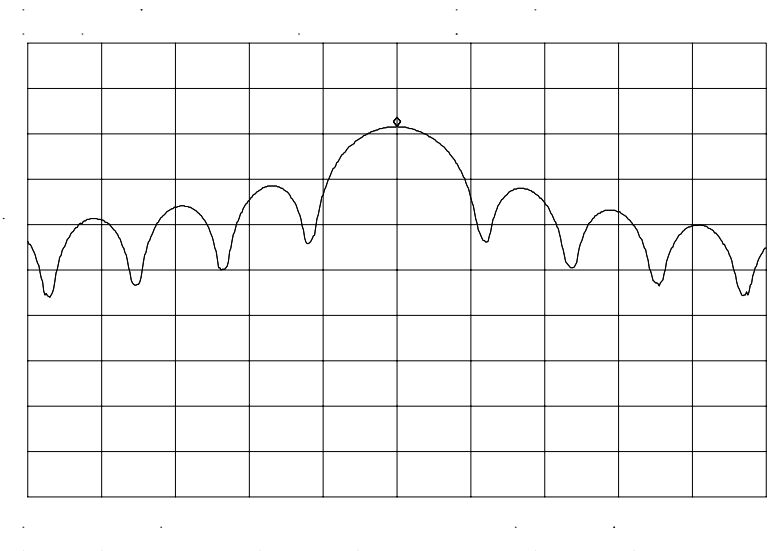
Figure 2-84 Trace Displayed as a Solid Line



Center Frequency, Sidelobe Ratio, and Pulse Width

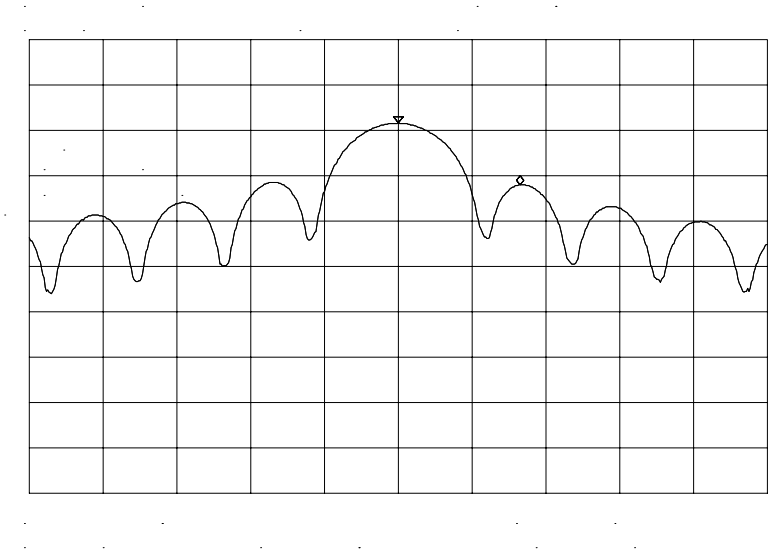
1. For a pulsed RF signal, the center frequency is at the center of the main lobe (see Figure 2-85). To identify this frequency, simply use the spectrum analyzer peak search function. The marker also reads the main lobe amplitude.

Figure 2-85 Center Frequency at Center of Main Lobe



2. To measure the side lobe ratio, with the marker still at the center frequency of the main lobe, press **PEAK SEARCH**, **MARKER DELTA** and **NEXT PEAK**. See Figure 2-86. The difference between the amplitude of the main lobe and the side lobe is the side lobe ratio.

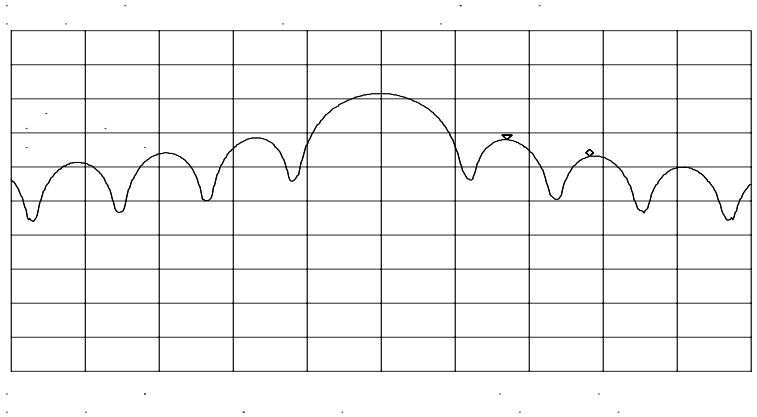
Figure 2-86 Markers Show Sidelobe Ratio



3. The pulse width is also easy to identify. The pulse width is the reciprocal of the frequency difference between two envelope peaks. To determine this difference, continuing from the last procedure, press **MARKER DELTA**, and **NEXT PK RIGHT**; then press **MKR**, and **MARKER 1/DELTA**.

4. The pulse width is equal to the time value displayed in the active function block on the spectrum analyzer screen, as in Figure 2-87. For best pulse-width accuracy, measure the distance between two adjacent lobe nulls by manually adjusting the marker positions. If desired, first reduce the resolution bandwidth for sharper nulls.

Figure 2-87 Markers Show Pulse Width

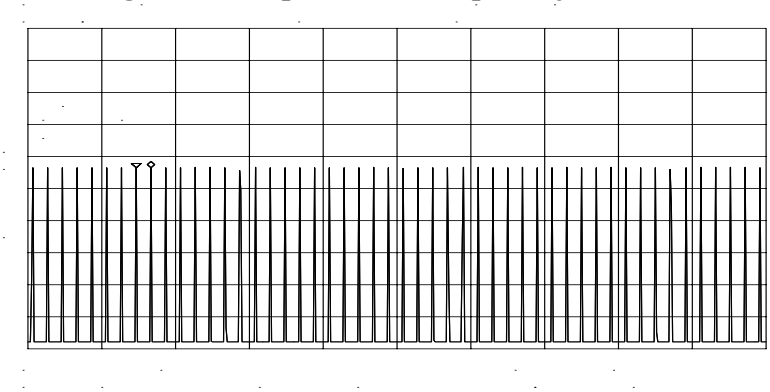


Pulse Repetition Frequency (PRF)

Pulse repetition interval (PRI) is the spacing in time between any two adjacent pulse responses, shown in Figure 2-83. Using the **MARKER 1/DELTA** function, PRI can easily be inverted to read PRF instead.

1. To measure PRI, set the span to 0 Hz and adjust amplitude of the main lobe to the reference level.
2. Set the amplitude scale to linear and readjust the signal so that it is on screen.
3. Decrease the sweep time (that is, the sweep becomes faster) until the display resembles Figure 2-88.
4. Select the single trigger mode by pressing **SGL SWP**.
5. Press **PEAK SEARCH**, **MARKER DELTA**, and **NEXT PK RIGHT** or **NEXT PK LEFT**. The difference displayed between the two markers is equal to the PRI.
6. Press **MKR** and **MARKER 1/DELTA** to display the PRF, as shown in Figure 2-88.

Figure 2-88 Measuring Pulse Repetition Frequency



Peak Pulse Power and Desensitization

Now that you know the main lobe amplitude, the pulse width, and can easily note the spectrum analyzer resolution bandwidth, the peak pulse power can be derived from a relatively simple equation:

$$\text{Peak Pulse Power} = (\text{Mainlobe Amplitude}) - 20\log(T_{eff})(BW_i)$$

where T_{eff} = pulse width, in seconds

BW_i = impulse bandwidth, in Hertz

BW_i = 1.5 × resolution bandwidth used to measure pulse width.

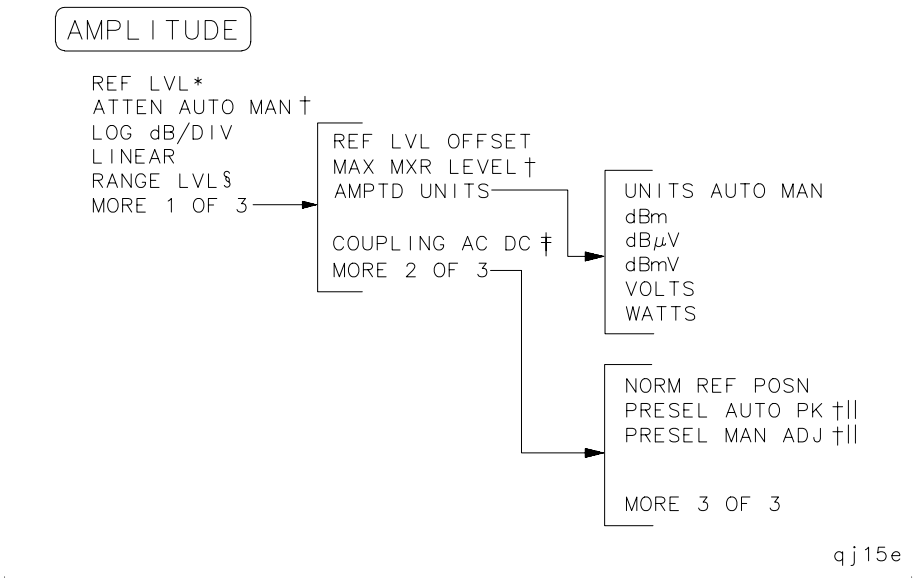
NOTE While measuring the main lobe amplitude, change the spectrum analyzer attenuation and check that the main lobe amplitude does not change. If it changes by more than 1 dB, the analyzer is in compression and the RF attenuation must be increased. For carrier frequencies above 2.75 GHz, be sure to peak the preselector to measure the main lobe amplitude accurately.

The difference between the peak pulse power and the main lobe amplitude is called pulse desensitization. The term "pulse desensitization" can be somewhat misleading, because pulsed signals do not reduce spectrum analyzer sensitivity. Rather, apparent desensitization occurs because the power of a pulsed continuous wave (CW) carrier is distributed over a number of spectral components (that is, the carrier and sidebands). As a result, each spectral component contains only a fraction of the total power. For a complete discussion of pulse desensitization, refer to Application Note 150-2 (literature number 5952-1039) or Appendix A of Application Note 330-1 (literature number 5954-2705).

3 Softkey Menus

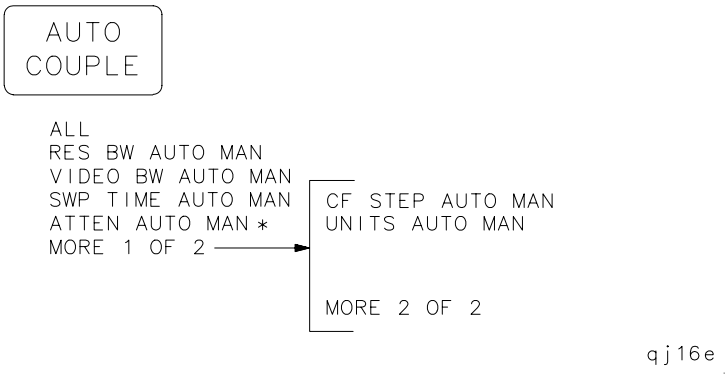
Menu Trees

Figure 3-1 AMPLITUDE Key Menu Tree



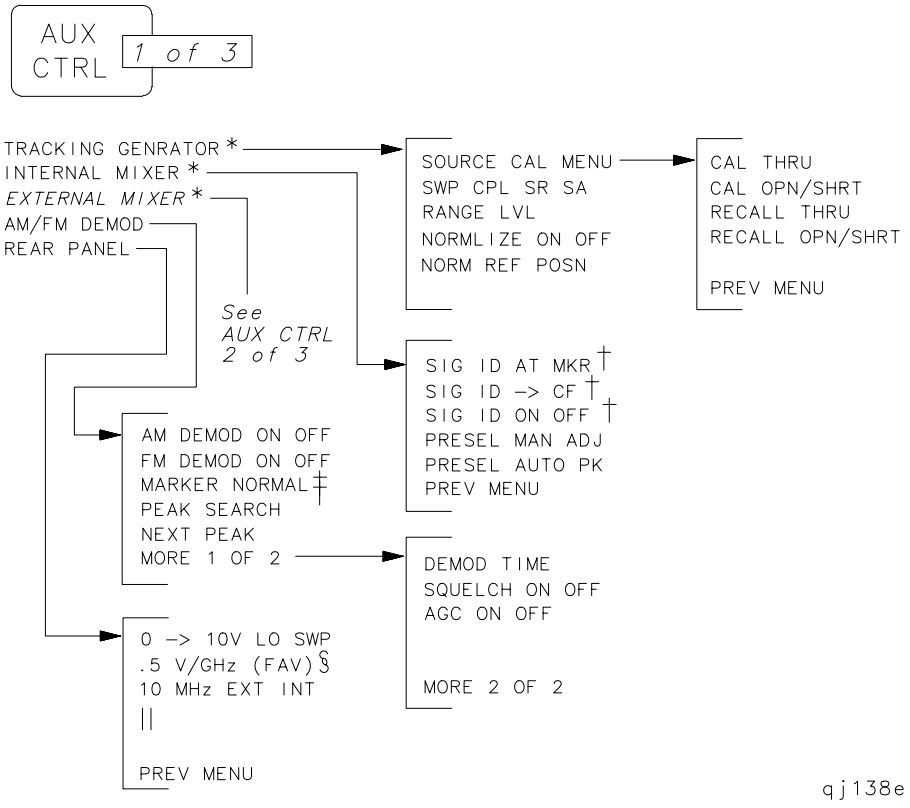
*	Becomes **NORM REF LVL** when **NORMLIZE ON OFF** is set to ON.
†	Available only with internal mixing (when set to external mixing, this key is not available).
‡	Not available for an Agilent 8563E/EC, Agilent 8564E/EC, or Agilent 8565E/EC.
§	Available only when **NORMLIZE ON OFF** is set to ON.
||	Not available for an Agilent 8560E/EC.

Figure 3-2 AUTO COUPLE Menu Tree



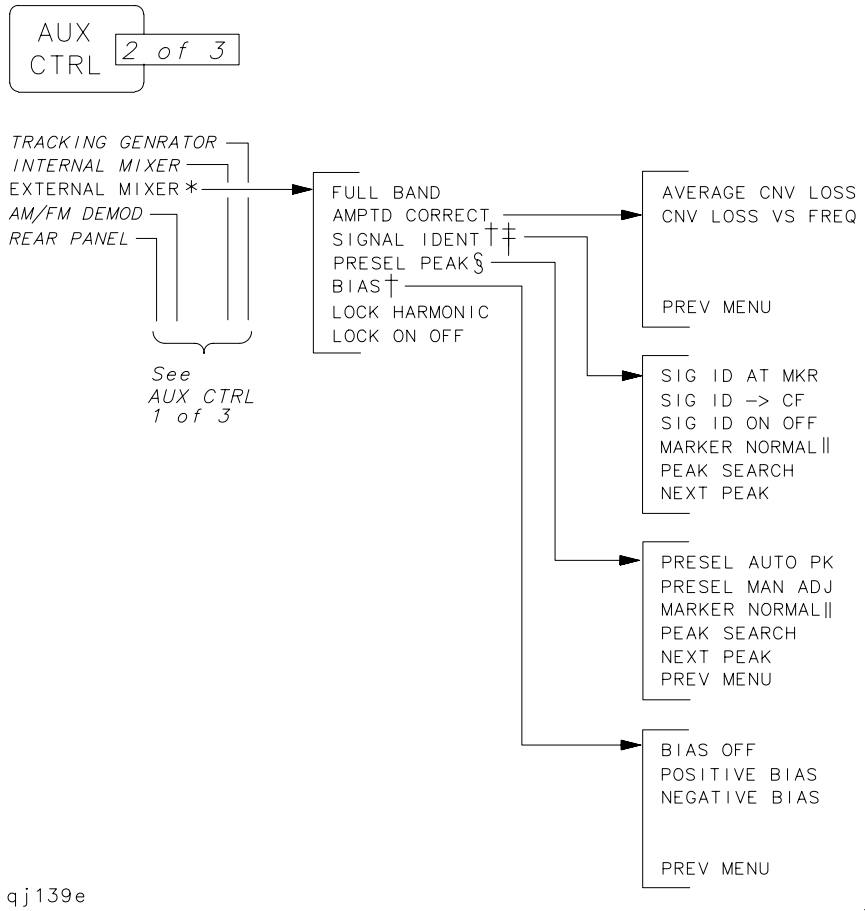
*	Available only with internal mixing.

Figure 3-3 AUX CTRL (1 of 3) Key Menu Tree



*	The TRACKING GENRATOR menu shown here is for spectrum analyzers without Option 002 installed. See AUX CTRL menu 3 of 3 for an 8560E/EC with Option 002 installed. **INTERNAL MIXE**R is not shown for an 8560E/EC with Option 002 installed. For an 8560E/EC without Option 002, only the **INTERNAL MIXER** softkey is available (the softkeys accessed by **INTERNAL MIXER** are not available). **EXTERNAL MIXER** is not shown for an 8560E/EC with Option 002 installed and is non-functional for Option 327.
†	Signal identification functions are only available in non-preselected external mixing mode, with firmware revisions ≤920528, or with Option 008 installed.
‡	This key changes to **MARKER DELTA** if the marker delta function is active.
§	This key changes to **V/GHz .25 .50** for the Agilent 8564E/EC and Agilent 8565E/EC.
‖	This key changes to **.25V/GHz** for the Agilent 8564E/EC and Agilent 8565E/EC.

Figure 3-4 AUX CTRL (2 of 3) Key Menu Tree



*	This key is not shown for an 8560E/EC with Option 002 installed and is non-functional for Option 327.
†	This signal identification function is only available with firmware revisions ≤920528 or with Option 008 installed.
‡	This key is displayed only if unpreselected external mixing is selected (**EXT MXR PRE UNPR** is set to **UNPR**), and is not displayed if external mixing is set to **PRE**.
§	This key is displayed only if preselected external mixing is selected (**EXT MXR PRE UNPR** is set to **PRE**).
‖	This key changes to **MARKER DELTA** if the marker delta function is active.

Figure 3-5 AUX CTRL (3 of 3) Key Menu Tree

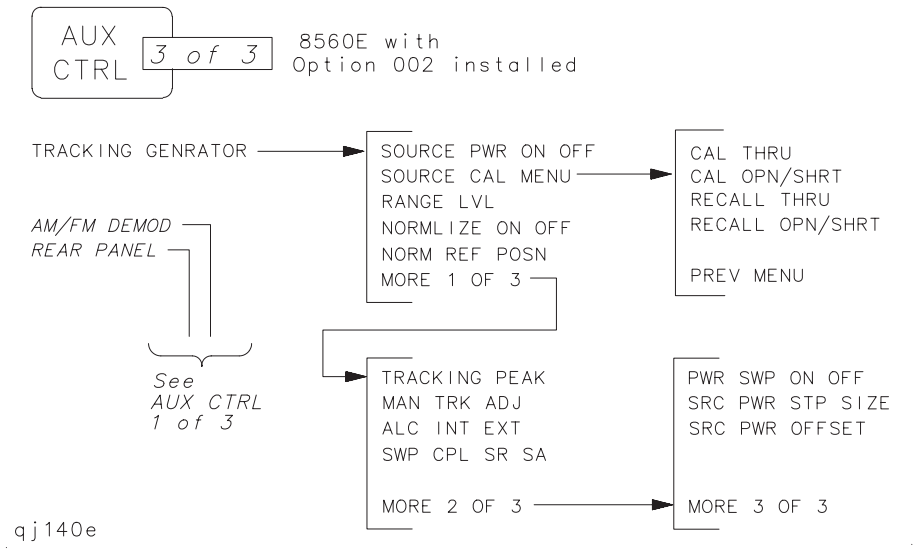
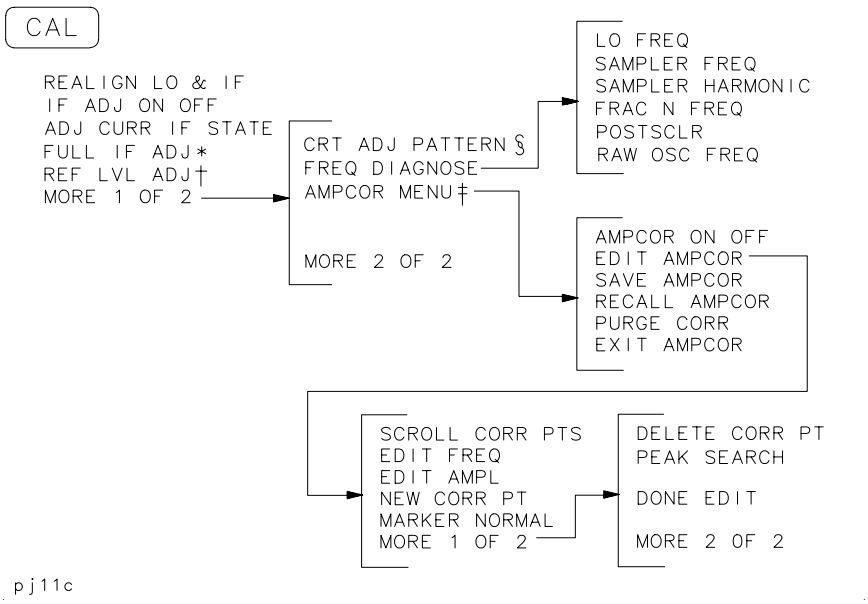


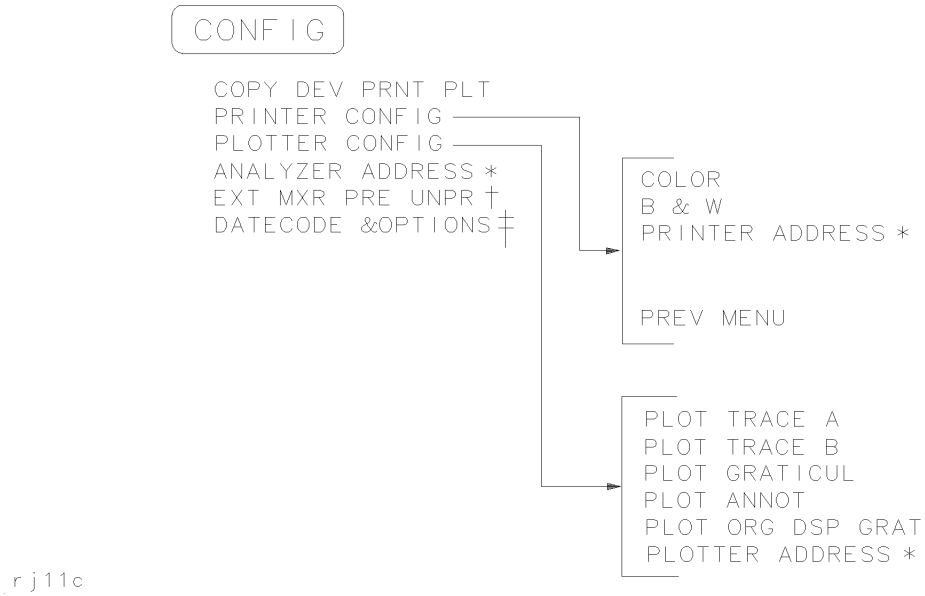
Figure 3-6 BW Key Menu

Figure 3-7 CAL Key Menu Tree



*	Changes to **STOP ADJUST** if **FULL IF ADJ** is pressed.
†	Changes to **STORE REF LVL** if **REF LVL ADJ** is pressed.
‡	These functions are only available with firmware revisions >930809.
§	The **CRT ADJ PATTERN** key activates a pattern on the screen which is used for adjusting the quadrature of the display. This pattern will appear in both E-series and EC-series instruments. However, EC-series instruments do not require adjustment and are not adjustable.

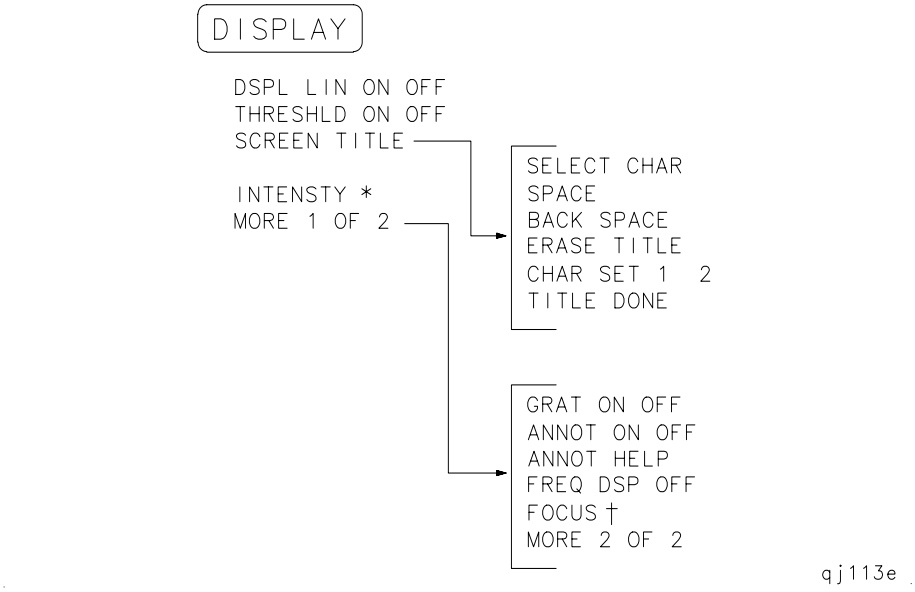
Figure 3-8 CONFIG Key Menu Tree



*	Changes to **STORE HPIB ADR** if pressed.
†	Not available for an 8560E/EC with Option 002 installed in it and non-functional for instruments with Option 327.
‡	Both E-series and EC-series instruments appear as E-series in the instrument display when the DATECODE&OPTIONS key is pressed. EC-series instruments also appear as Option 007 instruments (Option 007 is the FADC option, which is standard in EC-series instruments).

Figure 3-9 COPY Key

Figure 3-10 DISPLAY Key Menu Tree



*	Changes to **STORE INTENSTY** if **INTENSTY** is pressed. E-series instruments are adjustable. However, EC-series instruments do not require adjustment and are not adjustable.
†	Changes to **STORE FOCUS** if **FOCUS** is pressed. E-Series instruments are adjustable. However, EC-series instruments do not require adjustment and are not adjustable

Figure 3-11 FREQ COUNT Key Menu

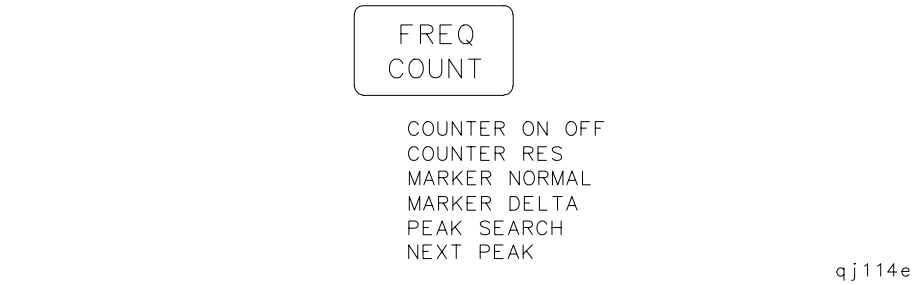
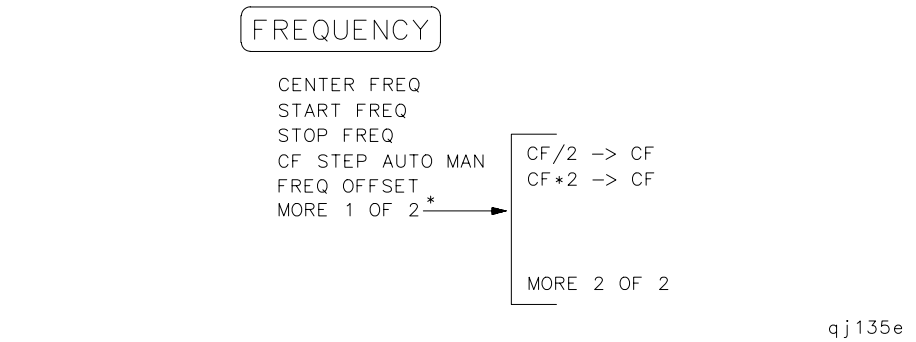


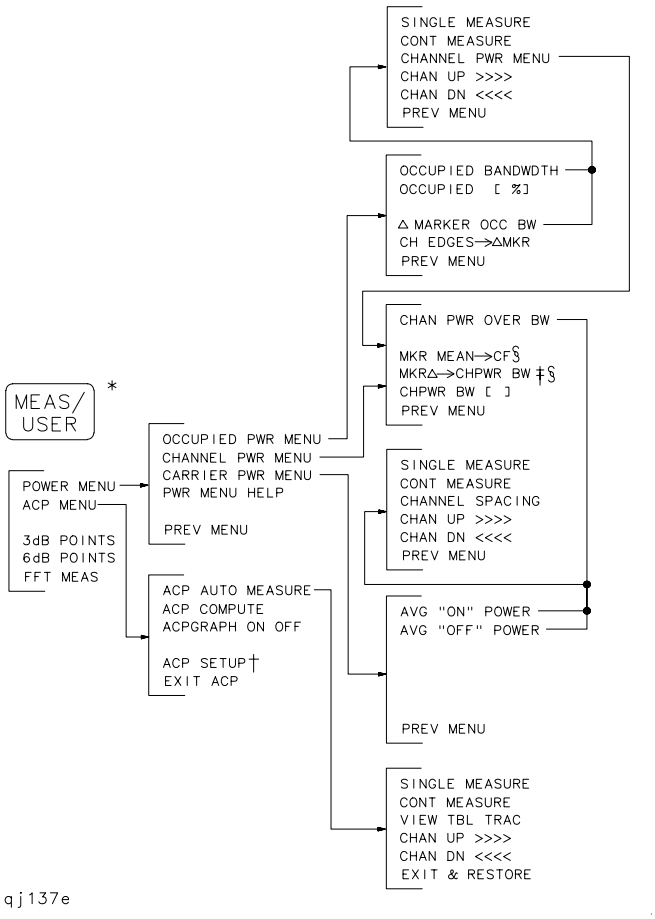
Figure 3-12 FREQUENCY Key Menu Tree



*	**MORE 1 OF 2** is displayed under **FREQUENCY** only on spectrum analyzers with firmware revision 960401 and later.

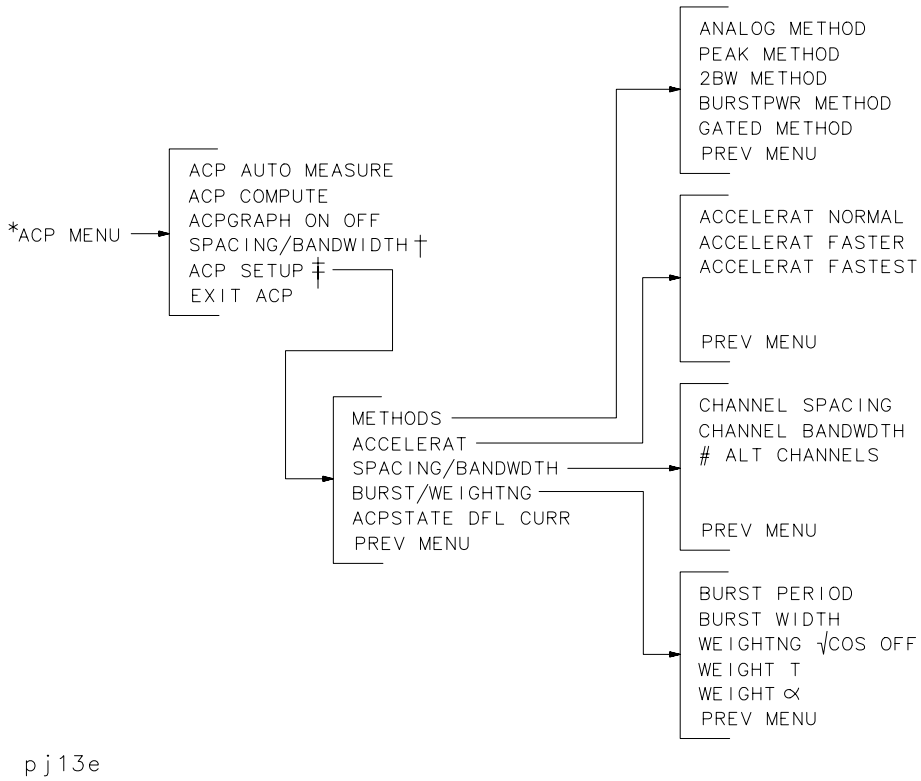
Figure 3-13 HOLD Key

Figure 3-14 MEAS/USER Key Menu Tree



*	Spectrum analyzers with firmware revisions ≤930809 have fewer power and adjacent channel power (ACP) functions.
†	See the following figure for ACP setup menus.
‡	The **SPAN** softkey is displayed if the markers are not active.
§	Present only when this menu is accessed from the occupied power menu.

Figure 3-15 ACP MENU Key Menu Tree



*	The **ACP MENU** softkey is under the **MEAS/USER** key. See the preceding figure.
†	For firmware revisions ≤930809.
‡	For firmware revisions >930809.

Figure 3-16 MKR Key Menu

Figure 3-17 MKR-> Key Menu

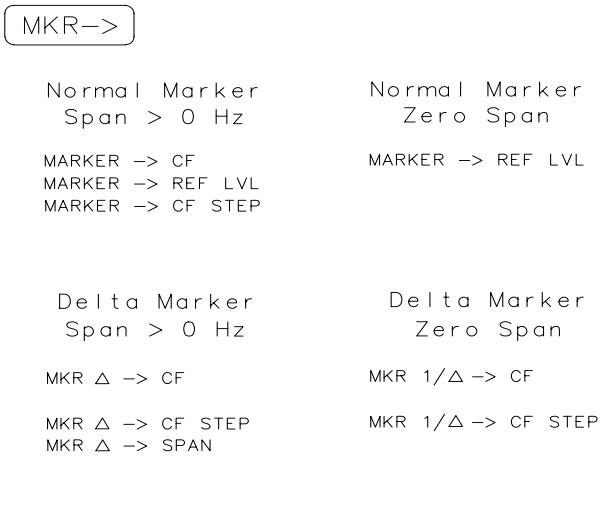
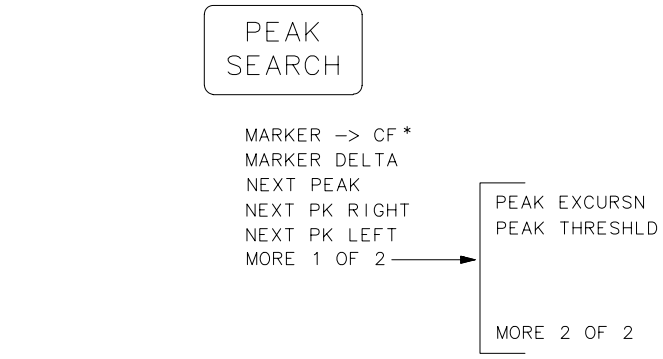


Figure 3-18 MODULE Key Menus

*	**MODULE** accesses these additional softkeys if the Agilent 85620A mass memory module is attached to the spectrum analyzer. See the Agilent 85620A documentation for more information about these softkeys.
†	**MODULE** accesses these additional softkeys if the Agilent 85629B test and adjustment module (TAM) is attached to the spectrum analyzer. See the Agilent 85629B documentation for more information about these softkeys. The Agilent 85629B is not compatible with the Agilent 8564E/EC or Agilent 8565E/EC.

NOTE The Agilent 8562E/TAM Interface Software is required when using the TAM with the Agilent 8562E/EC spectrum analyzer.

Figure 3-19 PEAK SEARCH Key Menu Tree



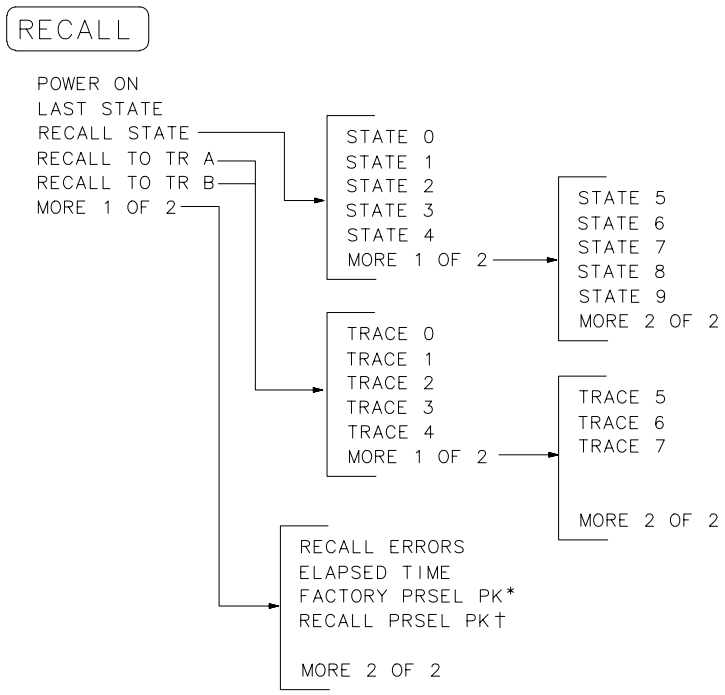
qj13e

*	Changes to **MARKER NORMAL** if the spectrum analyzer is in zero span or **MARKER DELTA** is active.

Figure 3-20 PRESET Key

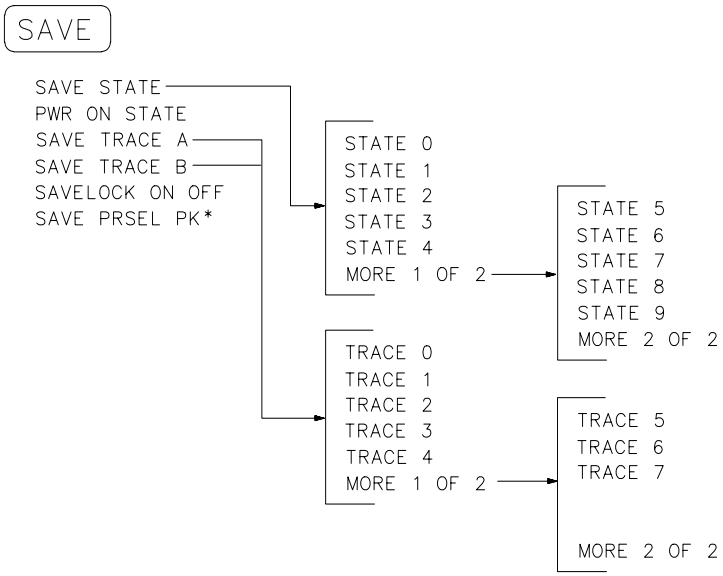
qj121e

Figure 3-21 RECALL Key Menu Tree



*	Available only with internal mixing above 2.9 GHz.
†	Available with preselected external mixing. Available with internal mixing above 2.9 GHz.

Figure 3-22 SAVE Key Menu Tree

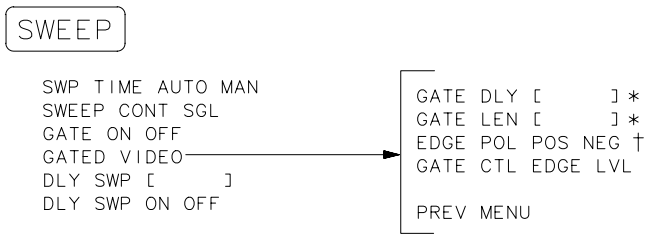


*	Available with preselected external mixing. Available with internal mixing above 2.9 GHz.

Figure 3-23 SGL SWP Key

Figure 3-24 SPAN Key Menu

Figure 3-25 SWEEP Key Menu Tree



*	This softkey is blanked if **GATE CTL EDGE LVL** is set to level (LVL).
†	This softkey becomes **LVL POL POS NEG** if **GATE CTL EDGE LVL** is set to level (LVL).

Figure 3-26 TRACE Key Menu Tree

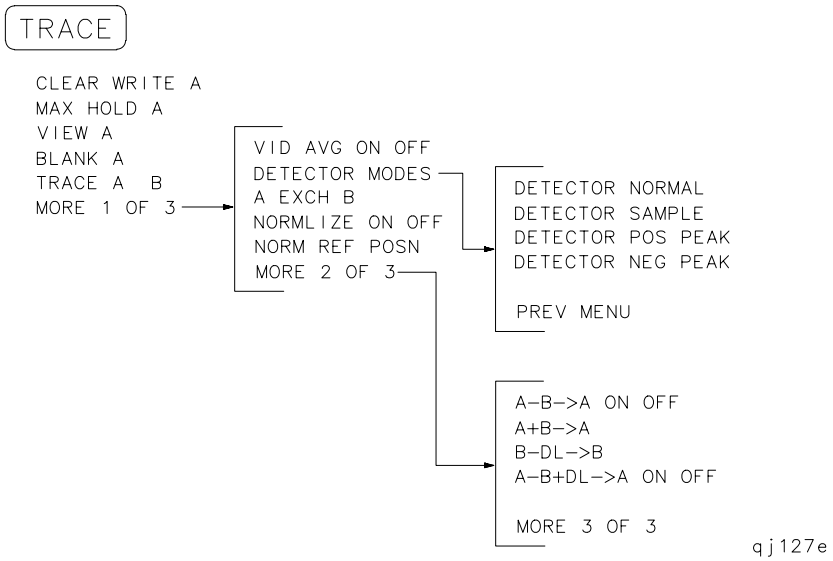
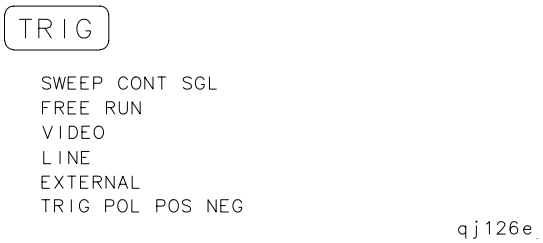


Figure 3-27 TRIG Key Menu



4 Key Function Descriptions

Key Function Tables

This chapter describes the functions that are available from the front panel of 8560 E-Series and EC-Series spectrum analyzers. The tables at the start of the chapter list the front-panel keys and softkeys by their functional groups with the location of the key and a very brief description. The functional groups are:

- Fundamental Functions (page 184)
- Instrument State Functions (page 186)
- Marker Functions (page 197)
- Control Functions (page 199)

Following the tables of key locations, each key and softkey is listed alphabetically along with a detailed description of its operation. The front-panel key under which the softkey can be found is indicated at the end of this description.

Table 4-1 Fundamental Functions

Function Keys	Access Key	Description
AMPLITUDE	—	Activates the reference level function and accesses a menu of amplitude related functions.
AMPTD UNITS	AMPLITUDE	Accesses a menu of amplitude units.
ATTEN AUTO MAN	AMPLITUDE	Adjusts the spectrum analyzer input attenuator that is either coupled to the reference level (AUTO) or adjusted manually (MAN).
CENTER FREQ	FREQUENCY	Activates the center frequency function and sets the spectrum analyzer to center-frequency span mode.
CF/2→CF	FREQUENCY	Sets the center frequency of the spectrum analyzer to the currently-displayed center frequency divided by two. This softkey appears in firmware revisions >941028.
CF*2→CF	FREQUENCY	Sets the center frequency of the spectrum analyzer to the currently-displayed center frequency times two. This softkey appears in firmware revisions >941028.
CF STEP AUTO MAN	FREQUENCY	Adjusts the center frequency step size so that when a step key is pressed, the center frequency shifts by the selected step size.
COUPLING AC DC	AMPLITUDE	Selects ac or dc coupling to the input; ac coupling protects the input of the analyzer from damaging dc signals. When dc coupling is selected, a C appears on the left edge of the display. *Not available with an Agilent 8563E/EC,, Agilent 8564E/EC or Agilent 8565E/EC.*
dBm	AMPLITUDE	Selects absolute decibels relative to 1 mW as the amplitude units.

Table 4-1 Fundamental Functions

Function Keys	Access Key	Description
dBμV	AMPLITUDE	Selects absolute decibels relative to 1 μV as the amplitude units.
dBmV	AMPLITUDE	Selects absolute decibels relative to 1 mV as the amplitude units.
FREQ OFFSET	FREQUENCY	Adds an offset value to displayed frequency values, including marker frequency values. The range of the sweep (that is, the span) is not affected. When this function is active an F appears on the left edge of the display.
FREQUENCY	—	Activates the center frequency (or the start frequency) and accesses a menu of frequency functions.
FULL SPAN	SPAN	Sets the spectrum analyzer span to its maximum frequency range.
HOLD	—	Holds the active function to its present value, blanks the softkeys and active function area from the display, and expands the remaining graticule and annotation.
LAST SPAN	SPAN	Sets the spectrum analyzer to the previously selected span.
LINEAR	AMPLITUDE	Selects the linear amplitude scale.
LOG dB/DIV	AMPLITUDE	Selects a 1, 2, 5, or 10 dB logarithmic amplitude scale.
MAX MXR LEVEL	AMPLITUDE	Selects the maximum mixer level seen at the input mixer for signals at or below the reference level.
NORM REF LVL	AMPLITUDE	Activates the normalized reference level, permitting an offset to be introduced to the displayed trace.
NORM REF POSN	AMPLITUDE	Adjusts the normalized reference position.
PRESEL AUTO PK	AMPLITUDE	Automatically peaks the preselector for the desired signal on a trace.
PRESEL MAN ADJ	AMPLITUDE	Permits manual adjustment of the preselector. Peak the preselector using the data keys, the step keys, or the knob.
RANGE LVL	AMPLITUDE	Activates the dynamic range level function and ensures the displayed range is compression free.
REF LVL	AMPLITUDE	Activates the reference level function.
REF LVL OFFSET	AMPLITUDE	Introduces an offset to all amplitude readouts, but does not change the position of the on-screen trace. When this function is active, an R appears on the left side of the display.

Table 4-1 Fundamental Functions

Function Keys	Access Key	Description
SPAN	—	Activates the frequency span, sets the spectrum analyzer to center-frequency span mode, and accesses a menu of span related functions.
SPAN	SPAN	Activates the span width function and sets the spectrum analyzer to center-frequency span mode.
SPAN ZOOM	SPAN	Tracks a marked signal and activates the span function so that the span may be reduced quickly without losing the signal from the display.
START FREQ	FREQUENCY	Activates the start frequency and sets the spectrum analyzer to start stop mode.
STOP FREQ	FREQUENCY	Activates the stop frequency and sets the spectrum analyzer to start stop mode.
UNITS AUTO MAN	AMPLITUDE	Accesses a menu of amplitude units. AUTO indicates default units for the amplitude scale are in use. MAN indicates other units have been selected.
VOLTS	AMPLITUDE	Selects volts as the display amplitude units.
WATTS	AMPLITUDE	Selects watts as the display amplitude units.
ZERO SPAN	SPAN	Sets the span to 0 Hz. This displays the input signal in an amplitude versus time mode which is especially useful for viewing modulation.

Table 4-2 Instrument State Functions

Instrument State Keys	Access Key	Description
# ALT CHANNELS	MEAS/USER	Selects the number of pairs of alternate channels for an ACP measurement.
ΔMARKER OCC BW	MEAS/USER	Calculates the occupied power bandwidth with respect to the power between the markers.
2BW METHOD	MEAS/USER	Makes ACP measurement using two different resolution bandwidths.
0→10V LO SWP	AUX CTRL	Selects the 0 V to 10 V ramp for J8 on the rear panel. The 0 V to 10 V ramp corresponds to the sweep ramp.
0.5 V/GHz (FAV)	AUX CTRL	Selects a 0.5 V per GHz sweep output for J8 on the rear panel. This is the frequency-analog voltage (FAV). It is primarily used with external tracking generators.
10MHz EXT INT	AUX CTRL	Selects an external (EXT) or internal (INT) frequency reference. When external mode is selected, an X appears on the left side of the display.

Table 4-2 Instrument State Functions

Instrument State Keys	Access Key	Description
3dB POINTS	MEAS/USER	A peak search is performed, and the 3 dB bandwidth of the largest signal on-screen is displayed in the message area.
6dB POINTS	MEAS/USER	A peak search is performed, and the 6 dB bandwidth of the largest signal on-screen is displayed in the message area.
ACCELRAT	MEAS/USER	Accelerates the adjacent channel power measurement.
ACCELRAT FASTER	MEAS/USER	Accelerates the ACP measurement with minimal affects on accuracy.
ACCELRAT FASTEST	MEAS/USER	Accelerates the ACP measurement, but affects the accuracy by as much as 2 dB.
ACCELRAT NORMAL	MEAS/USER	Makes the ACP measurement as specified by the standards.
ACP AUTO MEASURE	MEAS/USER	Measures the power that "leaks" from the transmitter output into the channels that are adjacent to the carrier.
ACP COMPUTE	MEAS/USER	Performs an adjacent channel power (ACP) computation on the current trace data without changing the instrument state settings.
ACP MENU	MEAS/USER	Accesses the adjacent channel power (ACP) menu of softkeys that measure the adjacent channel power ratio of a transmitter.
ACP GRAPH ON OFF	MEAS/USER	Displays a graphical representation of the adjacent channel power (ACP) ratio, for the selected channel bandwidth, as a function of the channel spacing.
ACP STATE DFL CURR	MEAS/USER	Selects the default state for measuring adjacent channel power, or allows you to create a current state.
ADJ CURR IF STATE	CAL	Adjusts various parameters in the IF for the bandwidth currently in use, producing optimum amplitude accuracy.
AGC ON OFF	AUX CTRL	Switches automatic gain control on or off and keeps the volume relatively constant during AM demodulation.
ALC INT EXT	AUX CTRL	Selects internal or external leveling which improves the amplitude accuracy of tracking generator measurements.
AM DEMOD ON OFF	AUX CTRL	Turns AM demodulation on and off.
AM/FM DEMOD	AUX CTRL	Accesses functions for AM or FM demodulation.

Table 4-2 Instrument State Functions

Instrument State Keys	Access Key	Description
AMPCOR MENU	CAL	Accesses functions that allow you to enter amplitude correction (ampcor) factors to correct system flatness.
AMPCOR ON OFF	CAL	Turns the amplitude correction factors on and off. When this mode is selected, a W appears on the left side of the display.
AMPTD CORRECT	AUX CTRL	Accesses functions that set conversion loss and flatness data for external mixer measurements.
ANALOG METHOD	MEAS/USER	Makes adjacent channel power (ACP) measurements by measuring continuous power integration versus frequency.
ANALYZER ADDRESS	CONFIG	Displays the current GPIB address of the spectrum analyzer.
AUX CTRL	—	Accesses a menu of tracking generator, internal mixer, external mixer, demodulation, and rear-panel functions.
AVERAGE CNV LOSS	AUX CTRL	Displays the mean conversion loss for the current harmonic and allows you to enter new conversion loss data.
AVG "OFF" POWER	MEAS/USER	Measures the power of the carrier when the burst is off.
AVG "ON" POWER	MEAS/USER	Measures the power of the carrier when the burst is on.
BW	CONFIG	Selects a monochromatic printer configuration for use with **COPY**.
BIAS	AUX CTRL	Displays a menu of functions for selecting external-mixer bias for unpreselected external mixers.
BIAS OFF	AUX CTRL	Turns external mixer bias off.
BURST/WEIGHTNG	MEAS/USER	Accesses functions that allow you to change the burst width and period for ACP measurements.
BURST PERIOD	MEAS/USER	Sets the burst period for ACP measurements.
BURST WIDTH	MEAS/USER	Sets the burst width for ACP measurements.
BURST PWR METHOD	MEAS/USER	Makes adjacent channel power (ACP) measurements on burst signals.
CAL	—	Accesses a menu of calibration functions.
CAL OPN/SHRT	AUX CTRL	Measures and computes the average of an open- and a shorted-input calibration, then stores the data in trace B and in instrument state register 8.

Table 4-2 Instrument State Functions

Instrument State Keys	Access Key	Description
CAL THR	AUX CTRL	Stores thru calibration in trace B and in instrument state register 9.
CARRIER PWR MENU	MEAS/USER	Accesses carrier power measurement functions.
CH EDGES → ΔMKR	MEAS/USER	Moves the marker locations to the channel edges, for an occupied power measurement.
CHAN DN	MEAS/USER	Moves the center frequency down (lower) by one channel spacing.
CHAN PWR OVER BW	MEAS/USER	Calculates the power in the channel power bandwidth.
CHAN UP	MEAS/USER	Moves the center frequency up (higher) by one channel spacing.
CHANNEL BANDWDTH	MEAS/USER	Sets the channel bandwidth for an adjacent channel power (ACP) measurement.
CHANNEL PWR MENU	MEAS/USER	Accesses the channel power measurement functions.
CHANNEL SPACING	MEAS/USER	Sets the spacing between channels for an adjacent channel power (ACP) measurement.
CHPWR BW [ ]	MEAS/USER	Sets the channel power bandwidth for adjacent channel power (ACP) measurements.
CNV LOSS VS FREQ	AUX CTRL	Displays the conversion loss for a specific frequency in the current band.
COLOR	CONFIG	Selects the HP PaintJet or compatible color printer configuration for use with **COPY**.
CONFIG	—	Accesses a menu of functions used to configure a plotter and a printer as hard-copy devices, sets the spectrum analyzer GPIB address, and views the instrument datecode and options.
CONT MEASURE	MEAS/USER	Sets the measurements so that they run continuously.
COPY	—	Copies the display contents onto a plotter or a printer.
COPY DEV PRNT PLT	CONFIG	Selects a printer or a plotter as the hard-copy device used with **COPY**.
CRT ADJ PATTERN	CAL	Displays an alignment pattern which is used in conjunction with X POSN, Y POSN, and TRACE ALIGN adjustments on E-series instruments. EC-series instruments do not require adjustment and are not adjustable.

Table 4-2 Instrument State Functions

Instrument State Keys	Access Key	Description
DATECODE OPTIONS	CONFIG	Displays the analyzer firmware datecode, its instrument serial number, its model number, and any options present. EC-series instruments also appear as Option 007 instruments (Option 007 is the FADC option, which is standard in EC-series instruments).
DELETE CORR PT	CAL	Ampcor function which deletes a single correction point.
DEMOD TIME	AUX CTRL	Selects the duration of demodulation between successive sweeps.
DONE EDIT	CAL	Exits the ampcor menu that is used for editing correction points.
EDIT AMPCOR	CAL	Allows you to edit the amplitude correction points.
EDIT AMPL	CAL	Allows you to edit the amplitude of an ampcor correction point.
EDIT FREQ	CAL	Allows you to edit the frequency of an ampcor correction point.
ELAPSED TIME	RECALL	Displays the cumulative operating time of the analyzer.
EXIT RESTORE	MEAS/USER	Exits the ACP menu turning off the function and restoring the previous spectrum analyzer state.
EXIT ACP	MEAS/USER	Exits the adjacent channel power measurement menu.
EXIT AMPCOR	CAL	Exits the amplitude correction menu.
EXT MXR PRE UNPR	CONFIG	Selects either preselected or unpreselected external mixing mode. (Non-functional in Option 327.)
EXTERNAL MIXER	AUX CTRL	Accesses a menu of external-mixer functions. (Non-functional in Option 327.)
FACTORY PRSEL PK	RECALL	Restores the factory preselector-peaking data as the current preselector data.
FFT MEAS	MEAS/USER	Performs a discrete Fourier transform on the input signal, converting zero-span information into the frequency domain.
FM DEMOD ON OFF	AUX CTRL	Switches FM demodulation on and off.
FRAC N FREQ	CAL	Displays the fractional N frequency corresponding to the current start frequency.
FREQ DIAGNOSE	CAL	Accesses a menu of diagnostic functions which allow the value of various internal parameters to be retrieved.

Table 4-2 Instrument State Functions

Instrument State Keys	Access Key	Description
FULL BAND	AUX CTRL	Selects commonly used frequency bands above 18 GHz and activates the harmonic lock function.
FULL IF ADJ	CAL	Executes a complete adjustment of the IF system for optimum measurement accuracy.
GATED METHOD	MEAS/USER	Makes adjacent channel power (ACP) measurements using time gating techniques.
IF ADJ ON OFF	CAL	Switches the automatic IF adjustment on and off. When it is on, various IF parameters are adjusted during retrace to ensure amplitude accuracy within specifications. If this function is turned off, an A appears on the left side of the display.
INTERNAL MIXER	AUX CTRL	Accesses a menu of signal identification functions or returns the spectrum analyzer from external mixer mode to its internal frequency coverage.
LAST STATE	PRESET, RECALL	Recalls the state that existed before preset was pressed or power was turned off.
LO FREQ	CAL	Displays the first local oscillator frequency corresponding to the current start frequency.
LOCK HARMONIC	AUX CTRL	Displays the number of the harmonic currently used to sweep the selected frequency band. Only frequencies and spans that fall within the frequency band of the current harmonic may be entered.
LOCK ON OFF	AUX CTRL	Turns the harmonic lock on and off. When it is on, it performs the same function as LOCK HARMONIC.
MAN TRK ADJ	AUX CTRL	Permits manual adjustment of the tracking generator oscillator using the data keys, the step keys or the knob.
MARKER DELTA	AUX CTRL	Reads the difference in amplitude and in frequency (or time when the span equals 0 Hz) and displays these values.
MARKER NORMAL	AUX CTRL, CAL	Activates a single marker and places it at the center of the trace.
MEAS/USER	—	Accesses softkeys for automatic functions and user defined functions like, power measurements, adjacent channel power, bandwidth measurements, and FFT measurements.
METHODS	MEAS/USER	Selects the measurement method that will be used to make the adjacent channel power measurement.

Table 4-2 Instrument State Functions

Instrument State Keys	Access Key	Description
MKRΔ → CH PWR BW	MEAS/USER	Sets the channel power bandwidth parameter to the value of the difference between the two markers.
MKR MEAN → CF	MEAS/USER	Moves the midpoint of the two displayed markers to the center frequency.
MODULE	—	Accesses the functions of an optional rear panel module, when it is present.
NEGATIVE BIAS	AUX CTRL	Selects negative bias for an external mixer. When this function is selected, a "-" appears on the left side of the display. *Not available with an 8560E/EC Option 002.*
NEW CORR PT	CAL	Allows you to create a new ampcor correction point.
NEXT PEAK	AUX CTRL	Moves the active marker to the next-highest trace peak relative to the current marker position.
NORM REF POSN	AUX CTRL	Adjusts the normalized reference position. For use with NORMLIZE ON OFF.
NORMLIZE ON OFF	AUX CTRL	Switches the normalization routine, for stimulus-response measurements, on and off. An N appears on the left side of the display when this function is active.
OCCUPIED [%]	MEAS/USER	Enters the desired percentage of occupied power for an occupied bandwidth measurement.
OCCUPIED BANDWDTH	MEAS/USER	Integrates the power displayed and returns the bandwidth containing the selected percent of the total displayed power.
OCCUPIED PWR MENU	MEAS/USER	Accesses the occupied power bandwidth functions.
PEAK METHOD	MEAS/USER	Makes adjacent channel power (ACP) measurements using peak power integration.
PEAK SEARCH	AUX CTRL, CAL	Places a marker on the highest point on a trace and displays the marker frequency and amplitude.
PLOT ANNOT	CONFIG	Plots only the display annotation. To halt plotting before it is complete, press STOP ANNOT.
PLOT GRATICUL	CONFIG	Plots only the graticule. To halt plotting before it is complete, press STOP GRATICUL.
PLOT ORG DSP GRAT	CONFIG	Selects either the display or the graticule area for plotting. In either case, the plot fills the entire area defined by the P1 and P2 plot parameters.

Table 4-2 Instrument State Functions

Instrument State Keys	Access Key	Description
PLOT TRACE A	CONFIG	Plots only the contents of trace A and any markers associated with the trace. To halt plotting before it is complete, press STOP TRACE A.
PLOT TRACE B	CONFIG	Plots only the contents of trace B and any markers associated with the trace. To halt plotting before it is complete, press STOP TRACE B.
PLOTTER ADDRESS	CONFIG	Displays the GPIB address of the plotter. After changing and entering the address, press STORE GPIB ADR.
PLOTTER CONFIG	CONFIG	Accesses a menu for configuring a plotter as a hard-copy device.
POSITIVE BIAS	AUX CTRL	Selects positive mixer bias for an external mixer. When this function is selected, a "+" appears on the left side of the display. *Not available with an 8560E/EC Option 002.*
POSTSCLR	CAL	Displays the value of the post scaler divider within the fractional N assembly.
POWER MENU	MEAS/USER	Accesses the power measurements including occupied power bandwidth, channel power and carrier power.
POWER ON	RECALL	Sets the instrument state to the state stored in the power-on register.
PRESEL AUTO PK	AUX CTRL	Automatically peaks the preselector for the selected signal on a trace.
PRESEL MAN ADJ	AUX CTRL	Permits manual adjustment of the preselector. Peak the preselector using the data keys, the step keys, or the knob.
PRESEL PEAK	AUX CTRL	Displays a menu of functions for preselected external mixers.
PRESET	—	Sets the spectrum analyzer to the preset state.
PRINTER ADDRESS	CONFIG	Displays the GPIB address of the printer. After changing the address, press STORE HPIB ADR.
PRINTER CONFIG	CONFIG	Accesses a menu for configuring a printer as a hard-copy device.
PURGE CORR	CAL	Allows you to purge all of the ampcor correction points that are in active memory.
PWR MENU HELP	MEAS/USER	Includes measurement information for making occupied power bandwidth, channel power, carrier power, and adjacent channel power measurements.

Table 4-2 Instrument State Functions

Instrument State Keys	Access Key	Description
PWR ON STATE	SAVE	Saves the current state in the power-on register. The spectrum analyzer is set to this state whenever **LINE** is turned on or when POWER ON is pressed.
PWR SWP ON OFF	AUX CTRL	Switches the power-sweep function on and off. The tracking generator output power sweeps over the chosen amplitude range.
RANGE LVL	AUX CTRL	Activates the dynamic range level function and ensures there is no signal compression in the displayed range. For use with NORMLIZE ON OFF.
RAW OSC FREQ	CAL	Displays the value of the oscillator frequency, which is used to generate the fractional N frequency.
REALIGN LO IF	CAL	Activates the LO and IF alignment routines for a complete LO and IF alignment.
REAR PANEL	AUX CTRL	Accesses a menu for selecting the signals available at connectors J8 (LO SWP | FAV OUTPUT) and J9 (10 MHz REF IN/OUT).
RECALL	—	Accesses a menu of functions that recall instrument data.
RECALL AMPCOR	CAL	Recalls a previously stored table of amplitude correction (ampcor) points.
RECALL ERRORS	RECALL	Displays the last error that has occurred. Use the step keys to cycle through accumulated errors.
RECALL OPN/SHRT	AUX CTRL	Recalls the stored, averaged open/short calibration data into trace B and sets the instrument to the calibration state.
RECALL PRSEL PK	RECALL	Recalls the preselector data initially stored in the user table using SAVE PRSEL PK.
RECALL STATE	RECALL	Displays a menu of ten registers from which instrument states can be recalled and displayed.
RECALL THRU	AUX CTRL	Recalls stored thru calibration data into trace B and sets the instrument to the calibration state.
RECALL TO TR A	RECALL	Displays a menu of eight registers from which data can be recalled and placed in trace A.
RECALL TO TR B	RECALL	Displays a menu of eight registers from which data can be recalled and placed in trace B.

Table 4-2 Instrument State Functions

Instrument State Keys	Access Key	Description
REF LVL ADJ	CAL	Permits adjusting the spectrum analyzer internal gain so that when the calibrator signal is connected to the input, the reference level at top screen equals the calibrator amplitude.
SAMPLER FREQ	CAL	Displays the sampling oscillator frequency and loop bandwidth compensation value corresponding to the current start frequency.
SAMPLER HARMONIC	CAL	Displays the sampler harmonic number corresponding to the current start frequency.
SAVE	—	Accesses a menu for storing instrument data.
SAVE AMPCOR	CAL	Saves the current table of amplitude correction (ampcor) points.
SAVE PRSEL PK	SAVE	Saves the current preselector peak data in a data table.
SAVE STATE	SAVE	Displays a menu of ten registers for storing the current instrument state.
SAVE TRACE A	SAVE	Displays a menu of eight registers for storing trace contents.
SAVE TRACE B	SAVE	Displays a menu of eight registers for storing trace contents.
SAVELOCK ON OFF	SAVE	When this function is on, the data in the state and trace registers cannot be erased or overwritten. No new data may be entered into the registers until this function is turned off.
SCROLL CORR PTS	CAL	Allows you to scroll through the list of ampcor amplitude correction points.
SGL SWP	—	Initiates one sweep and activates single sweep mode.
SIG ID –> CF	AUX CTRL	Sets the center frequency to the frequency obtained from executing SIG ID AT MKR.
SIG ID AT MKR	AUX CTRL	Locates the frequency and harmonic number of the mixer response where a marker has been positioned.
SIG ID ON OFF	AUX CTRL	Switches manual signal identification on and off. Signals that are correct for the selected band are identified by being shifted less than 50 kHz.
SIGNAL IDENT	AUX CTRL	Accesses a menu of signal identification functions.
SINGLE MEASURE	MEAS/USER	Puts the spectrum analyzer in single sweep mode, completing the current measurement.

Table 4-2 Instrument State Functions

Instrument State Keys	Access Key	Description
SOURCE CAL MENU	AUX CTRL	Accesses a menu of functions used to calibrate frequency response errors in test setups when using a tracking generator.
SPACING/BANDWDTH	MEAS/USER	Accesses the channel spacing and channel bandwidth softkeys for use in adjacent channel power (ACP) measurements.
SQUELCH ON OFF	AUX CTRL	Turns squelch on and off and adjusts the squelch level for demodulation.
SRC PWR OFFSET	AUX CTRL	Offsets the displayed power of the tracking generator.
SRC PWR ON OFF	AUX CTRL	Switches the tracking generator output power on and off. A G appears on the left side of the display when this function is active. *8560E/EC Option 002 only.*
SRC PWR STP SIZE	AUX CTRL	Sets the step size of the source power level, the source power offset, and the power sweep range function.
SWP CPL SR SA	AUX CTRL	Selects an auto-coupled sweep time equation for stimulus-response (SR) measurements or for spectrum analyzer (SA) measurements. When SR mode is selected, an E appears on the left side of the display.
TRACKING GENRATOR	AUX CTRL	Accesses a menu of tracking generator functions.
TRACKING PEAK	AUX CTRL	Adjusts the coarse and fine tracking adjustments to peak the tracking generator response on the spectrum analyzer display automatically.
V/GHz .25 .50	AUX CTRL	Selects a 0.25 V/GHz or 0.5 V/GHz output for connector J8 on the rear panel. This output is primarily used with external tracking generators or preselected external mixers.
VIEW TBL TRAC	MEAS/USER	Sets the display to show a table of the ACP measurement results or to show a trace.
WEIGHT α	MEAS/USER	Enters the α factor for root-raised-cosine weighting on an ACP measurement.
WEIGHT T	MEAS/USER	Enters the T factor for root-raised-cosine weighting on an ACP measurement.
WEIGHTING √COS OFF	MEAS/USER	Turns on and off root-raised-cosine weighting for an ACP measurement.

Table 4-3 Marker Functions

Marker Keys	Access Key	Description
COUNTER ON OFF	FREQ COUNT	Switches the precision frequency counter ON and OFF (activating a marker if none is present), and displays counter results when the counter is on.
COUNTER RES	FREQ COUNT	Adjusts the resolution of the frequency counter readout.
FREQ COUNT	—	Turns the frequency counter on (activates a marker if none is present) and accesses a menu of counter and marker functions.
MARKER → CF	MKR→, PEAK SEARCH	Sets the center frequency equal to the marker frequency.
MARKER → CF STEP	MKR→	Sets the center frequency step size equal to the marker frequency. The step keys change the center frequency in increments equal to the step size.
MARKER → REF LVL	MKR→	Sets the reference level equal to the amplitude of the marker.
MARKER 1/DELTA	MKR	Sets the marker readout to a frequency equal to the reciprocal of the delta value. For use with zero span mode.
MARKER DELTA	FREQ COUNT, MKR, PEAK SEARCH	Reads the difference in amplitude and in frequency (or time when the span equals 0 Hz) and displays these values.
MARKER NORMAL	FREQ COUNT, MKR	Activates a single marker and places it at the center of the trace.
MARKERS OFF	MKR	Turns all markers off and blanks the softkey menu.
MKR	—	Activates a marker and accesses a menu of marker functions.
MKR→	—	Activates a marker and accesses a menu of "marker-to" functions.
MKR Δ → CF	MKR→	Sets the center frequency equal to the delta frequency value.
MKR Δ → CF STEP	MKR→	Sets the center frequency step size equal to the delta frequency value.
MKR Δ → SPAN	MKR→	Sets the frequency span equal to the delta frequency value.

Table 4-3 Marker Functions

Marker Keys	Access Key	Description
MKR 1/Δ → CF	MKR→	Sets the center frequency equal to the reciprocal of the delta value. For use in zero span mode.
MKR 1/Δ → CF STEP	MKR→	Sets the center frequency step size equal to the reciprocal of the delta value. For use in zero span mode.
MKR NOISE ON OFF	MKR	Turns the marker noise function on or off. When it is on, it normalizes the equivalent amplitude of the measured noise to a 1 Hz bandwidth.
NEXT PEAK	FREQ COUNT, PEAK SEARCH	Moves the active marker to the next-highest trace peak relative to the current marker position.
NEXT PK LEFT	PEAK SEARCH	Finds the next peak to the left of the current marker position.
NEXT PK RIGHT	PEAK SEARCH	Finds the next peak to the right of the current marker position.
PEAK EXCURSN	PEAK SEARCH	Defines what constitutes a peak on a trace. The selected value specifies the amount that a trace must increase then decrease in order to be a peak.
PEAK SEARCH	—	Places a marker at the highest point on a trace and accesses a menu of marker functions.
PEAK SEARCH	FREQ COUNT	Places a marker on the highest point on a trace and displays the marker frequency and amplitude.
PEAK THRESHLD	PEAK SEARCH	Sets the minimum amplitude level from which a peak on a trace can be detected.
SIG TRK ON OFF	MKR	Switches the signal tracking function on and off. When it is on, it keeps the active marker on the peak of the signal where it was initially placed and keeps the center frequency at the marker value. A K appears on the left side of the display to indicate this function is active.

Table 4-4 Control Functions

Control Keys	Access Key	Description
A+B→A	TRACE	Adds the contents of trace A with those of trace B and places the result in trace A.
A-B→A ON OFF	TRACE	When on, this function continuously subtracts the contents of trace B from those of trace A and places the result in trace A. An M appears on the left side of the display when this function is on.
A-B+DL→A ON OFF	TRACE	When on, this function continuously subtracts the contents of trace B from those of trace A, adds the display line to the result, then places the final result in trace A. An M appears on the left side of the display when this function is on.
A EXCH B	TRACE	Exchanges the contents of trace A with those of trace B, then places traces A and B in the view mode.
ALL	AUTO COUPLE	Couples all "AUTO" functions; resolution bandwidth, video bandwidth, sweep time, input attenuation, center frequency step-size, and amplitude units.
ANNOT HELP	DISPLAY	Displays descriptions of the annunciators that appear on the left-hand side of the screen indicating which functions are turned on or off.
ANNOT ON OFF	DISPLAY	Switches the display annotation on or off.
ATTEN AUTO MAN	AUTO COUPLE	Sets the spectrum analyzer input attenuator, so it is either coupled to the reference level (AUTO) or manually adjustable (MAN).
AUTO COUPLE	—	Accesses a menu of coupled-mode functions.
B-DL→B	TRACE	Subtracts the display-line value from the contents of trace B, then places the result in trace B.
BACK SPACE	DISPLAY	Deletes the last character placed in the current title.
BLANK A	TRACE	Blanks the contents of trace A from the display.
BLANK B	TRACE	Blanks the contents of trace B from the display.
BW	—	Accesses the bandwidth functions menu.

Table 4-4 Control Functions

Control Keys	Access Key	Description
CF STEP AUTO MAN	AUTO COUPLE	Adjusts the center frequency step size so that when a step key is pressed, the center frequency shifts by the selected step size.
CHAR SET 1 2	DISPLAY	Accesses character sets used for creating titles.
CLEAR WRITE A	TRACE	Clears trace A and sets it to accept and display new input-signal data continuously.
CLEAR WRITE B	TRACE	Clears trace B and sets it to accept and display new input-signal data continuously.
DETECTOR MODES	TRACE	Accesses a menu of detector modes.
DETECTOR NEG PEAK	TRACE	Selects negative-peak detection of the video signal and places a D on the left side of the display.
DETECTOR NORMAL	TRACE	The normal-detector mode alternately displays positive and negative-peaks when the presence of noise is detected, and displays positive peaks otherwise.
DETECTOR POS PEAK	TRACE	Selects positive-peak detection of the video signal and places a D on the left side of the display.
DETECTOR SAMPLE	TRACE	Samples the video signal and places a D on the left side of the display.
DISPLAY	—	Accesses a menu of display related functions.
DLY SWP [ ]	SWEEP	Delays the start of the sweep until the specified time elapses after the trigger event (or before with Option 007.)
DLY SWP ON OFF	SWEEP	Turns on and off the function which delays the start of the sweep until after the trigger event. With Option 007 the sweep can be started before the trigger event.
DSPL LIN ON OFF	DISPLAY	Switches the display line on and off.
EDGE POL POS NEG	SWEEP	Selects the polarity for edge triggering of a gated measurement.
ERASE TITLE	DISPLAY	Erases the current title from the display.

Table 4-4 Control Functions

Control Keys	Access Key	Description
EXTERNAL	TRIG	Sets the trigger to external mode. Connect external trigger source to J5 (EXT/GATE TRIG INPUT) on the rear panel. When this mode is selected, a T appears on the left side of the display.
FOCUS	DISPLAY	Permits focusing of the display on E-series instruments, using the data keys, the step keys, or the knob.Note: EC-series instruments do not require adjustment and are not adjustable.
FREE RUN	TRIG	Sets the trigger to free-run mode; sweep triggers occur as rapidly as the spectrum analyzer will allow.
FREQ DSP ON OFF	DISPLAY	Turns off all frequency related annotation. Press **PRESET** to restore annotation.
GATE CTL EDGE LVL	SWEEP	Selects the use of edge triggering or level triggering to control the gate.
GATE DLY [ ]	SWEEP	Controls the length of time from the trigger until the gate is turned on.
GATE LEN [ ]	SWEEP	Controls the length of time that the gate is on when using edge triggering.
GATE ON OFF	SWEEP	Turns the gate function on and off.
GATED VIDEO	SWEEP	Accesses the menu of functions for setting gate parameters.
GRAT ON OFF	DISPLAY	Turns the display graticule on and off.
INTENSITY	DISPLAY	Permits changing the display intensity on E-series instruments, using the data keys, step keys, or the knob. Note: EC-series instruments do not require adjustment and are not adjustable.
LINE	TRIG	Sets the trigger to line mode; sweep triggers occur at intervals synchronized to the line frequency. When this mode is selected, a T appears on the left side of the display.
LVL POL POS NEG	SWEEP	Selects the polarity for turning the gate on when using level triggering for a gated measurement.
MAX HOLD A	TRACE	Displays and holds the maximum responses of the input signal in trace A.

Table 4-4 Control Functions

Control Keys	Access Key	Description
MAX HOLD B	TRACE	Displays and holds the maximum responses of the input signal in trace B.
NORM REF POSN	TRACE	Adjusts the normalized reference position. For use with NORMLIZE ON OFF.
NORMLIZE ON OFF	TRACE	Switches the normalization routine, for stimulus-response measurements, on and off.
RBW/SPAN RATIO	BW	Displays the current coupling ratio between the resolution bandwidth and the frequency span.
RES BW AUTO MAN	AUTO COUPLE, BW	Adjusts the resolution bandwidth of the spectrum analyzer. The resolution bandwidth may be coupled to other functions (AUTO) or adjusted manually (MAN).
SCREEN TITLE	DISPLAY	Accesses a menu of functions for creating on-screen titles.
SELECT CHAR	DISPLAY	Causes the currently selected character in the active block to appear in the next available position of the title.
SPACE	DISPLAY	Places a blank space in the next available character position in the title.
SWEEP	—	Activates the sweep time function and accesses a menu of sweep related function.
SWEEP CONT SGL	SWEEP, TRIG	Allows you to select continuous sweep or single sweep mode.
SWP TIME AUTO MAN	AUTO COUPLE, SWEEP	Adjusts the sweep time of the spectrum analyzer. The sweep time may be coupled to bandwidth and span settings (AUTO) or adjusted manually (MAN).
THRESHLD ON OFF	DISPLAY	Sets a threshold that determines the lower limit of an active trace. Adjust the threshold using the data keys, the step keys, or the knob.
TITLE DONE	DISPLAY	Ends editing of the current title.
TRACE	—	Accesses a menu of trace functions.
TRACE A B	TRACE	Accesses trace related functions for trace A or B.
TRIG	—	Accesses a menu of trigger functions.

Table 4-4 Control Functions

Control Keys	Access Key	Description
TRIG POL POS NEG	TRIG	Sets the external trigger to trigger on the rising edge (POS) or the falling edge (NEG) of the rear panel trigger input.
UNITS AUTO MAN	AUTO COUPLE	Accesses a menu of amplitude units. AUTO indicates default units for the amplitude scale are in use. MAN indicates other units can be selected.
VBW/RBW RATIO	BW	Displays the coupling ratio between the video bandwidth and the resolution bandwidth.
VID AVG ON OFF	BW, TRACE	Turns video averaging on and off. When on, it smoothes the trace by averaging successive traces.
VIDEO	TRIG	Sets the trigger to video mode. Sweep triggers occur whenever the input signal passes through the video trigger level, with the selected slope. When this mode is selected, a T appears on the left side of the display.
VIDEO BW AUTO MAN	AUTO COUPLE, BW	Adjusts the video bandwidth of the spectrum analyzer. The video bandwidth may be coupled to other functions (AUTO) or adjusted manually (MAN).
VIEW A	TRACE	Displays the current contents of trace A, but does not update the contents.
VIEW B	TRACE	Displays the current contents of trace B, but does not update the contents.

Key Descriptions

Descriptions are listed alphabetically by the front-panel key or softkey label.

ΔMARKER OCC BW

Calculates the occupied power bandwidth with respect to the power between the markers, instead of with respect to the total power in the span. The percent occupied power is set by the OCCUPIED [%] softkey. The markers are moved to positions that indicate the edges of the occupied power bandwidth. The OCCUPIED BANDWDTH softkey description has more information about making occupied power bandwidth measurements.

The post-measurement menu is then displayed. The original marker positions are remembered so that the measurement can be repeated from the post-measurement menu.

Front-panel key access: **MEAS/USER**

 # ALT CHANNELS

Allows you to select the number of pairs of alternate channels to be measured, in addition to the adjacent channels. Selecting a zero makes the measurement with the adjacent channel pair, but no alternate channels. A 1 selects the first alternate channel pair which is centered at ±2 times the channel spacing away from the center frequency of the main channel. A 2 selects the second alternate pair which is at ±3 times the channel spacing.

Front-panel key access: **MEAS/USER**

0 → 10V LO SWP

Specifies the 0 to 10 volt ramp that corresponds to the sweep ramp that tunes the local oscillator at the rear-panel sweep output connector, J8. Connector J8 is labeled LO SWP | FAV OUTPUT, (or LO SWP | 0.5V/GHz on older spectrum analyzers). Pressing **PRESET** does not change J8 output of 0 → 10V.

Front-panel key access: **AUX CTRL**

.5 V/GHz(FAV)

For 8560E/EC, Agilent 8561E/EC or Agilent 8563E/EC only. Specifies a 0.5 volts per GHz voltage output at the rear-panel connector J8.

This is also referred to as the frequency analog voltage (FAV). Connector J8 is labeled LO SWP | FAV OUTPUT, (or LO SWP 0.5 V/GHz on older spectrum analyzers). When using an 8560 E-Series or EC-Series with a tracking generator such as an Agilent 85640A, this softkey must be activated. Pressing **PRESET** does not change the selection of FAV as the output for J8.

If the preselected external mixer mode is selected, rear-panel output J8 is automatically switched to the 0.5 V/GHz (FAV) mode. The actual output at J8 becomes 1.5 V/GHz, referenced to the LO frequency. The 1.5 V/GHz of the LO frequency is required for the Agilent 11974 Series preselected external mixers.

Front-panel key access: **AUX CTRL**

2BWMETHOD Makes adjacent channel power (ACP) measurements using two different resolution bandwidths and measuring transient and random peak power. This method is meant for use with burst signals. The sweep time is set to 600 times the burst period. Two sweeps are made, one in each of the two resolution bandwidths, and positive peak detection is used. This method supports 1993 RCR standards for PDC systems.

The algorithm used for this method assumes that the power in the adjacent channels consists of two types of power: impulsive power (transients due to enabling and disabling the carrier power) and random power (noise-like signals due to the intermodulation of noise-like modulation in the main channel). The characteristics of these two types of power change differently with resolution bandwidth changes, so they can be computed algebraically from measurements in two bandwidths.

The impulsive powers for all frequencies within each adjacent channel are converted to an equivalent voltage. These voltages are assumed to be in phase so they are added to compute a peak voltage in the channel and a peak power is computed. The random powers are all added within a channel to give a peak random power. The peak random power is added to the peak impulsive power to give a peak weighted power.

Front-panel key access: **MEAS/USER**

3dBPOINTS When using 3dB POINTS, a peak search is performed and the 3 dB bandwidth of the largest on-screen signal is displayed in the message area.

When used remotely, the MKBW command finds the signal bandwidth at 3 dB below the on-screen marker (if a marker is present) or the signal peak (if no on-screen marker is present).

Front-panel key access: **MEAS/USER**

6dBPOINTS When using 6dB POINTS, a peak search is performed and the 6 dB bandwidth of the largest signal on-screen is displayed in the message area. When used remotely, the MKBW command finds the signal bandwidth at 6 dB below the on-screen marker (if a marker is present) or the signal peak (if no on-screen marker is present).

Front-panel key access: **MEAS/USER**

10 MHzEXT INT Allows you to select either an internal frequency reference or your own external frequency reference. An external reference must be 10 MHz ±100 Hz at a nominal amplitude of 0 dBm (limits are from –2 dBm to +10 dBm). The external reference must be connected to connector J9 (J9 is labeled "10 MHz REF IN/OUT"), on the rear panel. An X displayed on the left edge of the display denotes external reference mode.

Front-panel key access: **AUX CTRL**

NOTE If an external frequency reference is selected but not supplied to the rear panel, hardware error messages are displayed. Refer to the Chapter 8 for more information.

A-B→AON OFF Turns the trace math function A–B→A ON or OFF. When this function is ON, the contents of trace B are subtracted from the contents of trace A; the result is placed in trace A. When this function is on, the trace A minus trace B math function is executed on all subsequent sweeps. An M appears on the left edge of the display to indicate the function is active.

Front-panel key access: **TRACE**

A+B→A Sums the contents of trace A with the contents of trace B, and places the result in trace A. This function is done only once and not on a continuous basis.

Front-panel key access: **TRACE**

A-B+DL→AON OFF Turns the trace math function A–B+DL→A ON or OFF. When this function is ON, the contents of trace B are subtracted from the contents of trace A and the value of the display line is added to the result then displayed in trace A.

The trace math function is executed on all subsequent sweeps until it is turned off. An M appears on the left edge of the display to indicate the function is active. The display line is activated as a result of this function; however, it can only be turned off by DSPL LIN ON OFF. (DSPL LIN ON OFF can be accessed with **DISPLAY**.)

Front-panel key access: **TRACE**

A EXCH B Exchanges the contents of trace A with the contents of trace B, and places both trace A and trace B in view mode.

Front-panel key access: **TRACE**

ACCELRAT Allows you to change the speed (acceleration) at which different ACP measurements are made. Changing the measurement speed affects each measurement method in different ways.

ANALOG METHOD The sweep rate is increased by a factor of two (faster acceleration) or four (fastest acceleration) above that used in normal analog measurements. The center frequency of the spectrum analyzer is shifted to compensate for the expected shift in effective center frequency from the faster sweep rate. The amplitude of the transmitted power result is modified to compensate for its expected variation with sweep rate.

Compensation is not done to the ACP ratios because the compensation needs for the adjacent and main channels cancel in the ratio. The compensation is not needed for noise-like signals, so errors will occur in the transmitted power result if the modulation is noise-like. Errors will also occur in the ACP ratio if the modulation is not noise-like but the adjacent channel power has significant noise-like power components. Typical values for the amplitude errors due to acceleration are less than 0.02 dB for faster acceleration and less than 0.10 dB for fastest acceleration.

PEAK METHOD The sweep is changed from one sweep, to cover the range of all alternate and adjacent channels, to one sweep for each channel under test. In the faster acceleration, the sweep time is controlled to allow the same number of burst RF cycles in each sweep as would occur in the normal sweep if the spectrum analyzer had 400 measurement cells in its display; the peak is measured over time intervals equivalent to the burst period. The results should be equivalent to those of a spectrum analyzer with 400 display points. International standards (MKK method) are written around this so the faster mode has no errors due to acceleration.

In the fastest acceleration mode, the sweep time is further decreased by a factor of two.

2BW METHOD The faster acceleration mode is not available. The fastest acceleration changes the two bandwidth method to the burst power method. The burst power method is much faster and it provides results that are equivalent with less than 0.10 dB difference.

BURSTPWR METHOD No acceleration is available.

GATED METHOD The faster acceleration mode is not available. In the fastest acceleration, the sweep is changed from one sweep to cover the range of all alternate and adjacent channels, to one sweep for each channel under test. The sweep time is controlled to allow the same number of burst RF cycles in each sweep as would occur in the normal sweep if the spectrum analyzer had 400 measurement cells in its display; the peak is measured over time intervals equivalent to the burst period. The results should be equivalent to those of a spectrum analyzer with 400 display points.

International standards (MKK method) are written around this so the fastest mode has minimal errors due to acceleration.

Front-panel key access: **MEAS/USER**

ACCELRAT FASTER Speeds up the ACP measurement with a minimal affect on the accuracy or repeatability. Sweep speeds or measurement techniques are changed to allow faster measurements than those described by the standards. The techniques used to speed up the measurement depend on the method being used. These techniques may allow a small difference in the measured ACP ratio (1 dB error in amplitude).

Front-panel key access: **MEAS/USER**

ACCELRAT FASTEST Speeds up the ACP measurement significantly at the expense of up to 2 dB of difference from using the normal speed. The techniques used to speed up the measurement depend on the measurement method selected.

Front-panel key access: **MEAS/USER**

ACCELRAT NORMAL Selects the normal measurement speed. The measurement speed is limited by the requirements of the standard. The technique for making the measurement is in accordance with the applicable standards committee documents for the chosen method. No speed-up techniques are used, therefore, there is no additional measurement error due to the use of speed-up techniques.

Front-panel key access: **MEAS/USER**

ACP AUTOMEASURE Measures the power that "leaks" from the transmitter output into the channels that are adjacent to the carrier. ACP AUTO MEASURE performs an automatic measurement which calculates the ratio of the "leakage" power in the adjacent channel to the total power transmitted by a transmitter. ACP AUTO MEASURE uses the measurement method that you have selected and changes the instrument state to ensure that a valid measurement is made. The instrument state parameters that can be affected are frequency span, resolution bandwidth, video bandwidth, and detection mode. Center frequency and reference level, are not affected.

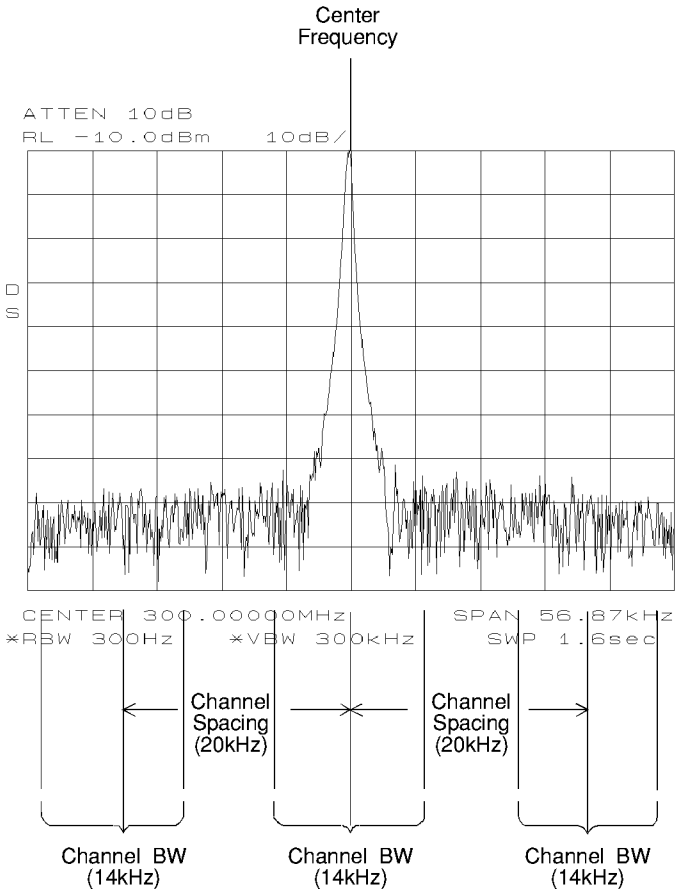
ACP AUTO MEASURE turns off the following functions if they are on:

- Trace Math
- Video Averaging Functions
- Frequency Count
- Signal Tracking
- AM/FM Demodulation

The spectrum analyzer center frequency should be set to the transmitter intended center frequency. The reference level should be set to optimize the displayed range to minimize the number of data points above the top or below the bottom of the range of the chosen display scale. The display scale should be set to LOG 10 dB/division. The input attenuator should be set to optimize the tradeoff between analyzer-induced third-order intermodulation distortion products and noise.

Front-panel key access: **MEAS/USER**

Figure 4-1 Channel Bandwidth Parameters



ACP COMPUTE Performs an adjacent channel power (ACP) computation on the current trace data without changing the instrument state settings. This computation operates exactly the same as that of ACP AUTO MEASURE, but ACP COMPUTE allows you to control the instrument state settings. The peak method or analog method must be selected to use this function. When ACP COMPUTE is pressed and the measurement setup is suitable for rms detection, the same rms voltage detection message displayed when using ACP AUTO MEASURE is displayed in the active function area. However, if the instrument state is unsuitable for rms detection, the following warning message is displayed.

```
****WARNING****
NOT RMS DETECTOR
```

In addition to the warning message, the instrument-state parameter that is causing the warning will also be displayed. The instrument-state messages that may be displayed are:

- RBW ≥ 300 kHz
- VBW < 10 × RBW
- DETECTOR MODE
- MIN HOLD
- MAX HOLD
- VIDEO AVERAGE

Even though a warning message with an invalid instrument-state parameter was indicated, the measurement is still made and the results are displayed in the active function area. If an invalid instrument-state parameter is suspected, the warning message can be viewed briefly by pressing ACP COMPUTE repeatedly. Computation results without rms detection can be accurate if the signals in the adjacent channels are similar to continuous wave (CW) signals, but not if the signals are noise-like. Also, some international standards for ACP measurements require the video bandwidth to be equal to the resolution bandwidth, which prohibits rms detection, while requiring the measurement to respond to the rms sum of all signals in the passband. If the video bandwidth is set according to this standard, the warning message will be displayed.

In addition to the warning messages for invalid instrument-state parameters listed above, the following three error messages may be observed in the lower right corner of the display:

- `ERR 908 BW>>SPCG` indicates that the channel bandwidth is too wide, compared to the channel spacing, for a valid computation.
- `ERR 909 SPAN<ACP` indicates that the frequency span is too narrow to obtain a valid measurement.
- `ERR 910 SPAN>ACP` indicates that the frequency span is too wide, compared to the channel bandwidth, to obtain an accurate measurement.

If any of the three errors occurs, the measurement is not completed. To correct the measurement, adjust your instrument state settings depending on the error that has occurred.

Front-panel key access: **MEAS/USER**

ACP MENU Accesses the adjacent channel power (ACP) menu of softkeys that measures the adjacent channel power ratio of a transmitter. The softkeys that are accessed by ACP MENU are ACP AUTO MEASURE, ACP COMPUTE, ACPGRAPH ON OFF, and ACP SETUP.

Front-panel key access: **MEAS/USER**

ACP SETUP Accesses the ACP setup functions. Many different measurement parameters can be set from this menu. Some of the parameters are interactive. Changing one parameter can change other parameters, or add and delete parameters. There are different measurement methods for measuring adjacent channel power and each method has several different parameters associated with it.

Different measurement methods are required by the different standards. Table 2-10 on page 63, included in chapter 2, relates the measurement methods to the various communications standards and formats.

Front-panel key access: **MEAS/USER**

ACP GRAPH ON OFF Displays a graphical representation of the adjacent channel power (ACP) ratio for the selected channel bandwidth, as a function of the channel spacing, using power integration (refer to the ANALOG METHOD softkey description.)

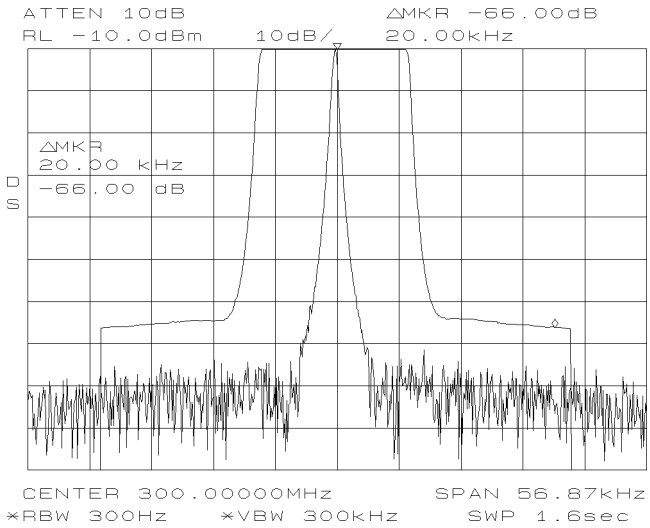
The graph can demonstrate how rapidly the ACP ratio changes with channel spacing. The peak method or analog method must be selected since the graph function requires data that is only available with these methods.

The upper graticule represents an ACP ratio of 0 dB. The vertical scale for the ACP graph is the same as the vertical scale for the spectrum trace, usually 10 dB/division. The horizontal scale represents the channel spacing, with 0 Hz spacing in the center and a scale factor that is the same as that for the spectrum trace, or the frequency span divided by 10 divisions.

The ACP graph is not defined for channel spacings where the graph is drawn at the bottom graticule line. For these points, the channel bandwidth would include frequencies beyond the edges of the screen, where no data was taken.

Front-panel key access: **MEAS/USER**

Figure 4-2 ACP Graph Display



ACPSTATE DFL CURR Allows you to select between using the default state for measuring adjacent channel power, or using the current state. In the default state the ACP function will alter parameters as needed to make the measurement. Using a current state allows you to specify some of the measurement parameters so they do not change while the measurement is being made.

The measurement state parameters that may be changed include:

- resolution bandwidth
- video bandwidth
- span
- sweep time
- detector mode
- gating parameters
- trigger parameter
- video averaging

Front-panel key access: **MEAS/USER**

ADJ CURRIF STATE Executes a routine that adjusts only the current bandwidth state. During this adjustment, the message `IF ADJUST STATUS: <text>` appears in the active function area. Depending on which portion of the IF system is being adjusted, either `AMPLITUDE` or a specific resolution bandwidth (for example, `1 MHz`) is displayed in the message.

Front-panel key access: **CAL**

AGC
ON OFF Switches automatic gain control (AGC) ON or OFF. AGC keeps the volume relatively constant during AM demodulation. AGC operates only during AM demodulation and when the frequency span is greater than 0 Hz.

Front-panel key access: **AUX CTRL**

ALC
INT EXT *For Option 002 only:* Activates internal (INT) leveling or external (EXT) leveling. The external leveling input is located on the rear panel of the analyzer. Negative-polarity detectors are supported. External leveling increases the amplitude accuracy by improving the effective source match.

Front-panel key access: **AUX CTRL**

ALL Sets the following functions to coupled mode: resolution bandwidth, video bandwidth, sweep time, input attenuator, center-frequency step-size, and units.

The spectrum analyzer chooses appropriate values for these functions depending on the selected frequency and span (or start and stop frequencies). These values are set according to the coupled ratios stored under VBW/RBW RATIO or RBW/SPAN RATIO. If no ratios are stored, default ratios are used instead.

Front-panel key access: **AUTO COUPLE**

AM DEMOD ON OFF

Not available in normalized mode.

Turns AM demodulation ON or OFF. If no marker is active and the frequency span is greater than 0 Hz, pressing AM DEMOD ON OFF automatically places a marker at the center of the trace and demodulates the signal at that marker position. Activating AM demodulation turns off FM demodulation, if it is on. When the frequency span is greater than 0 Hz, a 10 kHz resolution bandwidth is used during demodulation, regardless of the bandwidth annotated on the screen. When the span is equal to 0 Hz, the displayed bandwidth is used. In either case the video bandwidth is not applied to the demodulation.

Front-panel key access: **AUX CTRL**

AM/FM DEMOD Accesses a menu of demodulation functions, which are as follows: AM DEMOD ON OFF, FM DEMOD ON OFF, MARKER NORMAL or MARKER DELTA, PEAK SEARCH, and NEXT PEAK. When AM or FM demodulation is activated, the demodulated signal is output to the both the spectrum analyzer internal speaker, and the earphone jack connector. The earphone jack connector is located on the rear panel of the spectrum analyzer.

Front-panel key access: **AUX CTRL**

AMPCOR MENU Accesses functions that allow you to specify a correction to, or normalization of, the spectrum analyzer measurement. The corrections are entered as frequency-amplitude pairs and can be used to correct for variations in the flatness of the measurement system.

Front-panel key access: **CAL**

AMPCOR ON OFF Allows you to turn the amplitude correction function on and off. Correction points can be used to specify a correction to, or normalization of, the spectrum analyzer measurement.

A W appears on the left edge of the display to indicate the function is active. If you have not previously edited or recalled correction data, then the ampcor function is not activated and the message No Correction Loaded appears in the active annunciator area of the display.

Each correction point consists of a frequency at which the correction should be applied and an amplitude, in dB, of the correction. For frequencies between correction points, the ampcor function linearly interpolates the correction data you have entered. Frequencies outside the range over which you have specified correction are corrected by the amplitude values at the nearest (in frequency) end of the list of correction data. The correction is automatically recalculated for any span or vertical scale, including linear.

If any of the trace data is above or below the graticule, the ampcor function may not properly correct it. The spectrum analyzer amplitude accuracy is not specified above or below the graticule. Anytime ampcor applies a correction such that data outside the graticule is moved to within the graticule, an error (error number 921 or 922) is generated. In order to avoid these errors, make sure that the trace data which is being corrected is within the graticule before the correction is applied.

Front-panel key access: **CAL**

AMPLITUDE Accesses the amplitude functions, which are as follows: REF LVL, NORM REF LVL, ATTEN AUTO MAN, LOG dB/DIV, LINEAR, RANGE LVL, REF LVL OFFSET, MAX MXR LEVEL, AMPTD UNITS, COUPLING AC DC, NORM REF POSN, PRESEL AUTO PK, and PRESEL MAN ADJ. **AMPLITUDE** also activates the reference-level function.

Front-panel key access: **AMPLITUDE**

AMPTD CORRECT Displays a menu of functions that set conversion losses and flatness data.

Front-panel key access: **AUX CTRL**

AMPTD UNITS Accesses the softkeys that allow you to change the amplitude units of the spectrum analyzer. AMPTD UNITS accesses following softkeys: UNITS AUTO MAN, dBm, dBµV, dBmV, VOLTS, and WATTS.

Front-panel key access: **AMPLITUDE**

NOTE Amplitude units are not available in normalized mode.

ANALOG METHOD Makes adjacent channel power (ACP) measurements by measuring continuous power integration versus frequency. Uses an analog method that measures the power in the main and adjacent channels assuming a continuous carrier. The rms power of that carrier is detected using power detection. This is done by using a video bandwidth that is much wider than the resolution bandwidth. Then the power, not the log of the power, of each measurement cell is added. This method is used for measuring analog FM systems.

Front-panel key access: **MEAS/USER**

ANALYZER ADDRESS Displays the current GPIB address of the spectrum analyzer. A new address can be entered by using the data keys (and pressing **ENTER**), the step keys, or the knob. You should press STORE HPIB ADR once the GPIB address has been entered. If you do not press STORE HPIB ADR, the redefined GPIB address is retained if **PRESET** is pressed, but not if the power to the spectrum analyzer is turned off.

Front-panel key access: **CONFIG**

ANNOT HELP Defines the annunciators that appear in the special functions area at the left side of the display screen. The annunciators are:

A IF adjust turned OFF

C DC coupling selected (ac coupling is default)

D Detector mode set to sample, negative peak, or positive peak

E Special sweep-time equations in use (Refer to tracking generator SWP CPL SR SA key for more information.)

F Frequency offset is less than or greater than 0 Hz

G Internal tracking generator is on

K Signal track is on

M Trace math is on

N Normalization is on

R Reference level offset is less than or greater than 0 dB

S Single-sweep mode

T Trigger mode set to line, video, or external

W Amplitude correction (ampcor) is on

X 10 MHz reference is external

\+ External mixer bias is greater than 0 mA

– External mixer bias is less than 0 mA

Front-panel key access: **DISPLAY**

ANNOT ON OFF Blanks the annotation from the display (OFF) or reactivates it (ON).

Front-panel key access: **DISPLAY**

ATTEN AUTO MAN *Available with internal mixing only.*

Adjusts the spectrum analyzer input attenuator. In AUTO mode, the input attenuator is coupled to the reference level. In manual (MAN) mode, the input attenuation can be adjusted using the data keys, the step keys, or the knob. The attenuator ranges from 0 dB to 70 dB in 10 dB increments (0 dB to 60 dB range for the Agilent 8564E/EC and Agilent 8565E/EC). 0 dB attenuation can only be selected using the data keys.

Attenuation is normally a coupled function and is automatically adjusted when the reference level changes. The reference level generally does not change when the attenuation changes. The attenuator is adjusted so that the maximum signal amplitude at the input mixer is –10 dBm or less. For example, if the reference level is +23 dBm, the attenuation is 40 dB for an input of –17 dBm at the mixer (23 – 40 = –17). This prevents signal compression. To adjust the input attenuator set ATTEN AUTO MAN to MAN. A line under AUTO or MAN indicates whether the attenuator is coupled (AUTO) or in manual mode (MAN). When the input attenuator is in manual mode, pressing ATTEN AUTO MAN again recouples the attenuator to the reference level.

Front-panel key access: **AMPLITUDE** or **AUTO COUPLE**

CAUTION Maximum input signal amplitude is +30 dBm with at least 10 dB of input attenuation. Higher amplitude signals can result in damage to the input attenuator or to the input mixer.

AUTO COUPLE Accesses a menu of coupled-mode functions, as follows: ALL, RES BW AUTO MAN, VIDEO BW AUTO MAN, SWP TIME AUTO MAN, ATTEN AUTO MAN, CF STEP AUTO MAN, and UNITS AUTO MAN.

Front-panel key access: **AUTO COUPLE**

AUX CTRL Accesses the softkeys that control auxiliary functions, for example, the tracking generator and AM or FM demodulation. **AUX CTRL** accesses TRACKING GENRATOR, INTERNAL MIXER, EXTERNAL MIXER, AM/FM DEMOD, and REAR PANEL.

Front-panel key access: **AUX CTRL**

AVERAGE CNV LOSS Displays the mean conversion loss for the current harmonic and allows you to enter new conversion loss data. In a full frequency band (such as K band), the mean conversion loss is defined as the minimum loss plus the maximum loss for that band divided by two. To change the maximum and minimum values, use CNV LOSS VS FREQ. Any change to the average conversion loss also affects the flatness data, which is described in Table 4-1 on page 184.

The default conversion loss value for each band is 30 dB.

Front-panel key access: **AUX CTRL**

AVG "OFF"POWER Measures the average power of a burst carrier during the time that the carrier is off. The measurement should be made in zero span. The resolution bandwidth should be nearly as wide as (or wider than) the modulation bandwidth, during the on-time of the pulse.

The off-time is determined by the transitions through a power level 20 dB below the peak level. Trace data following a trailing edge or preceding a leading edge is used, except when it is close enough to the edge to possibly be due to resolution bandwidth and video bandwidth response times.

If the rising or falling performance of the burst signal to be tested is slow compared to the resolution bandwidth/video bandwidth responses, the transition power will be measured as part of the average off power. In this case, reducing the resolution bandwidth is recommended.

Front-panel key access: **MEAS/USER**

AVG "ON"POWER Measures the average power of the carrier during that portion of the time when the burst is on (within 20 dB of its peak level). The true mean carrier power is calculated. This is done by measuring the time waveform of the RF envelope, converting the trace data from dB to power units, and then averaging the power trace data.

Front-panel key access: **MEAS/USER**

BW Selects operation with a monochrome printer, such as an HP ThinkJet, for use by the **COPY** key.

Front-panel key access: **CONFIG**

B-DL→B Subtracts the value of the display line from the contents of trace B and places the result in trace B. This function is executed only once; to execute it again, press B-DL→B again. The display line is activated as a result of this function.

Front-panel key access: **TRACE**

BACKSPACE Deletes the last character placed in the title.

Front-panel key access: **DISPLAY**

BIAS *Available only with unpreselected external mixers.*Displays a menu of functions that allow you to select external-mixer bias. The external-mixer bias is provided on the center conductor of the IF INPUT connector on the front panel. The functions that are accessed by BIAS are BIAS OFF, POSITIVE BIAS, and NEGATIVE BIAS.

Front-panel key access: **AUX CTRL**

CAUTION External mixers that require bias may be damaged by the open-circuit bias voltage that can be as great as ±3.5 V through a source resistance of 300 ohms. Such voltage may appear when recalling an instrument state in which an active bias has been stored.

NOTE The bias value that appears on the spectrum analyzer display is expressed in terms of short-circuit current (that is, the amount of current that would flow if the center conductor of the IF INPUT were shorted to ground). The actual amount of current flowing into the mixer will be less.

BIAS OFF Turns off the external-mixer bias.

Front-panel key access: **AUX CTRL**

BLANK A Blanks trace A from the screen. The contents of trace A are retained, but not updated.

Front-panel key access: **TRACE**

BURST/WEIGHTNG Accesses a menu of functions that allow you to change the burst width and period when making adjacent channel power (ACP) measurements on burst signals and to select different weighting factors for ACP measurements.

Front-panel key access: **MEAS/USER**

BURST PERIOD Allows you to enter the period (cycle time) of the burst RF signal. The cycle time is needed to set sweep times.

Front-panel key access: **MEAS/USER**

BURST WIDTH Allows you to enter the pulse width ("on" time) of the burst RF signal. The pulse width is needed in the gated method to set gating times. It is also needed in the burst power method.

Front-panel key access: **MEAS/USER**

BURST PWR METHOD Makes adjacent channel power (ACP) measurements measuring peak transient, peak random, and average power. This method performs a measurement and computation to find the impulsive and random powers similar to the two-bandwidth method (2BW METHOD), but using a different and faster technique.

It also uses an rms-responding technique to compute a true power ratio between the main and adjacent channels, without peak weighting or assumptions about phase relationships.

Front-panel key access: **MEAS/USER**

BW Accesses the bandwidth functions menu: RES BW AUTO MAN, VIDEO BW AUTO MAN, VBW/RBW RATIO, RBW/SPAN RATIO, and VID AVG ON OFF. **BW** also activates the resolution-bandwidth function.

Front-panel key access: **BW**

CAL Displays all menus related to calibration and diagnostic routines.

Front-panel key access: **CAL**

CAL OPN/SHRT Activates a procedure to store the average of an open and a short calibration into trace B and into the nonvolatile memory of the spectrum analyzer (this average is stored in spectrum analyzer memory for future reference). When activated, the message `Connect OPEN. Store when ready.` appears in the active function block. Once the open is connected, press STORE OPEN. `Connect SHORT. Average with open when ready.` will then appear in the active function block. Connect the short, then press AVERAGE SHORT. The state of the open/short average trace is stored in state register number 8.

The SAVELOCK ON OFF function must be off. If this procedure needs to be interrupted at any time, press ABORT.

Front-panel key access: **AUX CTRL**

CAL THRU Activates a procedure to store a thru calibration trace into trace B and into the nonvolatile memory of the spectrum analyzer (for future reference). When activated, the message `Connect THRU. Store when ready.` appears in the active function block. Once the thru is connected, press STORE THRU. The state of the thru information is stored in state register number 9. The SAVELOCK ON OFF function must be off. If the procedure needs to be interrupted at any time, press ABORT.

Front-panel key access: **AUX CTRL**

Accesses the carrier power menu of functions which includes AVG "ON" POWER and AVG "OFF" POWER.

Front-panel key access: **MEAS/USER**

CENTER FREQ Activates the center frequency and sets the spectrum analyzer to the center-frequency/span mode. CENTER FREQ can be adjusted using the data keys, the step keys, or the knob. If a selected center frequency is not compatible with the current span, the span is adjusted to the nearest value that will accommodate the desired frequency.

Front-panel key access: **FREQUENCY**

CF/2→CF Sets the center frequency of the spectrum analyzer to the currently-displayed center frequency divided by two. The displayed center frequency is divided by two each time this key is pressed until the lower center frequency limit is reached. This allows quick and easy measurement of sub-harmonics. This softkey is available only in spectrum analyzers with firmware revisions >941028.

Front-panel key access: **FREQUENCY**

CF*2→CF Sets the center frequency of the spectrum analyzer to the currently-displayed center frequency times two. The displayed center frequency is multiplied by two each time this key is pressed until the upper center frequency limit is reached. This allows quick and easy measurement of harmonics. This softkey is available only in spectrum analyzers with firmware revisions >941028.

Front-panel key access: **FREQUENCY**

CF STEP AUTO MAN Adjusts the center-frequency step-size. When this function is in coupled (AUTO) mode and center frequency is the active function, pressing a step key yields a one-division shift (10 percent of span) in the center frequency for spans greater than 0 Hz. For zero span, pressing a step key when center frequency is the active function yields a center-frequency shift equal to 25 percent of the resolution bandwidth. For manual (MAN) mode, the step size can be adjusted using the data keys, the step keys, or the knob. After entering a step size and changing the active function to CENTER FREQ, use the step keys to adjust the center frequency by the step size selected. This function is useful for quickly tuning to the harmonics of an input signal. For example, to tune to the harmonics of a 300 MHz signal, set CF STEP AUTO MAN to MAN and enter 300 MHz. If the center frequency is at 300 MHz, pressing the step key increases the center frequency to 600 MHz, which is equal to the second harmonic. Pressing the STEP key again increases the center frequency by another 300 MHz, to 900 MHz. CF STEP AUTO MAN indicates whether the step size is in a coupled (AUTO) or manual (MAN) mode. When the step size is in manual mode, pressing CF STEP AUTO MAN returns the function to coupled mode.

Front-panel key access: **AUTO COUPLE** or **FREQUENCY**

CH EDGES→ ΔMKR Moves the marker locations to ±0.5 channel spacings from the center frequency. This allows power measurements within a channel with the ΔMARKER OCC BW softkey while multiple channels are shown in the displayed frequency span.

Front-panel key access: **MEAS/USER**

CHAN PWR OVER BW Calculates the power and power spectral density in the channel power bandwidth specified by the CHPWR BW [ ] softkey, and centered around the spectrum analyzer center frequency. The center frequency, reference level, and channel power bandwidth must be set by the user.

Front-panel key access: **MEAS/USER**

CHAN DN Moves the center frequency of the spectrum analyzer lower in frequency by one channel spacing.

Front-panel key access: **MEAS/USER**

CHAN UP Moves the center frequency of the spectrum analyzer higher in frequency by one channel spacing.

Front-panel key access: **MEAS/USER**

CHANNEL BANDWDTH Allows you to set the channel bandwidth for an adjacent channel power (ACP) measurement. Changing the channel bandwidth will affect the channel power bandwidth setting (CHPWR BW [ ]). The channel bandwidth can be adjusted using the data keys, the step keys, or the knob.

Front-panel key access: **MEAS/USER**

CHANNEL PWR MENU Accesses the channel power menu of functions which includes CHANNEL POWER, MKR MEAN →CF, MKRΔ →CHPWR BW, and CHPWR BW [ ].

Front-panel key access: **MEAS/USER**

CHANNEL SPACING Allows you to set the spacing between transmitted signals for an adjacent channel power (ACP) measurement. CHANNEL SPACING can be adjusted using the data keys, the step keys, or the knob.

Front-panel key access: **MEAS/USER**

CHPWR BW[ ] Allows you to set the channel power bandwidth. This is the frequency span over which the channel power is computed. It can be adjusted using the data keys, the step keys, or the knob. The CHAN PWR OVER BW softkey uses this bandwidth for its calculation of channel power.

Changing this parameter does not change the channel bandwidth parameter in the ACP setup menu. However, if the channel bandwidth is changed, this parameter is also updated.

Front-panel key access: **MEAS/USER**

CHAR SET 1 2 Selects one of two character sets. Character set 1 contains uppercase letters, numbers, and miscellaneous characters. Character set 2 contains lowercase letters and miscellaneous characters.

Front-panel key access: **DISPLAY**

CLEAR WRITE A Clears trace A and sets it to accept and display new input-signal data continuously.

Front-panel key access: **TRACE**

CNV LOSS VS FREQ Displays the stored conversion loss for a specific frequency in the current external mixing band.

This allows amplitude correction to be entered to compensate for changes in conversion loss with frequency. To enter a new value, use the data keys. To change the displayed frequency, use the step keys. Any changes to the data also affect the mean conversion loss stored under AVERAGE CNV LOSS. <Undefined Cross-Reference> shows the number of flatness points for each band and the default flatness values. To view the correction, connect a 310.7 MHz signal of a known amplitude (approximately –30 dBm) to the IF input and set the analyzer to sweep the associated band.

Front-panel key access: **AUX CTRL**

Table 4-5 Flatness Points and Conversion Losses for External Mixing Bands

Frequency Band	Frequency Range (GHz)	Number of Flatness Points	Point Spacing	Conversion Loss
K	18.0 to 26.5	6	2 GHz	30 dB
A	26.5 to 40.0	8	2 GHz	30 dB
Q	33.0 to 50.0	7	3 GHz	30 dB
U	40.0 to 60.0	6	4 GHz	30 dB
V	50.0 to 75.0	6	5 GHz	30 dB
E	60.0 to 90.0	7	5 GHz	30 dB
W	75.0 to 110.0	8	5 GHz	30 dB
F	90.0 to 140.0	6	10 GHz	30 dB
D	110.0 to 170.0	7	10 GHz	30 dB
G	140.0 to 220.0	9	10 GHz	30 dB
Y	170.0 to 260.0	7	15 GHz	30 dB
J	220.0 to 325.0	8	15 GHz	30 dB

COLOR Selects the HP PaintJet color printer (or compatible device) for use by the **COPY** key.

Front-panel key access: **CONFIG**

CONFIG Accesses a menu of settings that allow information shown on the instrument's display to be copied to an external GPIB printer or plotter. Under this menu, the analyzer GPIB address can be changed and external mixing set to preselected or unpreselected.

Front-panel key access: **CONFIG**

CONT MEASURE

Sets the measurements, available under the front panel **MEAS/USER** key, so that they run continuously. The selected measurement is repeated unless interrupted by another front panel key. The **COPY** key does not stop the measurement.

Front-panel key access: **MEAS/USER**

COPY

Transfers display data to a GPIB device (either a printer or a plotter) that has been selected with COPY DEV PRNT PLT.

COPY allows either a black and white or color print of the entire display screen, or a plot of the entire display screen. Softkeys cannot be printed or plotted.

See also COPY DEV PRNT PLT, PRINTER CONFIG, and PLOTTER CONFIG for more information on how to plot or print the spectrum analyzer display.

Front-panel key access: **COPY**

NOTE

If the message `CONNECT PLOTTER` appears briefly in the active function area of the display when executing any plot function, and there are no other errors, the plotter is not connected to the GPIB. Check that the GPIB cable between the spectrum analyzer and plotter is functional and that the plotter is turned on.

If the `CONNECT PLOTTER` message appears, and either `ERR 109 CtrlFail` or `ERR 110 NOT CTRL` are displayed, the spectrum analyzer is not able to take control of the GPIB. Disconnect any other controller from the bus.

If the message `CHECK PLOTTER` appears briefly in the active function area of the display when executing any plot function, the plotter is not responding to a query for its P1 and P2 coordinates. Check that the plotter is not set to listen-only.

COPY DEV PRNT PLT

Designates the hardcopy device (printer or plotter) that is used when the **COPY** key is pressed. The current copy selection (PRNT for a printer, PLT for a plotter) is underlined.

Front-panel key access: **CONFIG**

COUNTER ON OFF

Activates (ON) or deactivates (OFF) the counter mode. This softkey is not available when a tracking generator is active.

The counted value appears in the upper right corner of the display.

Front-panel key access: **FREQ COUNT**

COUNTER RES

Adjusts the resolution of the frequency-count measurement. The resolution ranges from 1 Hz to 1 MHz in decade increments. The default value is 10 kHz. The counter measurement occurs over a time interval of twice the reciprocal of the counter resolution for resolution bandwidths greater than or equal to 300 Hz.

Front-panel key access: **FREQ COUNT**

COUPLING

AC DC

Not available with an Agilent 8563E/EC, Agilent 8564E/EC, or Agilent 8565E/EC. Toggles the input between ac and dc coupling. The preset state of the analyzer is ac-coupled. This protects the input of the analyzer from damaging dc signals. It also limits the lower frequency-range response to 100 kHz (although the analyzer will tune down to 0 Hz with signal attenuation).

Front-panel key access: **AMPLITUDE**

CRT ADJ PATTERN

Displays a fixed pattern of lines and characters on the screen, each of which is used in setting the various adjustments in display hardware (such as vertical gain, focus, and so on) that are available in E-series instruments. Three of these adjustments—X POSN, Y POSN, and TRACE ALIGN—are available from the rear panel. Use the CRT alignment pattern and the above three adjustments to align the display. Refer to Figure 4-3. When this function is active, all front-panel keys are inactive except **PRESET**. Press EXIT to remove the pattern and return the analyzer to its previous state. For other display adjustments, refer to the Chapter 8. EC-series instruments do not require adjustment and are not adjustable.

Front-panel key access: **CAL**

Figure 4-3 CRT Alignment Pattern

DATE CODE OPTIONS Displays the analyzer firmware datecode, the instrument serial number, the model number, and the number of options that are installed in the spectrum analyzer. Note that both E-series and EC-series instruments will appear as E-series instruments in the display when the DATECODE&OPTION key is pressed. EC-series and E-series instruments with Option 007 will both appear as Option 007 instruments.

For the 8560E/EC, valid options are:

- Option 001 Second IF output
- Option 002 Built-in tracking generator
- Option 005 Alternate sweep output
- Option 008 Signal Identification
- Option 103 Delete precision frequency reference
- Option 104 Delete Agilent 85620A
- Option 327 Delete IF input and video output

- Option 007 Fast time domain sweeps (E-series only)

For the Agilent 8561E/EC and Agilent 8562E/EC, valid options are:

- Option 001 Second IF output
- Option 005 Alternate sweep output
- Option 008 Signal Identification
- Option 103 Delete precision frequency reference
- Option 104 Delete Agilent 85620A
- Option 327 Delete IF input and video output

- Option 007 Fast time domain sweeps (E-series only)

For the Agilent 8563E/EC, valid options are:

- Option 001 Second IF output
- Option 005 Alternate sweep output
- Option 007 Fast time domain sweeps (E-series only)
- Option 008 Signal Identification
- Option 026 APC 3.5 front panel RF connector
- Option 103 Delete precision frequency reference
- Option 104 Delete Agilent 85620A

- Option 007 Fast time domain sweeps (E-series only)

For the Agilent 8564E/EC, valid options are:

- Option 001 Second IF output
- Option 005 Alternate sweep output
- Option 006 Frequency extension down to 30 Hz
- Option 008 Signal Identification
- Option 103 Delete precision frequency reference
- Option 104 Delete Agilent 85620A

- Option 007 Fast time domain sweeps (E-series only)

For the Agilent 8565E/EC, valid options are:

- Option 001 Second IF output
- Option 005 Alternate sweep output
- Option 006 Frequency extension down to 30 Hz
- Option 008 Signal Identification
- Option 103 Delete precision frequency reference
- Option 104 Delete Agilent 85620A

- Option 007 Fast time domain sweeps (E-series only)

Front-panel key access: **CONFIG**

dBm

Selects absolute decibels relative to 1 milliwatt as the amplitude units.

Front-panel key access: **AMPLITUDE**

dBμV

Selects absolute decibels relative to 1 μvolt as the amplitude units.

Front-panel key access: **AMPLITUDE**

dBmV

Selects absolute decibels relative to 1 millivolt as the amplitude units.

Front-panel key access: **AMPLITUDE**

DELETE CORR PT

Deletes the currently selected frequency-amplitude correction pair from the list of correction points. The display of correction point data and the applied correction is updated as soon as the key is pressed. If there are no correction points in the list, or if the currently selected point is a new point past the end of the list, no action is taken.

Front-panel key access: **CAL**

DEMOD TIME

Adjusts the duration of demodulation between successive sweeps when the span is greater than 0 Hz. The time ranges from 0.1 seconds to 60 seconds; the default value is 1 second. When the frequency span equals 0 Hz, demodulation is continuous, except for transients during retrace. To avoid these transients, set the analyzer to external trigger mode, but do not supply a trigger input.

Front-panel key access: **AUX CTRL**

DETECTOR MODES

Accesses a menu of detector modes, which include normal, sample, and positive or negative peak detection. When any detector mode other than NORMAL is active, a D appears on the left edge of the display.

Front-panel key access: **TRACE**

Detector Mode	Typical Measurement
Positive Peak	Good for making sure you do not miss any fast signal peaks. Good for seeing signals that are very close to the noise floor. Shows a noise floor that is slightly higher than the actual noise floor.
Negative Peak	Mostly used for troubleshooting the spectrum analyzer and not for making measurements. Gives a good representation of the modulation envelope for an AM modulated signal.
Normal	Used for most normal operation. Good for viewing signals and the noise floor at the same time. Does not miss any signal peaks. May display signal peaks with a slight shift in frequency. (Delayed by one display sample interval, 1/600 of the span.)
Sample	Good for making noise measurements. It's a more realistic representation of noise than normal detection.

DETECTOR NEG PEAK

Selects the negative-peak detector mode. Used to detect the negative-peak noise level of a trace.

Front-panel key access: **TRACE**

DETECTOR NORMAL

Sets the detector to normal mode; this is also the default mode. In normal mode, the display simulates an analog display by alternately displaying positive and negative peaks when the presence of noise is detected, and displaying positive peaks otherwise.

Front-panel key access: **TRACE**

DETECTOR POS PEAK

Selects the positive-peak detector mode. Used to detect the positive-peak noise level of a trace. This is the detector selected by MAX HOLD.

Front-panel key access: **TRACE**

DETECTOR SAMPLE

Sets the detector to sample mode. This mode is used with the video averaging and marker noise functions, as well as for the combination of resolution bandwidths greater than or equal to 300 Hz and video bandwidths less than or equal to 100 Hz. Note that when the resolution bandwidth is not much greater than the display resolution, the peak responses can be missed when the video signal is sampled.

Front-panel key access: **TRACE**

DISPLAY

Accesses the keys that control the display including setting the intensity and focus, turning the display line and threshold line on and off, turning the graticule and annotation on and off, and entering a screen title.

Front-panel key access: **DISPLAY**

DLY SWP[ ]

Delays the start of the sweep until the specified time elapses after the trigger event. With Option 007 the delay can be set to start the sweep before the trigger event, when using sweep times <30 ms. The second line of the softkey indicates the current setting of the sweep delay. This function is useful when making gated measurements.

Front-panel key access: **SWEEP**

DLY SWP ON OFF

Turns on and off the function that delays the start of the sweep until after the trigger event. With Option 007 the sweep can be started before the trigger event. Useful when making gated measurements.

Front-panel key access: **SWEEP**

DONE EDIT

Exits the ampcor edit menu and returns to the ampcor menu.

Front-panel key access: **CAL**

DSPL LIN ON OFF

Activates a display line that can be adjusted with the data keys, the step keys, or the knob. When the display line is ON, pressing DSPL LIN ON OFF again turns the display line OFF.

Front-panel key access: **DISPLAY**

EDGE POL POS NEG

Selects the polarity for edge triggering of a gated measurement. The gate can be triggered on either a positive or negative going edge of the rear panel input EXT/GATE TRIG INPUT.

NOTE When the polarity of the gate trigger is set, the instrument normal sweep trigger will always be set to the same polarity.

Front-panel key access: **SWEEP**

EDIT AMPCOR

Accesses a menu of functions for editing the frequency-amplitude pairs which define the desired measurement correction. The SCROLL CORR PTS softkey is automatically activated and highlighted upon entering the new menu. Current correction data is displayed. The knob and the step-keys can be used to scroll through the correction points.

If correction data is available when the edit ampcor function is activated, amplitude correction is turned on, the correction is applied to the displayed trace, and the data is available for editing. If there are no current correction points, the function is not turned on until you have entered a point.

Each correction point consists of a frequency at which the correction should be applied, and the amplitude of the correction in decibels. The spectrum analyzer accepts, stores and corrects frequencies with 1 Hertz resolution. The amplitude resolution is in hundredths of a dB, although the displayed resolution may be less. The list of correction points is sorted in order by frequency.

Front-panel key access: **CAL**

EDIT AMPL

Allows you to modify the amplitude information associated with the currently selected correction point. After pressing this softkey, the amplitude can be edited using the knob, step-keys, or numeric keypad.

Data entry is simplified if you are entering new correction pairs in frequency order. After using the EDIT FREQ softkey and entering the frequency data, a default amplitude is provided and the EDIT AMPL softkey is activated.

This default corresponds to the previous amplitude correction value in the list, if one exists, or 0 dB if the new point is the first correction on the list. If you use the numeric keypad and one of the terminator keys to enter the amplitude value, the correction list automatically moves to the end of the list and activates the EDIT FREQ softkey, allowing you to enter a new correction point.

Front-panel key access: **CAL**

EDIT FREQ

Allows you to modify the frequency information associated with the currently selected correction point. After pressing this softkey, the numeric keypad can be used to enter a frequency. This may be the frequency for a new correction point or a new frequency for a point that already exists. The knob and step-keys are inactive during "edit frequency".

The list of frequency-amplitude correction pairs is sorted according to frequency as soon as a frequency entry has been terminated. The currently selected correction point remains as the frequency which has just been entered. A maximum of 200 correction points can be entered.

You may have a frequency point that must be corrected with different values when it is approached from a lower frequency, than when it is approached from a higher frequency. This discontinuous correction can be created by entering the same frequency more than once with different correction amplitudes. Corrections specified for the same frequency remain on the list in the order in which they were entered. The ampcor function interpolates the correction. At measurement frequencies below the duplicate frequency, it uses the amplitude value corresponding to the first correction pair entered. Corrections applied above the duplicate frequency are interpolated using the last amplitude entered at the duplicate frequency. Once entered, the amplitudes at the duplicate frequency can be edited to obtain the desired correction behavior.

Front-panel key access: **CAL**

ELAPSED TIME Displays the cumulative operating time of the spectrum analyzer. The value, which is expressed in hours, appears in the active function block.

Front-panel key access: **RECALL**

ERASE TITLE Erases the current title from the display.

Front-panel key access: **DISPLAY**

EXIT & RESTORE Leaves the ACP menus, turns off the current function, and restores the spectrum analyzer state to the previous state. Exiting the ACP menus by pressing other front panel keys terminates the measurement but does not restore the spectrum analyzer state.

Front-panel key access: **MEAS/USER**

EXIT ACP Returns to the measure/user menu.

Front-panel key access: **MEAS/USER**

EXIT AMPCOR Exits the ampcor menu and returns to the calibration menu.

Front-panel key access: **CAL**

EXT MXR PRE UNPR *Not available with an 8560E/EC Option 002 and non-functional in instruments with Option 327.* Selects either preselected external mixing mode or unpreselected external mixing mode. This softkey sets the external mixer type, but does not select external mixing. Select external mixing with the EXTERNAL MIXER softkey under **AUX CTRL**.

If the preselected external mixer mode is selected, rear-panel output J8 of the analyzer is automatically switched to the 0.5 V/GHz (FAV) mode with an output of 1.5 V/GHz of the LO frequency. The 1.5 V/GHz of the LO frequency definition is required for the Agilent 11974 Series preselected external mixers.

Front-panel key access: **CONFIG**

NOTE There are two different types of external mixers available, preselected and unpreselected. The EXT MXR PRE UNPR softkey function applies only to the selection of the type of external mixer to be used. It does not switch the analyzer from internal to external mixing.

EXTERNAL Sets the trigger to external mode. Connect an external trigger source to J5 EXT/GATE TRIG INPUT on the rear panel of the spectrum analyzer. The source must range from 0 V to 5 V dc (TTL). The trigger occurs on the rising or falling edge of the signal (about 1.5 V) as selected by the TRIG POL POS NEG softkey function.

Front-panel key access: **TRIG**

EXTERNAL MIXER *Not available with Option 002 and non-functional in instruments with Option 327.* Accesses a menu of functions that allow you to extend the spectrum analyzer frequency range using external mixers. These functions include band and harmonic selection, amplitude correction, signal identification (if available), and setting the external mixer bias.

Front-panel key access: **AUX CTRL**

NOTE No external mixing capabilities are available with an 8560E/EC Option 002.

Resolution bandwidths less than 300 Hz are not available with external mixers.

FACTORY PRSEL PK *Available only with internal mixing of signals >2.9 GHz.* Restores the factory preselector-peaking data and makes this data the current preselector data. This data is stored in the factory data table and can only be changed by service personnel. For more information on the preselector data tables, refer to the RECALL PRSEL PK softkey.

Front-panel key access: **RECALL**

FFT MEAS Performs a discrete Fourier transform on the input signal. It is intended to convert zero-span information into the frequency domain, allowing the demodulated signal to be viewed as spectral data relative to the frequency of the modulation. However, performing a fast Fourier transform (FFT) on a frequency sweep will *not* provide time-domain results. When FFT MEAS is pressed, the function sets the analyzer to sample-detection mode and takes a sweep to obtain a sample of the input signal. Then the spectrum analyzer executes a series of computations on the time-domain data to produce the frequency-domain results.

NOTE Pressing FFT MEAS sets the analyzer into single-sweep mode. To leave the FFT measure mode, set the sweep to continuous by pressing SWEEP CONT SGL (CONT) under either the **SWEEP** or **TRIG** key.

The FFT results are displayed on the spectrum analyzer in a 10 dB per division logarithmic scale. For the horizontal dimension, the frequency at the left side of the graph is 0 Hz, and at the right side is 300 divided by the sweep time. Also, peak search marker is activated.

The FFT function is commonly used to measure AM in the presence of incidental FM. In this case, performing an FFT on the demodulated, zero-span AM signal, will result in a component (shown at 0 Hz) that depicts the power in the carrier of an AM signal. Other components are shown at the power level of the AM sidebands, with FM sidebands rejected. The amplitude accuracy of these sidebands is affected by the effective filtering of the resolution bandwidth filter (equivalent to a low-pass filter with a cutoff frequency equal to half the resolution bandwidth) and the video filter.

Aliasing can occur when modulation rates on the carrier are higher than one-half the sample rate for the zero-span signal, or 300 divided by the sweep time. The aliasing can be reduced by using a narrower resolution or video bandwidth.

Front-panel key access: **MEAS/USER**

FM DEMOD ON OFF *Not available in normalized mode.* Turns FM demodulation ON or OFF. If no marker is active and the frequency span is greater than 0 Hz, pressing FM DEMOD ON OFF automatically places a marker at the center of the trace and demodulates the frequency at that marker position. Turning FM demodulation on turns off AM demodulation, if it is active. When the frequency span is greater than 0 Hz, a 100 kHz bandwidth is used during the demodulation, regardless of the bandwidth annotated on the screen. When the span is equal to 0 Hz, the displayed bandwidth is used. In either case, the video bandwidth is not applied to the demodulation.

Front-panel key access: **AUX CTRL**

FOCUS Changes the focus of the display on E-series instruments. Press FOCUS, then use the data keys, the step keys, or the knob to adjust the focus. The focus ranges from 0 to 255; the current value appears in the active function block. When FOCUS is pressed, STORE FOCUS appears on the menu. Press STORE FOCUS to store the new focus value. The overall display focus can only be affected a small amount. EC-series instruments do not require adjustment and are not adjustable.

Front-panel key access: **DISPLAY**

FRAC N FREQ Displays the fractional N frequency corresponding to the start frequency. This oscillator is used for fine-tuning the local oscillator.

Front-panel key access: **CAL**

FREE RUN Sets the trigger to free-run mode. Sweep triggers occur as rapidly as the spectrum analyzer will allow.

Front-panel key access: **TRIG**

FREQ COUNT Activates the frequency counter and displays its results in the upper-right corner of the screen. This replaces any current marker readout in that area. If MARKER NORMAL or MARKER DELTA is already active, **FREQ COUNT** uses that marker mode to read the frequency or the difference in frequency between two markers, respectively. If no marker mode is active, pressing **FREQ COUNT** automatically activates MARKER NORMAL.

The counter will only count signals that are displayed on the screen. Thus, counter accuracy is lost when using MARKER DELTA when the anchor marker is off the screen or when either marker is not on a signal. All signal-counting is done during the retrace time of the sweep. **FREQ COUNT** uses the same marker priority as described under the MARKER NORMAL softkey. **FREQ COUNT** cannot be used on traces that are being viewed, in stimulus-response (tracking generator) measurements, or in video trigger.

FREQ COUNT also accesses a menu of additional counter functions, which are as follows: COUNTER ON OFF, COUNTER RES, MARKER NORMAL, MARKER DELTA, PEAK SEARCH, and NEXT PEAK.

Front-panel key access: **FREQ COUNT**

FREQ DIAGNOSE Displays a menu of diagnostic functions, which allow various internal parameters of the analyzer to be retrieved. Refer to the **CAL** menu tree for a list of all of the frequency diagnostic softkeys.

Front-panel key access: **CAL**

NOTE In multiband sweeps, the frequency displayed corresponds to the local-oscillator start frequency of the band that was being swept when the key was pressed.

FREQ DSP OFF Turns off all frequency annotation. This includes the start and stop frequencies, center frequency, frequency span, marker readouts, center-frequency step size, and signal identification to center frequency. Once this key is pressed, there is no way to display the frequency data. To reactivate the annotation, press **PRESET**.

Front-panel key access: **DISPLAY**

FREQ OFFSET Adds an offset to the displayed frequency values, including marker frequency values. It does not affect the frequency range of the sweep. Enter the value using the data keys, the step keys, or the knob. When this function is active (that is, when the frequency offset is not equal to 0 Hz), an F appears on the left edge of the display.

Front-panel key access: **FREQUENCY**

FREQUENCY Accesses CENTER FREQ, START FREQ, STOP FREQ, CF STEP AUTO MAN, and FREQ OFFSET. **FREQUENCY** also activates the center frequency function when the spectrum analyzer is in the center-frequency span mode. If the analyzer is in start-frequency stop-frequency mode, the start frequency is activated.

Front-panel key access: **FREQUENCY**

FULL BAND Allows you to select a commonly used external mixing frequency band above 18 GHz. These bands are shown in <Undefined Cross-Reference>. Use the step keys or the knob to select a desired frequency band. The selected band appears in the active function block. Activating FULL BAND also activates the harmonic-lock function. See the LOCK HARMONIC softkey for more information.

Front-panel key access: **AUX CTRL**

FULL IF ADJ Executes a complete adjustment of the IF system. Once activated, the softkey changes to STOP ADJUST which, if pressed, stops the IF adjustment and returns the analyzer to its previous state. During this adjustment, the message `IF ADJUST STATUS: <text>` appears in the active function area. Depending on which portion of the IF system is being adjusted, either `AMPLITUDE` or the specific resolution bandwidth (for example, 300 Hz) is displayed in the message.

Front-panel key access: **CAL**

FULL SPAN Sets the spectrum analyzer to the center-frequency span mode and sets the span to the maximum range. Full span is:

Spectrum Analyzer	Frequency Span
8560E/EC	2.9 GHz
Agilent 8561E/EC	6.5 GHz
Agilent 8562E/EC	13.2 GHz
Agilent 8563E/EC	26.5 GHz
Agilent 8564E/EC	40 GHz
Agilent 8565E/EC	50 GHz

Front-panel key access: **SPAN**

GRAT ON OFF Blanks the graticule from the display (OFF) or reactivates it (ON).

Front-panel key access: **DISPLAY**

GATE CTL EDGE LVL Selects the use of edge triggering or level triggering to control the gate. In edge mode the gate delay starts from the specified trigger edge. The gate is then on for the time specified by the gate length function.

In level mode the gate is controlled by the level of the input trigger signal, so gate delay and gate length are not functional.

Front-panel key access: **SWEEP**

GATE DLY[ ] Controls the length of time from the trigger until the gate is turned on. The second line of the softkey indicates the current setting of the gate delay.

Front-panel key access: **SWEEP**

GATE LEN[ ] Controls the length of time that the gate is on when using edge triggering to control the gate. The second line of the softkey indicates the current setting of the gate length.

Front-panel key access: **SWEEP**

GATE ON OFF Turns the gate function on and off. When set ON, the analyzer activates the gate circuitry to function according to the parameters controlled by gate length, gate delay, and the gate trigger input.

The gate function requires a gate trigger signal be connected to the rear panel. If the gate is turned on without a signal present, operating other functions like signal tracking, signal identification, frequency count, or preselector peaking may cause the spectrum analyzer to stop functioning until it is powered on again.

Front-panel key access: **SWEEP**

GATED METHOD Makes adjacent channel power (ACP) measurements of transient and random peak power using time-selective gating techniques. A TTL-type trigger signal must be applied to the spectrum analyzer when using this method. This method is the same as the two bandwidth method (2BW METHOD) except that the random and impulsive powers are separated using a different technique. Gated video techniques are used to allow a response to just the peak of the random part of the adjacent channel power. The impulsive part of the power is found by the power difference between an ungated measurement and a gated measurement. This method supports TIA/EIA IS-54 NADC-TDMA measurements.

Front-panel key access: **MEAS/USER**

GATED VIDEO Accesses the menu of functions for setting gate parameters.

Front-panel key access: **SWEEP**

HOLD Clears the active function area and the current softkey menu from the display, and expands the display horizontally to the full width of the screen. The width of the trace and graticule increase to occupy the resulting blank space. The current active function is held at a constant setting until another function is activated.

Front-panel key access: **HOLD**

IF ADJ ON OFF Allows you to turn the automatic IF adjustment ON or OFF. This function is normally ON. When IF ADJ ON OFF is ON, various parameters in the IF are adjusted during the retrace time of the sweep. Several minutes and several sweeps may be required to complete a cycle of all the adjustments. In single sweep mode, a small portion of the IF adjustment will be done at the end of each sweep and approximately every two seconds afterward while the spectrum analyzer waits for a trigger.

This function is automatically deactivated when the spectrum analyzer is set to zero span, with a sweep time less than 30 ms. It is automatically reactivated when either the spectrum analyzer is set to a span greater than 0 Hz, or the sweep time is set greater than or equal to 30 ms with a resolution bandwidth greater than or equal to 300 Hz. When reactivated, several sweeps may need to be taken before automatic adjustment is completed. When reactivated after being inactive for several minutes, the delay between sweeps will be longer than usual as the spectrum analyzer does a complete IF adjustment as quickly as possible. The IF adjust is also temporarily deactivated while waiting for an EXTERNAL or VIDEO trigger event.

When **IF ADJ ON OFF** is off, an A appears in the special functions area at the left side of the display screen.

Front-panel key access: **CAL**

INTENSTY Changes the intensity of the display on E-series instruments. Press INTENSTY, then use the data keys, the step keys, or the knob to adjust the intensity. The intensity ranges from 1 to 255; the current value appears in the active function block. When **INTENSTY** is pressed, **STORE INTEN** appears on the menu. Press **STORE INTEN** to store the new intensity value in nonvolatile memory. EC-series instruments do not require adjustment and are not adjustable.

For indoor use, keep the intensity around 80. For outdoor use, increase the intensity as necessary, keeping in mind that excessive brightness shortens the life of the CRT.

Front-panel key access: **DISPLAY**

INTERNAL MIXER Displays the internal mixer softkey menu with signal identification and preselector peaking. When using external mixers, this softkey returns the spectrum analyzer to its internal mixing mode.

Front-panel key access: **AUX CTRL**

NOTE The **INTERNAL MIXER** softkey and its lower-level softkeys are not available with an 8560E/EC Option 002. However, the **INTERNAL MIXER** softkey is available with a standard 8560E/EC; its softkey menus are not.

LAST SPAN Sets the spectrum analyzer to the previously selected span, allowing you to toggle between two settings. For example, you can toggle between zero span and a larger span to view modulation in both the frequency and time domains.

Front-panel key access: **SPAN**

LAST STATE Recalls the instrument state that existed before the last time that **PRESET** was pressed.If the spectrum analyzer has just been turned on, the recalled state will be the state that the instrument was in when power was turned off.

Front-panel key access: **PRESET** or **RECALL**

LINE Sets the trigger to line mode. Sweep triggers occur at intervals synchronized to the line frequency.

Front-panel key access: **TRIG**

LINEAR Selects a linear amplitude scale. Measurements using a linear scale are normally read in millivolts, but other units can be selected. See the UNITS softkey description.

Front-panel key access: **AMPLITUDE**

LOCK HARMONIC Displays and locks to the current harmonic number. A harmonic number refers to the local-oscillator harmonic that is used to sweep a specific external mixing frequency band. These numbers are shown in Table on page 244. When locked, only center frequencies and spans that fall within the frequency band of the current harmonic may be entered. When **FULL SPAN** under **SPAN** is activated, the span is limited to the frequency band of the selected harmonic.

Front-panel key access: **AUX CTRL**

Table 4-6 Mixing Harmonics for Unpreselected External Mixing

Frequency Band	Frequency Range (GHz)	Mixing Harmonic	Conversion Loss (Default)
K	18.0 to 26.5	6–	30 dB
A	26.5 to 40.0	8–	30 dB
Q	33.0 to 50.0	10–	30 dB
U	40.0 to 60.0	10–	30 dB
V	50.0 to 75.0	14–	30 dB
E	60.0 to 90.0	16–	30 dB

Table 4-6 Mixing Harmonics for Unpreselected External Mixing

Frequency Band	Frequency Range (GHz)	Mixing Harmonic	Conversion Loss (Default)
W	75.0 to 110.0	18–	30 dB
F	90.0 to 140.0	24–	30 dB
D	110.0 to 170.0	30–	30 dB
G	140.0 to 220.0	36–	30 dB
Y	170.0 to 260.0	44–	30 dB
J	220.0 to 325.0	54–	30 dB

LOCK ON OFF Displays the current external mixing harmonic number. When LOCK ON OFF is ON, only center frequencies and spans that fall within the frequency band of the current harmonic may be entered. When FULL SPAN under **SPAN** is activated, the span is limited to the frequency band of the selected harmonic.

When LOCK ON OFF is OFF, more than one harmonic can be used to sweep across a desired span. For example, sweep a span from 26.5 GHz to 60 GHz. In this case, the spectrum analyzer will automatically sweep first using the 8– mixing harmonic and then using the 10– mixing harmonic. When **FULL SPAN** is active and **LOCK ON OFF** is OFF, the entire range of external mixing for the selected band appears on the display.

Front-panel key access: **AUX CTRL**

LO FREQ Displays the first local-oscillator frequency corresponding to the current start-frequency.

Front-panel key access: **CAL**

LOGdB/DIV Selects a 1, 2, 5, or 10 dB logarithmic amplitude scale. The default value is 10 dB division. 1 dB per division and 5 dB per division scales are not available in fast zero span (sweep times less than 30 ms). Any activated markers read out in dBm, and delta markers read the difference between the markers in dB. If desired, it is possible to select other units while in a log-scale mode. See the UNITS softkey description.

Front-panel key access: **AMPLITUDE**

LVL POL POS NEG Selects the polarity for turning the gate on when using level triggering for a gated measurement. If (POS) is underlined, the gate will be on while the rear panel trigger input is high. The gate will be on while the trigger input is low if (NEG) is selected. The gate delay and gate length functions are not available when level triggering is used.

NOTE When the polarity of the gate trigger is set, the instrument normal sweep trigger will always be set to the same polarity.

Front-panel key access: **SWEEP**

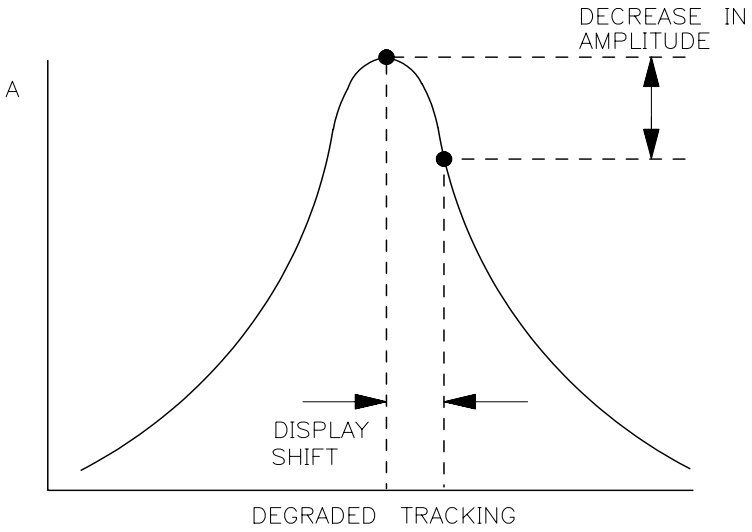
MAN TRK ADJ Allows you to adjust the frequency of the tracking-generator oscillator manually using the step keys or knob. The tracking adjust is tuned to maximize the amplitude of the trace.

Once activated, either the coarse or fine adjustment can be made. COARSE TRACK ADJ can be adjusted in digital-to-analog-converter (DAC) values from 0 to 255 using the step keys or data keys. FINE TRACK ADJ can be adjusted from 0 to 255 (DAC values) using the knob.

Tracking error occurs when the output frequency of the tracking generator is not exactly matched to the input frequency of the spectrum analyzer. The resulting mixing product from the spectrum analyzer input mixer is not at the center of the IF bandwidth. Any tracking errors may be compensated for through manual adjustments of the tracking generator oscillator, or through an automatic tracking routine, TRACKING PEAK.

Front-panel key access: **AUX CTRL**

Figure 4-4 Tracking Error



MARKER→CF Sets the center frequency equal to the marker frequency. This function provides a quick way to move a signal to the center of the screen.

Front-panel key access: **MKR →** or **PEAK SEARCH**

MARKER→CF STEP Sets the center frequency step-size equal to the marker frequency.

Front-panel key access: **MKR →**

MARKER→REF LVL Sets the reference level equal to the amplitude of the marker.

Front-panel key access: **MKR →**

MARKER 1/DELTA Displays the reciprocal of the frequency or time difference between two markers in the active function block and in the upper-right corner of the display. If two markers are on and the frequency span is greater than 0 Hz, MARKER 1/DELTA displays the difference between the two markers in time. If two markers are on and the frequency span is equal to 0 Hz, MARKER 1/DELTA reads the difference in frequency. You can toggle between MARKER 1/DELTA and MARKER DELTA without changing the position of the markers.

Front-panel key access: **MKR**

MARKER DELTA Reads the difference in amplitude and frequency between two markers, and displays these values in the active function block and in the upper-right corner of the display.

If a single marker is already on, MARKER DELTA places both an anchor marker and an active (movable) marker at the position of the original, single marker. To move the active marker, use either the knob, the step keys, or the data keys. If two markers are already on, pressing MARKER DELTA once makes it the active function. However, if MARKER DELTA is already the active function, pressing MARKER DELTA places the anchor marker at the same position as the active marker. The delta amplitude is displayed in dB, or as a ratio when linear units are selected.

Front-panel key access: **AUX CTRL**, **FREQ COUNT**, **MKR**, or **PEAK SEARCH**

MARKER NORMAL Activates a single marker and places it at the center of the trace. This softkey location is changed to the MARKER DELTA function, if delta-marker mode has been previously activated by the MARKER DELTA softkey under the **MKR** menus.

If one marker is already on, no operation takes place. If two markers are on (as in MARKER DELTA mode), MARKER NORMAL deletes the anchor marker and makes the active one the new, single marker. The marker reads the amplitude and the frequency (or the relative time, when the frequency span equals 0 Hz), and displays these values in the active function block and in the upper-right corner of the display. To move the marker, use either the knob, the step keys, or the data keys.

The marker reads data from the currently active trace. (An active trace is one in either the clear-write or max-hold mode; this may be either trace A or trace B.) If both traces are active, or if both traces are in view mode, the marker reads data from trace A.

Front-panel key access: **AUX CTRL**, **FREQ COUNT**, **CAL**, or **MKR**

MARKERS OFF Turns off all markers, blanks the softkey menu, and expands the display screen. This softkey turns off all marker-related functions such as SIG TRK ON OFF and MKRNOISE ON OFF, if they are on.

Front-panel key access: **MKR**

MAX HOLD A Displays and holds the maximum responses of the input signal in trace A. In this mode, the trace accepts data from subsequent sweeps and selects the positive-peak detector mode.

Front-panel key access: **TRACE**

MAX HOLD B Displays and holds the maximum responses of the input signal in trace B. In this mode, the trace accepts data from subsequent sweeps and selects the positive-peak detector mode.

Front-panel key access: **TRACE**

MAX MXR LEVEL *Available with internal mixing only*. Selects the maximum signal amplitude seen at the input mixer. This value is always in dBm, regardless of the selected scale or units. MAX MIXER LEVEL is especially useful when distortion-free dynamic range is an important consideration. The following procedure explains how to check for signal compression quickly. Press MAX MXR LEVEL and increase the attenuation using the step key. If the signal peak shifts more than 1 dB, the signal is in compression. In this case, continue to increase the attenuation until the peak moves less than 1 dB between steps; then decrease the attenuation one step.

Front-panel key access: **AMPLITUDE**

MEAS/USER Accesses the softkey functions that perform automatic measurements and user defined function: fast Fourier transform (FFT), occupied power bandwidth, carrier power, channel power, the bandwidth at 3dB or 6 dB, and the adjacent channel power (ACP) measurement.

Front-panel key access: **MEAS/USER**

METHODS Allows you to select the measurement method that will be used to make the adjacent channel power measurement. These measurement methods have different settable parameters. The different methods are required for the various communications formats. There are currently five different measurement methods and these are described on the following pages.

ANALOG METHOD **Continuous power integration versus frequency measurement** Selects the analog method which measures the power in the main and adjacent channels assuming a continuous carrier. The rms power of that carrier is detected using power detection. This is done by using a video bandwidth that is much wider than the resolution bandwidth. Then the power, not the log of the power, of each measurement cell is added. This method measures analog FM systems.

PEAK METHOD **Peak power integration measurement for TDMA** This method is similar to the analog measurement used by the analog method except that positive peak detection is used, allowing the measurement of burst carriers. For this method, the sweep time is set to 600 times the burst period. There are 600 measurement cells per sweep, so this sets one burst RF cycle per measurement cell. This method supports 1993 MKK standard for PDC systems and the 1993 RCR standards for PHP systems.

2BW METHOD **Two bandwidth, transient and random peak measurement for TDMA** This method is meant for use with burst signals. The sweep time is set to 600 times the burst period. Two sweeps are made, one in each of two resolution bandwidths and positive peak detection is used. This method supports 1993 RCR standard for PDC systems.

The algorithm used for this method assumes that the power in the adjacent channels consists of two types of power: impulsive power (transients due to enabling and disabling the carrier power) and random power (noise-like signals due to the intermodulation of noise-like modulation in the main channel).

The characteristics of these two types of power change differently with resolution bandwidth changes, so they can be computed algebraically from measurements in two bandwidths.

The impulsive powers for all frequencies within each adjacent channel are converted to an equivalent voltage. These voltages are assumed to be in phase so they are added to compute a peak voltage in the channel and a peak power is computed. The random powers are all added within a channel to give a peak random power. The peak random power is added to the peak impulsive power to give a peak weighted power.

BURSTPWR METHOD **Burst power, transient and random peak average power measurement** This method performs a measurement and computation to find the impulsive and random powers similar to the two-bandwidth method, but using a different and faster technique.

It also uses an rms-responding technique to compute a true power ratio between the main and adjacent channels, without peak weighting or assumptions about phase relationships.

GATED METHOD **Transient and random peak measurement for TDMA** This method is the same as the two-bandwidth method except that the random and impulsive powers are separated using a different technique. Gated video techniques are used to measure the response of just the peak of the random part of the adjacent channel power. A TTL-type trigger signal must be connected to the spectrum analyzer to do this time-selective gating.

The impulsive part of the power is found by the power difference between an ungated measurement and the gated measurement. This method supports TIA/EIA IS-54 NADC-TDMA measurements.

Front-panel key access: **MEAS/USER**

MKR Accesses a menu of softkeys: MARKER NORMAL, MARKER DELTA, MARKER 1/DELTA, MKRNOISE ON OFF, SIG TRK ON OFF, and MARKERS OFF. **MKR** also activates the current marker mode (such as MARKER DELTA); if no mode is active, **MKR** activates MARKER NORMAL.

Front-panel key access: **MKR**

MKR→ Accesses four different menus of marker functions. The menu that is accessed depends on the frequency span of the spectrum analyzer and if the marker is in the normal mode or the delta mode.

Span > 0 Hz	**Zero Span**
Normal Marker Mode	
MARKER → CF	—
MARKER → REF LVL	**MARKER → REF LVL**
MARKER → CF STEP	—
Delta Marker Mode	
MKR Δ → CF	**MKR 1/Δ → CF**
—	—
MKR Δ → CF STEP	**MKR 1/Δ → CF STEP**
MKR Δ → SPAN	—

These marker functions allow the user to use the marker as a reference for changing analyzer settings.

Front-panel key access: **MKR→**

MKR Δ →CF Sets the center frequency of the spectrum analyzer equal to the delta frequency value. Once activated, both the anchor marker and the active marker are positioned at the new center frequency.

This function is useful in harmonic distortion measurements, where the delta marker can be used to mark the difference between harmonics, and MKR Δ -> CF can be used to tune to the frequency of the fundamental.

Front-panel key access:**MKR →**

MKR Δ →CF STEP Sets the center-frequency step-size to the delta frequency value so that, when the center frequency function is active, using the step key will result in changes to the center frequency equivalent to the delta value. This can be used to step from one harmonic to another which is useful in harmonic distortion measurements.

Front-panel key access:**MKR →**

MKRΔ →CH PWR BW Sets the channel power bandwidth parameter to the value of the difference between the two markers. This key is useful when using the occupied bandwidth function to measure power in a channel. The MKRΔ → CHPWR BW softkey can be used to change the desired channel power bandwidth to the frequency difference between the two markers that are currently on the signal. The MKR MEAN → CF is then used to center this bandwidth on the display.

Front-panel key access: **MEAS/USER**

MKR Δ →SPAN Sets the frequency span to the delta frequency value, allowing you to span down quickly to the spectrum of interest.

Front-panel key access: **MKR→**

MKR 1/Δ →CF Sets the center frequency equal to the reciprocal of the delta value. In zero span, the delta-marker frequency readout units are seconds. Therefore, the units for the reciprocal of the delta value will be in Hz.

Front-panel key access: **MKR →**

MKR 1/Δ →CF STEP Sets the center-frequency step-size equal to the reciprocal of the delta value.

Front-panel key access: **MKR→**

MKR MEAN→ CF Moves the midpoint of the two displayed markers to the spectrum analyzer center frequency. This key is useful when using the occupied bandwidth function to measure power in a channel.

The MKRΔ → CHPWR BW softkey can be used to change the desired channel power bandwidth to the frequency difference between the two markers that are currently on the signal. The MKR MEAN → CF is then used to center this bandwidth on the display.

Front-panel key access: **MEAS/USER**

MKR NOISE ON OFF *Not available when a tracking generator is active.*Turns the marker noise function ON or OFF. When ON, this function normalizes the equivalent amplitude of the measured noise to a 1 Hz bandwidth. To do this, it sets the detector mode to sample and displays the average of 33 data points (16 data points to the left of the marker, the marker itself, and 16 data points to the right of the marker).

This average is corrected for effects of the log amplifier, bandwidth shape factor, RF detector, and resolution bandwidth. If two markers are on, MKRNOISE ON OFF works on the active marker and not on the anchor marker.

When MKR NOISE ON OFF is ON, the sample detector mode is initiated. This is the most appropriate detector mode for making noise measurements. Turning off the active marker also turns off MKRNOISE ON OFF, and returns the detector mode to its previous setting.

Front-panel key access: **MKR**

MODULE Gives access to additional functions of an option module, such as the Agilent 85629B test and adjustment module or the Agilent 85620A mass memory module, when the module is connected to J3, OPTION MODULE, on the rear of the spectrum analyzer. If an option module is not connected when the **MODULE** key is pressed, the `MODULE NOT FOUND` message appears. For specific information on operating an option module, refer to the operating manual for that module.

Front-panel key access: **MODULE**

NEGATIVE BIAS Selects negative mixer bias for an external mixer. This value, which can be entered using the data keys, the step keys, or the knob, appears in the active function block and is expressed in milliamps. When the bias is less than 0 mA, a "–" appears on the left edge of the display.

Front-panel key access: **AUX CTRL**

NEW CORR PT Moves you to a new point at the end of the list of frequency-amplitude correction points and activates the EDIT FREQ softkey. This is a convenient way to enter a new correction point when you are not currently at the end of the list of corrections.

Front-panel key access: **CAL**

NEXT PEAK Moves the active marker to the next highest trace point relative to the current marker position. Finds successively lower peaks when pressed repeatedly. The next trace peak must meet the current peak excursion and peak threshold criteria in order to be considered a peak.

Front-panel key access: **AUX CTRL**, **FREQ COUNT**, or **PEAK SEARCH**

NEXT PK LEFT Finds the next peak to the left of the current marker position. The next trace peak must meet the current peak excursion and peak threshold criteria in order to be considered a peak.

Front-panel key access: **PEAK SEARCH**

NEXT PK RIGHT Finds the next peak to the right of the current marker position. The next trace peak must meet the current peak excursion and peak threshold criteria in order to be considered a peak.

Front-panel key access: **PEAK SEARCH**

NORM REF LVL *Available only when NORMLIZE ON OFF is ON.* Activates the normalized reference level. Adjustments may be made using the data keys, step keys, or knob. The units for the normalized reference level is dB. NORM REF LVL is *not* equivalent to REF LVL. When NORM REF LVL is adjusted, the input attenuator and IF step gains are not affected. This function is a trace-offset function, enabling the user to offset the displayed trace without introducing errors into the stimulus-response measurement.

Front-panel key access: **AMPLITUDE**

NORM REF POSN Allows the user to adjust the normalized reference position that corresponds to the position on the graticule where the difference between the measured and calibrated traces resides. The dB value of normalized reference position is equal to the normalized reference level.

The normalized reference position may be adjusted between 0.0 and 10.0 (corresponding to the bottom and top graticule lines, respectively) using the data keys, step keys, or knob.

The normalized-reference-position adjustment allows measured data to be compared to a reference position, where the difference between the measured data and the reference position represents the gain or loss of the device under test.

When normalization is on, two indicators (→ and ←) appear on-screen to mark the location of the normalized reference position.

Front-panel key access: **AMPLITUDE**, **AUX CTRL**, or **TRACE**

NORMLIZE ON OFF Activates (ON) or deactivates (OFF) the normalization routine for stimulus-response measurements. The routine subtracts the calibration trace stored in trace B from the active trace, trace A. The result is then offset by the normalized reference position. Results are displayed in trace A. The reference level value is displayed in dB when normalization is active.

When normalization is activated, an `N` appears in the special functions area at the left side of the display screen. The REF LVL softkey under **AMPLITUDE** is replaced by NORM REF LVL in addition to RANGE LVL now being available.

NOTE If a trace math function has been previously activated, turning normalize mode on can deactivate the trace math function.

If a thru or open/short calibration state does not correspond to the current state when normalization is activated (that is, have the same center frequency, start frequency, stop frequency, frequency span, or amplitude scale), the error message `ERR 902 BAD NORM` appears.

This can happen when several open/short or thru calibrations are performed. The NORMLIZE ON OFF function recalls the last calibration run. If one of the earlier short or thru states has been recalled just before turning the normalization function on, then the current and recalled states don't match and the error occurs.

To avoid this error, update the CAL THRU or CAL OPN/SHRT state register with the current state before turning NORMLIZE ON OFF on. The CAL THRU state register is state register 9. The CAL OPN/SHRT state register is state register 8. Make sure the trace is updated before saving the state.

Front-panel key access: **AUX CTRL** or **TRACE**

OCCUPIED[%] Allows you to enter the desired percentage of occupied power for the OCCUPIED BANDWDTH and ΔMKR → OCC % functions. The settability is 0.01% and the current percentage is displayed on the softkey label.

Front-panel key access: **MEAS/USER**

OCCUPIED BANDWDTH Integrates the power displayed and places the delta markers at the points containing the desired percent of the power. The occupied power bandwidth can be read directly from the delta markers. The OCCUPIED [%] softkey is used to select the desired percentage of power to be measured.

The power-bandwidth routine first computes the combined power of all signal responses contained in the trace. It then puts markers at the frequencies for which 1/2 of (100 – occupied %) of the power lies to the right of the right marker and to the left of the left marker. Thus, the selected percent of the power lies between the markers. The difference between the marker frequencies is the occupied power bandwidth for the selected occupied percentage, and is displayed on-screen.

Front-panel key access: **MEAS/USER**

OCCUPIED PWR MENU Accesses the occupied power bandwidth menu including the OCCUPIED BANDWDTH, OCCUPIED [%], ΔMARKER OCC BW and CH EDGES → ΔMKR softkeys.

Front-panel key access: **MEAS/USER**

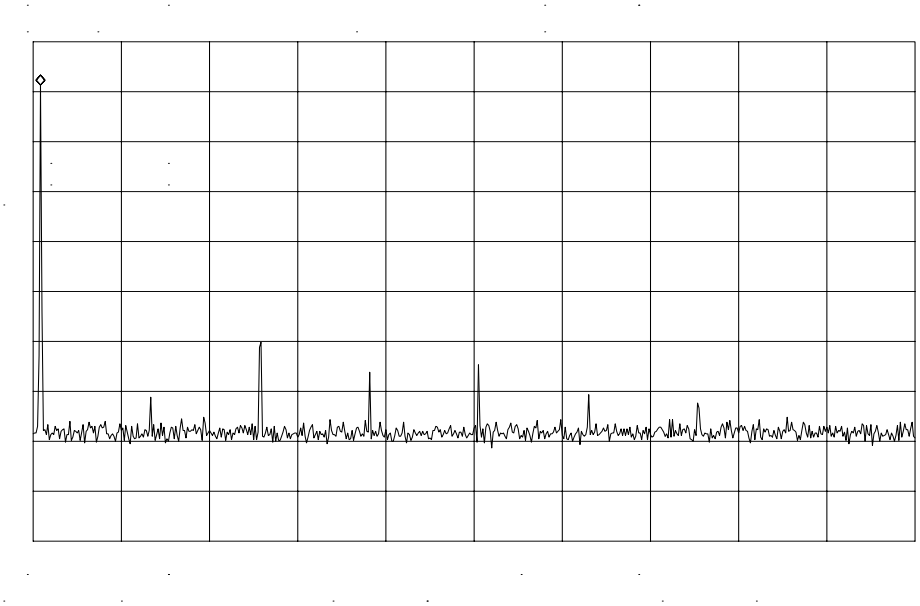
PEAK EXCURSN Defines what constitutes a peak on a trace. To enter a value, use the data keys, step keys, or the knob and terminate the entry with **dB**. The value specifies the amount that a trace must increase monotonically and then decrease monotonically in order to be a peak. For example, if the peak excursion is 5 dB, the amplitude of the sides of a candidate peak must descend at least 5 dB in order to be considered a peak (see <Undefined Cross-Reference>).

The excursion values range from 0 dB to 30 dB in log mode, and 0.1 to 10.0 divisions in linear mode. The default value is 6 dB.

Any portion of a peak that falls below the peak threshold is also used to satisfy the peak excursion criteria. For example, when the peak excursion is equal to 6 dB, a peak that is equal to 3 dB above the peak threshold will be found if the peak extends an additional 3 dB or more below the threshold.

Front-panel key access: **PEAK SEARCH**

Figure 4-5 PEAK EXCURSN defines the peaks on a trace.



PEAK METHOD Makes adjacent channel power (ACP) measurements using peak power integration. This is a method that measures the power in the main and adjacent channels. It differs from the analog method because it uses positive peak detection, allowing the measurement of burst carriers. The power, not the log of the power, of each measurement cell is added. For this method, the sweep time is set to 600 times the burst period. There are 600 measurement cells per sweep, so this sets one burst RF cycle per measurement cell. This method supports 1993 MKK standards for PDC systems and 1993 RCR standards for PHP systems.

Front-panel key access: **MEAS/USER**

PEAK SEARCH and PEAKSEARCH Places a marker on the highest point on a trace. The frequency and amplitude of the marker are displayed in the upper-right corner of the screen; PEAK SEARCH does not alter the active function.

The trace must meet the criterion set by the marker threshold function in order for a peak to be found. If no peak is found and no marker is active, the marker will be placed on the trace at center screen. If no peak is found and a marker is active, the marker position will not change.

Front-panel key access: **AUX CTRL**, **FREQ COUNT**, **CAL**, or **PEAK SEARCH**

PEAK THRESHLD Sets the minimum amplitude level from which a peak on the trace can be detected. This function places a dashed line across the graticule to denote the selected level. To enter a value, use the data keys, the step keys, or the knob and terminate the entry with **+dBm** or **–dBm**. The default is –130 dBm.

Any portion of a peak that falls below the peak threshold is also used to satisfy the peak excursion criteria. For example, when the peak excursion is equal to 6 dB, a peak that is equal to 3 dB above the threshold will be found if the peak extends an additional 3 dB or more below the threshold.

Front-panel key access: **PEAK SEARCH**

PLOT ANNOT Plots only the annotation (excluding the menu, trace markers, and error codes). When PLOT ANNOT is active, STOP ANNOT appears in its place, allowing you to stop the plot before it is finished. If the annotation is turned off, no output will be plotted.

Front-panel key access: **CONFIG**

PLOT GRATICUL Plots only the graticule. When PLOT GRATICUL is active, STOP GRATICUL appears in its place, allowing you to stop the plot before it is finished. If the graticule is turned off, no output will be plotted.

Front-panel key access: **CONFIG**

PLOT ORG DSP GRAT Selects either the display (DSP) or the graticule (GRAT) origin mode. Agilent Technologies plotters allow the user to define the size of the plot using P1 and P2 parameters. P1 defines the lower-left corner of the plot, while P2 defines the upper-right corner.

When DSP is selected, the analyzer scales the full display (excluding the softkey area), so that the corresponding hardcopy plot resides completely within the user-defined P1 and P2 limits.

When GRAT is selected, P1 and P2 correspond to the lower-left and upper-right corners of the graticule. If a full plot is activated using **COPY**, the graticule will be scaled according to the P1 and P2 parameters; however, the annotation will be plotted outside the defined range. GRAT allows you to position the desired plot information on a preprinted graticule to save plotting time.

This softkey function is locked out when any plot is in progress or pending.

Front-panel key access: **CONFIG**

PLOT TRACE A Plots only the contents of trace A and any markers associated with trace A. When PLOT TRACE A is active, STOP TRACE A appears in its place, allowing you to stop the plot before it is finished. If trace A is blanked, the message `TRACE IS BLANKED` will momentarily appear in the active function area, and no plotting will occur.

Front-panel key access: **CONFIG**

PLOT TRACE B Plots only the contents of trace B and any markers associated with trace B. When PLOT TRACE B is active, STOP TRACE B appears in its place, allowing you to stop the plot before it is finished. If trace B is blanked, the message `TRACE IS BLANKED` will momentarily appear in the active function area, and no plotting will occur.

Front-panel key access: **CONFIG**

PLOTTER ADDRESS Displays the current GPIB address of the plotter. A new address can be entered by using the data keys (and pressing **ENTER**), the step keys, or the knob, and pressing STORE HPIB ADR. The new address is stored in nonvolatile memory and is recalled when the power is cycled. If the plotter address is redefined without saving it with STORE HPIB ADR, the new address will still be valid after **PRESET** is pressed, but will be lost if the power is turned off. The PLOTTER ADDRESS softkey is not displayed whenever a plot is pending or in progress.

Front-panel key access: **CONFIG**

PLOTTER CONFIG Accesses plotter configuration options to set the plotter address, to assign the origin, and to plot trace A, trace B, the graticule, or the frequency annotation.

Front-panel key access: **CONFIG**

NOTE

If the message `CONNECT PLOTTER` appears briefly in the active function area of the display when executing any plot function, and there are no other errors, the plotter is not connected to the GPIB. Check that the GPIB cable between the spectrum analyzer and plotter is functional and that the plotter is turned on.

If the `CONNECT PLOTTER` message appears, and either `ERR 109 CtrlFail` or `ERR 110 NOT CTRL` are displayed, the spectrum analyzer is not able to take control of the GPIB. Disconnect any other controller from the bus.

If the message `CHECK PLOTTER` appears briefly in the active function area of the display when executing any plot function, the plotter is not responding to a query for its P1 and P2 coordinates. Check that the plotter is not set to listen-only.

POSITIVE BIAS Selects positive mixer bias for an external mixer. This value, which can be entered using the data keys, the step keys, or the knob, appears in the active function block and is expressed in milliamps. When the bias is greater than 0 mA, a "+" appears on the left edge of the display.

Front-panel key access: **AUX CTRL**

POST SCLR Displays the value of the post-scaler divider within the fractional N assembly. This value is used to divide down the raw oscillator frequency to the required fractional N frequency.

Front-panel key access: **CAL**

POWER MENU Accesses the menu of power measurements including occupied power bandwidth, channel power and carrier power. Adjacent channel power measurements are found under the ACP MENU softkey.

Front-panel key access: **MEAS/USER**

POWER ON Sets the instrument state to the state stored in the power-on register, which is the same state that occurs when **LINE** is switched on. This state must be saved initially under the **SAVE** key.

Front-panel key access: **RECALL**

PRESEL AUTO PK Automatically peaks the preselector on the desired signal on a trace.

For internal mixing the marker must be positioned above band 0. Set the trace to clear-write mode, place a marker on the desired point, then press PRESEL AUTO PEAK. The peaking routine zooms to zero span, peaks the preselector tracking, then returns to the original span. To read the new preselector peaking number, press PRESEL MAN ADJ. Preselector peaking is available only with resolution bandwidths greater than 100 Hz.

The automatic preselector peaking routine is not designed to work when an Agilent 85644A or Agilent 85645A tracking source is used with the spectrum analyzer.

Front-panel key access: **AMPLITUDE** or **AUX CTRL**

NOTE

For internal mixing, when **PRESET** is pressed, the preselector data stored by the user does not change. However, the factory settings now become active.

Factory preselector data always takes precedence over user-activated preselected data, unless the user data is explicitly recalled using RECALL PRSEL PK. For more information on storing and recalling preselector data, refer to the SAVE PRSEL PK and RECALL PRSEL PK softkeys.

PRESEL MAN ADJ Allows you to adjust the preselector tracking to maximize amplitude response with either internal or external mixers. Preselector peaking is only available with resolution bandwidths greater than 100 Hz.

When the PRESEL MAN ADJ softkey appears under the menus **AMPLITUDE** or INTERNAL MIXER, and the start frequency is set equal to or above 2.9 GHz, then the preselector tracking can be adjusted for internal mixing.

Spectrum Analyzer	Preselected Range
Agilent 8561E/EC	2.75 GHz to 6.5 GHz
Agilent 8562E/EC	2.75 GHz to 13.2 GHz
Agilent 8563E/EC	2.75 GHz to 26.5 GHz
Agilent 8564E/EC	2.75 GHz to 40 GHz
Agilent 8565E/EC	2.75 GHz to 50 GHz

Place a marker on the desired signal on a trace, then press PRESEL MAN ADJ. The current preselector tracking number, which is displayed in the active function block, can be changed using the data keys, the step keys, or the knob. The value ranges from 0 to 255. If no marker is active, pressing PRESEL MAN ADJ automatically activates a marker at the peak. Executing the function affects data in the current data table (which may be data from either the user or the factory data tables). To save this data, use SAVE PRSEL PK found under **SAVE**.

When the PRESEL MAN ADJ softkey appears under the EXTERNAL MIXER menu, preselector tracking of external mixers can be adjusted. Pressing PRESEL MAN ADJ causes the preselector tracking number that applies to the marker frequency to be displayed in the active function block. If no marker is active, pressing PRESEL MAN ADJ automatically activates a marker at the peak. When the tracking number is displayed in the active function block, it can be changed using the data keys, the step keys, or the knob. This tracking number ranges from 0 to 255. It is initialized to 128 when entering the external mixer mode of operation or whenever the band number is changed. Changing the tracking number affects the data in the current data table which may be a previously saved user data table. The resulting value after changing this function is only valid for the current band. To save this data, use the SAVE PRSEL PK softkey found under **SAVE**. This overwrites any previously saved preselector data regardless of whether that data was generated while using internal or external preselectors.

Front-panel key access: **AMPLITUDE** or **AUX CTRL**

PRESEL PEAK *Available only with preselected external mixing*.Displays the *preselected* external mixer softkey menu. This softkey menu is available only when the EXT MXR PRE UNPR softkey under **CONFIG** is set to preselected (PRE) mode.

Front-panel key access: **AUX CTRL**

NOTE The **PRESEL PEAK** softkey and its lower-level softkeys are for use only with preselected external mixers. The preselected configuration must initially be set up using the **EXT MXR PRE UNPR** softkey under **CONFIG**.

PRESET Sets the spectrum analyzer to a known, predefined state. **PRESET** does not affect the spectrum analyzer GPIB address, the contents of any data or trace registers, stored preselector data, or any state and trace registers that are locked (SAVELOCK). **PRESET** also accesses the LAST STATE softkey. Refer to Table 4-7 on page 264 for a description of each analyzer predefined state which is stored in memory and cannot be changed.

Front-panel key access: **PRESET**

NOTE When **PRESET** is pressed, the preselector data stored by the user does not change. However, the factory settings now become active.

Table 4-7 Instrument State after PRESET Is Executed

Function	State
10 MHz REF	INTERNAL
A–B→A	OFF
A–B+DISPLAY LINE→A	OFF
AGC	OFF
ANNOTATION	ON
AUTO IF ADJUST	ON
BAND LOCK	OFF
CENTER FREQUENCY	1.45 GHz (8560E/EC) 3.25 GHz (Agilent 8561E/EC) 6.6 GHz (Agilent 8562E/EC) 13.25 GHz (Agilent 8563E/EC) 20 GHz (Agilent 8564E/EC) 25 GHz (Agilent 8565E/EC)
CF STEP	290 MHz (8560E/EC) 650 MHz (Agilent 8561E/EC) 1.32 GHz (Agilent 8562E/EC) 2.65 GHz (Agilent 8563E/EC) 4.0 GHz (Agilent 8564E/EC) 5.0 GHz (Agilent 8565E/EC)
DELAY SWEEP	2µs, OFF
DEMODULATION	FM OFF; AM OFF
DEMODULATION TIME	1 second
DETECTOR	NORMAL
DISPLAY LINE	0 dBm, OFF
EXT MIXER BIAS	0 mA, OFF
EXT MIXER LO HARMONIC	6

Table 4-7 Instrument State after PRESET Is Executed

Function	State
FREQUENCY COUNTER	OFF
FREQUENCY COUNTER RESOLUTION	10 kHz
FREQUENCY DISPLAY	ON
FREQUENCY MODE	CENTER FREQUENCY, SPAN
FREQUENCY OFFSET	0 Hz
GATE	OFF
GATE CONTROL	EDGE
GATE DELAY	3µs
GATE LENGTH	1µs
GATE POLARITY	POSITIVE
GRATICULE	ON
INPUT ATTENUATION	10 dB, AUTO
MARKER MODE	OFF
MAX MIXER LEVEL	–10 dBm
MIXER	INT
MIXER CONV LOSS	30.0 dB, OFF
NOISE MARKER	OFF
PEAK EXCURSION	6 dB
PEAK THRESHOLD	–130 dBm
PRESELECTOR PEAK TABLE	factory data (for Agilent 8561E/EC, Agilent 8562E/EC, Agilent 8563E/EC, Agilent 8564E/EC, Agilent 8565E/EC)
RBW/SPAN RATIO	0.011
REFERENCE LEVEL	0 dBm
REFERENCE LEVEL OFFSET	0 dB, OFF
RESOLUTION BW	1 MHz, AUTO
SIGNAL IDENTIFICATION	OFF
SIGNAL TRACK	OFF

Table 4-7 Instrument State after PRESET Is Executed

Function	State
SPAN	2.9 GHz, AUTO (8560E/EC) 6.5 GHz, AUTO (Agilent 8561E/EC) 13.2 GHz, AUTO (Agilent 8562E/EC) 26.5 GHz, AUTO (Agilent 8563E/EC) 40 GHz, AUTO (Agilent 8564E/EC) 50 GHz, AUTO (Agilent 8565E/EC)
SQUELCH	OFF
SQUELCH LEVEL	–120 dBm
SWEEP TIME	60 ms, AUTO (8560E/EC) 200 ms, AUTO (Agilent 8561E/EC) 264 ms, AUTO (Agilent 8562E/EC) 530 ms, AUTO (Agilent 8563E/EC) 800 ms, AUTO (Agilent 8564E/EC) 1 s, AUTO (Agilent 8565E/EC)
THRESHOLD	–90 dBm, OFF
TRACE A	CLEAR-WRITE
TRACE B	BLANK
TRACE-DATA FORMAT	P
TRIGGER MODE	CONTINUOUS
TRIGGER POLARITY	POSITIVE
TRIGGER SOURCE	FREE-RUN
UNITS	dBm, AUTO
VERTICAL SCALE	10 dB/DIV
VBW/RBW RATIO	1
VIDEO BW	1 MHz, AUTO
VIDEO AVERAGE	100, OFF
VIDEO TRIG LEVEL	0 dBm

PRINTER ADDRESS Displays the current GPIB address of the designated printer. A new address can be entered by using the data keys (and pressing **ENTER**), the step keys, or the knob, and pressing STORE HPIB ADR. The new address is stored in nonvolatile memory and is recalled when the power is cycled. If the printer address is redefined without saving it with STORE HPIB ADR, the redefined address is valid after **PRESET** is pressed, but not through a power cycle.

Front-panel key access: **CONFIG**

PRINTER CONFIG Accesses printer configuration options to set the printer address and to select a black-and-white or color printer.

Front-panel key access: **CONFIG**

NOTE If the printer is not connected when any of the print functions are executed, then the message `CONNECT PRINTER` appears in the active function block.

PURGE CORR Allows you to delete the entire table of frequency-amplitude correction points currently being edited.

Front-panel key access: **CAL**

PWR MENU HELP Includes measurement information for making occupied power bandwidth, channel power, carrier power, and adjacent channel power measurements.

Front-panel key access: **MEAS/USER**

PWR ON STATE Saves the current instrument state in the power-on register. The spectrum analyzer is then set to this state whenever **LINE** is switched on. The same state can be retrieved with POWER ON, available from the **RECALL** menu.

Front-panel key access: **SAVE**

PWR SWP ON OFF *For 8560E/EC Option 002.* Activates (ON) or deactivates (OFF) the power-sweep function, where the output power of the tracking generator is swept over the power-sweep range chosen. The value of the power-sweep range is displayed in the active function block, when PWR SWP ON OFF is turned on. The power-sweep range can be set from 0 to 12.8 dB; however, the power-sweep range specified under warranty is 10 dB. It can be adjusted using the data keys, step keys, or knob.

The output power of the tracking generator is swept according to the sweep rate of the spectrum analyzer.

Power-sweep measurements are particularly useful in making gain compression or output power versus frequency measurements.

Front-panel key access: **AUX CTRL**

RANGE LVL *Appears only when NORMLIZE ON OFF is set to ON.*Activates the dynamic-range-level function, which corresponds to the top of the display in dBm. RANGE LVL ensures that the displayed range is compression-free by adjusting the input attenuator and IF gain accordingly. RANGE LVL is equivalent to REF LVL, which is commonly used in signal-analysis measurements.

When in normalized mode, NORM REF LVL and NORM REF POSN affect the value of the top of the display (that is, the top of screen does not necessarily represent the gain compression limit). If the actual measured signal is beyond the gain compression limit, or below the bottom line of the graticule, the error message `ERR 903 A > DLMT` will appear. Adjusting RANGE LVL until the error message disappears, assures the user that the measured signal level is no longer beyond the measurement limits of the instrument. If the signal of interest is both above the gain compression limit and below the bottom line of the graticule, changing RANGE LVL does not clear the error message. Refer to Chapter 2 for a measurement example using RANGE LVL.

`ERR 904 B > DLMT` appears in normalized mode only if any one of the following conditions occur:

- Any data point of the calibration trace is off-screen.
- No calibration has been performed after a preset.
- Trace B is blank.

To ensure valid calibration trace data, readjust analyzer settings, turn normalize off, and perform a CAL THRU or CAL OPN/SHRT operation.

RANGE LVL can be adjusted from +30 dBm to –120 dBm using the data keys, step keys, or the knob.

Front-panel key access: **AMPLITUDE** or **AUX CTRL**

RAW OSC FREQ Displays the value of the oscillator frequency which is used to generate the fractional N frequency. The fractional N frequency is one-half of the raw oscillator frequency divided by the post scaler. See the POSTSCLR softkey.

Front-panel key access: **CAL**

RBW/SPAN RATIO Displays the current coupling ratio between the resolution bandwidth and the frequency span. The ratio is displayed in the active function block, and it is used when resolution bandwidth is in coupled mode. The ratio ranges from 0.002 to 0.10, in a 1, 2, 5 sequence. The default ratio is 0.011.

Front-panel key access: **BW**

REALIGN LO & IF Activates the automatic local oscillator (LO) and intermediate frequency (IF) alignment routines. These are the same routines that occur when **LINE** is switched on. When REALIGN LO &IF is active, STOP REALIGN appears and all other softkeys are blank during this time. STOP REALIGN allows you to stop the IF adjustment routine before it is finished; however the routine is not stopped immediately. If STOP REALIGN is activated, the amplitude accuracy of measurements made by the instrument may not meet published specifications.

Front-panel key access: **CAL**

REAR PANEL Accesses the softkeys that allow you to select the signals at the rear-panel connectors. The 10 MHz EXT INT softkey controls the J9 connector output. The softkeys 0 → 10V LO SWP and .5 V/GHz (FAV) (or V/GHz .25 .50) select the signal that is present at J8. Selections are not changed when **PRESET** is pressed.

If the preselected external mixer mode is selected, rear-panel output J8 is automatically switched to the 0.5 V/GHz (FAV) mode. The actual output at J8 becomes 1.5 V/GHz, referenced to the LO frequency. The 1.5 V/GHz of the LO frequency is required for the Agilent 11974 Series preselected external mixers.

Front-panel key access: **AUX CTRL**

The VGA output port on the rear panel is always active and does not require user interaction.

RECALL Accesses softkeys that allow you to recall stored instrument-state and trace data. The softkeys are: POWER ON, LAST STATE, RECALL STATE, RECALL TO TR A, and RECALL TO TR B.

Front-panel key access: **RECALL**

RECALL AMPCOR Recalls a table of frequency-amplitude correction points that was previously saved.

Front-panel key access: **CAL**

RECALL ERRORS Displays the last error that has occurred. Use the step keys to cycle through accumulated errors. For a list of all error codes and additional error information, refer to Appendix C, "Error Messages", or to the installation and verification manual.

Front-panel key access: **RECALL**

NOTE

When **PRESET** is pressed, the preselector data stored by the user does not change. However, the factory settings now become active.

Factory preselector data always takes precedence over user-activated preselected data, unless the user data is explicitly recalled using RECALL PRSEL PK. For more information on storing and recalling preselector data, refer to the SAVE PRSEL PK and RECALL PRSEL PK softkeys.

RECALL OPN/SHRT Recalls the internally-stored open/short average calibration trace into trace B. The instrument state is also set to the state of the stored open/short calibration.

Front-panel key access: **AUX CTRL**

RECALL PRSEL PK *Only for use with internal mixing or for preselected external mixing.* Recalls the preselector data that is stored by the user in the user data table. This data can be saved using SAVE PRSEL PK, found under the **SAVE** menu. The three available tables of preselector data are described below.

1. **Current Data Table** contains the data used to tune the preselector. The data is obtained from either the user data table or the factory data table. Use either the PRESEL MAN ADJ or PRESEL AUTO PK softkey (located under **AMPLITUDE** or **AUX CTRL**) to modify the data in the current table. To save the data, use SAVE PRSEL PK. If the current data is not saved, it is lost when the instrument is preset, turned off, or whenever bands are changed in the case of external mixing.
2. **Factory Data Table** is the default data table for internal mixing. This data is set at the factory and can be changed only by service personnel. This data is copied to the current data table when **PRESET** is pressed.

The data in this table is sufficient for virtually all applications, because this is the table that allows the spectrum analyzer to meet its published specifications.

3. **User Data Table** is the current data table that was saved last and is recalled using the RECALL PRSEL PK softkey. The same user data table is used to store either internal or external preselector data. The preselector data saved depends on the current mode (internal or external). Therefore, when in external mixer mode and internal preselector data was previously saved, recalling the user data table will cause an `ERR 704 PRESELCT` error message. `ERR 704` also occurs if internal mixer mode and external preselector data is recalled.

Front-panel key access: **RECALL**

RECALL STATE Displays a menu of 10 registers from which the stored instrument states can be recalled and displayed on the spectrum analyzer screen. The recall-state registers appear on two menus: STATE 0 through STATE 4 on the first page, and STATE 5 through STATE 9 on the second page. To recall the data, press the softkey next to the desired register number, or enter the number using the data keys. Terminate the entry with any units (**Hz**, **kHz**, and so on). If a recall-state register does not contain a previously-saved instrument state, the `NOT SAVED!` message appears.

If a stored state has a title, the first sixteen characters of the title are used as the softkey annotation for that register. The register annotation appears in two rows of eight characters each. For example, if the data previously stored in register 0 has the title "Harmonic Test," the softkey annotation `STATE 0` is replaced with the text `Harmonic Test`.

Front-panel key access: **RECALL**

NOTE State registers 8 and 9 are used to store normalization traces. Refer to tracking-generator calibration softkey descriptions in this chapter for more information.

RECALL THRU Recalls the internally stored thru calibration trace into trace B. The instrument state is also set to the stored thru state.

Front-panel key access: **AUX CTRL**

RECALL TO TR A Displays a menu of eight registers from which trace data can be recalled and placed in trace A. The recall-trace registers appear on two menus: TRACE 0 through TRACE 4 on the first page, and TRACE 5 through TRACE 7 on the second page. To recall trace data from a desired register into trace A, press the softkey next to the register number, or enter the number using the data keys. Terminate the entry with any units key (**Hz**, **kHz**, and so on). If a recall-trace register does not contain previously-saved trace data, the NOT SAVED! message appears.

Front-panel key access: **RECALL**

RECALL TO TR B Displays a menu of eight registers from which trace data can be recalled and placed in trace B. The recall-trace registers appear on two menus: TRACE 0 through TRACE 4 on the first page, and TRACE 5 through TRACE 7 on the second page. To recall trace data from a desired register into trace B, press the softkey next to the register number, or enter the number using the data keys. Terminate the entry with any units key (**Hz**, **kHz**, and so on). If a recall-trace register does not contain previously-saved trace data, the NOT SAVED! message appears.

Front-panel key access: **RECALL**

REF LVL Activates the reference-level function. The reference level can be adjusted using the data keys, the step keys, or the knob. The reference level is the top line of the graticule. For best measurement accuracy, place the peak of the signal of interest on the reference-level line. The spectrum analyzer input attenuator is coupled to the reference level and is automatically adjusted to avoid compression of the input signal.

The minimum reference level, with 0 dB of attenuation, is –120 dBm when using a logarithmic scale. It is 2.2 μV with the linear scale.

Front-panel key access: **AMPLITUDE**

REF LVL ADJ Allows the analyzer internal gain to be adjusted so that when the calibrator signal is connected to the input, a reference level equal to the calibrator amplitude displays the signal at top-screen. When REF LVL ADJ is pressed, the STORE REF LVL softkey appears in its place and a number without units appears in the active function area. The reference-level value can be changed by using the data keys, the step keys, or the knob.

When the desired calibration level is reached, STORE REF LVL may be pressed to store the new value in nonvolatile memory. If STORE REF LVL is not pressed, the new value remains in use until a power-on occurs.

Front-panel key access: **CAL**

REF LVL OFFSET Introduces an offset to all amplitude readouts (for example, reference level and marker amplitude). It does not change the position of the trace on-screen. The offset is in dB, regardless of the selected scale and units. The offset can be useful to account for gains or losses in accessories connected to the input of the analyzer. To enter an offset value, use the data keys, the step keys, or the knob. When this function is active, an R appears on the left edge of the display.

Front-panel key access: **AMPLITUDE**

RES BW AUTO MAN Adjusts the resolution bandwidth. The bandwidth, which appears in the active function block, ranges from 1 Hz to 2 MHz in a 1, 3, 10 sequence. The value can be changed using the data keys, the step keys, or the knob. A line under AUTO or MAN indicates whether the bandwidth is coupled (AUTO) or is in manual mode (MAN). When the resolution bandwidth is in manual mode, press RES BW AUTO MAN until AUTO is underlined to return the bandwidth to coupled mode.

Front-panel key access: **AUTO COUPLE**

SAMPLER FREQ Displays the sampling-oscillator frequency corresponding to the current start frequency. It also displays the loop bandwidth compensation value (established during local oscillator calibration) for the sampler frequency. This value is displayed below the sampler frequency and is preceded by a "#" sign.

Front-panel key access: **CAL**

SAMPLER HARMONIC Displays the sampler harmonic number corresponding to the current start frequency.

Front-panel key access: **CAL**

SAVE Accesses a menu of softkeys that allow you to save instrument-state data and trace data. These softkeys are as follows: SAVE STATE, PWR ON STATE, SAVE TRACE A, SAVE TRACE B, SAVELOCK ON OFF, and SAVE PRSEL PK.

Front-panel key access: **SAVE**

SAVE AMPCOR Saves the current table of frequency-amplitude correction points. Front-panel key access: **CAL**

SAVE PRSEL PK *For use only with internal mixing or preselected external mixing.* Saves the current preselector-peak data in the user data table. This does not affect the preselector data that is set at the factory or by service personnel. To recall saved data to the current data table, use either FACTORY PRSEL PK to recall the factory data table, or RECALL PRSEL PK to recall the user data table. Both of these softkeys are located under **RECALL**. The three available tables of preselector data are described below.

1. **Current Data Table** contains the data used to tune the preselector. The data is obtained from either the user data table or the factory data table. Use either the PRESEL MAN ADJ or PRESEL AUTO PK softkey (located under **AMPLITUDE** or **AUX CTRL**) to modify the data in the current table. To save the data, use SAVE PRSEL PK. If the current data is not saved, it is lost when the instrument is preset, turned off, or whenever bands are changed in the case of external mixing.
2. **Factory Data Table** is the default data table for internal mixing. This data is set at the factory and can be changed only by service personnel. This data is copied to the current data table when **PRESET** is pressed. The data in this table is sufficient for virtually all applications, because this is the table that allows the spectrum analyzer to meet its published specifications.
3. **User Data Table** is the current data table that was saved last and is recalled using the RECALL PRSEL PK softkey. The same user data table is used to store either internal or external preselector data. The preselector data saved depends on the current mode (internal or external). Therefore, when in external mixer mode and internal preselector data was previously saved, recalling the user data table will cause an `ERR 704 PRESELCT` error message. `ERR 704` also occurs if internal mixer mode and external preselector data is recalled.

Front-panel key access: **SAVE**

NOTE When **PRESET** is pressed, the preselector data stored by the user does not change. However, the factory settings now become active.

Factory preselector data always takes precedence over user-activated preselected data, unless the user data is explicitly recalled using RECALL PRSEL PK. For more information on storing and recalling preselector data, refer to the SAVE PRSEL PK and RECALL PRSEL PK softkeys.

SAVE STATE Displays a menu of 10 registers in which the current instrument state can be stored. The save-state registers appear on two menus: STATE 0 through STATE 4 on the first page, and STATE 5 through STATE 9 on the second page. To store the current instrument state in a desired register, press the softkey next to the register number, or enter the number using the data keys. Terminate the entry with any units key (**Hz**, **kHz**, and so on). The SAVELOCK ON OFF function must be OFF to save a state.

If a stored state has a title, the first 16 characters of the title are used as the softkey annotation for that register. The register annotation appears in two rows of eight characters each. For example, if the data stored in register 0 has the title "Harmonic Test," the softkey annotation `STATE 0` is replaced with the text `Harmonic Test`.

Front-panel key access: **SAVE**

NOTE State registers 8 and 9 are used to store normalization traces. Refer to tracking-generator calibration softkey descriptions in this chapter for more information.

SAVE TRACE A Displays a menu of eight registers in which the current contents of trace A can be stored. The save-trace registers appear on two menus: TRACE 0 through TRACE 4 on the first page, and TRACE 5 through TRACE 7 on the second page. To store current trace A data in a desired register, press the softkey next to the register number, or enter the number using the data keys. Terminate the entry with any units key (**Hz**, **kHz**, and so on).

NOTE

SAVE TRACE A and **SAVE TRACE B** use exactly the same eight save-trace registers in which to store trace data. Be careful not to overwrite previously saved trace data.

Trace-registers 5, 6, and 7 should not be used when using an Agilent 85620A mass memory module. These registers are used by the module and may be overwritten if data has been previously stored in them.

Front-panel key access: **SAVE**

SAVE TRACE B Displays a menu of eight registers in which the current contents of trace B can be stored. The save-trace registers appear on two menus: TRACE 0 through TRACE 4 on the first page, and TRACE 5 through TRACE 7 on the second page. To store current trace B data in a desired register, press the softkey next to the register number, or enter the number using the data keys. Terminate the entry with any units key (**Hz**, **kHz**, and so on).

Front-panel key access: **SAVE**

SAVE LOCK ON OFF Prevents storing any new data in the state or trace registers. When SAVELOCK ON OFF is ON, the registers are "locked"; the data in them cannot be erased or overwritten, although the data can be recalled. To "unlock" the registers and store new data, switch SAVELOCK ON OFF to OFF.

Front-panel key access: **SAVE**

SCREEN TITLE Displays a menu of functions that allow you to create a title on the screen or to erase an existing title. SCREEN TITLE also displays a set of characters in the active function block. Use the step keys or the knob to select the desired characters for your title. After selecting the desired character, press SELECT CHAR to place it in the title area, which is in the upper-right corner of the graticule. The title can be up to two lines of 16 characters each.

Front-panel key access: **DISPLAY**

SCROLL CORR PTS Activates a 3 line display of the current frequency-amplitude correction data. Each correction point consists of a frequency at which the correction should be applied and an amplitude, in dB, of the correction. The list of correction points is sorted in order by frequency and is numbered.

The currently selected frequency-amplitude correction pair is marked with an *. You can scroll through the list of correction pairs by using the knob, or by using the step-keys. You can go directly to the point that you wish to edit by entering its number using the numeric keypad and pressing one of the terminator keys.

Front-panel key access: **CAL**

SELECT CHAR Causes the currently selected character in the active function block to appear in the next available character position of the title, which is indicated by a blinking dot. This key may be held down for repeated characters.

Front-panel key access: **DISPLAY**

SGL SWP Selects the single sweep mode and triggers a sweep if the spectrum analyzer is in continuous sweep mode. If the analyzer is in the single sweep mode, pressing **SGL SWP** triggers another sweep.

Front-panel key access: **SGL SWP**

SIG ID→ CF *For firmware revisions ≤920528 or for Option 008 only.* Sets the center frequency to the frequency obtained from the softkey SIG ID AT MKR. If the frequency is outside the range of the analyzer, no action takes place. If no signal identification has previously been performed, the message `DO: SIG ID AT MKR` momentarily appears in the active function block, and no other action takes place. Use this function only after executing SIG ID AT MKR.

Front-panel key access: **AUX CTRL**

SIG ID AT MKR *For firmware revisions ≤920528 or for Option 008 only.* Activates a signal-identification function that locates the frequency and harmonic number of the mixer response. Place a marker on the desired signal, then activate SIG ID AT MKR. The frequency of the signal and the LO harmonic mixing number appear in the active function block. If the function cannot identify the signal, either one of two messages, NOT FOUND or LOST SIGNAL, is displayed in the active function block.

If the analyzer traces are in states other than clear-write, then no action takes place and the message ACTIVATE TRACE appears.

Front-panel key access: **AUX CTRL**

SIG ID ON OFF *For firmware revisions ≤920528 or for Option 008 only.* Switches the manual signal-identification function ON and OFF. When ON, this function employs a frequency-shift method of identifying signals. Displayed signals are shifted horizontally and vertically on alternate sweeps. Signals that are correct for the selected harmonic band are shifted less than 50 kHz. In addition, all signals are shifted downward in amplitude by approximately one division, regardless of scale. This routine is only effective for signal identification in certain spans; the user must ensure that a proper span is selected. (To ensure accuracy, limit the frequency span to less than 20 MHz.)

Front-panel key access: **AUX CTRL**

SIG TRK ON OFF *Not available when a tracking generator is active.*Turns the signal-tracking function ON or OFF. The signal-track function keeps the active marker on the peak of the signal where it has been initially placed, and sets the center frequency to its value. This is done after every sweep, thus maintaining the marked signal at the center frequency. This allows you to "zoom in" quickly from a wide span to a narrow one without losing the signal from the screen. Or, use SIG TRK ON OFF to keep a slowly drifting signal centered on the display. When this function is active, a K appears on the left edge of the display.

Front-panel key access: **MKR**

SIGNAL ID ENT *For firmware revisions ≤920528 or for Option 008 only.* Displays a menu of signal-identification functions for use with unpreselected external mixers.

Front-panel key access: **AUX CTRL**

SINGLE MEASURE Puts the spectrum analyzer in single sweep. Completes the current measurement and stops further measurements from occurring. If the measurement is already stopped, it is re-started and one measurement is completed.

Front-panel key access: **MEAS/USER**

SOURCE CAL MENU Accesses a menu of softkeys that allow you to calibrate for frequency-response errors in test setups. Thru calibration is used when making transmission measurements, and open/short average calibration is used when making reflection measurements.

Front-panel key access: **AUX CTRL**

SPACE Places a blank space in the next available character position in the title.

Front-panel key access: **DISPLAY**

SPACING/BANDWDTH Accesses the functions that allow you to change channel spacing and channel bandwidth when making adjacent channel power measurements.

Front-panel key access: **MEAS/USER**

SPAN Activates the span function and sets the spectrum analyzer to center-frequency span mode. A span hard key and a span softkey are available. The **SPAN** hard key also accesses SPAN, SPAN ZOOM, FULL SPAN, ZERO SPAN, and LAST SPAN. The span setting can be changed using the data keys, the step keys, or the knob. The span can be set to 0 Hz using either the data keys or ZERO SPAN.

Front-panel key access: **SPAN**

SPAN ZOOM Tracks a marked signal and activates the span function. If no marker is active, an active marker is positioned at the highest peak, signal track is turned on, and SPAN is made the active function. Once the span is entered and the new span is reached, the marker and signal track both remain on with SPAN as the active function. Therefore, keying in consecutive frequency span values continues to activate the span-zoom function. To deactivate the span-zoom function, press **MKR**, and then press MARKERS OFF, or set SIG TRK ON OFF to OFF.

Front-panel key access: **SPAN**

SQUELCH ON OFF Adjusts the squelch level. The value is displayed in the active function block, in dBm. The squelch level is also indicated by a dashed line across the display. A marker must be active and located above the squelch line for demodulation to occur when squelch is on. Note that in zero span, squelch for AM is inactive.

Front-panel key access: **AUX CTRL**

SRC PWR OFFSET *For 8560E/EC Option 002.* Allows you to offset the displayed power of the tracking generator. Offset values may range from –100 dB to +100 dB.

Using the source-power-offset capability of the tracking generator allows you to take system losses into account, thereby displaying the actual power delivered to the device under test.

Front-panel key access: **AUX CTRL**

SRC PWR ON OFF *For 8560E/EC Option 002.* Activates (ON) or deactivates (OFF) the output power of the tracking generator. The power level can then be adjusted using the data keys, step keys, or knob. The output power level can be varied from –10 dBm to +2.8 dBm, with 0.1 dB resolution.

When source power is on, a G appears in the special functions area at the left side of the display screen.

Front-panel key access: **AUX CTRL**

NOTE The tracking generator warmup period begins when the source power is set to ON and the G is displayed in the special functions area. The tracking generator is not turned on automatically when the analyzer is turned on, unless the power-on state is specified as having the source power set to ON.

SRC PWR STP SIZE *For 8560E/EC Option 002.* Allows the user to set the step size of the source power level, source power offset, and power-sweep range functions. The step size may be values from 0.1 dB to 12.8 dB.

Front-panel key access: **AUX CTRL**

START FREQ Activates the start frequency and sets the spectrum analyzer to the start-frequency stop-frequency mode. START FREQ can be adjusted using the data keys, the step keys, or the knob. When adjusting START FREQ, if the selected start frequency exceeds the stop frequency, the stop frequency increases to equal the start frequency plus the minimum swept span (100 Hz x N, where N is the local oscillator harmonic).

Front-panel key access: **FREQUENCY**

STATE 0 through **STATE 9** Allows you to select which state register to recall or save instrument state information.

NOTE State registers 8 and 9 are used to store normalization traces. Refer to tracking-generator calibration softkey descriptions in this chapter for more information.

Recalling from a state register You can recall previously saved state information from 10 state registers (STATE 0 through STATE 9). When state information is recalled, the state of the spectrum analyzer changes to the state of the recalled information. To recall state information, press the softkey next to the desired register number, or enter the number using the data keys. Terminate the entry with any units (**Hz**, **kHz**, and so on). If a recall-state register does not contain a previously saved instrument state, the `NOT SAVED!` message appears.

If a stored state has a title, the first 16 characters of the title are used as the softkey annotation for that register. The register annotation appears in two rows of eight characters each. For example, if the data previously stored in register 0 has the title "Harmonic Test," the softkey annotation `STATE 0` is replaced with the text `Harmonic Test`.

Saving to a state register You can save instrument state information in 10 state registers (STATE 0 through STATE 9). If there is a title on the spectrum analyzer display when the state data is saved, the first 16 characters of the title are used as the softkey annotation for that register. The register annotation appears in two rows of eight characters each. For example, if the data is saved in register 0 has the title "Harmonic Test," the softkey annotation `STATE 0` is replaced with the text `Harmonic Test`.

Front-panel key access: **RECALL** or **SAVE**

STOP FREQ Activates the stop frequency and sets the spectrum analyzer to the start-frequency stop-frequency mode. STOP FREQ can be adjusted using the data keys, the step keys, or the knob. When adjusting STOP FREQ, if the selected stop frequency is less than the start frequency, the start frequency decreases to equal the stop frequency minus the minimum swept span (100 Hz x N, where N is the local oscillator harmonic).

Front-panel key access: **FREQUENCY**

SWEEP Activates the sweep time function and accesses a menu of sweep-related functions, which are as follows: SWP TIME AUTO MAN, SWEEP CONT SGL, GATE ON OFF, GATED VIDEO, DLY SWP [ ], DLY SWP ON OFF, GATE DLY [ ], GATE LEN [ ], EDGE POL POS NEG, and GATE CTL EDGE LVL. **SWEEP** also activates the sweep-time function.

Front-panel key access: **SWEEP**

SWEEP CONT SGL Allows you to select continuous sweep or single sweep mode. Pressing **SWEEP CONT SGL** so that CONT is underlined, activates the continuous-sweep mode. Continuous sweep mode is the default mode. Pressing SWEEP CONT SGL so that SGL is underlined, activates the single-sweep mode. Press SGL SWP to restart the sweep at the next trigger. When the single-sweep mode is active, an S appears at the left edge of the display.

Front-panel key access: **SWEEP** or **TRIG**

SWP CPL SR SA Allows the user to choose a stimulus-response (SR) or spectrum-analyzer (SA) auto-coupled sweep time. In spectrum analyzer mode, the sweep times are coupled so that the measurement remains calibrated. In stimulus-response mode, auto-coupled sweep times are usually faster for swept-response measurements. Stimulus-response auto-coupled sweep times are typically valid in stimulus-response measurements when the system frequency span is less than 20 times the bandwidth of the device under test. When a stimulus-response sweep time is chosen, an E appears in the special functions area at the left side of the display screen.

Front-panel key access: **AUX CTRL**

SWP TIME AUTO MAN Adjusts the sweep time of the spectrum analyzer. To change the sweep time, use the data keys, the step keys, or the knob. A line under MAN indicates that the sweep time can be manually set. A line under AUTO, indicates a coupled sweep time based on the resolution bandwidth, span, and video bandwidth settings. When the sweep time is in manual mode, press SWP TIME AUTO MAN until AUTO is underlined to return the sweep time to coupled mode.

In stimulus response, auto-coupled sweep-time mode (SR), sweeps are usually much faster than spectrum analyzer, auto-coupled sweep time mode (SA).

An E appears in the special functions area at the left side of the display screen when the stimulus response mode is selected. Manual sweep mode only applies to SA mode. If SWP TIME AUTO MAN is set to MAN, the analyzer sweep time coupling defaults to SA mode. The SWP CPL SR SA softkey is located under the TRACKING GENRATOR menu.

Front-panel key access: **AUTO COUPLE** or **SWEEP**

THRESHLD ON OFF Sets a threshold that determines the lower limit of the active traces. To change the threshold, use the data keys, the step keys, or the knob. The selected level is indicated by a dashed line across the screen. When the trace is in max-hold mode, once the threshold is raised, any data below the new threshold is permanently lost.

Front-panel key access: **DISPLAY**

TITLE DONE Ends editing of the current title and returns to the previous softkey menu.

Front-panel key access: **DISPLAY**

TRACE Accesses a menu of trace-related functions, which are as follows: CLEAR WRITE A, MAX HOLD A, VIEW A, BLANK A, TRACE A B, VID AVG ON OFF, DETECTOR MODES, A EXCH B, NORMLIZE ON OFF, NORM REF POSN, A–B→A ON OFF, A+B→A, B–DL→B, and A–B+DL→A ON OFF. Trace A is brighter than trace B, to distinguish between the two traces.

Front-panel key access: **TRACE**

TRACE 0 through **TRACE 7** Allows you to select a trace register to recall or save trace information.

Front-panel key access: **RECALL** or **SAVE**

NOTE

SAVE TRACE A and **SAVE TRACE B** use exactly the same eight save-trace registers in which to store trace data. Be careful not to overwrite previously saved trace data.

Trace-registers 5, 6, and 7 should not be used when using an Agilent 85620A mass memory module. These trace registers are used by the module and may be overwritten if trace data has been previously stored in them.

TRACE A B Toggles the trace softkey functions between traces A and B.

Front-panel key access: **TRACE**

TRACKING GENRATOR *For an 8560E/EC Option 002 see the alternate softkey description below.* Displays softkey menus only for use with an external tracking generator. The minimum resolution bandwidth that is supported for stimulus-response measurements is 300 Hz.

Front-panel key access: **AUX CTRL**

NOTE Before making a stimulus-response measurement, maximize the tracking adjustment of the tracking generator to ensure amplitude accuracy.

TRACKING GENRATOR *8560E/EC Option 002 only*. Displays softkey menus only for use with a built-in tracking generator. When selected, TRACKING GENRATOR also displays the RF power level of the tracking generator in the active function block. The tracking generator warmup period begins when the source power is set to ON and the G is displayed in the special functions area. The tracking generator is not turned on automatically when the analyzer is turned on, unless the power-on state is specified as having the source power set to ON.

The minimum resolution bandwidth that is supported for stimulus-response measurements is 300 Hz. If a tracking generator is active and a resolution bandwidth less than 300 Hz is selected, then the error message
TG/RBW
INCOMPATIBLE will flash in the message area.

Front-panel key access: **AUX CTRL**

NOTE Before making a stimulus-response measurement, maximize the tracking adjustment of the tracking generator to ensure amplitude accuracy.

TRACKING PEAK Activates a routine that automatically adjusts both the coarse- and fine-tracking adjustments to obtain the peak response of the tracking generator on the spectrum-analyzer display. The routine uses a 300 Hz resolution bandwidth for peaking; therefore, narrowing the resolution bandwidth after a tracking peak has been done results in no tracking adjustment. Tracking peak is not needed for resolution bandwidths greater than or equal to 300 kHz.

Front-panel key access: **AUX CTRL**

NOTE The tracking generator must be connected to the spectrum analyzer in order for tracking peak to function properly.

TRIG Accesses a menu of trigger functions: SWEEP CONT SGL, FREE RUN, VIDEO, LINE, EXTERNAL, and TRIG POL POS NEG. When any mode other than FREE RUN is selected, a T appears in the special functions area at the left side of the display screen.

Front-panel key access: **TRIG**

TRIG POL POS NEG Sets the sweep to trigger on the rising edge (POS) or the falling edge (NEG) of the trigger signal.

Front-panel key access: **TRIG**

UNITS AUTO MAN Selects amplitude units automatically (AUTO) or manually (MAN). When in AUTO mode, the default units are dBm (in log scale) or VOLTS (in linear scale). The units available from this menu are: dBm, dBµV, dBmV, VOLTS, WATTS.

Front-panel key access: **AMPLITUDE** or **AUTO COUPLE**

VBW/RBW RATIO Displays the current coupling ratio between the video bandwidth and the resolution bandwidth. The ratio is displayed in the active function block, and is used when the two bandwidths are in coupled mode. The ratio ranges from 0.003 to 3, in a 1, 3, 10 sequence. The default value is 1.

Front-panel key access: **BW**

V/GHz .25 .50 *For Agilent 8564E/EC and Agilent 8565E/EC only.* Specifies a 0.25 or 0.5 volts per GHz sweep output at the rear-panel connector J8. This is also referred to as the frequency analog voltage (FAV). Connector J8 is labeled LO SWP | FAV OUTPUT. When using a 8560 E-Series or EC-Series with a tracking generator such as an Agilent 85640A, this softkey must be activated and set to 0.5 V/GHz. Pressing **PRESET** does not change the selection of FAV as the output for J8.

If the preselected external mixer mode is selected, rear-panel output J8 is automatically switched to the 0.5 V/GHz (FAV) mode. The actual output at J8 becomes 1.5 V/GHz, referenced to the LO frequency. The 1.5 V/GHz of the LO frequency is required for the Agilent 11974 Series preselected external mixers.

Front-panel key access: **AUX CTRL**

VID AVG ON OFF Turns the video averaging ON or OFF. Video averaging smooths the displayed trace without using a narrow video bandwidth. The function sets the detector mode to sample mode and smoothes the trace by averaging successive traces with each other.

Front-panel key access: **BW** or **TRACE**

VIDEO Sets the trigger to video mode. Sweep triggers occur whenever the input signal passes through the video trigger level with a slope determined by the TRIG POL POS NEG function. This trigger level can be changed using the data keys, the step keys, or the knob. A dashed line appears on the screen to denote the selected level. Note that in 1 dB per division, the error in this line can be up to three divisions.

Front-panel key access: **TRIG**

VIDEO BW AUTO MAN Adjusts the video bandwidth, which appears in the active function block, and ranges from 1 Hz to 3 MHz in a 1, 3, 10 sequence. The value can be changed using the data keys, the step keys, or the knob. A line under AUTO or MAN indicates whether the bandwidth is coupled (AUTO) or is in manual mode (MAN). When the video bandwidth is in manual mode, press VIDEO BW AUTO MAN until AUTO is underlined to return the bandwidth to coupled mode. When the video bandwidth is less than or equal to 100 Hz and the resolution bandwidth is greater than or equal to 300 Hz, the detector mode automatically changes to sample mode.

Front-panel key access: **AUTO COUPLE** or **BW**

VIEW A Displays the current contents of trace A, but does not update the contents.

Front-panel key access: **TRACE**

VIEW B Displays the current contents of trace B, but does not update the contents.

Front-panel key access: **TRACE**

VIEW TBL TRCE Sets the display mode for an adjacent channel power measurement to show a table (TBL) of the measurement results or to show a representative spectrum trace (TRCE). The trace option is not available when using the burst power measurement method. The trace option is also not available when using acceleration with any of the methods except the analog method.

Front-panel key access: **MEAS/USER**

VOLTS Selects volts as the display amplitude units.

Front-panel key access: **AMPLITUDE**

WATTS Selects watts as the display amplitude units.

Front-panel key access: **AMPLITUDE**

WEIGHT α Allows you to enter the "alpha" factor of the root-raised-cosine weighting function. The current value is displayed on the softkey.

Front-panel key access: **MEAS/USER**

WEIGHT T Allows you to enter the "T" factor of the root-raised-cosine filter function. The current value is displayed on the softkey.

Front-panel key access: **MEAS/USER**

WEIGHTNG √ COS OFF Turns on or off the function that does root-raised-cosine weighting of the spectrum data for an ACP measurement. This weighting simulates the filtering expected in the radio receiver to be used.

Front-panel key access: **MEAS/USER**

The root-raised-cosine weighting function is described by the following equations:

$$W(\Delta f)= \begin{cases} |\Delta f| \le \left(\frac{1-\alpha}{2T}\right) \rightarrow W(\Delta f) = 0\text{dB} \\ \left(\frac{1-\alpha}{2T}\right) < [\Delta f] < \left(\frac{1-\alpha}{2T}\right) \rightarrow [\Delta f] = (10\text{dB})\log_{10}\left\{\frac{1}{2}\left[1-\sin\left(\frac{\pi(2|\Delta f|T-1)}{2\alpha}\right)\right]\right\} \\ \frac{1-\alpha}{2T} \le |\Delta f| \rightarrow \Delta f = -\infty\text{dB} \end{cases}$$

The resolution bandwidth of the spectrum analyzer is of a finite width. Therefore, we compensate slightly for α and for the threshold of the zero response:

$$\frac{1-\alpha}{2T}$$

ZERO SPAN Sets the span to 0 Hz. This effectively allows an amplitude versus time mode in which to view signals. This is especially useful for viewing modulation.

Front-panel key access: **SPAN**

5 Programming

Programming Features

This chapter describes how to operate an 8560 E-Series or EC-Series spectrum analyzer by remote (computer) control.

- Setup Procedure for Remote Operation
- Communication with the System
- Initial Program Considerations
- Program Timing
- Data Transfer to Computer
- Input and Output Buffers
- Math Functions
- Creating Screen Titles
- Generating Plots and Prints Remotely
- Monitoring System Operation (service requests)

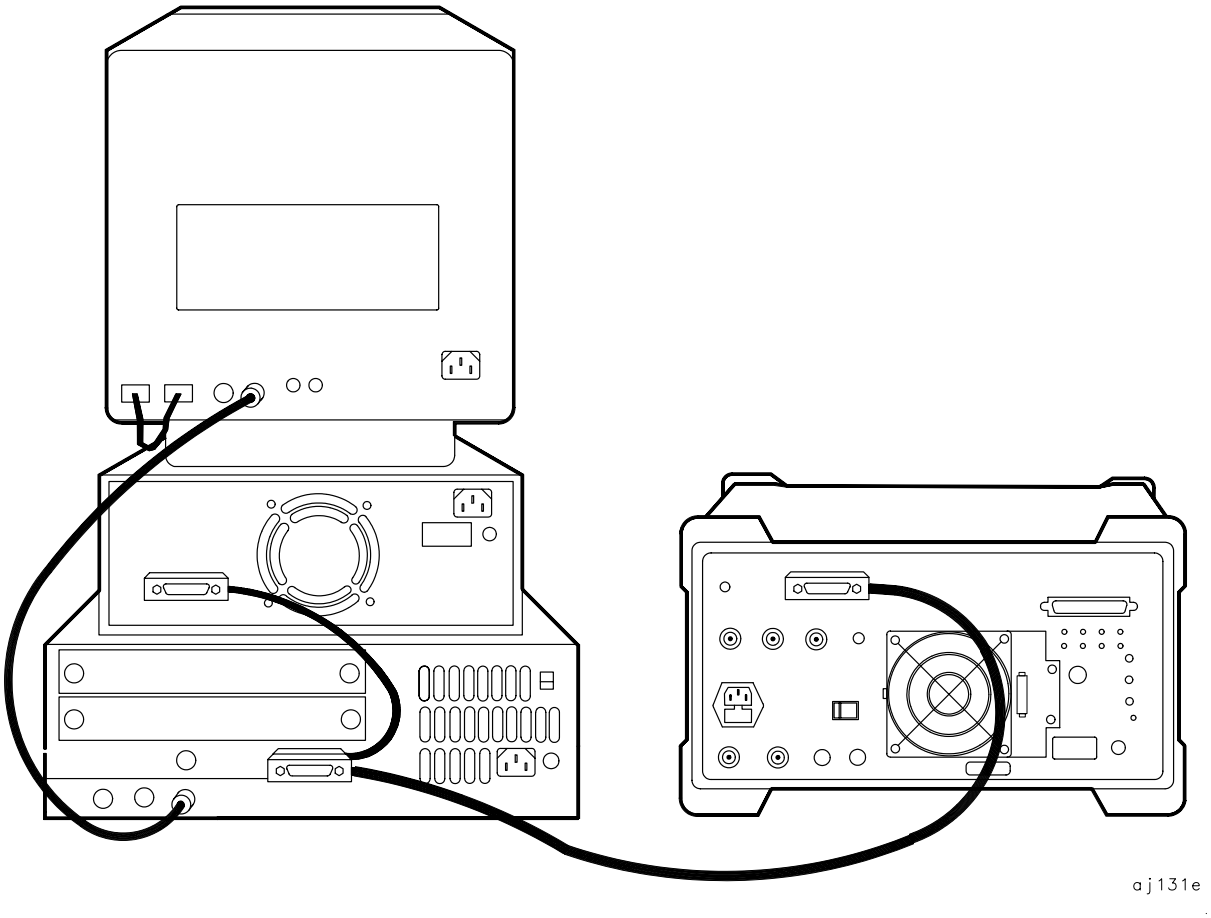
Setup Procedure for Remote Operation

The following procedure describes how to connect your equipment for remote operation of the 8560 E-Series or EC-Series spectrum analyzers.

NOTE Refer to the Chapter 1 for more information on installing, configuring, and addressing the system.

1. Connect computer, spectrum analyzer system, and other peripherals with GPIB cables. The Agilent 85620A mass memory module can be attached for downloadable programming (DLP) capabilities. Turn off the analyzer before installing or removing any option module.
2. After the GPIB cables are installed, reset all instruments connected to the bus. (If you are not sure how to reset a device, switch off the line power to the device, and then switch the line power back on to reset it.)
3. Check the GPIB address of the spectrum analyzer by pressing **CONFIG**, then ANALYZER ADDRESS. Note that examples in this section, use GPIB address 18.

Figure 5-1 8560E connected to an HP 9000 Series 300 computer.



Communication with the System

This section develops some fundamental techniques for controlling the spectrum analyzer and obtaining reliable measurement results. The spectrum analyzer is remotely controlled with commands that correspond to front-panel softkey functions.

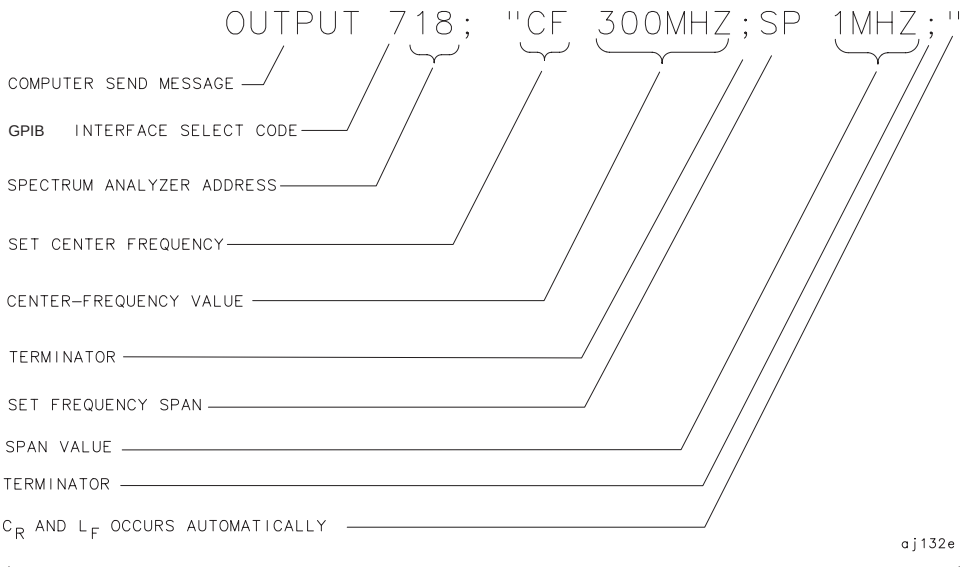
It is important to understand how messages are communicated to the spectrum analyzer; therefore, enter and output statements and command syntax discussed in this chapter should be understood before proceeding. HP BASIC is used for all examples in this manual.

Executing Remote Commands

The computer communicates with the spectrum analyzer system on the General Purpose Interface Bus (GPIB), using HP BASIC `OUTPUT` and `ENTER` statements.

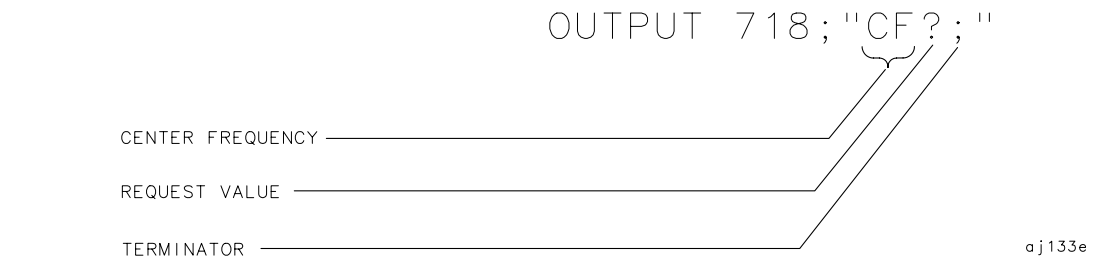
An `OUTPUT` statement tells the computer to send a message to the spectrum analyzer. For example, executing the statement below sets the center frequency to 300 MHz and the frequency span to 1 MHz.

Figure 5-2 Output Statement Example (I)



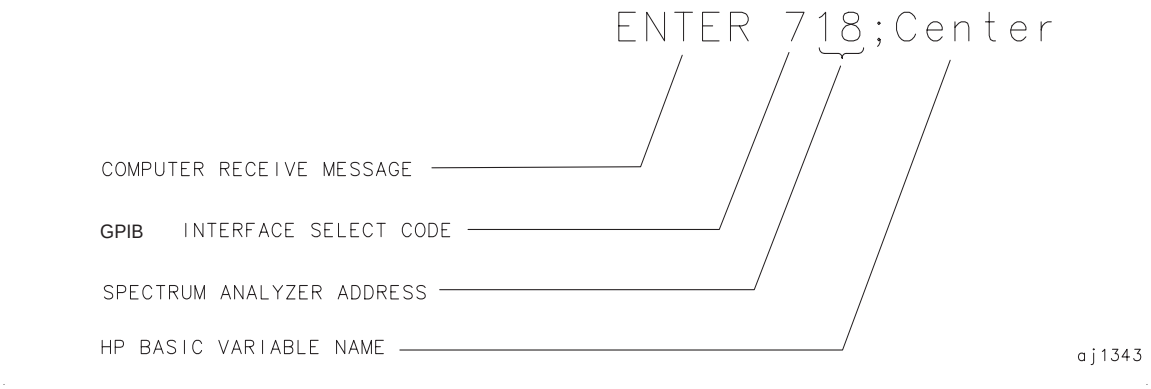
An ENTER statement used in conjunction with a spectrum analyzer query returns information to the computer. To return the center-frequency value to the computer, first form a query by adding a question mark (?) to the command:

Figure 5-3 Output Statement Example (II)



Next, the ENTER statement is used to assign the returned value to a variable in the computer:

Figure 5-4 Output Statement Example (III)



The value of the center frequency above is placed in the variable named "Center." The variable can be printed, stored, or used for other computer functions.

Syntax Requirements

All of the program examples in this manual show recommended command syntax. All spectrum analyzer commands must be constructed according to specific syntactical rules that are outlined in Chapter 7, "Language Reference." Chapter 7 lists all of the remote spectrum analyzer commands in alphabetical order, and contains a syntax diagram for each command. Refer to Chapter 6 for a complete command listing of all valid remote commands sorted by function, rather than alphabetically.

Local and Remote Control

Whenever the spectrum analyzer is remotely addressed, all front-panel keys and softkeys are disabled, except for the one GPIB related softkey RMT LCL. When the analyzer is remotely addressed, the remote mode (RMT) is selected. Pressing RMT LCL until "LCL" is underlined returns the analyzer to local mode, clears the softkey menu, and reactivates front-panel operation. Executing the HP BASIC statement LOCAL achieves the same result.

You can also use the HP BASIC LOCAL LOCKOUT command to disable the spectrum analyzer keys. If you use LOCAL LOCKOUT, you must either use the LOCAL command to reenable the spectrum analyzer keys, or turn the spectrum analyzer off and then back on.

NOTE

Local mode should not be activated, via the RMT LCL softkey, until other processes are complete (for example, instrument preset, recall state, fast Fourier transform, and so on). Using the LOCAL command via GPIB may require the HP BASIC command WAIT to precede it. Executing a WAIT statement before the LOCAL command ensures that sufficient time has been allocated for full execution of other commands before local mode is activated.

Program timing can be affected when using the LOCAL command at the end of a command string or at the end of a program without preceding it with a WAIT command. In this case, all commands in the program cannot be executed, and errors that are generated cannot be reported due to the fact that the analyzer has exited remote mode as soon as the LOCAL command is received.

Initial Program Considerations

Programs should begin with a series of HP BASIC statements and signal analyzer commands that form a good starting point for measurements. Some initial program considerations are discussed below.

CLEAR is an HP BASIC statement that puts a GPIB instrument (for example, 8560E) in a known state (the preset state) by clearing the input buffer, the output buffer, and the command parser of the specified instrument so that it is ready for operation. This command can be used to clear devices on the bus singly or in unison. It is often desirable to clear only one instrument so that other instruments on the bus are not affected. Refer to the "Program Timing" section, in this chapter, for more information.

To clear only the spectrum analyzer, CLEAR 718 should be used.

To clear all devices at select code 7, CLEAR 7 must be used.

IP, the **instrument preset** command, presets all parameters of the spectrum analyzer for the current mode of operation, and provides a good starting point for all measurement processes. Executing IP is actually the same as executing a number of commands that set the spectrum analyzer to a known state (the preset state). Refer to Table 4-8 for more information about the preset state.

Program Timing

Most remotely controlled measurements require control of the sweep. The TS (take sweep) command initiates a sweep when the trigger conditions are met. When TS is executed as part of a command sequence, the analyzer starts and completes one full sweep before the next analyzer command is executed.

Use the SNGLS (single sweep) command to maintain absolute control over the sweep and to reduce execution time. Once SNGLS activates the single-sweep mode, TS can be used to initiate a sweep only when necessary.

NOTE

If a TS command is executed, but the trigger conditions are not met, the spectrum analyzer will not respond on GPIB. The analyzer continues to take commands into its input buffer, however the commands are not processed at this time. This can also appear to happen if the sweep time is very long. If this occurs, the HP BASIC CLEAR (that is, `CLEAR 718`) statement can be used to abort the TS command. (CLEAR also causes an instrument preset.)

Because many remote commands process trace information, updating trace information with TS becomes important whenever the input signal or analyzer settings change. Use TS to update the trace *after* the analyzer settings or input signals change, but *before* the trace information is returned to the computer or processed by other commands, like trace math or marker commands.

When developing measurement algorithms with the front-panel controls, use the single-sweep function to simulate the effect of the TS command updating the trace. Pressing either **SGL SWP** or **SWEEP CONT SGL** (so that SGL is underlined), and waiting until the end of the sweep, is the same as executing TS via remote control during the single-sweep mode.

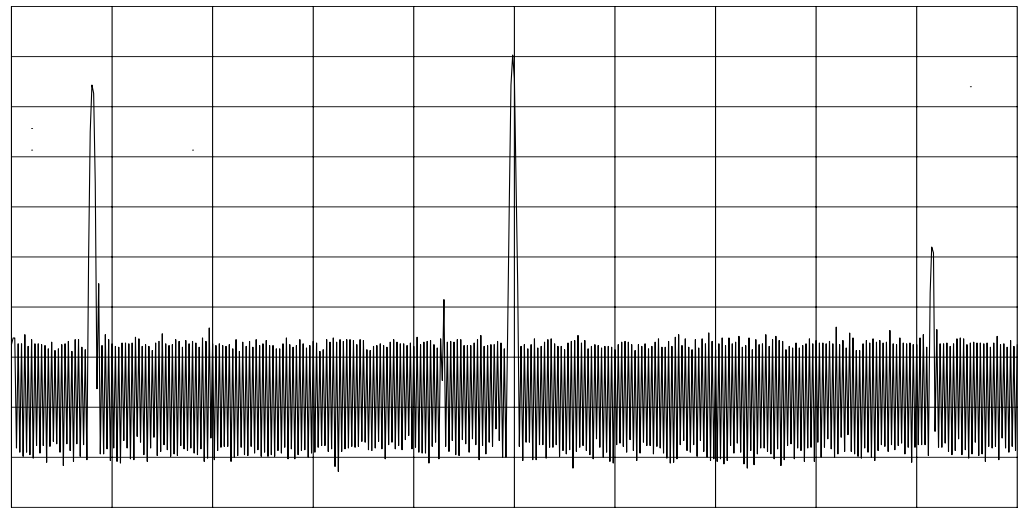
The following examples demonstrate the importance of updating trace information with the TS command.

EXAMPLE: Change the measurement range but do not update trace information.

Connect the calibrator signal to the analyzer 50Ω INPUT before performing this example.

```
10  CLEAR 718


20  OUTPUT 718;"IP;SNGLS;TS;"
Initialize analyzer.
30  OUTPUT 718;"CF 300MHZ;SP 1MHZ;"
Change measurement
range.
40  END
```

Figure 5-5 Invalid Trace Information

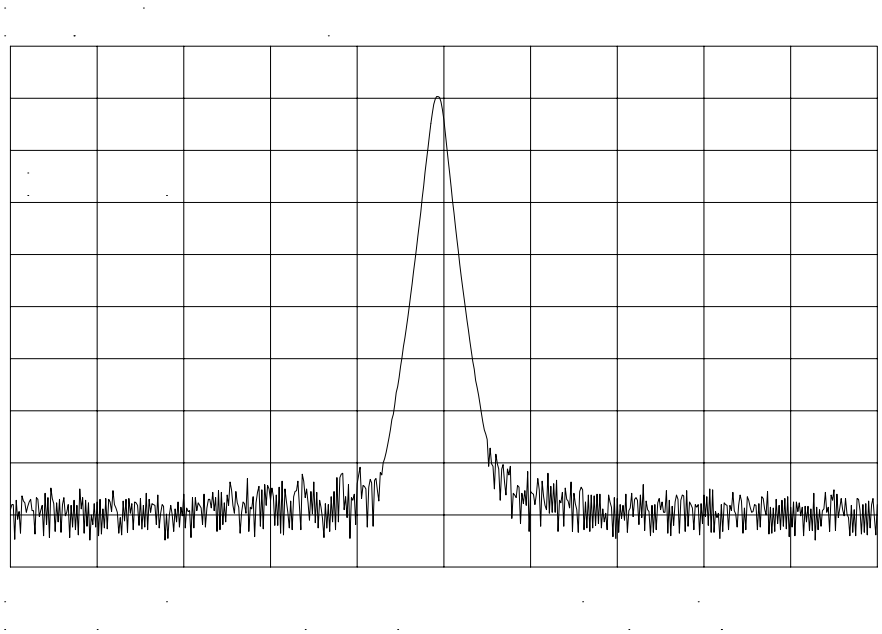


The previous program example does not measure with the new analyzer settings as depicted by the data-invalid indicator "*" in the upper right corner. To obtain valid trace information, the trace must be updated with the TS command. Here is the program again, corrected to include the TS command. EXAMPLE. Change the measurement range, then update trace information.

Connect the calibrator signal to the analyzer 50Ω INPUT before performing this example.

```
10  CLEAR 718


20  OUTPUT 718;"IP;SNGLS;"
Initialize analyzer.

30  OUTPUT 718;"SP 1MHZ;CF 300MHZ;"
Change measurement
range.

40  OUTPUT 718;"TS;"
Measure with trace A.

50  END
```

Figure 5-6 Updated Trace Information

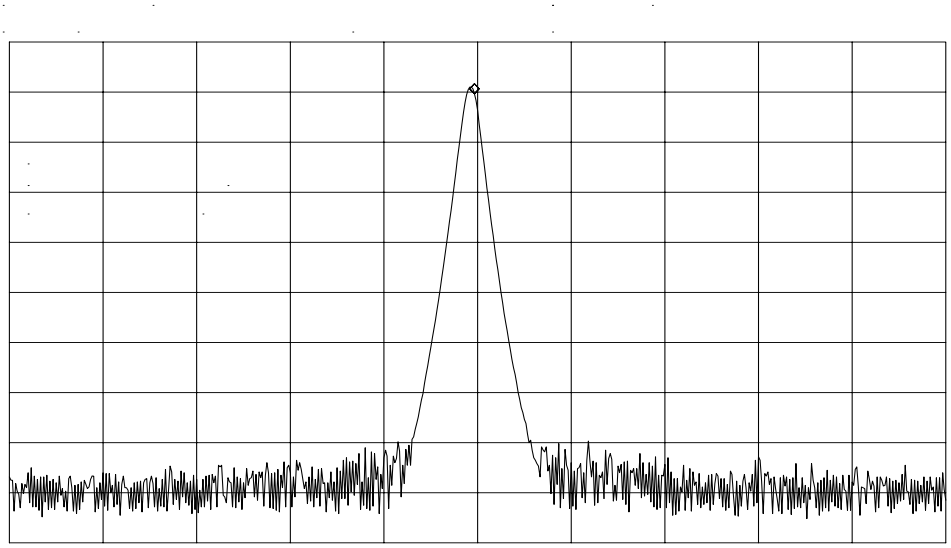


The next example processes trace information with a marker command, MKPK HI (marker peak highest), which selects the highest amplitude level in the trace. Because the program changes the measurement range, the trace information must be updated with TS before MKPK HI is executed. EXAMPLE. Use TS to update trace information before using the marker commands.

Connect the calibrator signal to the analyzer INPUT 50Ω before performing this example.

```
10  CLEAR 718


20  OUTPUT 718;"IP;SNGLS;"
Initialize analyzer.

30  OUTPUT 718;"SP 1MHZ;CF 300MHZ;RL -5DBM;"
Change
measurement
range.

40  OUTPUT 718;"TS;"
Update trace.

50  OUTPUT 718;"MKPK HI;"
Place marker on highest signal
level.

60  END
```

Figure 5-7 Update trace with TS before executing marker commands.



As the example shows, TS is executed *after* analyzer settings are changed, but *before* trace information is processed.

There are two commands that change the measurement range indirectly: MKCF (marker to center frequency) and MKRL (marker to reference level). They set the center frequency and reference level equal to the marker frequency and amplitude, respectively. If valid trace information is needed, a TS command must be executed after these commands are executed.

The TS command invokes at least one entire sweep. It invokes more than one sweep when certain commands are active, such as SP (frequency span) when MKTRACK (marker tracking) is turned on.

NOTE To ensure that all processes have been completed (for example, MKFC), take a sweep and then query the data.

Data Transfer to Computer

An important part of spectrum-analyzer remote operation is sending and receiving trace data to and from a computer via GPIB. Three requirements apply to all trace data transfers:

1. Determine the trace length.

   The traces are composed of 601 data points, or trace elements. This is the length of all traces and cannot be changed. When transferring trace data to or from a computer, trace-data array dimensions must be set to 601 elements.

2. Determine the trace conditions.

   Trace data is of little value if you do not also know the trace conditions from which the data was taken. The five conditions that you must store in addition to the trace data are the start and stop frequencies, the reference level, the amplitude scaling, and the absolute amplitude units. You may want to store additional conditions such as the resolution bandwidth, attenuation, or sweep time. Example 1 below queries the spectrum analyzer for the trace conditions shown on the display and stores them. Example 2 shows how to return this data to the analyzer. These procedures, which you may find useful and are referred to by subroutine name, are used throughout the programming examples in this chapter.

   EXAMPLE 1

```
10  SUB Get_settings(Fa,Fb,Rl,Rb,Vb,St,Lg,Aunits$)
20  OUTPUT 718;"FA?;FB?;RL?;RB?;VB?;ST?;LG?;AUNITS?;"
30  ENTER 718 USING "K";Fa,Fb,Rl,Rb,Vb,St,Lg,Aunits$
40  SUBEND
```

   EXAMPLE 2

```
10   SUB Setup_analyzer(Fa,Fb,Rl,Rb,Vb,St,Lg,Aunits$)
20   OUTPUT 718;"FA ";Fa;"HZ;"
30   OUTPUT 718;"FB ";Fb;"HZ;"
40   OUTPUT 718;"RL ";Rl;"DBM;"
50   OUTPUT 718;"AUNITS ";Aunits$;";"
60   OUTPUT 718;"RB ";Rb;"HZ;"
70   OUTPUT 718;"VB ";Vb;"HZ;"
80   OUTPUT 718;"ST ";St;"SEC;"
90   If Lg=0 THEN
100    OUTPUT 718;"LN;"
110    ELSE
120    OUTPUT 718;"LG ";Lg;" dB;"
130    END IF
140  SUBEND
```

3. Specify the data format before transferring data.

Use the TDF (trace data format) command to specify the format before sending data from the spectrum analyzer to the computer. The examples in this section illustrate how to use this command.

The examples in this section use the] (trace A) command. This command transfers data to and from trace A. The TRB (trace B) command is also available for transferring trace B data. It is possible to read data from trace A and then send it to trace B, and also to read data from trace B and send it to trace A. For simplicity, this capability is not reflected in the programming examples in this section.

The analyzer returns information as decimal values in fundamental units shown in Table 5-1. The analyzer does not automatically apply these units to data received from the computer; the user *must* specify the units.

Table 5-1 Units for Returned Data

Measured Data	Fundamental Unit
Frequency	Hz
Power	dBm, dBmV, dBµV, W
Amplitude	dBm, dBmV, dBµV, W, V
Ratio	dB, unitless (voltage ratio)
Voltage	V
Time	s

As indicated in Table 5-1, power and amplitude information can be returned in several different units. The AUNITS (amplitude units) command is used to select the desired unit. The AUNITS command can either specify a single unit to be used for all power and amplitude information, or it can be set to automatically select the units, based on certain measurement settings. Refer to the description of the AUNITS command in Chapter 7 of this manual for more information.

Parameter Units versus Measurement Units

All units referred to above are **parameter units**, which are standard scientific units. Trace data can optionally be sent to and received from the analyzer in non-standard units, **measurement units**, which are used internally by the analyzer. The main advantage to communicating with the analyzer in measurement units is speed; when the analyzer communicates in parameter units, it must convert between internal measurement units and parameter units.

The TDF (trace data format) command is used to select measurement or parameter units. Traces are stored internally as integers in the range from 0 to 600, where 0 represents the bottom graticule line and 600 represents the top graticule line. Because there are 10 graticule divisions vertically, there will be 60 measurement units per graticule. There is a small over-range area above the top graticule line (up to 610), so traces can contain numbers slightly larger than 600.

To convert from measurement units to parameter units or from parameter units to measurement units, you must have the following information at the time that the trace data is measured: log-scale setting (dB/division or linear), reference level, and the amplitude units in which the reference level is expressed. For log scales where the reference level is expressed in a dB-related unit, the following formulas can be used:

$$\text{Parameter Units} = \text{Reference Level} + \text{Log Scale} \times \frac{\text{Measurement Units} - 600}{60}$$

$$\text{Measurement Units} = \frac{\text{Parameter Units} - \text{Reference Level}}{\text{Log Scale}} \times 60 + 600$$

If reference level is not expressed in a dB-related unit, it must first be converted to such a unit before using the formulas.

When using a linear display scale, the following formulas can be used with the reference level expressed in volts. If the reference level is not expressed in volts, it must be converted to volts before these formulas are used.

$$\text{Parameter Units} = \text{Reference Level} \times \frac{\text{Measurement Units}}{600}$$

$$\text{Measurement Units} = \frac{\text{Parameter Units}}{\text{Reference Level}} \times 600$$

Notice that the interpretation of measurement units *always* depends on the reference level and amplitude scaling of the display at the time that the trace data was measured.

Position Units and Trace Elements

Traces are comprised of a fixed number of **elements** (601). Each element has a fixed position on the horizontal axis of the trace. An element is identified by specifying its horizontal position in **position units**. Position units are integers, ranging from 1 to 601. The element at the left end of a trace is always identified by a position value of 1. The element at the right end of a trace has a position value of 601.

The left edge of the trace corresponds to the start frequency and the right edge corresponds to the stop frequency. You will need to know start and stop frequencies under which the trace data was measured if you plan to convert from position units to frequency.

Trace-Data Formatting

The TDF (trace-data format) command controls the formatting of trace-amplitude data. There are five format modes: real-number parameter units (P) format, binary (B) format, A-block format, I-block format, and measurement units (M) format. All the format modes return amplitude information in measurement units except for TDF P, which returns parameter units.

The output format, and how to transfer data to and from a computer with each format, is described in the following section. **TDF P: Return Decimal Numbers in Parameter Units**

The real number, or "P" format allows you to receive or send data as ASCII decimal values in real-number (parameter) units. This is the default format when the instrument is turned on, and when instrument preset (IP) is activated. Numbers are in dBm, dBmV, dBµV, volts, or watts, as determined using the amplitude units (AUNITS) command. Default units are volts for linear trace information, and dBm for logarithmic trace information.

A line feed (ASCII code 10) follows data output. The end-or-identify message (EOI) is sent with a line feed.

NOTE When using the P-format, be sure to include amplitude units with the trace data using the AUNITS command.

Real-number data can be an advantage if you wish to use the data later in a program. However, data transfers using P-format tend to be slow and require more storage memory (approximately 1200 bytes for binary and 4800 bytes for real numbers). In some cases, P-format can take up to four times the amount of controller memory compared to binary format.

Example 3 below illustrates how to send trace data to a computer.

EXAMPLE 3

```
10   REAL A(1:601)
20   OUTPUT 718;"IP;CF 300MHZ;SP 20MHZ;SNGLS;TS;"
30   CALL Get_settings(Fa,Fb,Rl,Rb,Vb,St,Lg,Aunits$)
40   OUTPUT 718;"TDF P;TRA?"
50   ENTER 718;A(*)
60   END
70   SUB Get_settings(Fa,Fb,Rl,Rb,Vb,St,Lg,Aunits$)
80   OUTPUT 718;"FA?;FB?;RL?;RB?;VB?;ST?;LG?;AUNITS?;"
90   ENTER 718 USING "K";Fa,Fb,Rl,Rb,Vb,St,Lg,Aunits$
100  SUBEND
```

Line 10 dimensions array A to 601 elements (one element for each point of trace data). The array is dimensioned using the REAL statement, allowing each array element to accept real-number data.

Line 20 sets the analyzer to a desired state.

Line 30 calls the subprogram that queries the spectrum analyzer for the required state data.

Line 40 specifies P-format (TDF P), then queries the analyzer for data in trace A (TRA?).

Line 50 enters the data into the array.

Example 4 illustrates how to return data from a computer to the spectrum analyzer.

EXAMPLE 4

```
10   REAL A(1:601)
20   OUTPUT 718;"IP;CF 300MHZ;SP 20MHZ;SNGLS;TS;"
30   CALL Get_settings(Fa,Fb,Rl,Rb,Vb,St,Lg,Aunits$)
40   OUTPUT 718;"TDF P;TRA?"
50   ENTER 718;A(*)
60   PRINT "PRESS CONTINUE TO RETURN DATA TO THE ANALYZER"
70   PAUSE
80   OUTPUT 718;"IP;TDF P;VIEW TRA;"
90   CALL Setup_analyzer(Fa,Fb,Rl,Rb,Vb,St,Lg,Aunits$)
100  OUTPUT 718;"TRA ";
110    FOR I=1 TO 600
120    OUTPUT 718;A(I);"DBM,";
130    NEXT I
140  OUTPUT 718;A(601);"DBM;"
150  END
```

Lines 10 to 50 are the same as in Example 3.

Line 80 begins to send trace data by presetting the analyzer, preparing the spectrum analyzer to accept data into trace A, and selecting the P-format.

Line 90 sets the analyzer to the stored trace conditions per the subroutine in Example 2.

Lines 100 to 140 enter the stored trace data into trace A. When sending trace data into the analyzer using P-format, the data points must be entered into the analyzer one point at a time. Note that in line 120, each data point value of the trace array is followed by the amplitude units (in this case, dBm).

See Table 5-2 on page 315 for an example of how data is sent to the computer using the TDF P format.

TDF M (M-format): Return Decimal Numbers in Measurement Units (output only)

The measurement units (M) format transfers trace data as ASCII integer values in measurement units, which is the internal format used by the spectrum analyzer. See Figure 5-8 on page 309. The displayed amplitude of each element falls on one of 601 vertical points (with the 601st equal to the reference level). For example, the peak of the signal in Figure 5-8 on page 309 is equal to –10 dBm, or one division below the reference level. This is equal to 540 measurement units (600 measurement units at the reference level, less 60 measurement units for one division down, equals 540 measurement units). There are also ten additional points of overrange. Measurement units range from 0 to 610.

A line feed (ASCII code 10) follows data output. The end-or-identify message (EOI) is sent with a line feed.

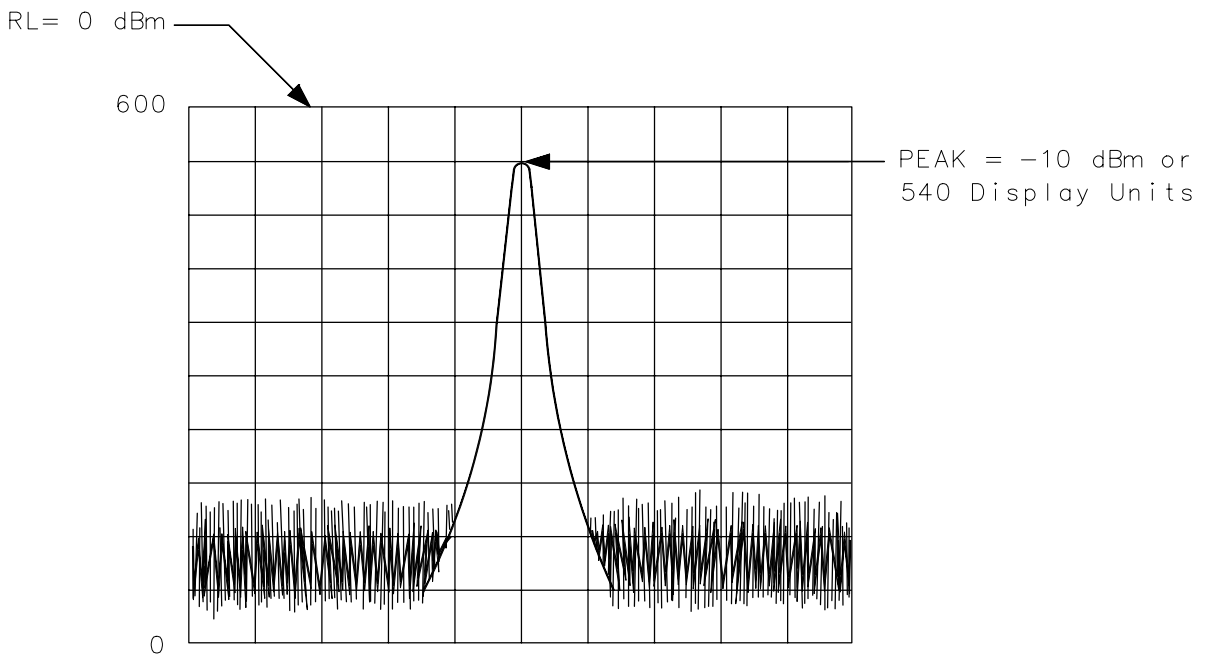
The M-format is faster than the P-format, but most applications will require computer conversion to parameter units. Also, because the M-format transfers data as ASCII characters, the data can be viewed directly.

To send trace data to the computer, see Example 5.

EXAMPLE 5

```
10   INTEGER A(1:601)
20   OUTPUT 718;"IP;CF 300MHZ;SP 20MHZ;SNGLS;TS;"
30   CALL Get_settings(Fa,Fb,Rl,Rb,Vb,St,Lg,Aunits$)
40   OUTPUT 718;"TDF M;TRA?;"
50   ENTER 718;A(*)
60   PRINT A(*)
70   END
```

Figure 5-8 Data Transferred in TDF M Format



See Table 5-1 on page 304 for an example of how data is sent to the computer using the TDF M format.

TDF B (B-Format): Return Binary Numbers in Measurement Units (output only)

The binary (B) format transmits data in measurement units, as binary numbers. This format provides the fastest data transfer and requires the least amount of memory to store data. Each data point is transferred in binary as two 8-bit bytes; the most significant byte is sent first, followed by the least significant byte. Binary data can also be easily converted into measurement data. If speed and memory are important considerations, you may prefer B-format to P-format.

Unlike A-block and I-block formats, the B-format does not send a header. The data is sent immediately, and the end-or-identify message (EOI) is sent with the last byte.

Example 6 shows how to transfer data in B-format from the spectrum analyzer to a computer.

EXAMPLE 6

```
10   INTEGER Tra_binary(1:601)
20   ASSIGN @Sa_bin TO 718;FORMAT OFF
30   OUTPUT 718;"IP;CF 300MHZ;SP 20MHZ;SNGLS;TS;"
40   CALL Get_settings(Fa,Fb,Rl,Rb,Vb,St,Lg,Aunits$)
50   OUTPUT 718;"TDF B;TRA?"
60   ENTER @Sa_bin;Tra_binary(*)
70   END
```

Line 10 dimensions the array Tra_binary to 601 elements. Here the INTEGER statement dimensions each array element as two bytes (remember, each data point transferred in B-format is sent as two 8-bit bytes).

Line 20 assigns the spectrum analyzer address to "@Sa_bin". Format is set to off because the trace data is transferred in the format of two 8-bit bytes and this format is also the internal format of the computer.

Line 40 enters the instrument state conditions.

Line 50 selects B-format, then queries the spectrum analyzer for trace A data.

Line 60 enters the data into the array Tra_binary.

To convert a trace-data point from binary to a real, logarithmic number (for example, dBm), use the equation below:

$$n = \text{RL} - 10\ \text{divisions} \times \text{Log Scale} + \text{Log Scale} \times \left(\frac{x}{600/10\ \text{divisions}} \right)$$

$$= \text{RL} + \text{Log Scale} \times \left(\frac{x}{600/10\ \text{divisions}} - 10\ \text{divisions} \right)$$

where:

x = binary data in an array element

RL = reference level in dBm, dBmV, or dBµV

Log Scale = the log scale in units of dB per division selected on the spectrum analyzer.

n = real, log data

Example 7 converts binary values to measurement data and prints them on the computer display.

EXAMPLE 7

```
10   INTEGER Trace_a(1:601)
20   DIM Real_num(1:601)
30   Ref_lvl=0                  !0 dBm reference level
40   Log_scale=10               !10dB/division log scale
50   OUTPUT 718;"TDF B;TRA?;"
60   ENTER 718 USING "#,W";Trace_a(*)
70   MAT Real_num= Trace_a
80     FOR X=1 TO 601
90     Real_num(X)=Ref_level+Log_scale*(Real_num(X)/60-10)
100    NEXT X
110  END
```

For converting linear data, use this equation:

$$n = \mathrm{RL} \times \left(\frac{x}{600} \right)$$

where:

x = binary data in an array element.

RL = reference level. When RL is in volts, n will be in volts.

These equations are useful when you are interested in viewing only a few points of data, rather than an entire trace. B-format saves time and memory, and these equations provide a means to view the data, if necessary.

NOTE It is not possible to return data to the analyzer using binary format. You must use either A-block or I-block format. These two formats are described below.

See Table 5-2 on page 315 for an example of how data is sent to the computer using the TDF B format.

TDF A (A-block format): Return Absolute Block-Data Fields in Measurement Units

The A-block format transmits data in measurement units as binary numbers in an absolute block-data field, or field of a known size, similar to the binary format. Each data point is sent as two 8-bit bytes; the most significant byte is sent first, followed by the least significant byte. The A-block format also transfers a four-byte header before the 601 points of trace data. The bytes are the ASCII characters "#", "A", and a two-byte length field specifying the number of data bytes in the block that follows (that is, 1202).

The first two characters indicate that the transferred data is in A-block format. "1202" indicates the length of the trace data, expressed in bytes. As previously mentioned, trace data is composed of 601 trace elements. Each trace element is transferred as one word that is composed of two 8-bit bytes. Thus, 601 words contain 1202 bytes. 1202 is the trace length sent. You may want to keep this format and trace length information separate from the actual trace data, as in Example 8.

The end-or-identify message (EOI) is sent with a line feed.

IP (instrument preset) and device clear select words as the default data size. Block data formats are the fastest method of transferring trace data.

Example 8 illustrates how to keep the format and trace length information separate from the actual trace data.

EXAMPLE 8

```
10   INTEGER Tra_binary(1:601)
20   DIM Header$[4]
30   OUTPUT 718;"IP;CF 300MHZ;SP 20MHZ;SNGLS;TS;"
40   CALL Get_settings(Fa,Fb,Rl,Rb,Vb,St,Lg,Aunits$)
50   OUTPUT 718;"TDF A;TRA?;"
60   ENTER 718 USING "#,4A,601(W)";Header$,Tra_binary(*)
70   END
```

Line 10 creates the array Tra_binary using the INTEGER statement.

Line 20 creates a string, Header$. The header will be placed in this string, separate from the trace data.

Line 50 specifies the data format, then queries for the contents of trace A.

Line 60 places the header in "Header$" and places 601 points of trace data in "Tra_binary". Header$ will contain the #A and two non-printing characters that represent in binary the integer 1202. The first non-printing character is CHR$(4), and the second non-printing character is CHR$(178). Because this string does not contain desired trace data, you can discard it. The USING statement specifies that four header characters will be transferred, followed by 601 16-bit words, which are the actual trace data. The "#" sign within the USING statement suppresses any end-of-line signals that can occur before the last trace-data byte is sent.

To send trace data from the computer to the analyzer, refer to Example 9.

EXAMPLE 9

```
10   INTEGER Tra_binary(1:601)
20   DIM Header$[4]
30   OUTPUT 718;"IP;CF 300MHZ;SP 20MHZ;SNGLS;TS;"
40   CALL Get_settings(Fa,Fb,Rl,Rb,Vb,St,Lg,Aunits$)
50   OUTPUT 718;"TDF A;TRA?;"
60   ENTER 718 USING "#,4A,601(W)";Header$,Tra_binary(*)
70   PRINT "PRESS CONTINUE TO RETURN DATA TO THE ANALYZER"
80   PAUSE
90   OUTPUT 718;"IP;TS;VIEW TRA;"
100  CALL Setup_analyzer(Fa,Fb,Rl,Rb,Vb,St,Lg,Aunits$)
110  OUTPUT 718;"TDF A;"
120  OUTPUT 718 USING
"#,K,W,601(W)";"TRA#A",1202,Tra_binary(*),";"
130  END
```

Line 90 presets the analyzer and sets trace A to view mode.

Line 100 returns the state data to the analyzer.

Line 110 sets the data format to A-block.

Line 120 sends the TRA command, the format information, and the trace data. The USING statement specifies that the data "TRA#A" will be sent as characters, followed by a word (1202) and 601 16-bit words (the actual trace data). Remember, you must send #A to indicate the format and 1202 to indicate the length of the trace, in bytes. The "#" sign within the USING statement suppresses any end-of-line signal characters.

See Table 5-2 on page 315 for an example of how data is sent to the computer using the TDF A format.

TDF I (I-block format): Return Indefinite Block-Data Fields in Measurement Units

Very similar to A-block format, the I-block format transmits data in measurement units as binary numbers in an indefinite block-data field of unknown size. Each data point is sent as two 8-bit bytes; the most significant byte is sent first, followed by the least significant byte. The I-block format also transfers a header before the trace data. The header is comprised of ASCII characters "#", and "I". These characters indicate that the trace data is in I-block format. Like the A-block format examples, when sending the trace data to the computer, you may want to keep these two characters separate from the trace data, as in Example 10.

I-format sends an end-or-identify message (EOI) with the last byte of data. IP (instrument preset) and device clear select words as the default data size. Block data formats are the fastest method of transferring trace data.

Example 10 uses the I-block format to separate the # and I characters from the trace data.

EXAMPLE 10

```
10   INTEGER Tra_binary(1:601)
20   DIM Header$[2]
30   OUTPUT 718;"IP;CF 300MHZ;SP 20MHZ;SNGLS;TS;"
40   CALL Get_settings(Fa,Fb,Rl,Rb,Vb,St,Lg,Aunits$)
50   OUTPUT 718;"TDF I;TRA?;"
60   ENTER 718 USING "#,2A,601(W)";Header$,Tra_binary(*)
70   END
```

Like the examples for the A-block format, you store format information in a string (Header$) and store the desired trace data in an integer array (Tra_binary).

Returning the trace data to the analyzer requires an important instruction. The "I" in the term I-block refers to the ability of the spectrum analyzer to accept data of "indefinite" length when using I-block format. Even though the analyzer uses only 601 points of trace data, the I-block format lets you send any number of data points. The spectrum analyzer will continue to accept data until an end-of-instruction (EOI) signal is sent to it. HP 9000 Series 200/300 BASIC allows you to send an EOI with the last data byte using the END command. Refer to Example 11.

EXAMPLE 11

```
10   INTEGER Tra_binary(1:601)
20   DIM Header$[2]
30   OUTPUT 718;"IP;CF 300MHZ;SP 20MHZ;SNGLS;TS;"
40   CALL Get_settings(Fa,Fb,Rl,Rb,Vb,St,Lg,Aunits$)
50   OUTPUT 718;"TDF I;TRA?;"
60   ENTER 718 USING "#,2A,601(W)";Header$,Tra_binary(*)
70   PRINT "PRESS CONTINUE TO RETURN DATA TO THE ANALYZER"
80   PAUSE
90   OUTPUT 718;"IP;TS;VIEW TRA;"
100  CALL Setup_analyzer(Fa,Fb,Rl,Rb,Vb,St,Lg,Aunits$)
110  OUTPUT 718;"TDF I;"
120  OUTPUT 718 USING "#,K,601(W)";"TRA#I",Tra_binary(*) END
130  END
```

By now most of this program should look familiar. Line 120 requires some explanation, however. The END statement appearing after the array Tra_binary sends (to the spectrum analyzer) the last data byte stored in the array, with the GPIB EOI line set "true," as required by I-block format.

See Table 5-2 on page 315 for an example of how data is sent to the computer using the TDF I format.

Transmission Sequence of Data on GPIB

Table 5-2 on page 315 shows a GPIB transmission sequence for each format mode. Each one transmits the +10 dBm amplitude level of a one-element trace with the amplitude equal to the reference level. In each case, the HP 9000 Series 200 or 300 computer must be instructed how to interpret the data received correctly. The parenthetical numbers in the table are decimal values representing binary 8-bit numbers.

Table 5-2 GPIB Transmission Sequence for Different Trace-Data Formats (TDF)

	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6
TDF P	1	0	.	0	0	(10-EOI)
TDF M	6	0	0	(10-EOI)		
TDF A	#	A	(0)	(2)	(2)	(88-EOI)
TDF I	#	I	(2)	(88-EOI)		
TDF B	(2)	(88-EOI)				

Input and Output Buffers

Features of the 8560 E-Series and EC-Series include the input and output data buffers. This section describes how to take advantage of the buffers and how to avoid potential programming pitfalls.

Benefits of an Output Buffer

The 64-character input buffer allows you to send several data queries to the spectrum analyzer using only one HP BASIC OUTPUT statement. The 64-character output-data buffer holds queried values so that you can read them into variables using only one ENTER statement. This is a more efficient method than using one OUTPUT statement per query and one ENTER statement per value read. See Example 1.

EXAMPLE 1

```
10  OUTPUT 718;"IP;SNGLS;MKPX 6DB;MKPT -65DB;FA 270MHZ;FB
1200MHZ;TS;"
20  OUTPUT 718;"MKPK HI;MKD;MKPK NR;MKF?;MKA?;"
30  ENTER 718 USING "K";Mkf,Mka
40  PRINT Mkf,Mka
50  END
```

Example 1 reads the difference in frequency and amplitude between two peaks, then enters the values into variables. Note the order of the queries and entries. The first query is the first value to come out of the output-data buffer; you read the values into variables in the same order that you query the spectrum analyzer.

Whenever you execute a query, be sure to read that value out. If you do not read it out, you will get that value returned for your next query. See Example 2.

EXAMPLE 2

```
10   OUTPUT 718;"CF?;"
20   OUTPUT 718;"AT UP;RL?;"
30   ENTER 718;Rl
40   PRINT Rl
50   END
```

In Example 2, even though you wanted to read the reference level, the printed value is equal to the center frequency. The center frequency had been left in the output-data buffer and was the first value to come out of the buffer.

If you are entering multiple values into multiple variables with one ENTER statement, use a "K" format with the ENTER statement. The spectrum analyzer separates queried values by a line feed with an end-or-identify (EOI) asserted; "K" format recognizes that a new value starts after each line feed with EOI. If you omit the USING statement, the ENTER statement will terminate on the first EOI encountered and generate an error.

Buffer Space

The maximum number of characters that the output-data buffer can hold is 64. In Example 1, the query MKD? filled seven character spaces in the output-data buffer. The returned value, –33.34, fills six spaces; the line feed that separates this value from the next one fills the seventh space. This method is used to enter all queries into the output-data buffer. You can continue to query the analyzer until the queries fill all 64 spaces. The input buffer fills similarly. The query AT? fills four spaces in the input data buffer. The input buffer can hold as many commands as will fill its 64-character capacity. The returned frequency value is not dependent on the current resolution bandwidth.

Preventing Timeouts

A program can pause unexpectedly when the output data buffer is completely filled with query values, the input buffer is completely filled with commands, and the spectrum analyzer is currently executing a query. Under this set of conditions, the program will pause indefinitely. The spectrum analyzer is trying to complete the query, but there is simply no more room in the output-data buffer for any more query data and no place to hold the query in the input buffer. If you have a timeout statement in the program, a timeout will occur. To prevent this situation, do not allow query values or commands to stack up in the buffers. Query for only a few values, then read them into variables before you send more queries. If you must leave the output buffer full, do not send more than 64 characters of commands with one OUTPUT statement.

A program can also pause unexpectedly while the spectrum analyzer is executing a command that takes a long time to complete. Consider executing the take-sweep (TS) command when the selected sweep time is equal to 100 seconds. In this case, the TS command requires 100 seconds before it is completed. While this command is executing, the input-data buffer fills with 64 characters of commands. When the buffer is full, if there are any remaining commands in that OUTPUT statement, the program will pause. It will start again when the TS command is complete; the spectrum analyzer can then begin processing the commands in the buffer, and the remaining commands in the OUTPUT statement will move into the input data buffer.

If you have a timeout statement in your program, the timeout can occur; this depends on whether the timeout setting is shorter than the pause in the program.

Synchronizing Your Program

You can use spectrum analyzer queries to synchronize a program. For example, when executing a TS command, if you want to know when the TS command is complete, execute the DONE command immediately after TS. The DONE query is satisfied only after the sweep has been completed. In fact, you can use any query in this manner. No query operation can take place until after the previous command is complete.

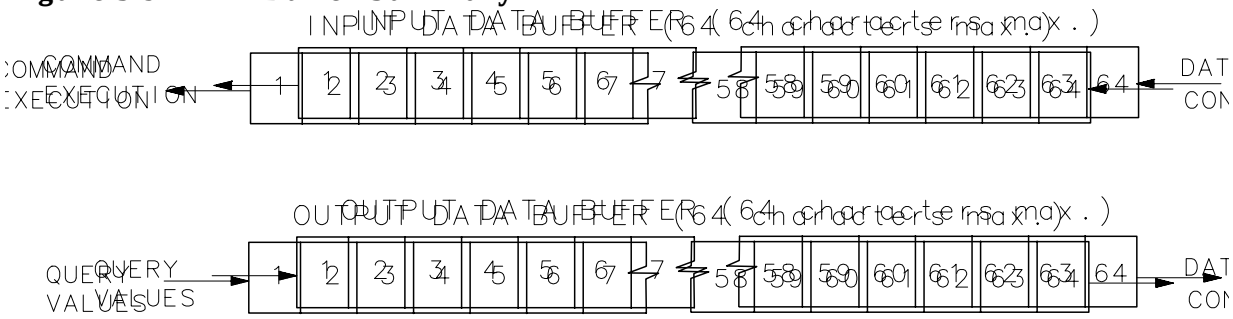
Clearing the Buffers

If you use the output-data buffer correctly, the buffer should be clear after the last ENTER statement is executed. But if you want to ensure that the buffer is empty, execute the device clear statement CLEAR 718. If your program is returning incorrect values, use this statement to clear the buffer; then look through your program for any missing ENTER statements. Or, use CLEAR at the beginning of a program. CLEAR flushes out the output-data and input-data buffers; however, it also executes an instrument preset.

Summary

Figure 5-9 on page 318 illustrates the input and output data buffers. Below, the causes for the analyzer not accepting data are described.

Figure 5-9 Buffer Summary



The spectrum analyzer will stop accepting data under these nonexclusive conditions:

1. A sweep or lengthy command is not done and the input buffer is full.
2. The output and input buffers are full and the command currently executed is a query.

Math Functions

The analyzer processes and stores measurement results that can be displayed or manipulated arithmetically.

This section describes the internal processing of traces and tells how to manipulate data correctly with the math commands.

Variables and Traces

The analyzer processes all information as variables and trace arrays. For example, the analyzer reserves an area in memory for trace A information. Whenever trace A is swept, the analyzer updates that memory area with new data. The analyzer also has space in memory for variables. Whenever a marker is placed on a trace, the analyzer assigns the amplitude value to the variable, MKA (marker amplitude).

Variables

Variables exist permanently in the analyzer memory. The CF (center frequency) command and SP (frequency span) command are examples of variables.

Traces

Traces consist of a series of data points that contain amplitude information. Two separate traces can be swept: trace A or B. These are the predefined traces that exist permanently in the analyzer memory. Traces A and B each have preset lengths of 601 data points.

Math Commands

Math commands are data-manipulating functions that modify traces or return modified data to the computer.

Two Rules for Trace Math

Special consideration must be exercised when using math commands with traces. Otherwise, these data-manipulating commands can yield inaccurate results. Follow these two rules to obtain accurate results:

1. Avoid truncation of data. Be sure that the destination length is equal to or greater than the source length.
2. Remember that the analyzer limits numbers greater than 600 (610 with overrange) and less than 0 (slightly above the top and at the bottom graticule, respectively), when operating with trace elements.

Math operations are restricted to the legal range of measurement units when trace arrays form the destination or source.

Adding and Subtracting in dBm

Trace-math functions allow easy addition and subtraction of correction values in dBm units. For example, to correct for 3 dB of loss in trace A data values, you can add or subtract trace B, which has been preloaded with +3 dBm or –3 dBm as its data values. The two traces can then be added or subtracted using APB (trace A plus trace B) or AMB (trace A minus trace B) and thus eliminate the effects of the loss.

Note that in the example above, the result is an addition or subtraction of dBm and not an addition or subtraction of power. Consider a trace-data value of –50 dBm and a second trace-data value of –50 dBm. When the two values are added using the APB command, the result is –50 dBm + –50 dBm = –100 dBm. However, if two –50 dBm power sources at two different frequencies (but close enough in frequency to be within the resolution bandwidth passband) are physically summed, the result is a power of –47 dBm. To illustrate this point further, if trace A is at 3.0 dBm and trace B is at 7.0 dBm, performing APB; moves trace A to 10.0 dBm (that is, trace A would move up on the screen). On the other hand, if trace A is at –10 dBm and trace B is at –6.0 dBm, performing APB; drops trace A data to –16 dB, even though trace B is 4.0 dBm higher in power in both cases. As you can see, the spectrum analyzer is not adding and subtracting physical values, but rather providing an efficient method for calculations in dBm units.

Use AMBPL to Correct Data

The AMBPL (trace A minus trace B plus display line) command provides the most versatile method for applying correction data to a trace. AMBPL subtracts the contents of trace B from the contents of trace A and adds the result to the display line. Consider characterizing the response of a device under test in a swept-measurement system. Enter the response of the system in trace B. Insert the device into the system, then enter this response into trace A. Use AMBPL to subtract the system response from the response with the device under test; the result is the response of the device under test, which is centered about the display line. So, to correct data, use trace B to store a copy of the uncorrected response and subtract this from new data in trace A; the result is a corrected response.

If the two traces are identical, as in the following example, the result of subtracting these two traces will equal 0 dBm. Note, however, that if the reference level is less than 0 dBm, the results will be off the screen, or even clipped (clipping is described under "Trace Data Limits" below). The display line is added to return the result to the screen, with no clipping occurring. Because you can specify the position of the display line, you can move the corrected data to any on-screen position.

Example 1 illustrates how to correct data remotely. Before running this example, connect the calibration signal to the INPUT 50Ω.

EXAMPLE 1

```
10   OUTPUT 718;"IP;SNGLS;CF 300MHZ;SP 20KHZ;RB 10KHZ;RL
–10DBM;LG 5DB;TS;"
20   OUTPUT 718;"CLRW TRA; CLRW TRB;TS;"
30   OUTPUT 718;"VIEW TRB;DL –16DBM;"
40   OUTPUT 718;"AMBPL ON;"
50   END
```

Line 10 executes an instrument preset, then uses the calibration signal to simulate uncorrected data. The program sets the reference level to –10 dBm, the span to 20 kHz, the center frequency to 300 MHz, the resolution bandwidth to 10 kHz, the log scale to 5 dB, and the sweep to single mode.

Line 20 sets traces A and B to clear-write mode and takes data into both traces.

Line 30 sets trace B to view mode in order to freeze the data in this trace. Use the display line to indicate where you want the corrected data to appear on the screen; for this example, the display line is set to –16 dBm.

Line 40 executes the function AMBPL. Trace B is subtracted from trace A; because the traces are identical, the result is a flat response equal to 0 dBm. Note, however, that the reference level is at –10 dBm; if this were the end of the calculation, you would not be able to see the result. The display line is added to move the response to –16 dBm and onto the screen where you can view the result.

Adding and Subtracting in Volts

In linear mode, all trace math is executed in positive-voltage units. This means that the APB command moves trace A data up the screen, while the AMB command moves trace A data down the screen (assuming trace B contains non-zero data).

To illustrate the difference between trace math in log mode and in linear mode, see Example 2. Here, both trace A and trace B are set to mid-screen values. When in log mode, the result of executing "AMB ON" appears at the top of the screen. When in linear mode, the result appears at the bottom of the screen.

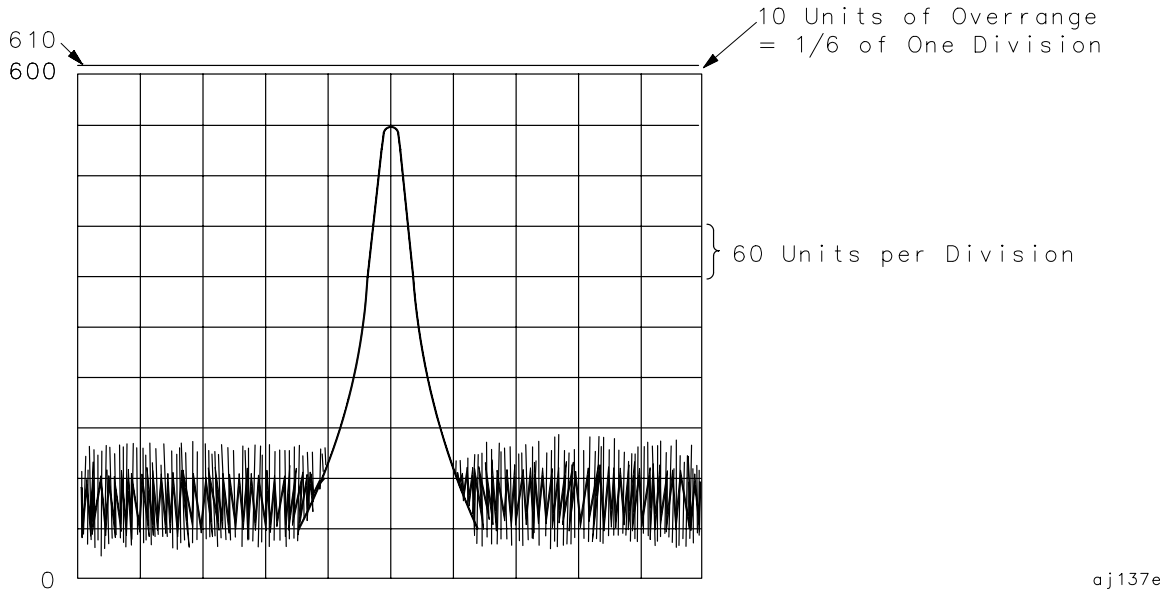
EXAMPLE 2

```
10   ! PUT TRACES ON SCREEN
20   INTEGER Atrace(1:601)
30     FOR I=1 TO 601
40     Atrace(I)=300
50     NEXT I
60   OUTPUT 718;"IP;LG 10DB;SNGLS;TS;"
70   OUTPUT 718 USING "#,K,W,601(W) ,K";"TDF
A;TRA#A",1202,Atrace(*),";"
80   OUTPUT 718 USING "#,K,W,601(W) ,K";"TDF
A;TRB#A",1202,Atrace(*),";"
90   OUTPUT 718;"AMB ON;"
100  PRINT "PRESS CONTINUE"
110  PAUSE
120  OUTPUT 718;"LN;SNGLS;TS;"
130  OUTPUT 718 USING "#,K,W,601(W) ,K";"TDF
A;TRA#A",1202,Atrace(*),";"
140  OUTPUT 718 USING "#,K,W,601(W) ,K";"TDF
A;TRB#A",1202,Atrace(*),";"
150  OUTPUT 718;"AMB ON;"
160  PAUSE
170  END
```

Trace Data Limits

The displayed amplitude of each trace element falls in one of 601 vertical data points. See Figure 5-10. There are an additional 10 points of overrange. The spectrum analyzer clips results that exceed these limits. The overrange is equal to one-sixth of a division above the reference level. Also, the same clipping algorithm is applied to correction data in a trace (for example, correction data that you enter into trace B). For example, if the reference level is 0 dBm, the scale is equal to 10 dB per division; therefore, the correction values must be within the range of +1.66 dBm to –100.00 dBm (one-sixth of 10 dB is equal to 1.66 dB).

Figure 5-10 Display Units

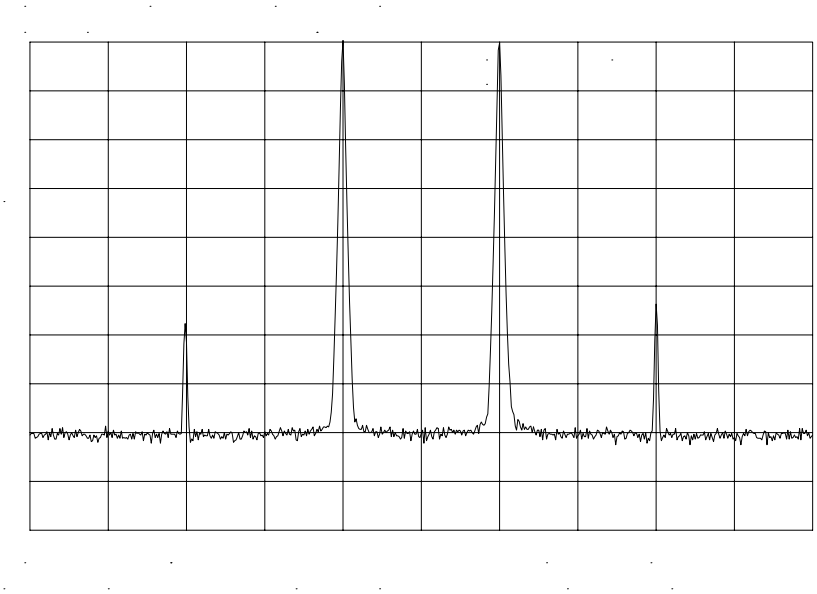


Creating Screen Titles

Screen titles allow you to label instrument data as shown in Figure 5-11. They can help identify on-screen data or data that you want to store or print. There are commands to create titles remotely and several methods can be used to make titles. These include using no format, or using A-block or I-block format. Each method is described below.

Note also that the first 16 characters of a title become the label for a stored instrument state or stored trace. The label replaces the register number of the state or trace that usually appears on the spectrum analyzer menu. If you save or recall states or traces remotely, be sure to use the register number and not this label.

Figure 5-11 Screen Titles Appear in the Upper-Right Corner of the Graticule



No-Format Method

This is the simplest method for creating a title. No format is used; you simply enclose the title within string delimiters. A list of delimiters appears below. Refer to Example 1.

EXAMPLE 1

```
10    OUTPUT 718;"TITLE@This is a title@;"
20    END
```

In this example, the "@" symbols are the string delimiters. Inside the delimiters is the title. A title can be up to 32 characters in length. On the spectrum analyzer display, a title appears on up to two lines of 16 characters each. The title can be made up of any valid, printing ASCII characters (line feed and carriage return are not recommended).

The string delimiters are: `! $ % &' / : = @ \ | < > {}`

Format Methods

The method described above allows you to enter a title directly. Using formats provides greater flexibility. You can use data that has been previously stored in a string as the title. This data can be in ASCII characters, or even in binary or decimal equivalents. The two formats, A-block and I-block, are described below.

Making a Title in A-Block Format

A-block format allows you to use a string of data as a title. A-block format also requires that this string be of a known length; the length is sent to the spectrum analyzer. To place the title in a string, see Example 2.

EXAMPLE 2

```
10   DIM A$[15]
20   A$="THIS IS A TITLE"
```

A-block format also requires that you send the length of the title, in bytes. When using Hewlett-Packard BASIC (HPBASIC), this task is easily accomplished. See Example 3.

EXAMPLE 3

```
10   DIM A$[15]
20   A$="THIS IS A TITLE"
30   OUTPUT 718 USING "#,K,W,K";"TITLE#A",LEN(A$),A$,";"
40   END
```

Line 30 sends the TITLE command to the analyzer: the #A to specify that the title is in A-block format; the string length; and the contents of the string, which is the actual title. The # sign in the USING statement suppresses any end-of-line characters. The USING statement specifies that some of the data will be sent as characters (K) and some as a 16-bit word (W). The character data is the spectrum analyzer command (TITLE #A) and the title (in A$). The length of the trace (LEN(A$)) is sent as one 16-bit word that is made up of two 8-bit bytes.

Making a Title in I-Block Format

I-block format, like A-block format, also allows you to use string data as a title. With I-block, however, you can send a string of indefinite length. The spectrum analyzer will continue to accept data (up to 32 characters) until an end-or-identify (EOI) signal is sent to the spectrum analyzer. See Example 4.

EXAMPLE 4

```
10   DIM A$[15]
20   A$="THIS IS A TITLE"
30   OUTPUT 718 USING "#,K";"TITLE#I",A$,END
40   END
```

This example is much like the previous one. For I-block format, you must place the title in a string. However, you do not send the title length. Line 30 sends all character data; thus, the USING statement specifies K format only. Again, the # sign in the USING statement suppresses any end-of-line characters. TITLE #I activates the analyzer TITLE function and specifies that the title is in I-block format. A$ sends the title, and the END statement, which is sent with the last byte of title data, activates the end-or-identify control line.

Generating Plots and Prints Remotely

In addition to the plot and print functions available from the spectrum analyzer front panel, you can also generate plots and prints remotely. This section describes how to combine plot commands to generate plots, as well as the print command to generate a color or monochrome print.

Plotter Requirements

Be sure your plotter satisfies the following requirements to execute the programming examples in this section successfully.

1. The following plotters are supported: the Agilent 7470A, Agilent 7475A, Agilent 7550A and the Agilent 7440A ColorPro. Be sure that the Agilent 7550A plotter is in "standard" mode.
2. Set the plotter to address 5 and cycle the power. To change the address on the plotter, refer to the plotter operation manual. If you want to use a different plotter address for remote operation, be sure to modify the examples accordingly. Remember, to generate plots from the spectrum analyzer front panel, you must reset the address to 5.

NOTE

The plotter should *not* be set to LISTEN ALWAYS mode.

The plotter address of 5 corresponds to the default plotter address that the analyzer uses. This default can be changed via **PLOTTER ADDRESS** under the **CONFIG** key.

3. Know how to select the scaling points on your plotter. The scaling points (referred to as the P1 and P2 plotter coordinates) define the lower-left and upper-right corners of the plot. See Figure 5-12 on page 328. These coordinates define the size of the plot. Table 5-3 on page 328 shows the scaling points for two Agilent Technologies plotters.

Figure 5-12 P1 and P2 Coordinates

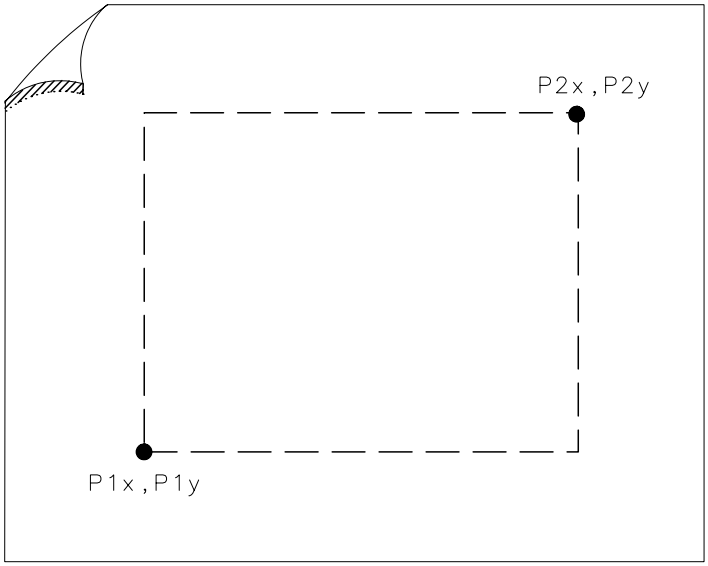


Table 5-3 Scaling Points for Various Plotters

	Typical Scaling Points		Plotting Range	
Plotter	**P1x,P1y**	**P2x,P2y**	**X-Axis**	**Y-Axis**
Agilent 7440	250,279	10250,7479	0 to 10900	0 to 7650
Agilent 7470A	250,279	10250,7479	0 to 10900	0 to 7650
Agilent 7475A	250,596	10250,7796	0 to 10365	0 to 7962

Making a Basic Plot

To make a basic plot, choose P1 and P2 coordinates for the plot size you desire and set the plotter to these values. The typical coordinates shown in Table 5-1 on page 304 create a plot with approximately 1 in margins on an 8-1/2 in by 11 in sheet of paper. (Many plotters have default values for this size of paper.) You can enter coordinates in a program directly, or query the plotter for the values. The latter method is used in the example program below. To generate a plot, connect the plotter via GPIB to the computer and execute Example 1.

EXAMPLE 1

```
10   OUTPUT 705;"OP;"
20   ENTER 705; P1x,P1y,P2x,P2y
30   OUTPUT 718;"PLOT ";P1x;",";P1y;",";P2x;",";P2y;";"
40   SEND 7;UNL LISTEN 5 TALK 18 DATA
50   END
```

Line 10 queries the plotter for its P1 and P2 coordinates.

Line 20 enters the P1 and P2 coordinate values into variables.

Line 30 sends the spectrum analyzer PLOT command and the plotter coordinates.

Line 40 sends the following statements over the GPIB interface: UNL sets all instruments on the GPIB to unlisten mode; LISTEN 5 sets only the plotter to listen mode; TALK 18 specifies the spectrum analyzer as the talker, which can then send its display contents to the plotter. Because the controller GPIB interface must not interfere with the plot, the DATA statement puts the controller GPIB interface on standby and sets the attention line low. Example 1 illustrates the statements required to generate a plot. However, there is no provision to indicate to the controller when the plot is finished. Example 2 uses a spectrum analyzer "command complete" service request to indicate when the plot is done. (Service requests are discussed later in this chapter.) When the spectrum analyzer PLOT command is finished, a "command complete" service request is triggered and signals that the plot is done. EXAMPLE 2

```
10   OUTPUT 705;"OP;"
20   ENTER 705;P1x,P1y,P2x,P2y
30   ON INTR 7 GOTO Done
40   ENABLE INTR 7;2
50   OUTPUT 718;"RQS 16;"
60   OUTPUT 718;"PLOT ";P1x;",";P1y;",";P2x;",";P2y;";"
70   SEND 7;UNL LISTEN 5 TALK 18 DATA
80   Idle:  GOTO Idle
90   Done:  S_poll=SPOLL(718)
100  OUTPUT 718;"RQS 0;"
110  PRINT "COMMAND IS COMPLETE"
120  END
```

Lines 10 and 20 obtain the P1 and P2 coordinates, as in the previous example.

Line 30 commands the controller to go to the subroutine Done when an interrupt occurs.

Line 40 enables the controller to receive service request interrupts.

Line 50 The RQS command specifies that a "command complete" condition will generate a service request.

Lines 60 and 70 plot the display contents.

Line 80 keeps the controller on Line 80 of the program until the plot is finished and the PLOT command satisfies the "command complete" condition. When the plot is finished, the controller continues to the subroutine Done. Done performs a serial poll on the spectrum analyzer and reads the generated service request. This also clears the analyzer of this request.

Line 100 returns the spectrum analyzer service requests to their initial condition.

Line 110 prints on the computer screen that the plot is done.

Plotting Options

Perhaps you do not want the entire display contents transferred to the plotter. You may want to plot only a trace, or only a trace and the screen annotation. The spectrum analyzer PLOTSRC (plot source) command specifies the display contents you want to plot. Choose to plot the entire display, trace A, trace B, the annotation, or the graticule. Example 3 illustrates how to plot trace A and the annotation. EXAMPLE 3

```
10    OUTPUT 705;"OP;"
20    ENTER 705;P1x,P1y,P2x,P2y
30    OUTPUT 718;"PLOTSRC TRA;RQS 16;PLOT
       ";P1x;",";P1y;",";P2x;",";P2y;";RQS 0;"
40    GOSUB Wait_plot
50    OUTPUT 718;"PLOTSRC ANNT;RQS 16;PLOT
       ";P1x;",";P1y;",";P2x;",";P2y;";RQS 0;"
60    GOSUB Wait_plot
70    PRINT "COMMAND IS COMPLETE"
80    STOP
90    Wait_plot:   ON INTR 7 GOTO Go_back
100                ENABLE INTR 7;2
110                SEND 7;UNL LISTEN 5 TALK 18 DATA
120   Idle:    GOTO Idle
130   Go_back:        S_poll=SPOLL(718)
140                   RETURN
150   END
```

Another available plot function, the PLOTORG (display origins) command, specifies whether the plotter P1 and P2 coordinates are the origins for the entire analyzer display or for its graticule. If you choose the graticule as the origin and plot only the graticule, you can, in effect, create graph paper especially for analyzer plots. Using paper with preprinted graticule lines can save plotting time. When you use this paper, be sure to set the PLOTORG command in reference to the graticule ("PLOTORG GRT") and use the P1 and P2 coordinates that you used to create the graticule lines.

Printer Requirements

Be sure your printer satisfies the following requirements to execute the programming examples in this section successfully.

1. GPIB printers with graphics capability are supported (for example, the HP 2225A ThinkJet and the HP 3630A PaintJet).

2. Set the printer to address 1, turn the printer off, and then turn the printer back on. If you cannot locate the address switch on the printer, refer to the printer operation manual. If you want to use a different printer address for remote operation, be sure to modify the examples accordingly. Remember, to generate prints from the spectrum analyzer front panel, you must reset the address to 1.

NOTE The printer address of 1 corresponds to the default printer address that the analyzer uses. This default can be changed via **PRINTER ADDRESS** under the **CONFIG** key.

Making a Basic Print

To make a basic print, use any GPIB printer with graphics capability. If using a color printer, the color format (PRINT 1) can be selected; otherwise, a monochrome output is the default output selected. The example program shown below demonstrates how to generate a print.

NOTE The color format output cannot be selected for use with a monochrome printer (for example, an HP ThinkJet).

```
10   OUTPUT 718;"IP;"
20   OUTPUT 718;"CF 300MHZ;SP 1MHZ;TS;DONE?;"
30   ENTER 718;Done
40   ON INTR 7 GOTO Finish
50   ENABLE INTR 7;2
60   OUTPUT 718;"PRINT 0;RQS 16;"
70   SEND 7;UNT UNL LISTEN 1 TALK 18 DATA
80   Idle:  GOTO Idle
90   Finish:  S_poll=SPOLL(718)
100           OUTPUT 718;"RQS 0;"
110  PRINT "PRINT IS COMPLETE"
120  END
```

Monitoring System Operation

The programming techniques discussed so far describe communication between the analyzer and the computer, where the sequence of all data transfer is controlled by a computer program. This section describes how the analyzer can interrupt computer operation when the analyzer has attained a particular state.

The interrupting process is called a service request. Service requests have many applications. They facilitate economical use of computer-processing time when the analyzer is part of a large measurement system. For example, after the computer initiates an analyzer measurement, the computer can make calculations or control other devices via GPIB while the analyzer is measuring. When the analyzer is through, it signals the computer with a service request. The computer service-request subprogram then determines what the computer will do next. Service requests can also be used to report analyzer errors and other analyzer events, such as end-of-sweep.

Interrupt Process

The interrupt process begins when the analyzer "requests" attention by setting the GPIB service-request line (SRQ) true. The computer must be programmed to respond to this event. Typically, the computer is programmed to interrupt normal program execution and call a user-specified subroutine when the service request occurs. If multiple instruments are being controlled remotely, this subroutine determines which instrument or instruments on GPIB caused the service request. Then, it may be necessary to call another subroutine that determines why a particular instrument requested service (because there can be more than one possible cause). Finally, one or more subroutines will be called to respond to the indicated events. Note that more than one instrument can request service simultaneously, and each instrument can have more than one event to report. These steps are summarized below.

1. Computer monitors GPIB service request line (SRQ).
2. Analyzer requests service by setting the SRQ line true.
3. Computer branches to routine that determines the instrument or instruments that caused the SRQ.
4. Computer branches to routine that determines why a particular instrument is requesting service.
5. Computer branches to routine to process a specific event in a particular instrument.

Some of the routines (that are shown above) can be omitted, if only one instrument has been instructed to use the SRQ line, or if a particular instrument has been instructed to use the SRQ line for only one event.

Several system-level statements are required to make the computer respond to service requests. The HP BASIC statement, ENABLE INTR (enable interrupt), tells the computer to monitor the service-request line. The on-interrupt statement, ON INTR, specifies where the computer program will branch when a service request occurs. If more than one instrument could cause the service request, or if an instrument can cause a service request for more than one reason, the serial-poll statement, SPOLL, is used. The serial-poll statement is always required to clear the service request being generated by the instrument.

Analyzer Status Byte

The analyzer **status byte** indicates the status or occurrence of certain analyzer functions. The status byte contains eight bits, numbered 0 to 7, with bit 0 being the least significant bit.

Bits 0, 1, 2, 3, 4, 5, and 7 represent specific conditions or events. These bits are referred to as **condition bits** and **event bits**. Condition bits reflect a condition in the analyzer that can be present or absent at any given moment. Event bits reflect the occurrence of a transition or event within the analyzer.

Bit 6 is set by the analyzer to indicate whether or not it is requesting service.

When the analyzer is instructed not to use the service request line on GPIB, the status bits always reflect the current condition of the analyzer. In this situation, the *event bits* in the status byte should not be used. Event bits are only true at the exact instant of a transition in the analyzer and as such are not reliable when service requests are disabled.

When the analyzer is instructed to generate service requests for one or more conditions or events, the status bits reflect the current condition of the analyzer until a service request is generated. Then, the bits that are generating the service request are held true until the status byte is read out of the analyzer (by the HP BASIC SPOLL system-level statement), by the STB? command, or until a GPIB DEVICE CLEAR (HP BASIC CLEAR system-level statement) is received. These actions clear the status byte to once again reflect the current conditions and events within the analyzer.

The Service-Request Mask

The service-request mode is enabled and controlled by the request-service-condition command, RQS. It defines a **service-request mask** that specifies which of the status-byte bits can generate a service request. Below, RQS specifies the ERROR-PRESENT and COMMAND-COMPLETE states (bits 5 and 4, respectively) for service requests.

```
OUTPUT 718;"RQS ";DVAL("00110000",2)
Selects bit 5 and 4
(32+16) to enable
service request mode for ERROR-PRESENT and COMMAND-COMPLETE.

OUTPUT 718;"RQS 48;"
Also selects bits 5
and 4 as above, but is somewhat easier to read.
```

Once RQS is executed, the analyzer requests service by setting the SRQ line true when the desired conditions or events occur.

Table 5-4 Status Register

Bit Number	Decimal Equivalent	Analyzer State	Description
7	128		Not used
6	64	RQS	Requests service
5	32	ERROR PRESENT	Set when error present
4	16	COMMAND COMPLETE	Any command is completed
3	8		Not used
2	4	END OF SWEEP	Set when any sweep is completed
1	2	MESSAGE	Set when display message appears
0	1	TRIGGER	Trigger is activated

Computer Interrupt Statements

Now that the spectrum analyzer is prepared to trigger service requests, you must prepare the computer to accept this type of interrupt. Use the BASIC statements ON INTR…GOTO or CALL or GOSUB and ENABLE INTR. ON INTR…GOTO causes the computer to branch to a subroutine or some other part of the program when an interrupt is generated. ENABLE INTR enables the computer to accept an interrupt. These two commands appear below.

```
10  OUTPUT 718;"RQS 16;"
20  ON INTR 7 GOSUB Srq
30  ENABLE INTR 7;2
```

In this example, Line 20 indicates that if an interrupt appears (ON INTR 7), the computer is to go to the subroutine Srq (GOSUB Srq). The 7 specifies the interface select code; in this case, it refers to the General Purpose Interface Bus (GPIB). Line 30 enables the computer to accept an interrupt. Here, the 7 again specifies the GPIB select code. The semicolon is part of the BASIC statement ENABLE INTR. The 2 indicates that the interrupt is specifically a service request interrupt, which is asserted from the SRQ line of the GPIB. From Line 10, you know the interrupt will be a service request triggered from a "command complete" condition.

Now that the spectrum analyzer and computer can assert and accept service-request interrupts, choose an event that will trigger the service request and create a subroutine to handle the interrupt. In the example below, the take sweep command (TS) is used to trigger a command complete signal. (Because 10 video-averaging sweeps are desired, this signal does not occur until after the selected number of averages is complete.) This service request will cause the computer to go to the subroutine Srq. The subroutine identifies the type of service request and prints it on the computer screen. See Example 1.

EXAMPLE 1

```
10   OUTPUT 718;"IP;SNGLS;CF 300MHZ;SP 20MHZ;TS;"
20   OUTPUT 718;"VAVG 10;RQS 16;"
30   ON INTR 7 GOTO Srq
40   ENABLE INTR 7;2
50   OUTPUT 718;"TS;"
60   Idle: GOTO Idle
70   Srq:  Sbyte=SPOLL(718)
80         PRINT Sbyte
90         PRINT "VIDEO AVERAGING IS COMPLETE"
100         OUTPUT 718;"RQS 0;"
110  END
```

Line 10 sets the desired instrument state. Note that the instrument is set to single-sweep mode. This allows the video averages to happen only when the take-sweep command is sent.

Line 20 selects the number of video averages desired. It is not until after the VAVG (video average) command is sent that the RQS command is sent. This ensures that no previous commands can accidentally generate an SRQ.

Line 30 directs that the computer should execute the Srq routine when an interrupt occurs.

Line 40 enables the computer to accept the interrupt.

Lines 50 and 60 sends the take-sweep command; during the 10 video averages that will now occur, the computer remains on line 60. When the video averaging is complete, TS is complete and the "command complete" condition is satisfied. The computer then branches to the subroutine Srq.

Lines 70 and 80 causes the computer to read the decimal equivalent of the generated service request into the variable Sbyte. The computer then prints the value, alerting you that the interrupt has occurred.

Line 100 returns the status register to its initial state (that is, no conditions are masked).

Reading Service Request Data

In the above example, you used the serial-poll statement (SPOLL) to read the service request data into a variable. The STB (status byte query) command also reads service request data. Example 2 shows how.

EXAMPLE 2

```
10    OUTPUT 718;"IP;SNGLS;CF 300MHZ;SP 20MHZ;TS;"
20    OUTPUT 718;"VAVG 10;RQS 16;"
30    ON INTR 7 GOSUB Srq
40    ENABLE INTR 7;2
50    Done=0
60    OUTPUT 718;"TS;"
70    Idle:  IF Done=0 GOTO Idle
80           STOP
90    Srq:OUTPUT 718;"STB?;";
100   ENTER 718;Sbyte
110   PRINT Sbyte
120   PRINT "VIDEO AVERAGING IS COMPLETE"
130   OUTPUT 718;"RQS 0;"
140   Done=1
150   RETURN
160   END
```

Line 20 sets the bit mask so that only the "command complete" condition is set. On Line 70, once the "command complete" condition is satisfied (in this case, after ten video averages), the STB command queries the spectrum analyzer for the service-request data. The data is then entered into variable Sbyte and printed. The value returned is the decimal equivalent of the generated service request.

Reading Service Requests From More Than One Instrument

Most instruments that can be controlled remotely have service request capability similar to that in the 8560 E-Series and EC-Series. You may want to take advantage of this capability in other instruments as well as in the spectrum analyzer. If you have more than one instrument on a bus that can generate a service request, you need to modify the above program to look for interrupts from more than one instrument.

See Example 3.

EXAMPLE 3

```
10    OUTPUT 718;"IP;SNGLS;CF 300MHZ;SP 20MHZ;TS;"
20    OUTPUT 718;"VAVG 10;RQS 16;"
30    ON INTR 7 GOSUB Srq
40    ENABLE INTR 7;2
50    Done=0
60    OUTPUT 718;"TS;"
70    Idle:  IF Done=0 GOTO Idle
80           STOP
90    Srq:  Sbyte_1=SPOLL(718)
100         Sbyte_2=SPOLL(705)
110         IF BIT (Sbyte_1,6)=1 THEN
120           PRINT "SERVICE REQUEST",Sbyte_1,"ON ADDRESS 18
"
130           OUTPUT 718;"RQS 0;"
140           STOP
150         END IF
160         IF BIT(Sbyte_2,6)=1 THEN
170           PRINT "SERVICE REQUEST",Sbyte_2,"ON ADDRESS 5"
180         END IF
190         ENABLE INTR 7;2
200         Done=1
210         RETURN
220         END
```

In this example, you execute the SPOLL command for each instrument that can cause a service request interrupt; in this case, the analyzer or an instrument that is set to address 5. Once the instruments are queried for interrupts, the IF…THEN statements provide a way to branch to the appropriate routine.

Testing Service Request Routines

In the previous programming examples, you knew that a service request would be generated when the VAVG command was completed. You could easily test the program and make sure that it worked. However, service requests may not always be so predictable; this can make a program difficult to test. The spectrum analyzer SRQ command automatically triggers any service request you choose. Of course, as with other service requests, you must set the bit mask before executing the SRQ command. See Example 4.

EXAMPLE 4

```
10    OUTPUT 718;"IP;SNGLS;CF 300MHZ;SP 20MHZ;TS;"
20    OUTPUT 718;"RQS 16;"
30    ON INTR 7 GOSUB Srq
40    ENABLE INTR 7;2
50    Done=0
60    OUTPUT 718;"SRQ 16;"
70    Idle:  IF Done=0 GOTO Idle
80           STOP
90    Srq:   Sbyte=SPOLL(718)
100          PRINT Sbyte
110          PRINT "INTERRUPT GENERATED"
120          OUTPUT 718;"RQS 0;"
130          Done=1
140          RETURN
150          END
```

Here, on Line 50, a "command complete" service request is immediately generated, and you can be sure that the routine will work.

Summary

The main points to using service requests are highlighted below.

1. Choose the conditions for generating service requests.
2. Set a bit mask that enables only these chosen conditions.
3. Prepare the computer to accept service requests. Use the ON INTR...GOSUB and ENABLE INTR statements.
4. Once an interrupt is triggered, use the analyzer STB command or the SPOLL statement to read the interrupt.

6 Programming Command Cross Reference

Programming Command Cross Reference Features

- **Front Panel Key Versus Command** lists the front panel keys alphabetically and indicates the corresponding programming command, if any.
- **Programming Command Versus Front Panel Key** lists the programming commands by functional groups and indicates the corresponding front panel key.
- **Agilent 8566A and Agilent 8568A Compatible Commands** lists the commands that are the same in the Agilent 8566A and Agilent 8568A spectrum analyzers, and in the Agilent 8560 E-Series and EC-Series.
- **Mass Memory Module Commands** lists the commands that are available through the Agilent 85620A mass memory module, when it is used with the spectrum analyzer.

Front Panel Key Versus Command

Table 6-1 Front Panel Key Versus Command

Key	Programming Command
# ALT CHANNELS	ACPALTCH
ΔMARKER OCC BW	DELMKBW
0→10V LO SWP	SWPOUT
.5 V/GHz (FAV)	SWPOUT
2BW METHOD	ACPMETHOD
3dB POINTS	MKBW
6dB POINTS	MKBW
10 MHz EXT INT	FREF
A	
A+B→A	APB
A–B→A ON OFF	AMB
A–B+DL→A ON OFF	AMBPL
ACCELERAT	ACPACCL
ACCELERAT FASTER	ACPACCL
ACCELERAT FASTEST	ACPACCL
ACCELERAT NORMAL	ACPACCL
ACP AUTO MEASURE	ACPMEAS
ACP COMPUTE	ACPCOMPUTE
ACPGRAPH ON OFF	ACPGRAPH
ACP MENU	—
ACP SETUP	—
ACP STATE DFL CURR	ACPMSTATE
A EXCH B	AXB
ADJ CURR IF STATE	ADJIF
AGC ON OFF	DEMODAGC
ALC INT EXT	SRCALC
ALL	AUTOCPL

Table 6-1 Front Panel Key Versus Command

Key	Programming Command
AM DEMOD ON OFF	DEMOD
AM/FM DEMOD	—
AMP COR MENU	—
AMP COR ON OFF	AMPCOR
AMPLITUDE	RL
AMPTD CORRECT	—
AMPTD UNITS	AUNITS
ANALOG METHOD	ACPMETHOD
ANALYZER ADDRESS	—
ANNOT HELP	—
ANNOT ON OFF	ANNOT
ATTEN AUTO MAN	AT
AUTO ACP MEASURE	ACPMEAS
AUTO COUPLE	—
AUX CTRL	—
AVERAGE CNV LOSS	CNVLOSS
AVG "OFF" POWER	CARROFF
AVG "ON" POWER	CARRON
B	
B–DL→B	BML
B &W	PRINT
BACK SPACE	—
BIAS	MBIAS
BIAS OFF	MBIAS
BLANK A	BLANK
BLANK B	BLANK
BURST/WEIGHTNG	—
BURST PERIOD	ACPBRPER
BURST WIDTH	ACPBRWID

Table 6-1 Front Panel Key Versus Command

Key	Programming Command
BURST PWR METHOD	ACPMETHOD
BW	RB
C	
CAL	—
CAL OPN/SHRT	STOREOPEN, STORESHORT
CAL THRU	STORETHRU
CARRIER PWR MENU	—
CENTER FREQ	CF
CF STEP AUTO MAN	SS
CF/2→CF	—
CF*2→CF	—
CH EDGES → ΔMKR	MKCHEDGE
CHAN DN	CHANNEL
CHAN PWR OVER BW	CHPWRBW
CHAN UP	CHANNEL
CHANNEL BANDWDTH	ACPBW
CHANNEL PWR MENU	—
CHANNEL SPACING	ACPSP
CHPWR BW [ ]	CHPWRBW
CHAR SET 1 2	—
CLEAR WRITE A	CLRW
CLEAR WRITE B	CLRW
CNV LOSS VS FREQ	—
COLOR	PRINT
CONFIG	—
CONT MEASURE	MEAS
COPY	PLOT, PRINT
COPY DEV PRNT PLT	—
COUNTER ON OFF	MKFC

Table 6-1 Front Panel Key Versus Command

Key	Programming Command
COUNTER RES	MKFCR
COUPLING AC DC	COUPLE
CRT ADJ PATTERN	ADJCRT
D	
DATECODE & OPTIONS	ID, REV, SER
dBμV	AUNITS
dBm	AUNITS
dBmV	AUNITS
DELETE CORR PT	AMPCORDATA
DEMOD TIME	DEMODT
DETECTOR MODES	—
DETECTOR NEG PEAK	DET
DETECTOR NORMAL	DET
DETECTOR POS PEAK	DET
DETECTOR SAMPLE	DET
DISPLAY	—
DLY SWEEP [ ]	DLYSWP
DLY SWP ON OFF	DLYSWP
DONE EDIT	—
DSPL LIN ON OFF	DL
E	
EDGE POL POS NEG	GP
EDIT AMPCOR	AMPCORDATA
EDIT AMPL	AMPCORDATA
EDIT FREQ	AMPCORDATA
ELAPSED TIME	ET
ERASE TITLE	—
EXIT ACP	—
EXIT AMPCOR	—

Table 6-1 Front Panel Key Versus Command

Key	Programming Command
EXTERNAL	TM
EXTERNAL MIXER	MXRMODE
EXT MXR PRE UNPR	EXTMXR
F	
FACTORY PRSEL PK	—
FFT MEAS	FFT
FM DEMOD ON OFF	DEMOD
FOCUS	—
FRAC N FREQ	FDIAG
FREE RUN	TM
FREQ COUNT	MKFC
FREQ DIAGNOSE	FDIAG
FREQ DSP OFF	FDSP
FREQ OFFSET	FOFFSET
FREQUENCY	CF
FULL BAND	FULBAND
FULL IF ADJ	ADJIF
FULL SPAN	FS
G	
GATE CTL EDGE LVL	GATECTL
GATE DLY [ ]	GD
GATE LEN [ ]	GL
GATE ON OFF	GATE
GATED METHOD	ACPMETHOD
GATED VIDEO	—
GRAT ON OFF	GRAT
H	
HOLD	HD

Table 6-1 Front Panel Key Versus Command

Key	Programming Command
I	
IF ADJ ON OFF	ADJIF
INTENSTY	—
INTERNAL MIXER	MXRMODE
L	
LAST SPAN	SP
LAST STATE	RCLS
LINE	TM
LINEAR	LN
LOCK HARMONIC	HNLOCK
LOCK ON OFF	HNLOCK, HNUNLK
LO FREQ	FDIAG
LOG dB/DIV	LG
LVL POL POS NEG	GP
M	
MAN TRK ADJ	SRCCRSTK, SRCFINTK
MARKER →CF	MKCF
MARKER →CF STEP	MKSS
MARKER →REF LVL	MKRL
MARKER DELTA	MKD
MARKER 1/DELTA	MKDR
MARKER NORMAL	MKN
MARKERS OFF	MKOFF
MAX HOLD A	MXMH
MAX HOLD B	MXMH
MAX MXR LEVEL	ML
MEAS/USER	—
METHODS	ACPMETHOD
MKR	MKN

Table 6-1 Front Panel Key Versus Command

Key	Programming Command
MKR→	MKN
MKR Δ→CF	MKCF
MKR Δ→CF STEP	MKSS
MKR Δ →CHPWR BW	MKDELCHBW
MKR Δ →SPAN	MKSP
MKR 1/Δ→CF	—
MKR 1/Δ->CF STEP	—
MKR MEAN → CF	MKMCF
MKRNOISE ON OFF	MKNOISE
MODULE	—
N	
NEGATIVE BIAS	MBIAS
NEW CORR PT	AMPCORDATA
NEXT PEAK	MKPK
NEXT PK LEFT	MKPK
NEXT PK RIGHT	MKPK
NORMLIZE ON OFF	NORMLIZE
NORM REF LVL	NRL
NORM REF POSN	NRPOS
O	
OCCUPIED [%]	OCCUP
OCCUPIED BANDWIDTH	PWRBW
OCCUPIED PWR MENU	—
P	
PEAK EXCURSN	MKPX
PEAK METHOD	ACPMETHOD
PEAK SEARCH	MKPK
PEAK SEARCH	MKPK
PEAK THRSHLD	MKPT

Table 6-1 Front Panel Key Versus Command

Key	Programming Command
PLOT ANNOT	PLOTSRC
PLOT GRATICUL	PLOTSRC
PLOT ORG DSP GRAT	PLOTORG
PLOT TRACE A	PLOTSRC
PLOT TRACE B	PLOTSRC
PLOTTER ADDRESS	—
PLOTTER CONFIG	PLOTSRC
POSITIVE BIAS	MBIAS
POSTSCLR	FDIAG
POWER MENU	—
POWER ON	RCLS
PRESEL AUTO PK	PP
PRESEL MAN ADJ	PSDAC
PRESEL PEAK	—
PRESET	IP
PRINTER ADDRESS	—
PRINTER CONFIG	—
PURGE CORR	AMPCORDATA
PWR MENU HELP	—
PWR ON STATE	SAVES
PWR SWP ON OFF	SRCPSWP
R	
RANGE LVL	RL
RAW OSC FREQ	FDIAG
RBW/SPAN RATIO	RBR
REALIGN LO & IF	ADJALL
REAR PANEL	—
RECALL	—
RECALL AMPCOR	AMPCORRCL

Table 6-1 Front Panel Key Versus Command

Key	Programming Command
RECALL ERRORS	ERR
RECALL OPN/SHRT	RCLOSCAL
RECALL PRSEL PK	—
RECALL STATE	RCLS
RECALL THRU	RCLTHRU
RECALL TO TR A	RCLT
RECALL TO TR B	RCLT
REF LVL	RL
REF LVL ADJ	RLCAL
REF LVL OFFSET	ROFFSET
RES BW AUTO MAN	RB
S	
SAMPLER FREQ	FDIAG
SAMPLER HARMONIC	FDIAG
SAVE	—
SAVE AMPCOR	AMPCORSAVE
SAVE PRSEL PK	—
SAVE STATE	SAVES
SAVE TRACE A	SAVET
SAVE TRACE B	SAVET
SAVELOCK ON OFF	PSTATE
SCREEN TITLE	TITLE
SCROLL CORR PTS	AMPCORSIZE
SELECT CHAR	—
SGL SWP	SNGLS
SIG ID AT MKR	SIGID
SID ID ON OFF	SIGID
SIG ID→CF	IDCF
SIGNAL IDENT	—

Table 6-1 Front Panel Key Versus Command

Key	Programming Command
SIG TRK ON OFF	MKTRACK
SINGLE MEASURE	MEAS
SOURCE CAL MENU	—
SPACE	—
SPACING/BANDWDTH	—
SPAN	SP
SPAN ZOOM	—
SQUELCH ON OFF	SQUELCH
SRC PWR OFFSET	SRCPOFS
SRC PWR ON OFF	SRCPWR
SRC PWR STP SIZE	SRCPSTP
START FREQ	FA
STOP FREQ	FB
SWEEP	ST
SWEEP CONT SGL	CONTS, SNGLS
SWP CPL SR SA	SWPCPL
SWP TIME AUTO MAN	ST
T	
THRESHLD ON OFF	TH
TITLE DONE	TITLE
TRACE	—
TRACE A B	TRA, TRB
TRACKING GENRATOR	—
TRACKING PEAK	SRCTKPK
TRIG	—
TRIG POL POS NEG	TRIGPOL
U	
UNITS AUTO MAN	AUNITS

Table 6-1 Front Panel Key Versus Command

Key	Programming Command
V	
VBW/RBW RATIO	VBR
V/GHz .25 .50	SWPOUT
VID AVG ON OFF	VAVG
VIDEO	TM, VTL
VIDEO BW AUTO MAN	VB
VIEW A	VIEW
VIEW B	VIEW
VIEW TBL TRCE	ACPRSLTS
VOLTS	AUNITS
W	
WATTS	AUNITS
WEIGHT α	ACPALPHA
WEIGHT T	ACPT
WEIGHTNG √**COS OFF**	ACPFRQWT
Z	
ZERO SPAN	SP

Programming Command Versus Front Panel Key

This table is a functional sort of the programming commands. Alternate commands common to the 8560 E-Series and EC-Series, and the Agilent 8566 and Agilent 8568, are shown within parentheses. For further information about alternate commands, see "Agilent 8566A and Agilent 8568A Compatible Commands" in this chapter.

Table 6-2 Programming Command Functional Index

Function Category	Command	Corresponding Key Function	Description
AMPLITUDE	AMPCOR	**AMPCOR ON OFF**	Turns on and off the correction for system flatness.
	AMPCORDATA	**EDIT AMPCOR**	Enters amplitude correction data.
	AMPCORSIZE		Indicates the number of correction points.
	AMPCORRCL	**RECALL AMPCOR**	Recalls ampcor data.
	AMPCORSAVE	**SAVE AMPCOR**	Saves ampcor data.
	AT	**ATTEN AUTO MAN**	Specifies input attenuation.
	AUNITS	**AMPTD UNITS**	Specifies amplitude units for input, output, and display.
	COUPLE	**COUPLE AC DC**	Selects dc or ac coupling.
	LG	**LOG dB/DIV**	Specifies log scale.
	LN	**LINEAR**	Specifies linear scale.
	MKRL	**MARKER → REF LVL**	Moves active marker amplitude to reference level (E4).
	ML	**MAX MXR LVL**	Specifies the mixer level.
	NRPOS	**NORM REF POSN**	Adjusts the normalized reference position.
	PP	**PRESEL AUTO PK**	Peaks preselector.
	PSDAC	**PRESEL MAN ADJ**	Adjusts or returns preselector-peak DAC number.
	RL	**REF LVL RANGE LVL**	Specifies the amplitude value of the reference level.
	RLCAL	**REF LVL ADJ**	Calibrates reference level.
	ROFFSET	**REF LVL OFFSET**	Offsets all amplitude readouts without affecting the trace.
AUTO COUPLING	AT AUTO	**ATTEN AUTO MAN (AUTO)**	Auto-couples the RF attenuator (CA).
	AUTOCPL	**ALL**	Auto-couples all controls.
	RB AUTO	**RES BW AUTO MAN (AUTO)**	Auto-couples resolution bandwidth (CR).
	RBR	**RBW/SPAN RATIO**	Specifies coupling ratio of resolution bandwidth and frequency span.

Table 6-2 Programming Command Functional Index

Function Category	Command	Corresponding Key Function	Description
	SS AUTO	**CF STEP AUTO MAN (AUTO)**	Auto-couples center-frequency step-size (CS).
	ST AUTO	**SWP TIME AUTO MAN (AUTO)**	Auto-couples sweep time (CT).
	VB AUTO	**VIDEO BW AUTO MAN (AUTO)**	Auto-couples video bandwidth (CV).
	VBR	**VBW/RBW RATIO**	Specifies coupling ratio of video bandwidth and resolution bandwidth.
AUXILIARY CONTROL	CNVLOSS	**AVERAGE CNV LOSS**	Sets reference-level offset to compensate for external mixer conversion loss.
	DEMOD	**AM DEMOD ON OFF FM DEMOD ON OFF**	Turns demodulation on or off.
	DEMODAGC	**AGC ON OFF**	Demodulation auto gain control.
	DEMODT	**DEMOD TIME**	Demodulation time.
	EXTMXR	**EXT MXR PRE UNPR**	Specifies the external mixing mode as either preselected or unpreselected.
	FREF	**10 MHz EXT INT**	Specifies the frequency reference source.
	FULBAND	**FULL BAND**	Sets start and stop frequencies for full waveguide bands.
	HNLOCK	**LOCK HARMONIC**	Locks to specified harmonic number.
	HNUNLK	**LOCK ON OFF**	Unlocks the specified harmonic number.
	IDCF	**SIG ID → CF**	Sets center frequency to frequency of SIGID.
	IDFREQ		Returns frequency of identified signal.
	MBIAS	**BIAS**	Specifies the bias level for external mixers.
	MKN	**MARKER NORMAL**	Activates marker and moves marker to specified frequency or center screen (M2).
	MKPX	**PEAK EXCURSN**	Specifies minimum excursion for peak identification.
	MXRMODE	**EXTERNAL MIXER** **INTERNAL MIXER**	Specifies either internal or external mixing.
	NORMLIZE	**NORMLIZE ON OFF**	Activates normalization routine.
	NRL	**NORM REF LVL**	Sets the normalized reference level.
	NRPOS	**NORM REF POSN**	Adjusts the normalized reference position.
	PP	**PRESEL AUTO PK**	Peaks preselector.

Table 6-2 Programming Command Functional Index

Function Category	Command	Corresponding Key Function	Description
AUXILIARY CONTROL (continued)	PSDAC	**PRESEL MAN ADJ**	Adjusts or returns preselector-peak DAC number.
	RCLOSCAL	**RECALL OPN/SHRT**	Recalls stored open/short trace calibration data.
	RCLTHRU	**RECALL THRU**	Recalls stored thru calibration data.
	RL	**REF LVL RANGE LVL**	Adjusts the range level.
	SIGID	**SIG ID AT MKR SIG ID ON OFF**	Identifies signals for external mixing frequency bands.
	SQUELCH	**SQUELCH ON OFF**	Controls the squelch for demodulation.
	SRCALC	**ALC INT EXT**	Selects internal or external leveling.
	SRCCRSTK	**MAN TRK ADJ**	Course-tunes the tracking generator oscillator.
	SRCFINTK	**MAN TRK ADJ**	Fine-tunes the tracking generator oscillator.
	SRCPOFS	**SRC PWR OFFSET**	Offsets the displayed tracking-generator source power.
	SRCPSTP	**SRC PWR STP SIZE**	Sets the step size of the source power level.
	SRCPSWP	**PWR SWP ON OFF**	Controls the power-sweep function.
	SRCPWR	**SRC PWR ON OFF**	Controls the output power of the tracking generator.
	SRCTKPK	**TRACKING PEAK**	Peaks the tracking generator response.
	STOREOPEN	**CAL OPN/SHRT**	Saves open-input calibration data for use with STORESHORT.
	STORESHORT	**CAL OPN/SHRT**	Averages shorted-input and open-input calibration data and saves the average.
	STORETHRU	**CAL THRU**	Stores thru-calibration data.
	SWP CPL	**SWP CPL SR SA**	Selects a stimulus response or spectrum analyzer coupled sweep time.
	SWP OUT		Specifies the sweep output.
BANDWIDTH	RB	**RES BW AUTO MAN**	Specifies resolution bandwidth.
	RBR	**RBW/SPAN RATIO**	Specifies the coupling ratio of resolution bandwidth and frequency span.
	VAVG	**VID AVG ON OFF**	Turns video averaging on or off.
	VB	**VIDEO BW AUTO MAN**	Specifies video bandwidth.
	VBR	**VID/RBW RATIO**	Specifies coupling ratio of video bandwidth and resolution bandwidth.

Table 6-2 Programming Command Functional Index

Function Category	Command	Corresponding Key Function	Description
CALIBRA TION	ADJALL	**REALIGN LO &IF**	Initiates power-on adjustment sequence.
	ADJCRT	**CRT ADJ PATTERN**	Initiates CRT adjustment patterns.
	ADJIF	**IF ADJ ON OFF ADJ CURR IF STATE** **FULL IF ADJ**	Initiates IF adjustment sequence.
	AMPCOR	**AMPCOR ON OFF**	Turns on and off the correction for system flatness.
	AMPCORDATA	**EDIT AMPCOR**	Enters amplitude correction data.
	AMPCOR SIZE		Indicates the number of correction points.
	AMPCOR RCL	**RECALL AMPCOR**	Recalls ampcor data.
	AMPCOR SAVE	**SAVE AMPCOR**	Saves ampcor data.
	FDIAG	**FREQ DIAG LO FREQ SAMPLER FREQ SAMPLER HARMONIC**, **FRAC N FREQ**, **POSTSCLR**, **RAW OSC FREQ**	Returns frequency of specified oscillator.
	RLCAL	**REF LVL ADJ**	Calibrates reference level.
CONFIGURATION	EXT MXR	**EXT MXR PRE UNPR**	Selects either preselected or unpreselected external mixing mode.
	ID	**DATECODE OPTIONS**	Returns the model number of analyzer used.
	OP		Returns the display lower-left and upper-right coordinates.
	PLOT	**COPY**	Sends analyzer display to a plotter.
	PLOTORG	**PLOT ORG DSP GRT**	Selects scaling points for plot.
	PLOTSRC	**PLOT ANNOT** **PLOT GRATICUL** **PLOT ORG DSP GRAT** **PLOT TRACE A** **PLOT TRACE B**	Specifies plot source.
	PRINT	**COPY**	Sends analyzer display to a printer.
	REV	**DATECODE &OPTIONS**	Returns analyzer firmware revision date.
	SER	**DATECODE &OPTIONS**	Returns analyzer serial number.
COPY	PLOT	**COPY** with **COPY DEV PRNT PLT**	Sends analyzer display to a plotter.
	PRINT	**COPY** with **COPY DEV PRNT PLT**	Sends analyzer display to a printer.

Table 6-2 Programming Command Functional Index

Function Category	Command	Corresponding Key Function	Description
DISPLAY	ANNOT	**ANNOT ON OFF**	Turns annotation on or off.
	BLANK	**BLANK A BLANK B**	Stores and blanks specified trace register (A4 and B4).
	DL	**DSPL LIN ON OFF**	Specifies display-line level in dBm, and turns the display line on or off. (L0)
	FDSP	**FREQ DSP OFF**	Turns all frequency display annotation off.
	GRAT	**GRAT ON OFF**	Turns graticule on or off.
	TH	**THRESHLD ON OFF**	Specifies display threshold value.
	TITLE	**SCREEN TITLE**	Writes specified ASCII characters in title block area of display.
FREQUENCY	CF	**CENTER FREQ**	Specifies center frequency.
	FA	**START FREQ**	Specifies start frequency.
	FB	**STOP FREQ**	Specifies stop frequency.
	FOFFSET	**FREQ OFFSET**	Specifies frequency offset.
	SS	**CF STEP AUTO MAN**	Specifies center-frequency step-size.
FREQUENCY COUNT	MKFC	**COUNTER ON OFF**	Turns the frequency counter on or off.
	MKFCR	**COUNTER RES**	Specifies resolution of the frequency counter.
	MKD	**MARKER DELTA**	Moves delta marker to specified frequency (M3).
	MKN	**MARKER NORMAL**	Moves marker to specified frequency or center screen (M2).
	MKPX	**PEAK EXCURSN**	Specifies minimum excursion for peak identification.
HOLD	HD	**HOLD**	Holds or disables data entry and blanks active function display readout.
INFORMATION AND SERVICE DIAGNOSTICS	ADJALL	**REALIGN LO &IF**	Initiates power-on adjustment sequence.
	ADJCRT	**CRT ADJ PATTERN**	Initiates CRT adjustment patterns.
	ADJIF	**FULL IF ADJ**	Initiates IF adjustment sequence.
	DONE		Returns a 1 when task has been completed.
	ERR	**RECALL ERRORS**	Returns list of instrument error codes.
	ET	**ELAPSED TIME**	Returns elapsed time.
	FDIAG	**FREQ DIAGNOSE**	Returns frequency of specified oscillator.
	ID	**DATECODE &OPTIONS**	Returns the model number of analyzer used.

Table 6-2 Programming Command Functional Index

Function Category	Command	Corresponding Key Function	Description
	PSDAC	**PRESEL MAN ADJ**	Adjusts or returns preselector-peak DAC number.
	REV	**DATECODE &OPTIONS**	Returns analyzer firmware revision date.
	RLCAL	**REF LVL ADJ**	Calibrates reference level.
	SER	**DATECODE &OPTIONS**	Returns analyzer serial number.
MARKER	MKA		Amplitude of active marker (MA).
	MKBW	**3 dB POINTS 6 dB POINTS**	Finds the signal's bandwidth at the specified power level.
	MKCF	**MARKER → CF**	Enters marker frequency into center frequency (E2).
	MKD	**MARKER DELTA**	Moves delta marker to specified frequency (M3).
	MKDR	**MARKER 1/DELTA**	Marker delta reciprocal, readout in time.
	MKF		Frequency of active marker (MF).
	MKMIN		Moves marker to minimum signal detected.
	MKN	**MARKER NORMAL**	Moves marker to specified frequency or center screen (M2).
	MKNOISE	**MKRNOISE ON OFF**	Average noise value at marker and normalize to 1 Hz bandwidth.
	MKOFF		Turns the active marker off (M1).
	MKPK	**NEXT PEAK** **NEXT PK RIGHT** **NEXT PK LEFT**	Moves marker to signal peak (E1).
	MKPT	**PEAK THRESHLD**	Specifies marker peak threshold.
	MKPX	**PEAK EXCURSN**	Specifies minimum excursion for peak identification.
	MKRL	**MARKER → REF LVL**	Moves active marker to reference level (E4).
	MKSP	**MKR Δ → SPAN**	Moves marker delta frequency into span.
	MKSS	**MARKER → CF STEP**	Moves marker frequency to center-frequency step-size (E3).
	MKT	**MARKER NORMAL** (Span set to 0)	Positions marker at point corresponding to the time from beginning of sweep.
	MKTRACK	**SIG TRK ON OFF**	Turns marker signal track on (MT1) or off (MT0).
MEASURE/USER	ACPACCL	**ACCELRAT**	Changes the speed of the measurement.
	ACPALPHA	**WEIGHT** α	Sets the ACP alpha weighting.
	ACPALTCH	**# ALT CHANNELS**	Sets the number of alternate channels for the adjacent channel power measurement.

Table 6-2 Programming Command Functional Index

Function Category	Command	Corresponding Key Function	Description
	ACPBRPER	**BURST PERIOD**	Sets the burst period for an adjacent channel power measurement.
	ACPBRWID	**BURST WIDTH**	Sets the burst width for an adjacent channel power measurement.
	ACPBW	**CHANNEL BANDWDTH**	Sets the channel bandwidth for an adjacent channel power measurement.
	ACPCOMPUTE	**ACP COMPUTE**	Performs an adjacent channel power computation with current instrument settings.
	ACPFRQWT	**WEIGHTNG √COS OFF**	Sets the adjacent channel power frequency weighting.
	ACPGRAPH	**ACPGRAPH ON OFF**	Turns on or off the adjacent channel power graph mode.
	ACPLOWER		Returns the lower adjacent channel power result.
	ACPMAX		Returns the maximum adjacent channel power result.
	ACPMEAS	**AUTO ACP MEASURE**	Performs an automatic adjacent channel power measurement.
	ACPMETHOD	**METHODS**	Changes the adjacent channel power measurement algorithm.
	ACPMSTATE	**ACPSTATE DFL CURR**	Selects default or current for the measurement state of an adjacent channel power measurement.
	ACPPWRTX		Returns the total power transmitted in an adjacent channel power measurement.
	ACPRSLTS		Returns an array of the results of the adjacent channel power measurement.
	ACPSP	**CHANNEL SPACING**	Sets the channel spacing for an adjacent channel power measurement.
	ACPT	**WEIGHT T**	Sets the adjacent channel power tau weighting.
	ACPUPPER		Returns the upper adjacent channel power result.
	CARROFF	**AVG"OFF"POWER**	Measures the average carrier power when the burst is off.
	CARRON	**AVG "ON" POWER**	Measures the average carrier power when the burst is on.
	CHANPWR	**CHAN PWR OVER BW**	Measures the power in the channel bandwidth.
	CHANNEL	**CHAN UP CHAN DOWN**	Changes the center frequency by one channel width.

Table 6-2 Programming Command Functional Index

Function Category	Command	Corresponding Key Function	Description
MEASURE/ USER (continued)	CHPWRBW	**CHPWR BW [ ]**	Sets the bandwidth for the desired channel power.
	DELMKBW	**ΔMARKER OCC BW**	Measures the occupied power bandwidth with respect to the power between the delta markers.
	FFT	**FFT MEAS**	Performs a discrete Fourier transform.
	MEAS		Queries whether the power measurement is running continuously, or a single time.
	MKCHEDGE	**CH EDGES → ΔMKR**	Moves the delta markers to a channel spacing around the center frequency.
	MKDELCHBW	**MKRΔ → CHPWR BW**	Sets the channel power bandwidth to the value between the delta markers.
	MKMCF	**MKR MEAN → CF**	Changes the center frequency to the midpoint of the two displayed markers.
	OCCUP	**OCCUPIED [%]**	Enters the desired percent of the occupied channel power.
	PWRBW	**OCCUPIED POWER BW**	Returns the bandwidth equal to a percentage of total power.
	TWNDOW		Creates a trace array for the FFT function.
MODULE—A list of the Agilent 85620A mass memory module commands follows this table. (There are no remote commands for the Agilent 85629B test adjustment module.)			
OUTPUT FORMAT	AUNITS	**AMPTD UNITS**	Specifies amplitude units for input, output, and display.
	MKA		Returns marker amplitude (MA).
	MKF		Returns marker frequency (MF).
	SWPOUT	**REAR PANEL**	Specifies the sweep output.
	TRA		Outputs trace A (TA).
	TRB		Outputs trace B (TB).
	TDF		Selects trace data output format as real number parameter units (P) format, binary (B) format, A-block format, I-block format, and measurement units (M) format.
PRESET	IP	**PRESET**	Sets instrument parameters to preset values.
RECALL AND SAVE	ERR	**RECALL ERRORS**	Returns list of instrument error codes.
	ET	**ELAPSED TIME**	Returns elapsed time.
	PSDAC	**PRESEL MAN ADJ**	Adjusts or returns preselector-peak DAC number.

Table 6-2 Programming Command Functional Index

Function Category	Command	Corresponding Key Function	Description
	PSTATE	**SAVELOCK ON OFF**	Protects saved states (save lock).
	RCLS	**RECALL STATE**	Recalls previously saved state (RC).
	RCLT	**RECALL TO TRA** **RECALL TO TRB**	Recalls specified trace data.
	SAVES	**PWR ON STATE** **SAVE STATE**	Saves current state of the analyzer in the specified register (SV).
	SAVET	**SAVE TO TRA** **SAVE TO TRB**	Saves specified trace data.
SERVICE REQUEST	RQS		Specifies the decimal weighing of status byte bits that are allowed during service request. RQS is set to 0 with power-up or device clear.
	SRQ		Sets service request if operand bits are allowed by RQS.
	STB		Returns the decimal equivalent of the bits set in the status byte.
SPAN	FS	**FULL SPAN**	Specifies the full frequency span for the spectrum analyzer.
	SP	**SPAN ZERO SPAN**	Specifies the frequency span.
SWEEP	CONTS	**SWEEP CONT SGL (CONT)**	Selects continuous sweep mode (S1).
	DLYSWP	**DLY SWP [ ] DLY SWP ON OFF**	Delays the start of the sweep until the specified time elapses after the trigger event (or before the trigger event with Option 007).
	GATE	**GATE ON OFF**	Turns on or off the time-gating function.
	GATECTL	**GATE CTL EDGE LVL**	Selects between the edge and the level mode for time-gate function.
	GD	**GATE DLY [ ]**	Sets the delay time from when the gate trigger occurs to when the gate is turned on.
	GL	**GATE LEN [ ]**	Sets the length of time the time gate is turned on.
	GP	**EDGE POL POS NEG LVL POL POS NEG**	Sets the polarity (positive or negative) for the gate trigger.
	MEAS		Queries whether the instrument is sweeping continuously, or a single time.
	SNGLS	**SWEEP CONT SGL (SGL)**	Selects single sweep mode (S2).
	ST	**SWP TIME AUTO MAN**	Specifies sweep time.
	TS		Takes a sweep.
SYNCHRONI-ZATION	DONE		Returns a 1 when task has been completed.
	TS		Takes a sweep.

Table 6-2 Programming Command Functional Index

Function Category	Command	Corresponding Key Function	Description
TRACE	DET	**DETECTOR MODES**	Specifies video detector type.
TRACE MATH	AMB	**A–B→A ON OFF**	A – B into A (C1 and C2).
	AMBPL	**A–B+DL→A ON OFF**	A – B + DL into A.
	APB	**A+B → A**	A + B into A.
	AXB	**A EXCH B**	Exchanges A and B (EX).
	BML	**B–DL → B**	B – DL into B (BL).
TRACE PROCESSING	BLANK	**BLANK A BLANK B**	Stores and blanks specified trace register (A4 and B4).
	CLRW	**CLEAR WRITE A CLEAR WRITE B**	Clear-writes specified trace register (A1 and B1).
	MINH		Holds the minimum trace register values.
	MXMH	**MAX HOLD A MAX HOLD B**	Max-holds the specified trace register (A2 and B2).
	NORMLIZE	**NORMLIZE ON OFF**	Activates normalization routine.
	NRL	**NORM REF LVL**	Sets the normalized reference level.
	RCLT	**RECALL TO TRA RECALL TO TRB**	Recalls specified trace data.
	SAVET	**SAVE TO TRA SAVE TO TRB**	Saves specified trace data.
	TRA		Selects input and output of trace A.
	TRB		Selects input and output of trace B.
	VAVG	**VID AVG ON OFF**	Turns video averaging on or off.
	VIEW	**VIEW A VIEW B**	Views specified trace register (A3 and B3).
TRIGGER	CONTS	**SWEEP CONT SGL (CONT)**	Selects continuous sweep mode (S1).
	SNGLS	**SWEEP CONT SGL (SGL)**	Selects single sweep mode (S2).
	TM	**FREE RUN VIDEO LINE EXTERNAL**	Selects trigger mode: free run (T1), video (T4), line (T2), external (T3).
	TRIGPOL	**TRIG POL POS NEG**	Selects the edge (positive or negative) of the trigger input that causes the trigger event.
	VTL	**VIDEO**	Video trigger level.

Agilent 8566A and Agilent 8568A Compatible Commands

This is a list of commands from the Agilent 8566A and Agilent 8568A spectrum analyzers that use the same mnemonic as the 8560 E- Series and EC-Series. The preferred 8560 E-Series and EC-Series mnemonic is also listed. Other commands may have the same mnemonic, but their results may differ slightly.

This command compatibility allows programs that were originally written for the Agilent 8566A and Agilent 8568A spectrum analyzers to be used with the 8560 E-Series and EC-Series spectrum analyzers, with only minor modifications. We recommend that you do not use the old Agilent 8566A/8568A commands when writing new programs for the 8560 E-Series and EC-Series.

Table 6-3 Backward-Compatible Commands

Agilent 8566A Agilent 8568A Command	Preferred Agilent 8560 E-Series and EC-Series Command	Description
A1	CLRW TRA	Clear-Write Trace A
A2	MXMH TRA	Maximum Hold Trace A
A3	VIEW TRA	Store-View Trace A
A4	BLANK TRA	Blank Trace A
B1	CLRW TRB	Clear-Write Trace B
B2	MXMH TRB	Maximum Hold Trace B
B3	VIEW TRB	Store-View Trace B
B4	BLANK TRB	Blank Trace B
BL	BML	Trace B minus Display Line
C1	AMB OFF	Trace A minus Trace B off
C2	AMB ON	Trace A minus Trace B on
CA	AT AUTO	Couples the RF attenuator
CR	RB AUTO	Couples the resolution bandwidth
CS	SS AUTO	Couples the center frequency step size
CT	ST AUTO	Couples the sweep time
CV	VB AUTO	Couples the video bandwidth

Table 6-3 Backward-Compatible Commands

Agilent 8566A Agilent 8568A Command	Preferred Agilent 8560 E-Series and EC-Series Command	Description
E1	MKPK HI	Marker to highest peak
E2	MKCF	Marker to Center Frequency
E3	MKSS	Marker Frequency to Center Frequency Step Size
E4	MKRL	Marker to Reference Level
EX	AXB	Exchange Trace A and Trace B
GZ	GHZ	Gigahertz (unit)
KZ	KHZ	Kilohertz (unit)
L0	DL OFF	Display Line off
LB	TEXT	Write text to display
M1	MKOFF	Marker off
M2	MKN	Marker Normal on
M3	MKD	Marker Delta on
MA	MKA?	Query Marker Amplitude
MF	MKF?	Query Marker Frequency
MZ	MHZ	Megahertz (unit)
MT0	MKTRACK OFF	Marker Track off
MT1	MKTRACK ON	Marker Track on
PRSDAC	PSDAC	Query Preselector DAC number
RC	RCLS	Recall Instrument State
S1	CONTS	Continuous Sweep
S2	SNGLS	Single Sweep
SV	SAVES	Save Instrument State
T1	TM	Trigger Mode Free Run
T2	TM LIN	Trigger Mode Line
T3	TM EXT	Trigger Mode External
T4	TM VID	Trigger Mode Video
TA	TRA?	Trace A Data

Table 6-3 Backward-Compatible Commands

Agilent 8566A Agilent 8568A Command	Preferred Agilent 8560 E-Series and EC-Series Command	Description
TB	TRB?	Trace B Data

Mass Memory Module Commands

The following commands are available when the Agilent 85620A mass memory module is being used with the spectrum analyzer. See the documentation for the Agilent 85620A for more information.

Table 6-4 Mass Memory Module Commands

ABORT	Controls flow of your program.
ABS	Places the absolute value of the source values in the destination.
ACTVFUNC	Creates a user-defined active function.
ADD	Adds the sources and sends the sum to the destination.
ARRAYDEF	Defines an array.
AUTOEXEC	Turns on or off the function that was defined with the AUTOFUNC command.
AUTOFUNC	Defines a function for automatic execution.
AUTOSAVE	Automatically saves traces.
AVG	Averages the source and the destination.
CARDLOAD	Copies data from the memory card to module memory.
CARDSTORE	Copies data to a memory card.
CATALOG	Catalogs the files in the mass memory module or memory card.
CLRDSP	Clears the display.
CLRSCHED	Clears the Autosave and Autoexec Schedule buffer.
CNTLA	Controls auxiliary control line A.
CNTLB	Controls auxiliary control line B.
CNTLC	Controls auxiliary control line C.
CNTLD	Controls auxiliary control line D.
CNTLI	Reads auxiliary control line I.
CTRLHPIB	Allows the spectrum analyzer to control the GPIB.
DATEMODE	Allows you to set the format for displaying the real-time clock.
DISPOSE	Deletes user-defined functions.
DIV	Divides source 1 by source 2 and places the result in the destination.
DSPLY	Displays the value of a variable on the spectrum analyzer screen.
EDITDONE	Indicates that the limit-line editing is complete.
EDITLIML	Allows you to edit the current limit line.
EM	Erases user display memory.
ENTER	Allows the spectrum analyzer to receive data from other devices on the GPIB.
EXP	Places the exponential of the source in the destination.
FORMAT	Formats a memory card using default parameters.
FUNCDEF	Defines a routine consisting of spectrum analyzer commands, assigns the routine a label, and stores the routine and its label in the user memory.

Table 6-4 Mass Memory Module Commands

IF	IF THEN ELSE ENDIF forms a decision and branching construct.
INT	Places the greatest integer that is less than or equal to the source value into the destination.
KEYCLR	Clears softkeys 1 through 6.
KEYDEF	Assigns a label and user-defined function to a softkey.
LCLVAR	Defines a local variable for use within a downloadable program.
LIMD	Enters the delta amplitude value for a limit-line segment.
LIMF	Enters the frequency value for a limit-line segment.
LIMIFAIL	Returns a "0" if the last measurement sweep of trace A is equal to or within the limit-line bounds.
LIMIPURGE	Disposes of the current limit line, but not the limit-line table.
LIMIRCL	Recalls a limit line table from module memory.
LIMIREL	Specifies a relative limit line.
LIMISAV	Saves the current limit-line table in module memory.
LIMITEST	Compares trace A with the current limit-line data.
LIML	Assigns an amplitude value to a limit-line segment in the lower limit line.
LIMM	Assigns a middle amplitude value to a limit-line segment.
LIMTFL	Specifies a flat limit-line segment.
LIMTSL	Specifies a sloped limit-line segment.
LIMU	Assigns an amplitude value to a limit-line segment in the upper limit line.
LOG	Takes the logarithm (base 10) of the source, multiplies the result by the scaling factor, then stores it in the destination.
MEAN	Returns the mean value of the given trace in measurement units.
MEM	Returns the amount of spectrum analyzer memory available.
MENU	Selects and displays the softkey menus on the spectrum analyzer screen.
MIN	Compares source 1 and 2, point by point, and stores the lesser of the two in the destination.
MOD	Stores the remainder from the division of source 1 by source 2 in the destination.
MODRCLT	Recalls the trace from module memory.
MODSAVT	Saves the trace in module memory.
MOV	Copies the source values into the destination.
MPY	Multiplies the sources, point by point, and places the results in the destination.
MSDEV	Specifies the mass storage device.
MXM	Compares source 1 and source 2, point by point, sending the greater value of each comparison to the destination.
ONEOS	Executes the list of analyzer commands after the end of the sweep.

Table 6-4 Mass Memory Module Commands

OR	Sets the origin.
OUTPUT	Allows the spectrum analyzer to send data to other devices on the GPIB.
PA	Moves the pen to a vector location on the spectrum analyzer screen relative to the reference coordinates (0,0).
PD	Instructs the spectrum analyzer to plot vectors on the spectrum analyzer screen until a PU command is received.
PDA	Sums the probability distribution of amplitude in the destination trace with the amplitude distribution function of the source trace.
PDF	Increments an element of the destination trace whenever the corresponding element of the source trace exceeds a threshold.
PEAKS	Sorts signal peaks by frequency or amplitude, stores the results in the destination trace, and returns the number of peaks found.
PR	Moves the pen to a new plot location on the spectrum analyzer screen relative to the current coordinates in display units.
PU	Instructs the spectrum analyzer not to plot vectors on the spectrum analyzer screen until a PD command is received.
RELHPIB	Releases spectrum analyzer control of the GPIB.
REPEAT UNTIL	Forms a looping construct.
RETURN	Stops the operation of a user-defined command and returns program operation to the point where the user-defined function was called.
RMS	Returns the root mean square value of the trace in measurement units.
SADD	Adds a limit-line segment.
SDEL	Deletes the limit-line segment.
SDON	Indicates that the limit-line segment is done.
SEDI	Edits the limit-line segment.
SENTER	Enters the limit-line segment into the limit-line table.
SETDATE	Sets the date of the real-time clock.
SETTIME	Sets the time of the real-time clock.
SHOWMENU	Shows menu.
SKYCLR	Clears user softkey.
SKYDEF	Defines user softkey.
SMOOTH	Smooths the trace according to the number of points specified for the running average.
SQR	Places the square root of the source into the destination.
STDEV	Returns the standard deviation of the trace amplitude in measurement units.
SUB	Subtracts source 2 from source 1, point by point, and sends the difference to the destination.

Table 6-4 Mass Memory Module Commands

SUM	Returns the sum of the amplitudes of the trace elements in measurement units.
SUMSQR	Returns the sum of the squares of the amplitude of each trace element.
TEXT	Writes text on the analyzer screen at the current pen position.
TIMEDATE	Sets the time and date of the real-time clock.
TRDEF	Declares a user-defined trace.
VARDEF	Creates a user-defined variable and assigns it a value.
VARIANCE	Returns the amplitude variance of the specified trace, in measurement units.

7 Language Reference

Language Reference Features

This chapter contains complete information for the programming commands available to operate an 8560 E-Series or EC-Series spectrum analyzer.

Cross-reference information for the softkeys and programming commands are supplied in Chapter 6. The commands available when using the mass memory module with the spectrum analyzer are listed in Table 6-4 on page 365.

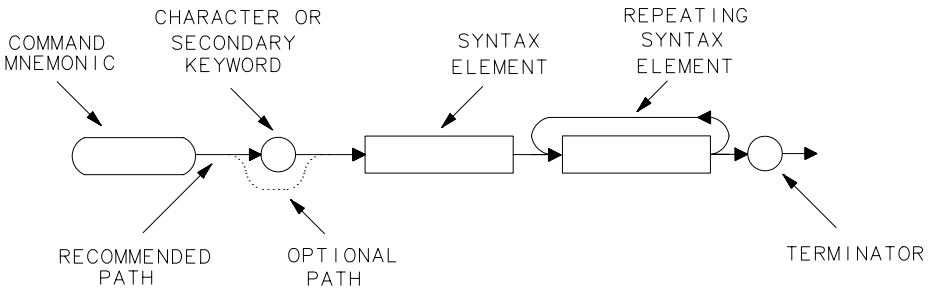
- **Syntax Diagram Conventions** describes the pictorial notation that represents the proper syntax for each command.
- **Syntax Elements** are listed in Table 7-1 on page 372.
- **Secondary Keywords and Characters** (Reserved Words) used by the programming commands are listed in Table 7-1 on page 372.
- **Programming commands** are listed in alphabetical order according to their mnemonic, followed by a complete description of their syntax, parameters, and function.

If using languages other than Rocky Mountain Basic (HP Basic), the information within quotes in the examples can be used with IBREAD and IBWRITE. For example, `718;"ACPWRTX?;"` can be written as `IBWRITE` (address, command string, error string).

Syntax Diagram Conventions

Command syntax is represented pictorially.

Figure 7-1 Command Syntax Figure



- Ovals enclose command mnemonics. The command mnemonic must be entered exactly as shown.
- Circles and ovals surround secondary keywords or special numbers and characters. The characters in circles and ovals are considered reserved words and must be entered exactly as shown. Table 7-1 on page 372 lists the characters and secondary keywords that are used in the syntax diagrams.

  Rectangles surround elements of the language being defined. All the syntax elements are defined in Table 7-1.

  A loop above a syntax element indicates that the syntax element can be repeated.

  Solid lines represent the recommended path.

  Dotted lines indicate a optional path for bypassing secondary keywords or using alternate units.
- Arrows and curved intersections indicate command path direction.

  A semicolon, line feed (LF), carriage return (CR), space (SP), or comma can be used to terminate the command line. A semicolon is the recommended terminator.

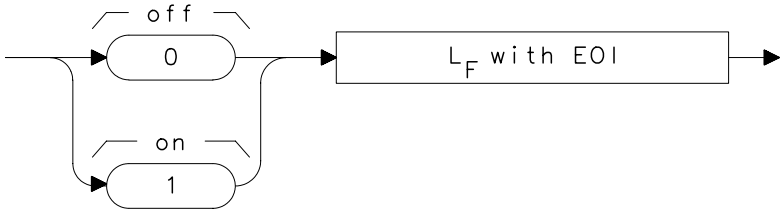
NOTE Uppercase is recommended for entering all commands unless otherwise noted.

Query Responses

Figure 7-2 Numeric Value Query Response

Commands that set a function to a numeric value can be queried to determine the current setting of that function. For example, the CF command sets the center frequency to a numeric value in hertz. The format for the response to a CF query command is shown above. Refer to Table on page 372 for definitions of syntax elements.

Figure 7-3 Binary State Query Response



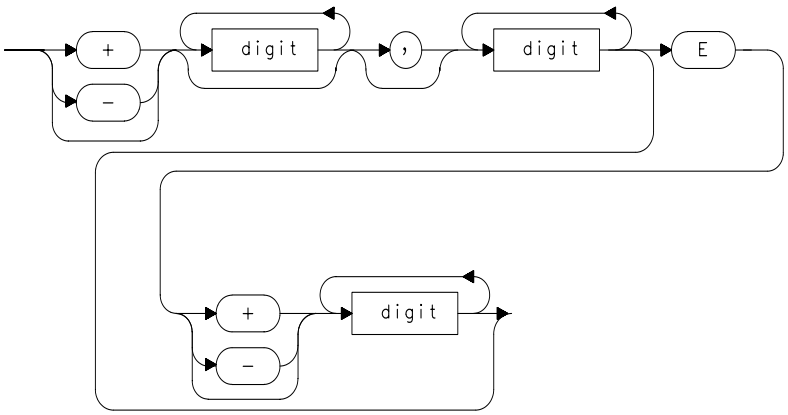
Other commands that control the binary state (on or off) of a function can also be queried to determine its state. Examples are commands that accept ON and OFF parameters such as the ANNOT or GRAT commands. The query response in this case, as shown above, is either zero (indicating that the queried state is off or inactive) or one (indicating that the queried state is on or active). As an example, GRAT? will return a zero if the display graticule is off, and a one if it is on.&&

Syntax elements are shown in the syntax diagrams as elements within rectangles.

Table 7-1 Syntax Elements

Syntax Component	Definition/Range
character	S_P a b c d e f g h i j k l m n o p q r s t u v w x y z data byte.
character &EOI	8-bit byte containing only character data and followed by end-or-identify (EOI) condition, where the EOI control line on GPIB is asserted to indicate the end of the transmission. END signifies the EOI condition.
data byte	8-bit byte containing numeric or character data.
data byte &EOI	8-bit byte containing numeric or character data followed by end-or-identify (EOI) condition, where the EOI control line on GPIB is asserted to indicate the end of the transmission. END signifies the EOI condition.

Table 7-1 Syntax Elements

Syntax Component	Definition/Range
delimiter	! $ % & ' / : = \ @ &^ ` | ~ A character, chosen from the above list, marks the beginning and end of a string of characters. For simplified use, choose delimiters that are *not* the same as any character within the string they delimit. Otherwise, every occurrence of the delimiter character inside the string being delimited must be replaced with a *pair* of delimiters when forming the delimited string.
digit	0 1 2 3 4 5 6 7 8 9
L_F with EOI	Line feed (L_F) with end-or-identify (EOI). ASCII code 10 (line feed) is sent with EOI control line.
lsb length	Represents the least significant byte of a two-byte word that describes the number of bytes returned or transmitted. See msb length.
msb length	Represents the most significant byte of a two-byte word that describes the number of bytes returned or transmitted. See lsb length.
number	Expressed as integer, decimal, or in exponential (E) form. Range: -10^{+100} through $+10^{+100}$. The smallest positive fractional number that can be represented is $+10^{-100}$. This is the range of numbers that can be used in commands. This range is further restricted when numbers are attached to specific types of units: • frequency values are limited to ±1000 GHz. • amplitude values are limited to ±300 dBm or ±300 dB. • power values are limited to ±300 dBm or ±300 dB. The above ranges can be further limited by hardware. These limitations are identified under the individual command descriptions. Precision: approximately 15 decimal digits, unless otherwise limited by hardware. Length: the complete number must be less than 25 characters.  qlength

In the syntax diagrams, characters and secondary keywords are shown within circles or ovals. Characters and secondary keywords must be entered exactly as shown.

Table 7-2 Characters and Secondary Keywords (Reserved Words)

Element	Description
A	ampere (unit); A-block data format; external mixer frequency band
AC	alternating current (coupling)
ALL	all (marker off, plot screen)
AM	amplitude modulation (DEMOD)
ANNT	annotation
AUTO	automatic operation
B	8-bit byte output format
CURR	current (IF adjustment)
D	external mixer frequency band
DB	relative decibel (unit)
DBM	absolute decibel milliwatt (unit)
DBMV	absolute decibel millivolt (unit)
DBUV	absolute decibel microvolt (unit)
DC	direct current (coupling)
DM	absolute decibel milliwatt (unit)
DN	decrement the parameter
DSP	display
E	external mixer frequency band
EDGE	trigger edge
EP	enable parameter for front panel operator entry (see note below)
EXT	external (reference, mixer mode)
F	external mixer frequency band
FAV	frequency analog voltage (0.5 V/GHz)
FAVA	frequency analog voltage attenuated (0.25 V/GHz)
FLATTOP	FFT window format
FM	frequency modulation (DEMOD)
FREE	free run
FULL	full band span width
G	external mixer frequency band
GHZ	gigahertz (unit)
GRT	graticule
GZ	gigahertz (unit)
HANNING	FFT window format
HARM	harmonic number (frequency diagnostic)
HI	highest
HZ	hertz
I	I-block data format

Table 7-2 Characters and Secondary Keywords (Reserved Words)

Element	Description
INT	internal (reference, mixer mode)
J	external mixer frequency band
K	external mixer frequency band
KHZ	kilohertz (unit)
KZ	kilohertz (unit)
LAST	previous state before a change or previous span before a change
LEVEL	trigger level
LINE	line, as in line trigger
LO	local oscillator (frequency diagnostic)
M	ASCII display data output format
MA	milliamp (unit)
MAN	manual operation
MHZ	megahertz (unit)
MROLL	fractional N frequency (frequency diagnostic)
MS	millisecond (unit)
MSEC	millisecond (unit)
MV	millivolt (unit)
MW	milliwatt (unit)
MZ	megahertz (unit)
NEG	negative peak detection or negative polarity
NH	next highest
NL	next left
NR	next right
NRM	normal rosenfell detection
OA	function query (same as "?")
OFF	turn function off
ON	turn function on
P	real number output format
POS	positive peak detection or positive polarity
POSTSC	postscaler value
PRE	preselected external mixer mode
PWRON	sets same state as turning power on
Q	external mixer frequency band
RAMP	sweep ramp voltage (LO SWP)
RAWOSC	raw oscillator frequency
S	second (unit)
SA	spectrum analyzer (sweep time coupling)
SC	second (unit)
SEC	second (unit)
SMP	sample detection, sampling oscillator (frequency diagnostic)

Table 7-2 Characters and Secondary Keywords (Reserved Words)

Element	Description
SR	stimulus response (sweep time coupling)
TRA	trace A
TRB	trace B
U	external mixer frequency band
UA	microamp (unit)
UNIFORM	FFT window format
UNPR	unpreselected external mixer mode
UP	increment the parameter
UV	microvolt (unit)
US	microsecond (unit)
V	volt (unit); external mixer frequency band
VID	video
W	watt (unit); external mixer frequency band
Y	external mixer frequency band
ZERO	zero span
0	off
1	on
?	returns a query response containing the value or state of the associated parameter (same as OA)

NOTE After executing a command with EP as a secondary keyword, select a numeric value using the spectrum analyzer **DATA** keys, **STEP** keys, or knob. When using the data keys, be sure to terminate the value with a units key (such as **Hz**, **dBm**, and so on.). When using the step keys or the knob, terminate the value with **HOLD**.

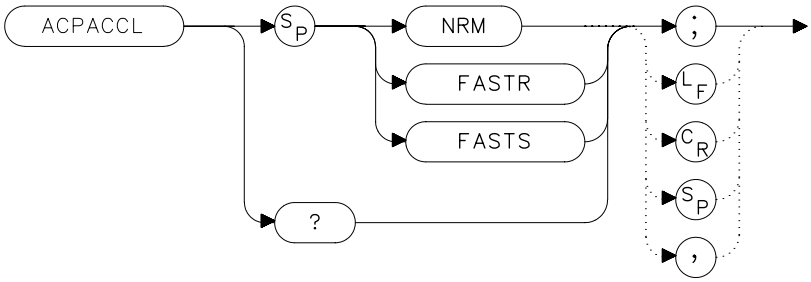
Programming Commands

This chapter contains the programming commands. Each spectrum analyzer command is described in this section. Before using this part of the manual, you may want to refer to Chapter 5 of this manual.

ACPACCL Accelerate Adjacent Channel Power Measurement

Syntax

Figure 7-4 ACPACCL Syntax



Description

The ACPACCL command sets the acceleration of the adjacent channel power measurement to normal (NRM), faster (FASTR), or fastest (FASTS). The ACP measurement techniques are changed when faster and fastest are selected to speed up the measurement process. This results in a degradation in the amplitude accuracy of 1 dB for faster and as much as 2 dB for fastest. Refer to the softkey description of ACCELERAT for more information.

Parameters

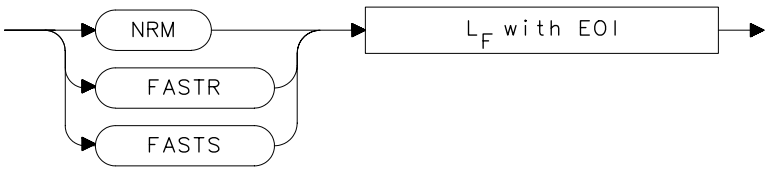
NRM, FASTR, FASTS

Preset State

NRM (normal)

Query Response

Figure 7-5 ACPACCL Query Response



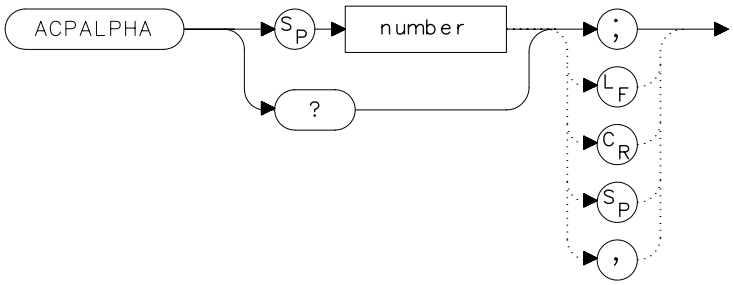
Example

```
10   OUTPUT 718;"ACPACCL FASTR;"
```

ACPALPHA Adjacent Channel Power Alpha Weighting

Syntax

Figure 7-6 ACPALPHA Syntax



Description

The ACPALPHA command is used to set the alpha weighting for an adjacent channel power measurement.

Parameters

number unitless real number between 0 and 1

Query Response

Figure 7-7 ACPALPHA Query Response

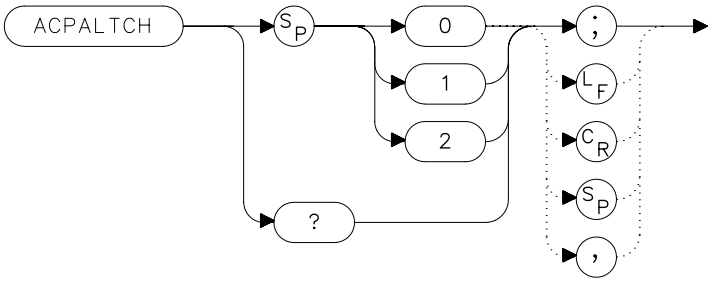
Example

```
10   REAL Alphaweight
20   Alphaweight = 0.13
30   OUTPUT 718;"ACPALPHA";Alphaweight;";"
40   END
```

ACPALTCH Adjacent Channel Power Alternate Channels

Syntax

Figure 7-8 ACPALTCH Syntax



Description

The ACPALTCH command sets the number of alternate channels to be measured by an adjacent channel power measurement to either 0, 1, or 2. Zero is the default. The number of alternate channels is used with the ACPRSLTS command.

Query Response

Figure 7-9 ACPALTCH Query Response

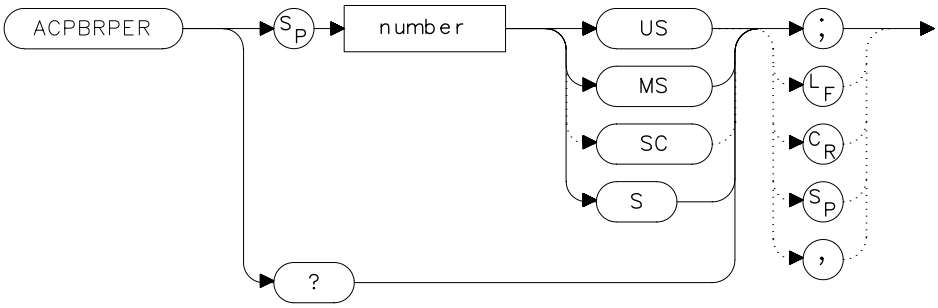
Example

```
10   INTEGER Altchannel
20   Altchannel = 2
30   OUTPUT 718;"ACPALTCH";Altchannel;";"
40   END
```

ACPBRPER Adjacent Channel Power Burst Period

Syntax

Figure 7-10 ACPBRPER Syntax



Description

The ACPBRPER command sets the cycle time (period) of the burst RF signal. The cycle time is needed to set the sweep times when using the peak, two bandwidth, burst power, and gated methods for adjacent channel power measurements.

Parameters

number 50 µs to 10 seconds

Query Response

Figure 7-11 ACPBRPER Query Response

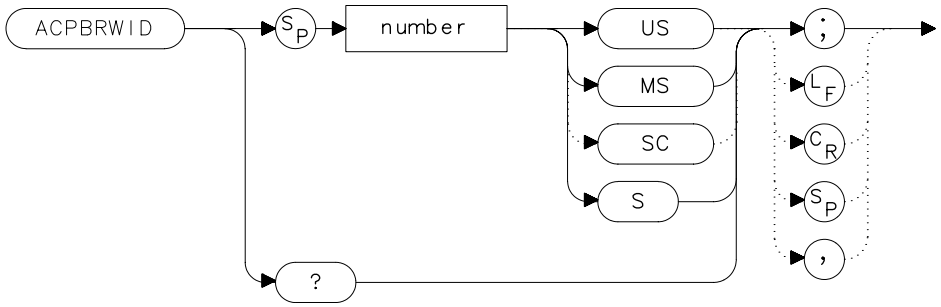
Example

```
10  REAL Burstperiod
20  Burstwidth = 20.0
30  OUTPUT 718;"ACPBRWID";Burstwidth;"MS;";
```

ACPBRWID Adjacent Channel Power Burst Width

Syntax

Figure 7-12 ACPBRWID Syntax



Description

The ACPBRWID command sets the on-time (pulse width) of the burst RF signal. The pulse width is needed to set the gating times when using the gated method for adjacent channel power measurements.

Parameters

number 5 µs to 9.5 seconds

Query Response

Figure 7-13 ACPBRWID Query Response

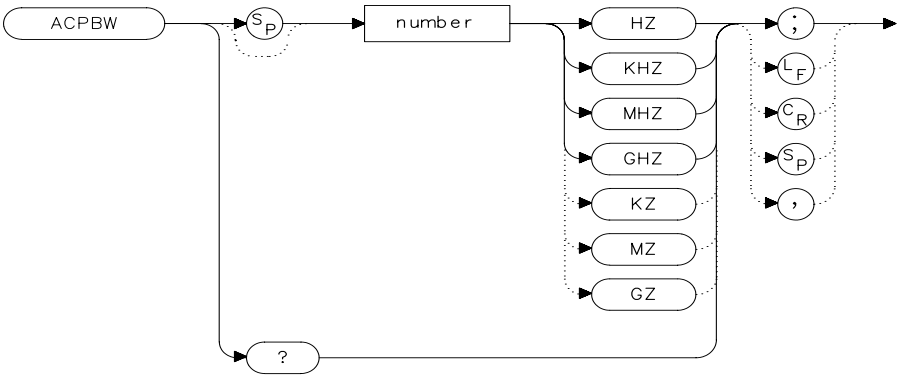
Example

```
10  REAL Burstwidth
20  Burstwidth = 6.53
30  OUTPUT 718;"ACPBRWID";Burstwidth;"MS;";
```

ACPBW Adjacent Channel Power Channel Bandwidth

Syntax

Figure 7-14 ACPBW Syntax

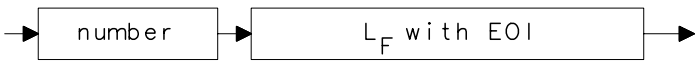


Description

The ACPBW command sets the bandwidth of the channels as an active function for the ACPMEAS and ACPCOMPUTE commands. The channel bandwidth cannot be greater than the channel spacing. If the channel bandwidth is greater than the channel spacing, the spacing is automatically increased. Checking for proper limits is performed in the ACPMEAS and ACPCOMPUTE measurement algorithms. The query returns the channel bandwidth in hertz.

Query Response

Figure 7-15 ACPBW Query Response



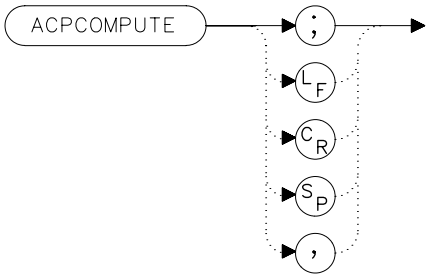
Example

```
10   REAL Channelbw
20   Channelbw = 8.5E3
30   OUTPUT 718;"ACPBW";Channelbw;";"
40   END
```

ACPCOMPUTE Adjacent Channel Power Compute

Syntax

Figure 7-16 ACPCOMPUTE Syntax



Description

The ACPCOMPUTE command calculates the adjacent channel power (ACP) of a transmitter based on the data that is on the display. This function does not make a new measurement before computing. The measurement must have been made with analog or peak method selected and with normal acceleration so the appropriate data is available to make the calculation.

The adjacent channel power measurement determines the leakage power that is in the adjacent channels from the carrier. The result is the ratio of the leakage power in the adjacent channel to the total power transmitted by the transmitter. This function is useful for making (ACP) calculations on data that has been recalled from memory.

The results generated by ACPCOMPUTE are categorized as follows and can be queried using the respective query command shown:

- lower channel power (ACPLOWER)
- upper channel power (ACPUPPER)
- total power transmitted (ACPPWRTX)
- maximum adjacent channel power (ACPMAX)

The following error messages may be observed when using this command:

- `ERR 908 BW>>SPCG` indicates that the channel bandwidth is too wide, compared to the channel spacing, for a valid computation.
- `ERR 909 SPAN<ACP` indicates that the frequency span is too narrow

to obtain a valid measurement.

- ERR 910 SPAN>ACP indicates that the frequency span is too wide, compared to the channel bandwidth, to obtain an accurate measurement.

If any of these errors occurs, the measurement is not completed. To make a measurement, adjust your instrument state settings depending on the error that has occurred.

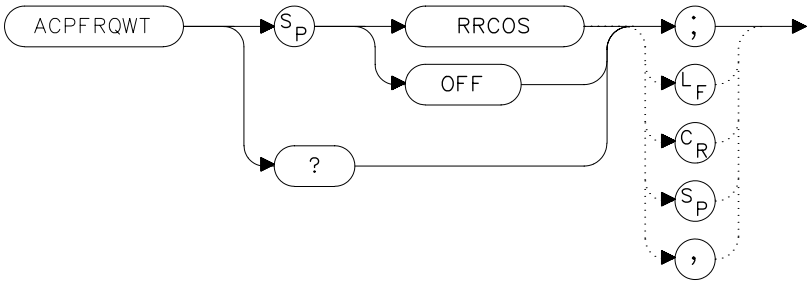
Example

```
10  OUTPUT 718;"ACPCOMPUTE;"
```

ACPFRQWT Adjacent Channel Power Frequency Weighting

Syntax

Figure 7-17 ACPFRQWT Syntax



Description

The ACPFRQWT command can be used to effect the frequency weighting when making an adjacent channel power measurement. Weighting is not used in the measurement if OFF has been selected. Root-raised-cosine weighting is selected with the RRCOS parameter.

Parameters

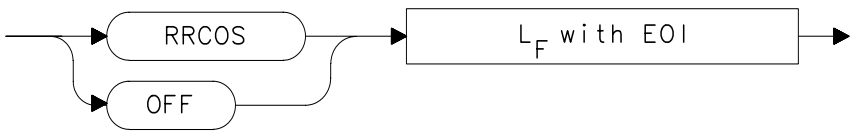
RRCOS, OFF

Preset State

Off

Query Response

Figure 7-18 ACPFRQWT Query Response



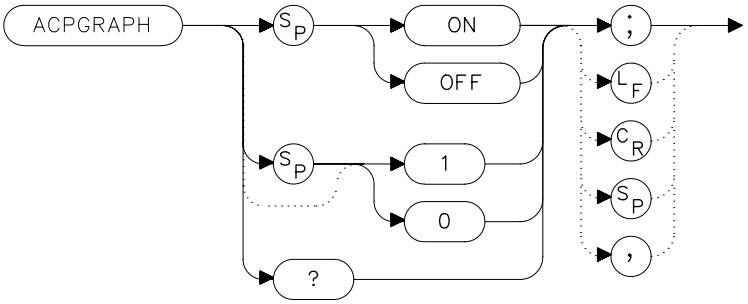
Example

```
10   OUTPUT 718;"ACPFRQWT OFF;"
```

ACPGRAPH Adjacent Channel Power Graph

Syntax

Figure 7-19 ACPGRAPH Syntax



Description

The ACPGRAPH command turns on or off a graphical representation of the adjacent channel power ratio, for the selected channel bandwidth, as a function of the channel spacing. The command requires data that is only available with the peak or analog method.

The upper graticule represents an ACP ratio of 0 dB. The vertical scale for the ACP graph is the same as the vertical scale for the spectrum trace, usually 10 dB/division. The horizontal scale represents the channel spacing, with 0 Hz spacing in the center and a scale factor that is the same as that for the spectrum trace, or the frequency span divided by 10 divisions.

The graph can demonstrate how rapidly the ACP ratio changes with channel spacing. The ACP graph is not defined for channel spacings where the graph is drawn at the bottom graticule line. For these points, the channel bandwidth would include frequencies beyond the edges of the screen, where no data was taken.

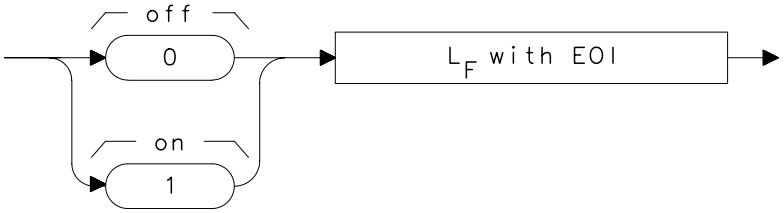
The ACP graph is drawn in trace B. Query trace B (see TRB command) to obtain the ACP graph via GPIB.

Preset State

Off

Query Response

Figure 7-20 ACPGRAPH Query Response



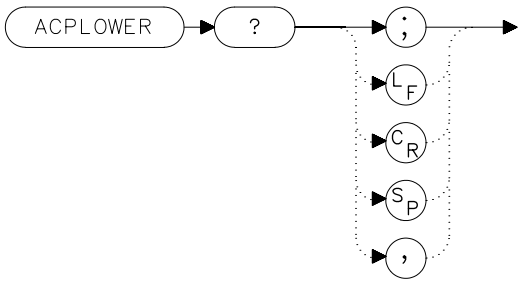
Example

```
10  OUTPUT 718;"ACPGRAPH ON;"
```

ACPLOWER Lower Adjacent Channel Power

Syntax

Figure 7-21 ACPLOWER Syntax



Description

The ACPLOWER query command returns the power ratio result of the adjacent channel power measurement for the lower frequency channel.

Query Response

Figure 7-22 ACPLOWER Query Response

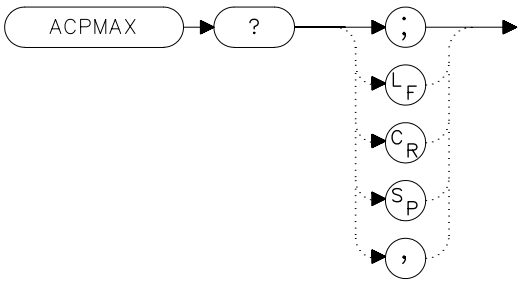
Example

```
10  REAL Low_chpwr
20  OUTPUT 718;"ACPLOWER?;"
30  ENTER 718;Low_chpwr
```

ACPMAX Maximum Adjacent Channel Power

Syntax

Figure 7-23 ACPMAX Syntax



Description

The ACPMAX query command returns the maximum adjacent channel power of the adjacent channel power measurement.

Query Response

Figure 7-24 ACPMAX Query Response

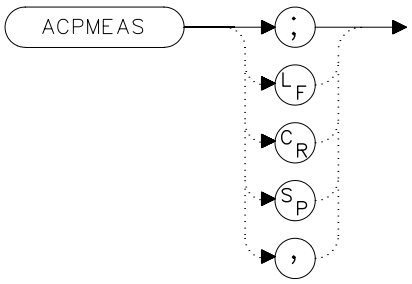
Example

```
10  REAL Max_chpwr
20  OUTPUT 718;"ACPMAX?;"
30  ENTER 718;Max_chpwr
```

ACPMEAS Measure Adjacent Channel Power

Syntax

Figure 7-25 ACPMEAS Syntax



Description

The ACPMEAS command makes a measurement and calculates the adjacent channel power (ACP) of a transmitter. The measurement determines the leakage power that is in the adjacent channels from the carrier. The result is the ratio of the leakage power in the adjacent channel to the total power transmitted by the transmitter.

The instrument state is evaluated to determine if the ACP measurement can be made with the current parameter settings. If the ACP state is set to default, the best settings for the measurement parameters will be used. If the ACP state is set to current, the measurement will be made with the current settings even though the results may not be optimum.

The instrument state parameters that can be affected by the ACPMEAS command are frequency span, resolution bandwidth, video bandwidth, and detection mode. If trace math or video averaging are currently on, they will be turned off.

The optional command SNGLS or CONTS can be used to make a single measurement, or to measure continuously. If no parameter is specified, the measurement is only made once. The results generated by ACPMEAS are categorized as follows and can be queried using the respective query command shown:

- lower channel power (ACPLOWER)
- upper channel power (ACPUPPER)
- total power transmitted (ACPPWRTX)
- maximum adjacent channel power (ACPMAX)

The current channel spacing and channel bandwidth values are also displayed as follows:

- channel spacing (ACPSP)
- channel bandwidth (ACPBW)

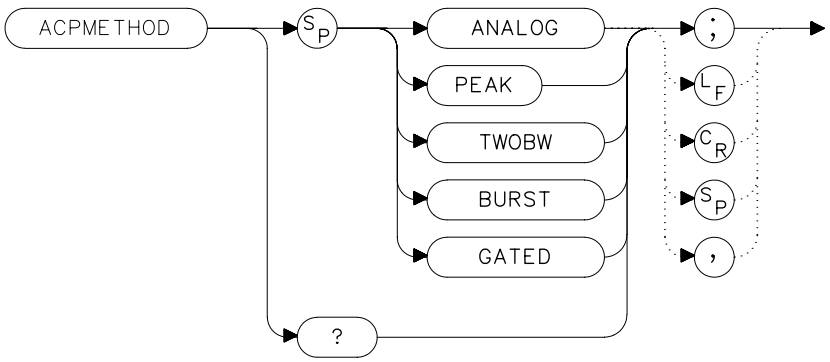
Example

```
10  REAL Lower,Upper,Total_pwr,Max_acp
20  OUTPUT 718;"ACPMEAS;"
30  OUTPUT 718;"ACPLOWER?;"
40  ENTER 718;Lower
50  OUTPUT 718;"ACPUPPER?;"
60  ENTER 718;Upper
70  OUTPUT 718;"ACPPWRTX?;"
80  ENTER 718;Total_pwr
90  OUTPUT 718;"ACPMAX?;"
100 ENTER 718;Max_acp
110 PRINT USING "K,K";"ACPUPPER= ",Upper
120 PRINT USING "K,K";"ACPLOWER= ",Lower
130 PRINT USING "K,K";"ACPPWRTX= ",Total_pwr
140 PRINT USING "K,K";"ACPMAX= ",Max_acp
150 END
```

ACPMETHOD Adjacent Channel Power Measurement Method

Syntax

Figure 7-26 ACPMETHOD Syntax



Description

The ACPMETHOD command is used to select the measurement method for making an adjacent channel power measurement (ACP). The selections include the analog method, peak method, two bandwidth method, burst method and gated method.

ANALOG METHOD **Continuous power integration versus frequency measurement** Selects the analog method which measures the power in the main and adjacent channels assuming a continuous carrier. The rms power of that carrier is detected using power detection. This is done by using a video bandwidth that is much wider than the resolution bandwidth. Then the power, not the log of the power, of each measurement cell is added. This method measures analog FM systems.

PEAK METHOD **Peak power integration measurement for TDMA** This method is similar to the analog measurement used by the analog method except that positive peak detection is used, allowing the measurement of burst carriers. For this method, the sweep time is set to 600 times the burst period.

There are 600 measurement cells per sweep, so this sets one burst RF cycle per measurement cell. This method supports 1993 MKK standard for PDC systems and the 1993 RCR standards for PHP systems.

2BW METHOD **Two bandwidth, transient and random peak measurement for TDMA** This method is meant for use with burst signals. The sweep time is set to 600 times the burst period. Two sweeps are made, one in each of two resolution bandwidths and positive peak detection is used. This method supports 1993 RCR standard for PDC systems.

The algorithm used for this method assumes that the power in the adjacent channels consists of two types of power: impulsive power (transients due to enabling and disabling the carrier power) and random power (noise-like signals due to the intermodulation of noise-like modulation in the main channel). The characteristics of these two types of power change differently with resolution bandwidth changes, so they can be estimated algebraically from measurements in two bandwidths.

The impulsive powers for all frequencies within each adjacent channel are converted to an equivalent voltage. These voltages are assumed to be in phase so they are added to estimate a peak voltage in the channel and a peak power is computed. The random powers are all added within a channel to give a peak random power. The peak random power is added to the peak impulsive power to give a peak weighted power.

BURSTPWR METHOD **Burst power, transient and random peak average power measurement** This method performs a measurement and computation to find the impulsive and random powers similar to the two-bandwidth method, but using a different and faster technique. It also computes the true power ratio between the main and adjacent channels, without peak weighting or assumptions about phase relationships, using an rms-responding technique.

GATED METHOD **Transient and random peak measurement for TDMA** This method is the same as the two-bandwidth method except that the random and impulsive powers are separated using a different technique. Gated video techniques are used to allow a response to just the peak of the random part of the adjacent channel power.

The impulsive part of the power is found by the power difference between an ungated measurement and the gated measurement. This method supports the TIA/EIA IS-54 NADC/TDMA measurements.

Parameters

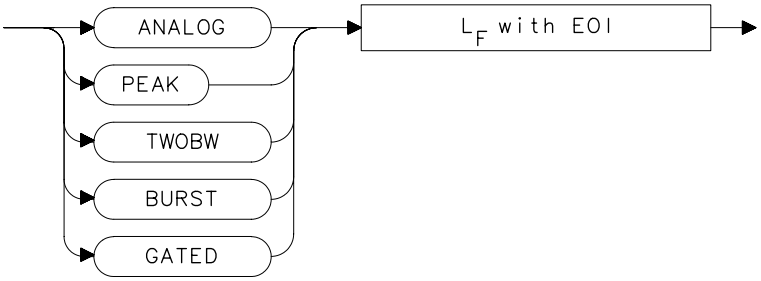
ANALOG, PEAK, TWOBW, BURST, GATED

Preset State

Analog

Query Response

Figure 7-27 ACPMETHOD Query Response



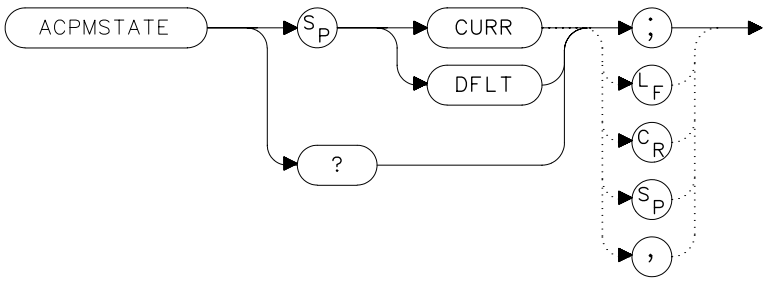
Example

```
10   OUTPUT 718;"ACPMETHOD TWOBW;"
```

ACPMSTATE Adjacent Channel Power Measurement State

Syntax

Figure 7-28 ACPMSTATE Syntax



Description

The ACPMSTATE command sets the parameters of the measurement state to either the default state (determined by the rest of the setup) or the current state. Using the current state allows you to select unusual conditions, such as testing to emerging standards that did not exist at the time this function was created.

The state parameters that could change between the default state and a current state include:

- Resolution bandwidth
- Video bandwidth
- Span
- Sweep time
- Detector mode
- Gating parameters
- Trigger parameters
- Video averaging

The center frequency for the measurement is always determined by the current state. The reference level, input attenuation, and scale are also determined by the current state.

Preset State

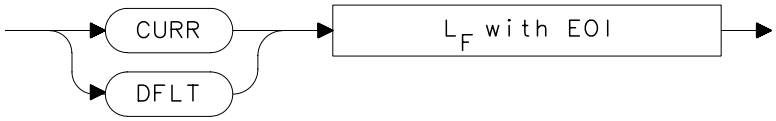
default

Parameters

CURR (current), DFLT (default)

Query Response

Figure 7-29 ACPMSTATE Query Response



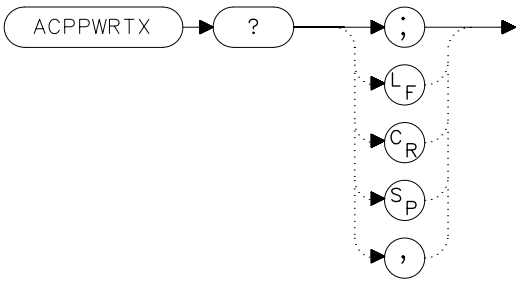
Example

```
10  OUTPUT 718;"ACPMSTATE CURR;"
```

ACPPWRTX Total Power Transmitted

Syntax

Figure 7-30 ACPPWRTX Syntax



Description

The ACPPWRTX query command returns the result of the total power transmitted calculation of the adjacent channel power measurement. The measurement must be made with the analog or burst power method selected.

Query Response

Figure 7-31 ACPPWRTX Query Response

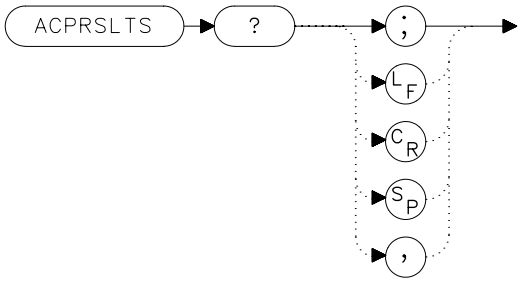
Example

```
10  REAL Totalpwr
20  OUTPUT 718;"ACPPWRTX?;"
30  ENTER 718;Totalpwr
```

ACPRSLTS Adjacent Channel Power Measurement Results

Syntax

Figure 7-32 ACPRSLTS Syntax



Description

The ACPRSLTS command returns an array of power data resulting from an adjacent channel power measurement of an RF signal. The size of the array is determined by the number of alternate channel pairs selected by the ACPALTCH command. (The default is 0.)

Power measurements and calculations are made for the selected channels. Different measurement methods (that is, ANALOG, 2BW) provide different power measurements. These power ratios are described below:

ACP Ratio It is a measure of the channel power that is done as a continuous integration.

Random Power It is a measure of the power (usually noise-like) that exists between the leading and falling edge transients of a burst signal.

Impulsive Power It is the peak power of the leading or falling edge (whichever is higher) of a burst signal.

Weighted Power It is a summed combination of the random power and impulsive power.

Average Power It is a measure of all the power in the pulse of a burst signal. This value is only available if the burst power method is selected.

The measurement method and the number of alternate channels you have selected determine the size of the data array that will be returned by the ACPRSLTS command. Table 7-1 indicates the values that will be returned for each method. The values are returned in the order indicated in the table. One set of values is returned if the number of alternate channels is set to zero. Each additional alternate channel pair selected will return another set of values. See Table 7-4 on page 402.

Table 7-3 ACP Methods Versus Results (with 0 Alternate Channels)

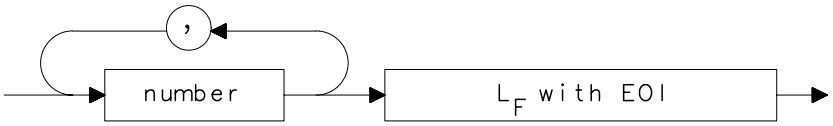
Method	Number of Results/Set	Results (in order of output)
Analog	2	ACP ratio (lower channel) ACP ratio (upper channel)
Peak	2	ACP ratio (lower channel) ACP ratio (upper channel)
2BW	6	Random power (lower channel) Impulsive power (lower channel) Weighted power (lower channel) Random power (upper channel) Impulsive power (upper channel) Weighted power (upper channel)
Gated	6	Random (lower channel) Impulsive power (lower channel) Weighted power (lower channel) Random (upper channel) Impulsive power (upper channel) Weighted power (upper channel)
Burstpwr	8	Random power (lower channel) Impulsive power (lower channel) Weighted power (lower channel) Average power (lower channel) Random power (upper channel) Impulsive power (upper channel) Weighted power (upper channel) Average power (upper channel)

Table 7-4 Alternate Channels

Alternate Channels	Channels Used For Calculation	Number of Values Returned
0	main channel lower adjacent channel upper adjacent channel	1 set (see Table 7-1 on page 372)
1	above channels plus: first alternate lower channel first alternate upper channel	2 sets (see Table 7-1 on page 372)
2	above channels plus: second alternate lower channel second alternate upper channel	3 sets (see Table 7-1 on page 372)

Query Response

Figure 7-33 ACPRSLTS Query Response



Example

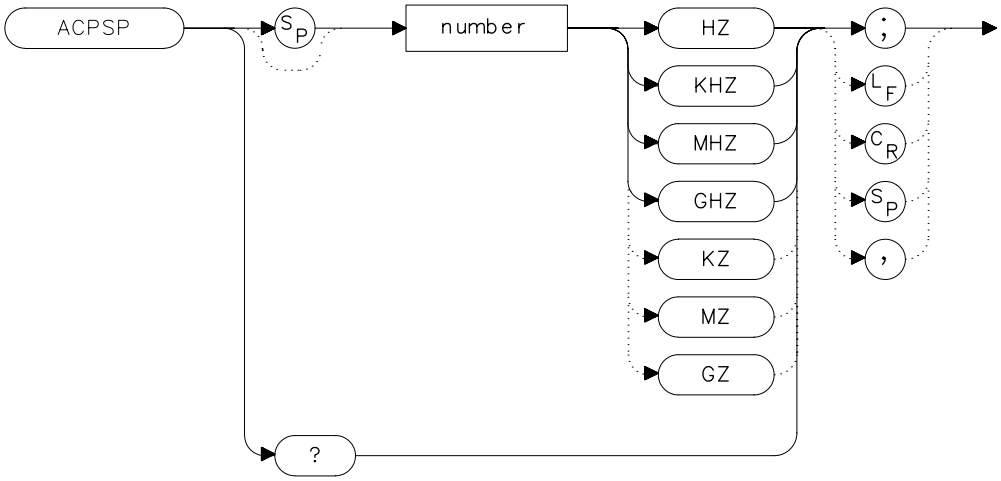
```
10  OUTPUT 718;"ACPALTCH 0;"
20  OUTPUT 718;"ACPMETHOD BURST;"
30  OUTPUT 718;"ACPMEAS;"
40  OUTPUT 718;"ACPRSLTS?;"
50  ENTER 718;Low_random;Low_impulse;Low_weight;Low_avg;
Up_random;Up_impulse;Up_weight;Up_avg
60  END
```

```
10  OUTPUT 718;"ACPALTCH 2;"
20  OUTPUT 718;"ACPMETHOD ANALOG;"
30  OUTPUT 718;"ACPMEAS;"
40  OUTPUT 718;"ACPRSLTS?;"
50  ENTER 718;Low0_ratio;Up0_ratio
60  ENTER 718;Low1_ratio;Up1_ratio
70  ENTER 718;Low2_ratio;Up2_ratio
80  END
```

ACPSP Adjacent Channel Power Channel Spacing

Syntax

Figure 7-34 ACPSP Syntax



Description

The ACPSP command sets channel spacing as the active function for the ACPMEAS and ACPCOMPUTE commands. The spacing is set between a minimum of 100 Hz to a maximum of 50 GHz. The query returns the channel spacing in hertz. The channel bandwidth cannot be more than twice the channel spacing, to make a valid measurement. The channel bandwidth is normally less than or equal to the channel spacing. Typical channel spacing/channel bandwidth values used for standards for analog FM radios include the following:

Channel Spacing	Channel Bandwidth
12.5 kHz	8.5 kHz
20.0 kHz	14.0 kHz
25.0 kHz	16.0 kHz

Query Response

Figure 7-35 ACPSP Query Response

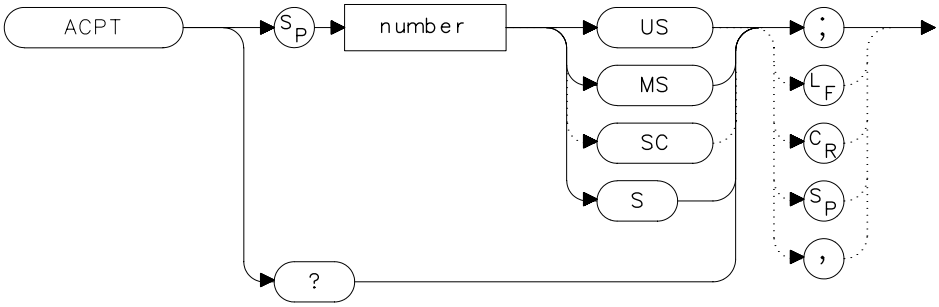
Example

```
10   REAL Channelsp
20   Channelsp = 12.5E3
30   OUTPUT 718;"ACPSP ";Channelsp;"HZ;"
40   END
```

ACPT Adjacent Channel Power T Weighting

Syntax

Figure 7-36 ACPT Syntax



Description

The ACPT command is used to set the T used in weighting for an adjacent channel power measurement.

Parameters

number real number between 1 µs and 1 s

Query Response

Figure 7-37 ACPT Query Response

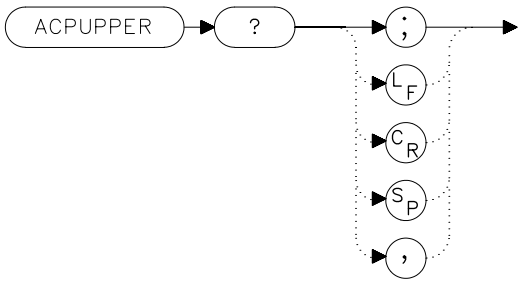
Example

```
10   REAL Tweight
20   Tweight = 41E-6
30   OUTPUT 718;"ACPT ";Tweight;"S;"
40   END
```

ACPUPPER Upper Adjacent Channel Power

Syntax

Figure 7-38 ACPUPPER Syntax



Description

The ACPUPPER query command returns the power ratio result of the adjacent channel power measurement for the upper frequency channel.

Query Response

Figure 7-39 ACPUPPER Query Response

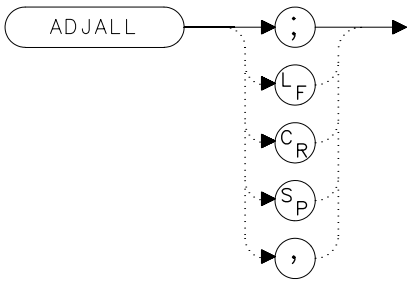
Example

```
10  REAL Up_chpwr
20  OUTPUT 718;"ACPUPPER?;"
30  ENTER 718;Up_chpwr
```

ADJALL LO and IF Adjustments

Syntax

Figure 7-40 ADJALL Syntax



Description

The ADJALL command activates the RF local oscillator (LO) and intermediate frequency (IF) alignment routines. These are the same routines that occur when the spectrum analyzer is switched on. Commands following ADJALL are not executed until after the analyzer has finished the alignment routines.

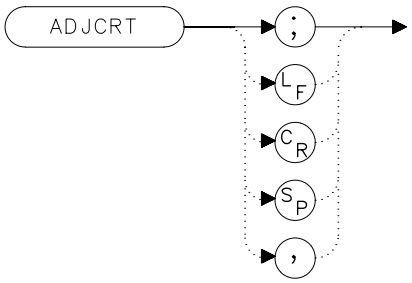
Example

```
10   OUTPUT 718;"ADJALL;"
20   END
```

ADJCRT Adjust CRT Alignment

Syntax

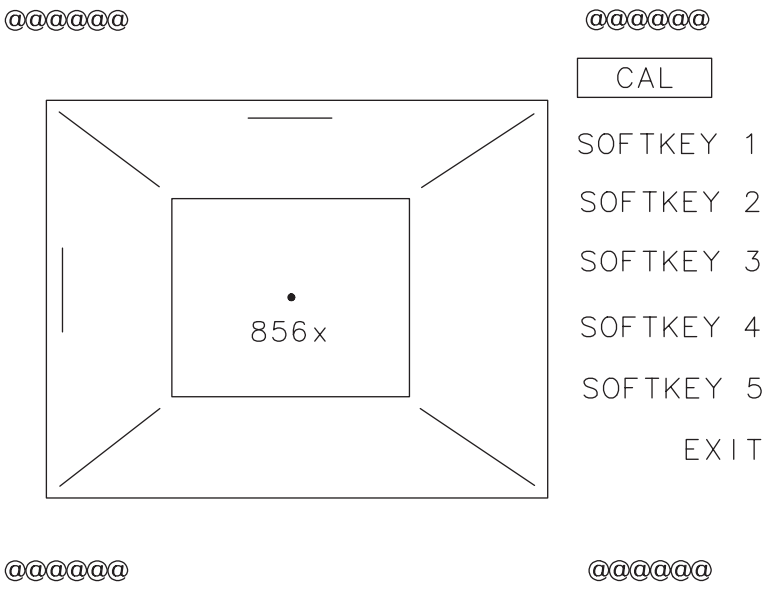
Figure 7-41 ADJCRT Syntax



Description

The ADJCRT command activates a CRT adjustment pattern, shown in Figure 7-42 on page 409. Use the X POSN, Y POSN, and TRACE ALIGN adjustments, available from the rear panel on E-series instruments, to align the display. Use X POSN and Y POSN to move the display horizontally and vertically, respectively. Use TRACE ALIGN to straighten a tilted display. To remove the pattern from the screen, execute the IP command. EC-series instruments do not require adjustment and are not adjustable.

Figure 7-42 CRT Alignment Pattern



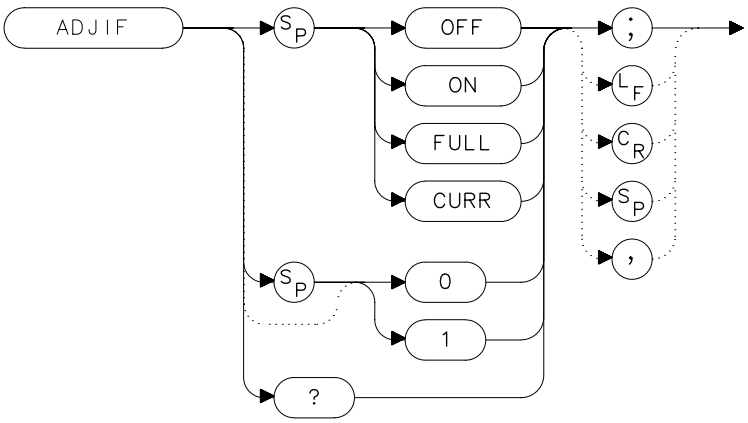
Example

```
10    OUTPUT 718;"ADJCRT;"
20    OUTPUT 2;CHR$(255)&"K";
30    PRINT TABXY(0,1);"USE X POSN AND Y POSN"
40    PRINT TABXY(0,3);"TO ADJUST THE DISPLAY"
50    INPUT "THEN PRESS ENTER",Ans$
60    OUTPUT 718;"IP;"
70    END
```

ADJIF Adjust IF

Syntax

Figure 7-43 ADJIF Syntax



Description

The ADJIF command turns the automatic IF adjustment on or off. This function is normally on. Because the IF is continuously adjusting, executing the IF alignment routine is seldom necessary. When the IF adjustment is not active, an "A" appears on the left side of the display.

Parameters

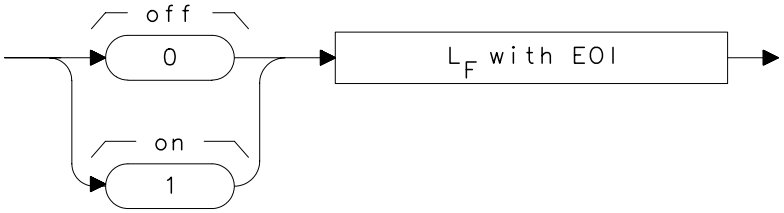
OFF	turns the continuous IF adjustment off.
ON	reactivates the continuous IF adjustment.
FULL	IF adjustment is done for all IF settings.
CURR	IF adjustment is done only for the IF settings currently displayed.

Preset State

On

Query Response

Figure 7-44 ADJIF Query Response



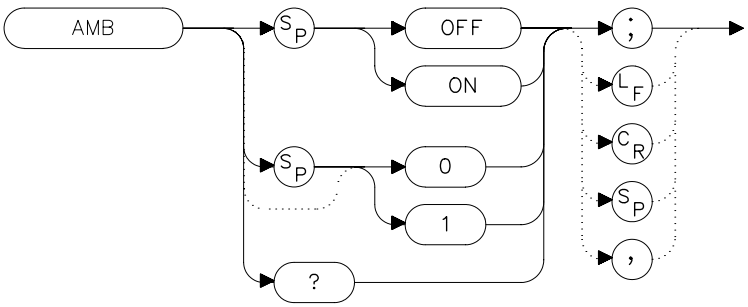
Example

```
10    OUTPUT 718;"ADJIF OFF;"
20    OUTPUT 718;"ADJIF?;"
30    ENTER 718;Adjif
40    PRINT Adjif
50    END
```

AMB Trace A Minus Trace B

Syntax

Figure 7-45 AMB Syntax



Description

The AMB command subtracts the contents of trace B from trace A and places the result in dBm (when in log mode) in trace A. When in linear mode, the result is in volts. If trace A is in clear-write or max-hold mode, this function is continuous. When AMB is active, an "M" appears on the left side of the display. The command AMBPL overrides AMB. For more information on trace math, refer to Chapter 5.

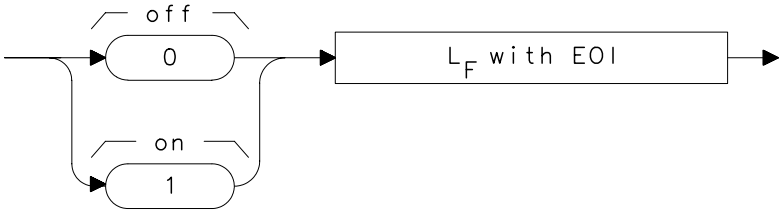
NOTE The displayed amplitude of each trace element falls in one of 600 data points. There are 10 points of overrange, which corresponds to one-sixth of a division of overrange. When adding or subtracting trace data, any results exceeding this limit are clipped at the limit.

Preset State

Off

Query Response

Figure 7-46 AMB Query Response



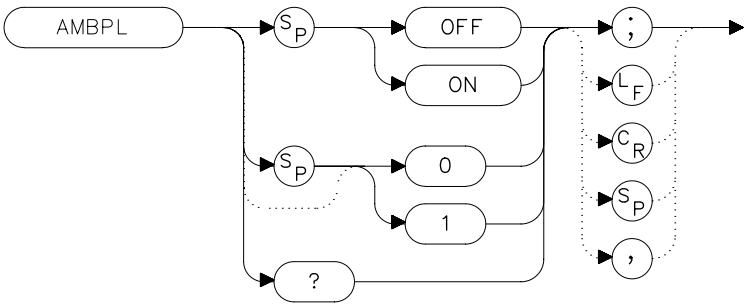
Example

```
10    OUTPUT 718;"IP;"
20    OUTPUT 718;"CLRW TRB;TS;VIEW TRB;AMB ON;"
30    OUTPUT 718;"AMB?;"
40    ENTER 718;Amb
50    PRINT Amb
60    END
```

AMBPL Trace A Minus Trace B Plus Display Line

Syntax

Figure 7-47 AMBPL Syntax



Description

The AMBPL command subtracts the contents of trace B from trace A, adds the display line to this value, and stores the result in dBm (when in log mode) in trace A. When in linear mode, the result is in volts. If trace A is in clear-write or max-hold mode, this function is continuous. When this function is active, an "M" appears on the left side of the display. AMBPL overrides the AMB command.

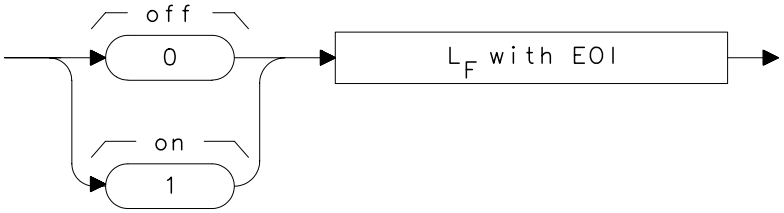
NOTE The displayed amplitude of each trace element falls in one of 600 data points. There are 10 points of overrange, which corresponds to one-sixth of a division of overrange. When adding or subtracting trace data, any results exceeding this limit are clipped at the limit.

Preset State

Off

Query Response

Figure 7-48 AMBPL Query Response



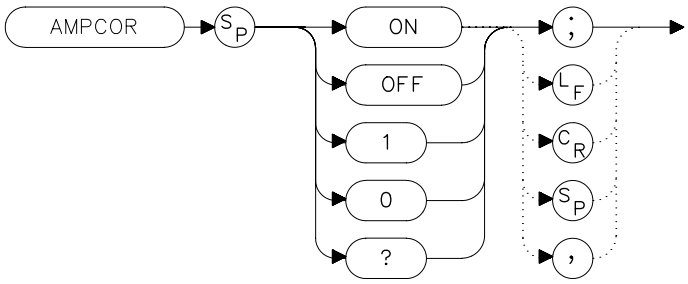
Example

```
10    OUTPUT 718;"IP;"
20    OUTPUT 718;"CLRW TRB;TS;VIEW TRB;DL -50DBM;"
30    OUTPUT 718;"AMBPL ON;"
40    OUTPUT 718;"AMBPL?;"
50    ENTER 718;Ambpl
60    PRINT Ambpl
70    END
```

AMPCOR Amplitude Correction

Syntax

Figure 7-49 AMPCOR Syntax



Description

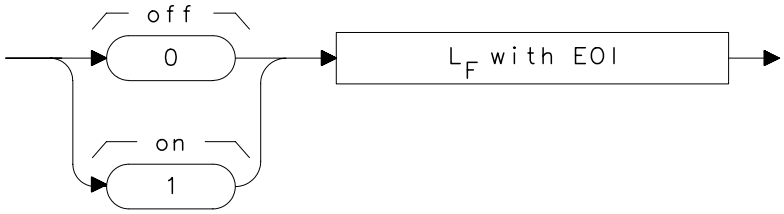
Use AMPCOR to turn the amplitude correction function on and off. The ampcor function is used to compensate for frequency-dependent amplitude variations. When ampcor is on, the current correction values are added to all measurement results. Turning ampcor off does not erase the current frequency-amplitude correction factors. Performing an instrument preset (IP) or turning off the spectrum analyzer will turn off ampcor.

Preset State

Off

Query Response

Figure 7-50 AMPCOR Query Response



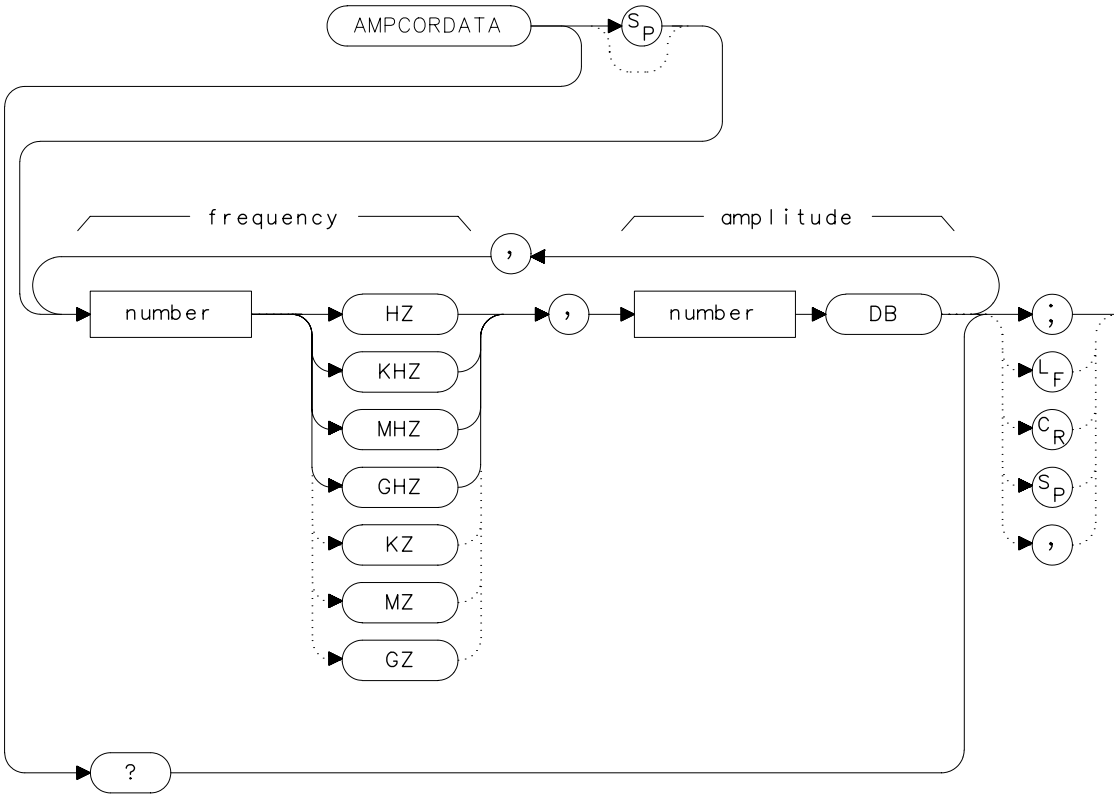
Example

```
10  OUTPUT 718;"AMPCOR ON;"
```

AMPCORDATA Amplitude Correction Data

Syntax

Figure 7-51 AMPCORDATA Syntax



Description

The AMPCORDATA function allows you to enter or query the frequency-amplitude correction points that are used to normalize the spectrum analyzer measurement. Up to 200 pairs of frequency-amplitude correction points can be entered.

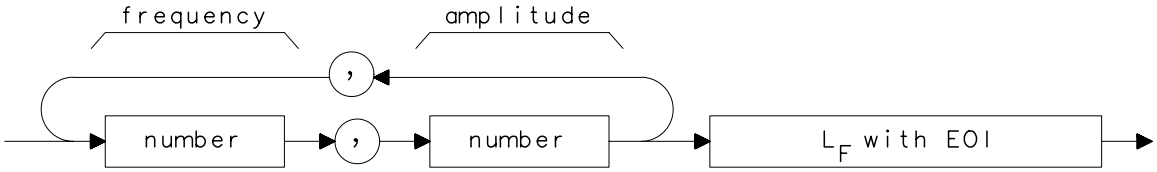
Whenever ampcor is on, the correction values are added to all measurement results. Setting ampcor off, performing an instrument preset, (IP) or turning off the spectrum analyzer turns off the amplitude correction. Turning ampcor off does not erase the current frequency-amplitude correction factors.

The values of the correction points are applied across the active measurement range. Between points, the correction values are interpolated. When measuring at frequencies outside the first and last correction points, these values are used as the correction value. If you do not want any amplitude correction outside of the first and last correction points, set the amplitude correction to 0 at the frequencies that are outside of the first and last correction values.

If any of the trace data is above or below the graticule, the ampcor function may not properly correct it. The spectrum analyzer amplitude accuracy is not specified above or below the graticule. Anytime ampcor applies a correction such that data outside the graticule is moved to within the graticule, an error (error number 921 or 922) is generated. In order to avoid these errors, make sure that the trace data which is being corrected is within the graticule before the correction is applied.

Query Response

Figure 7-52 AMPCORDATA Query Response



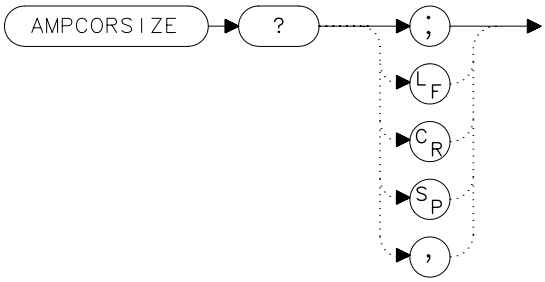
Example

```
10  OUTPUT 718;"AMPCORDATA 1GHZ, -1.56DB, 10MHZ, 10DB;"
```

AMPCORSIZE Amplitude Correction Data Array Size

Syntax

Figure 7-53 AMPCORSIZE Syntax



Description

The AMPCORSIZE query tells you how many frequency-amplitude correction points are in the current correction table.

Parameters

number integer from 0 to 200

Query Response

Figure 7-54 AMPCORSIZE Query Response

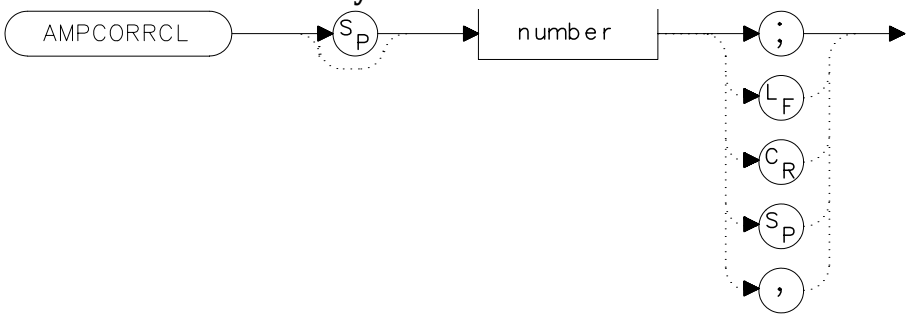
Example

```
10  REAL Ampcorpts
20  OUTPUT 718;"AMPCORSIZE?;"
30  ENTER 718;Ampcorpts
40  END
```

AMPCORRCL Amplitude Correction Recall

Syntax

Figure 7-55 AMPCORRCL Syntax



Description

The AMPCORRCL function recalls a set of correction points from one of five possible registers. The corrections must have been previously saved with the AMPCORSAVE command or the SAVE AMPCOR softkey.

Parameters

number integer from 0 to 4

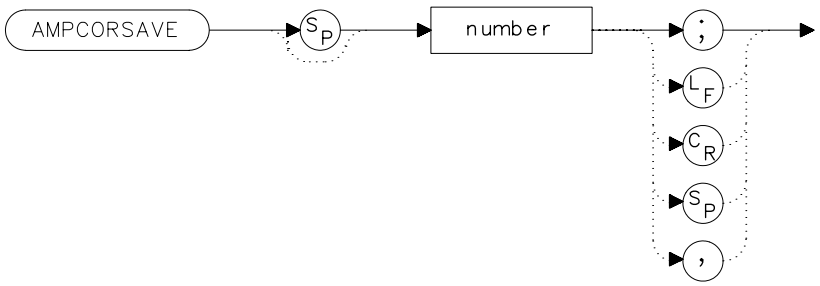
Example

```
10  REAL Regnumber
20  Regnumber=2
30  OUTPUT 718;"AMPCORRCL";Regnumber;";"
40  END
```

AMPCORSAVE Amplitude Correction Save

Syntax

Figure 7-56 AMPCORSAVE Syntax



Description

The AMPCORSAVE function saves the current correction points in one of ten possible registers. The correction points can be recalled with the AMPCORRCL command.

Parameters

number integer from 0 to 5

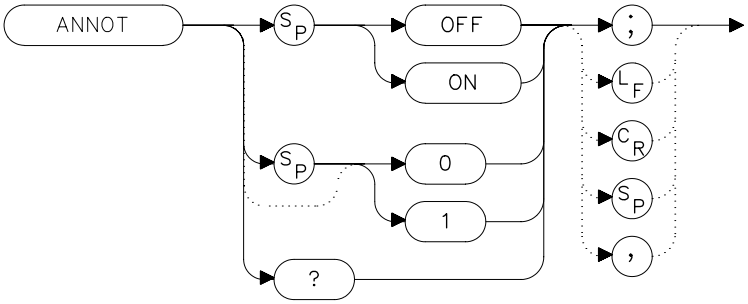
Example

```
10  REAL Regnumber
20  Regnumber=2
30  OUTPUT 718;"AMPCORSAVE";Regnumber;";"
40  END
```

ANNOT Annotation On/Off

Syntax

Figure 7-57 ANNOT Syntax



Description

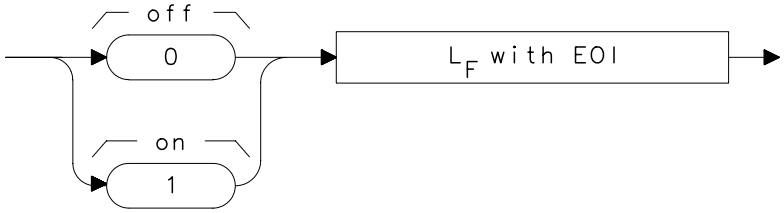
The ANNOT command turns the display annotation off or on.

Preset State

On

Query Response

Figure 7-58 ANNOT Query Response



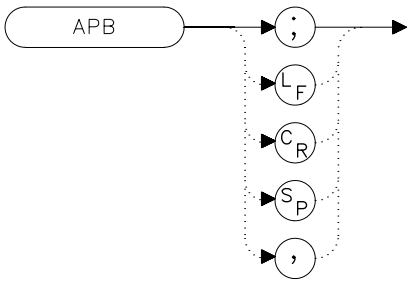
Example

```
10   OUTPUT 718;"IP;"
20   OUTPUT 718;"ANNOT OFF;"
30   OUTPUT 718;"ANNOT?;"
40   ENTER 718;Annot
50   PRINT Annot
60   END
```

APB Trace A Plus Trace B

Syntax

Figure 7-59 APB Syntax



Description

The APB command adds the contents of trace A to trace B and stores the result in dBm (when in log mode), in trace A. When in linear mode, the results are in volts. Trace A is placed in view mode. This command is done immediately and not on a repetitive basis.

NOTE The displayed amplitude of each trace element falls in one of 600 data points. There are 10 points of overrange, which corresponds to one-sixth of a division of overrange. When adding or subtracting trace data, any results exceeding this limit are clipped at the limit.

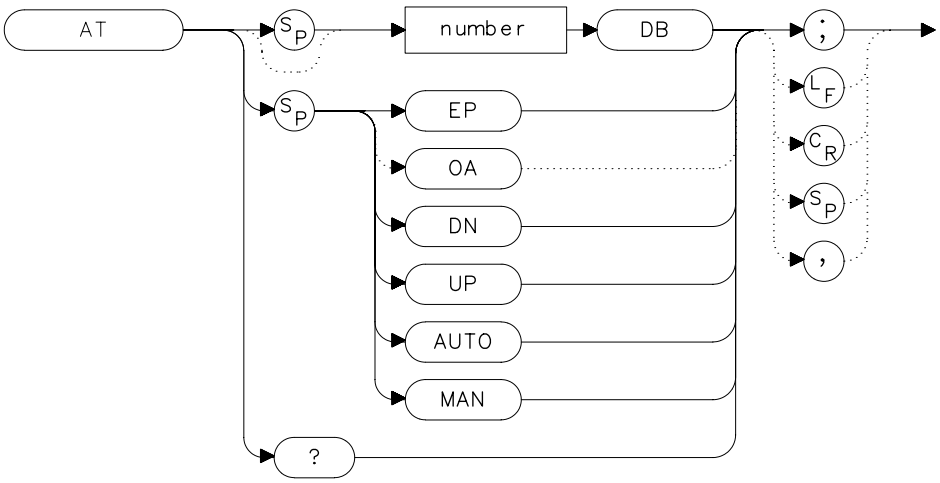
Example

```
10    OUTPUT 718;"IP;SNGLS;"
20    OUTPUT 718;"TS;VIEW TRA;CLRW TRB;TS;VIEW TRB;"
30    OUTPUT 718;"APB;BLANK TRB;"
40    END
```

AT Input Attenuation

Syntax

Figure 7-60 AT Syntax



Description

The AT command sets the amount of attenuation between the input and the first mixer. The attenuation can be set to 0 dB only by numeric data entry, and not by using the knob or step keys.

Parameters

number	integer from 0 to 70, in decade increments. Numbers are rounded up to the nearest decade. (integer from 0 to 60 for the Agilent 8564E/EC and Agilent 8565E/EC)
AUTO	sets the attenuation to coupled mode.
MAN	sets the attenuation to manual mode.
UP or DN	changes the attenuation by 10 dB (but cannot set attenuation to 0 dB).

Preset State

Coupled mode, 10 dB

Query Response

Figure 7-61 AT Query Response

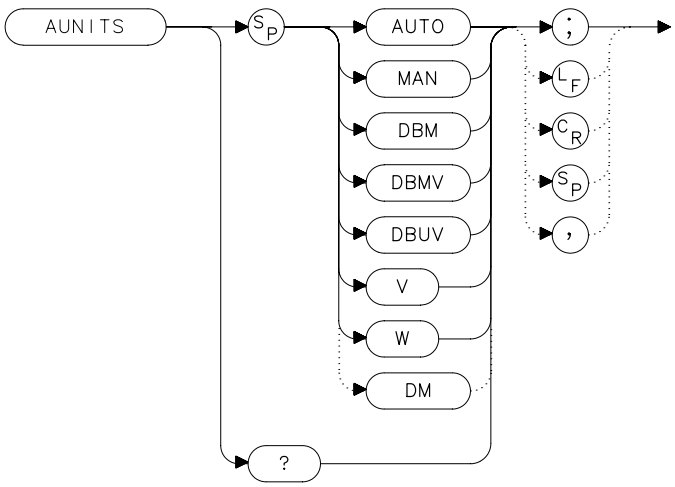
Example

```
10   OUTPUT 718;"AT UP;"
20   OUTPUT 718;"AT?;"
30   ENTER 718;At
40   PRINT At
50   END
```

AUNITS Absolute Amplitude Units

Syntax

Figure 7-62 AUNITS Syntax



xaui

Description

The AUNITS command sets the absolute amplitude units for the input signal and the display. AUNITS will affect the query responses of the following commands: MKA, TRA and TRB (when in trace data format P-format), DL, RL, SQUELCH, TH, and VTL. AUNITS is disabled when the 8560E/EC Option 002 tracking generator is in use.

Parameters

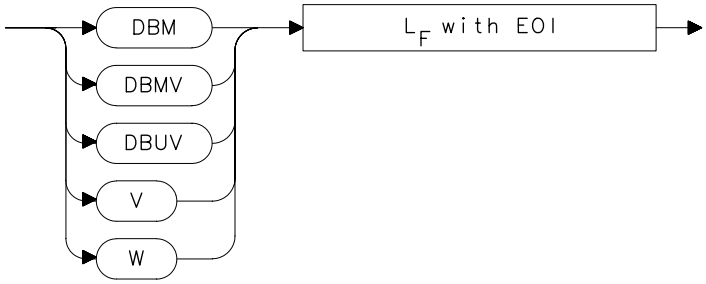
AUTO	sets amplitude units to coupled mode. For a log scale, the units default to dBm; for a linear scale, units default to volts.
MAN	sets amplitude units to manual mode.

Preset State

Coupled mode, dBm

Query Response

Figure 7-63 AUNITS Query Response



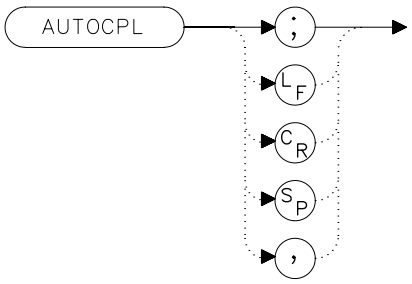
Example

```
10   OUTPUT 718;"AUNITS DBUV;"
20   OUTPUT 718;"AUNITS?;"
30   ENTER 718;Aunits$
40   END
```

AUTOCPL Auto Coupled

Syntax

Figure 7-64 AUTOCPL Syntax



Description

The AUTOCPL command sets video bandwidth, resolution bandwidth, input attenuation, sweep time, and center frequency step-size to coupled mode. These functions can be recoupled individually or all at once. The spectrum analyzer chooses appropriate values for these functions. The video bandwidth and resolution bandwidth are set according to the coupled ratios stored with VBW/RBW RATIO or RBW/SPAN RATIO, or the ratios selected using the VBR or RBR commands. If no ratios are chosen, default ratios (1.0 and 0.011, respectively) are used instead.

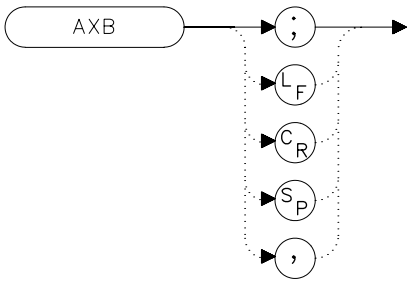
Example

```
10   OUTPUT 718;"AUTOCPL;"
20   END
```

AXB Trace A Exchange Trace B

Syntax

Figure 7-65 AXB Syntax



Description

The AXB command exchanges the contents of trace A with those of trace B. If the traces are in clear-write or max-hold mode, the mode is changed to view. Otherwise, the traces remain in their initial mode.

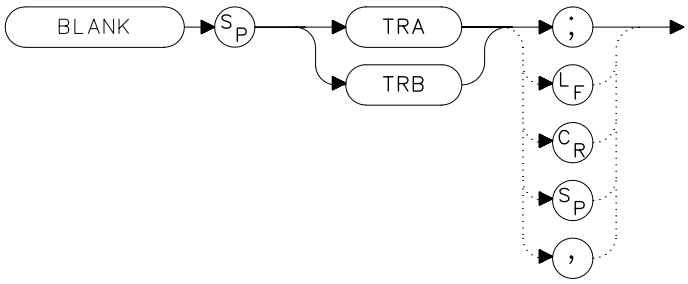
Example

```
10    OUTPUT 718;"AXB;"
20    END
```

BLANK Blank Trace

Syntax

Figure 7-66 BLANK Syntax



Description

The BLANK command blanks the chosen trace from the display. The current contents of the trace remain in the trace but are not updated.

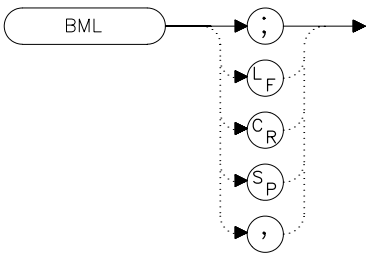
Example

```
10    OUTPUT 718;"BLANK TRA;"
20    OUTPUT 718;"CLRW TRB;"
20    END
```

BML Trace B Minus Display Line

Syntax

Figure 7-67 BML Syntax



xbm

Description

The BML command subtracts the display line from trace B and places the result in dBm (when in log mode) in trace B, which is then set to view mode. In linear mode, the results are in volts.

NOTE The displayed amplitude of each trace element falls into one of 600 data points. There are 10 additional points of overrange, which corresponds to one-sixth of a division. When adding or subtracting trace data, any results exceeding the limits are clipped at that limit.

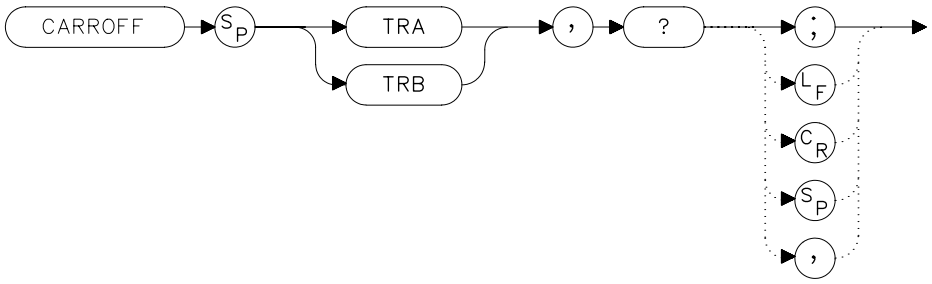
Example

```
10    OUTPUT 718;"IP;"
20    OUTPUT 718;"BLANK TRA;"
30    OUTPUT 718;"CLRW TRB;TS;DL -50DBM;"
40    OUTPUT 718;"BML;"
50    END
```

CARROFF Carrier Off Power

Syntax

Figure 7-68 CARROFF Syntax



Description

The CARROFF command measures the average power and the peak power of the carrier when the burst is off. The powers are combined to provide a calculation of the leakage power. Trace A or Trace B can be selected.

Query Response

Figure 7-69 CARROFF Query Response

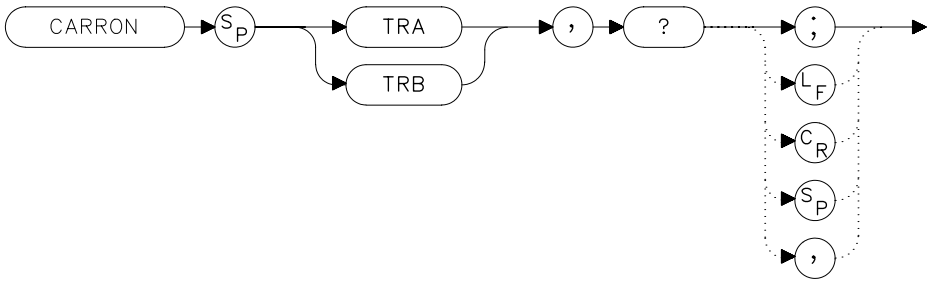
Example

```
10  REAL Offpower
20  OUTPUT 718;"CARROFF TRA,?;"
30  ENTER 718;Offpower
40  END
```

CARRON Carrier On Power

Syntax

Figure 7-70 CARRON Syntax



Description

The CARRON command measures the average power of the carrier during that portion of the time when it is on (when it is within 20 dB of its peak level). True mean carrier power is calculated by measuring the time waveform of the RF envelope, converting the trace data from dB to power units, and then averaging the power trace data.

The MEANPWR command makes a similar measurement but it allows you to define the on power range.

Query Response

Figure 7-71 CARRON Query Response

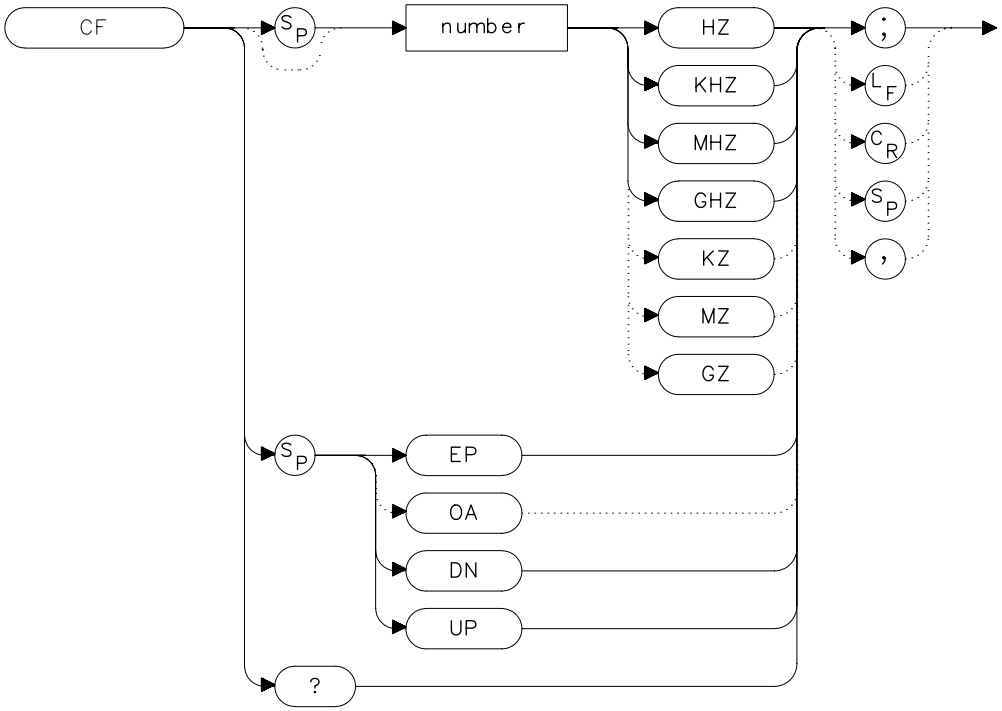
Example

```
10  REAL Carron_pwr
20  OUTPUT 718;"CARRON TRB,?;"
30  ENTER 718;Carron_pwr
40  END
```

CF Center Frequency

Syntax

Figure 7-72 CF Syntax



Description

The CF command sets the center frequency and sets the spectrum analyzer to center frequency and span mode. The span remains constant, unless it is limited by the spectrum analyzers frequency range. The start and stop frequencies change as the center frequency changes.

Parameters

number	real from 0 to 2.9E+9 (8560E/EC)
	0 to 6.5E+9 (Agilent 8561E//EC)

0 to 13.2E+9 (Agilent 8562E/EC)

0 to 26.5E+9 (Agilent 8563E/EC)

0 to 40E+9 (Agilent 8564E/EC)

0 to 50E+9 (Agilent 8565E/EC)

from 18E+9 to 325E+9 in external mixer mode.

UP or DN — 10 percent of the frequency span or the amount set by the SS command.

Preset State

- 1.45 GHz (8560E/EC)
- 3.25 GHz (Agilent 8561E/EC)
- 6.6 GHz (Agilent 8562E/EC)
- 13.25 GHz (Agilent 8563E/EC)
- 20 GHz (Agilent 8564E/EC)
- 50 GHz (Agilent 8565E/EC)

Query Response

Figure 7-73 CF Query Response

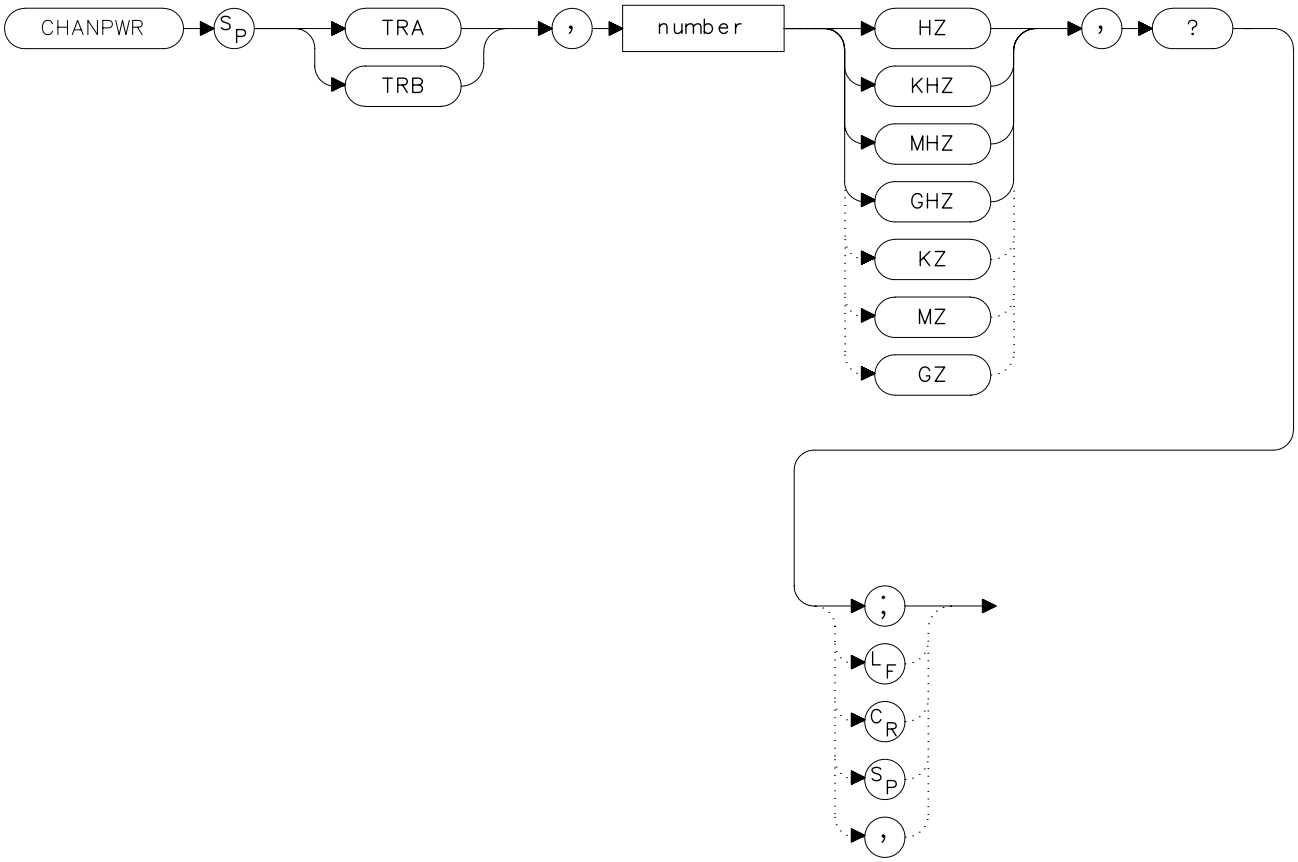
Example

```
10    OUTPUT 718;"IP;"
20    OUTPUT 718;"CF 300MHZ;SP 20MHZ;TS;"
30    OUTPUT 718;"CF?;"
40    ENTER 718;Cf
50    PRINT Cf
60    END
```

CHANPWR Channel Power

Syntax

Figure 7-74 CHANPWR Syntax



Description

The CHANPWR command measures the power within the channel power bandwidth specified by the command.

Query Response

Figure 7-75 CHANPWR Query Response

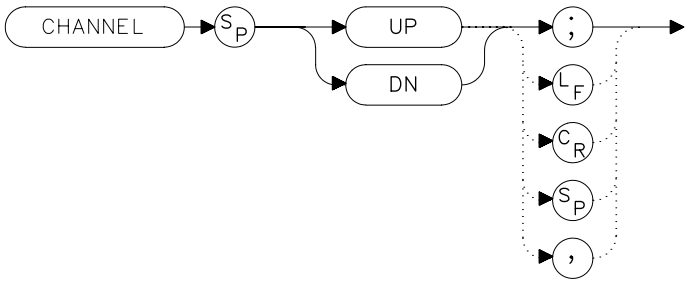
Example

```
10  REAL Chanbw, Chan_pwr
20  Chanbw = 12.8
30  OUTPUT 718; "CHANPWR TRA,";Chanbw;"KHZ,?;"
40  ENTER 718; Chan_pwr
```

CHANNEL Channel Selection

Syntax

Figure 7-76 CHANNEL Syntax



Description

The CHANNEL command changes the spectrum analyzer center frequency higher (UP) or lower (DN) in frequency by one channel spacing.

Parameters

UP, DN (down)

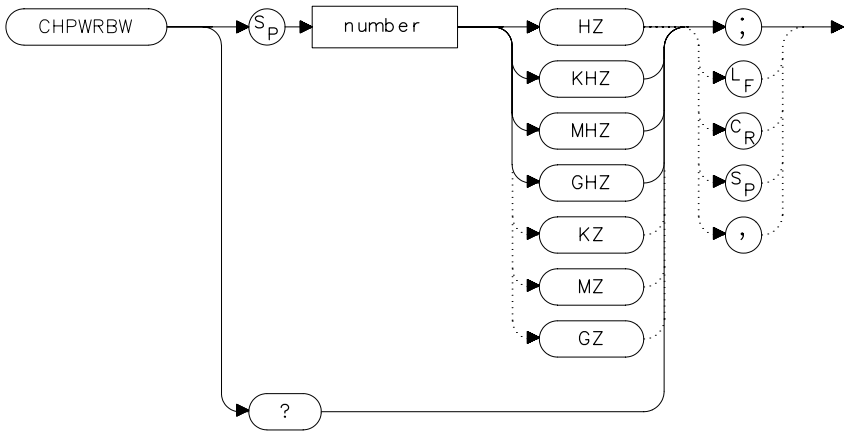
Example

```
10  OUTPUT 718;"CHANNEL UP;"
```

CHPWRBW Channel Power Bandwidth

Syntax

Figure 7-77 CHPWRBW Syntax



xch

Description

The CHPWRBW command is used to query or set the current value of the channel power bandwidth. Channel power can be measured with the CHANPWR command.

Query Response

Figure 7-78 CHPWRBW Query Response

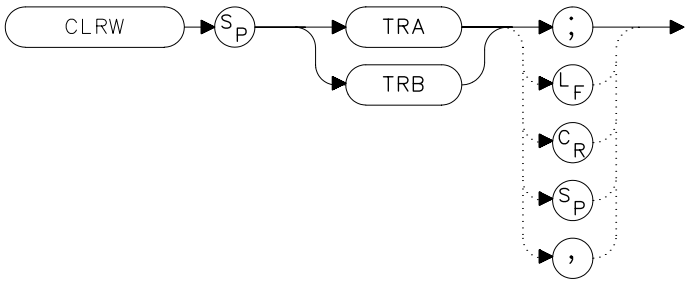
Example

```
10  REAL Powerbw
20  Powerbw = 30
30  OUTPUT 718; "CHPWRBW";Powerbw;"KHZ;"
```

CLRW Clear Write

Syntax

Figure 7-79 CLRW Syntax



Description

The CLRW command sets the chosen trace to clear-write mode. This mode sets each element of the chosen trace to the bottom-screen value; then new data from the detector is put in the trace with each sweep.

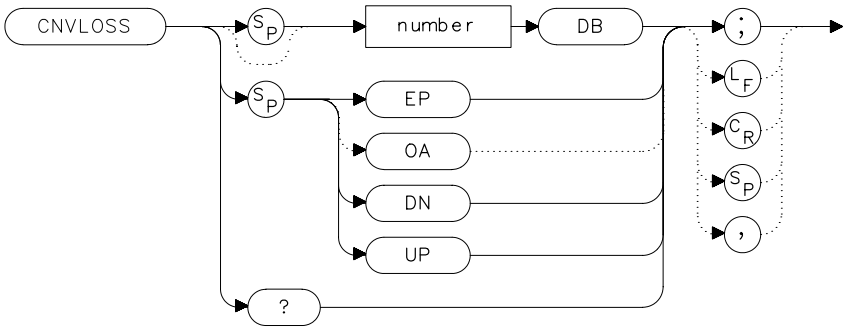
Example

```
10    OUTPUT 718;"IP;"
20    OUTPUT 718;"BLANK TRA;CLRW TRB;"
30    END
```

CNVLOSS Conversion Loss

Syntax

Figure 7-80 CNVLOSS Syntax



xcn

Description

The CNVLOSS command compensates for losses outside the instrument when in external mixer mode (such as losses within external mixers or connector cables). CNVLOSS specifies the mean conversion loss for the current harmonic band. In a full frequency band (such as band K), the mean conversion loss is defined as the minimum loss plus the maximum loss for that band divided by two. Adjusting for conversion loss allows the system to remain calibrated (that is, the displayed amplitude values have the conversion loss incorporated into them). The default value for any band is 30 dB. The spectrum analyzer must be in external-mixer mode in order for this command to work. When in internal-mixer mode, querying CNVLOSS returns a zero. This function is not available for an 8560E/EC Option 002.

Parameters

number	real from 15 to 60.
UP or DN	0.1 dB.

Preset State

30 dB

Query Response

Figure 7-81 CNVLOSS Query Response

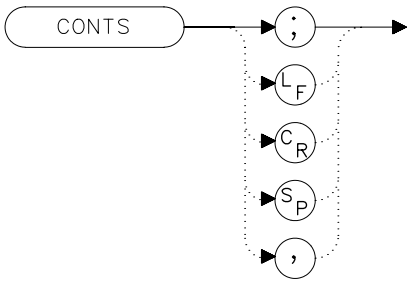
Example

```
10  OUTPUT 718;"IP;MXRMODE EXT;"
20  INPUT "ENTER DESIRED FREQUENCY BAND (KAQUVEWFDGY OR
J)",Fulband$
30  OUTPUT 718;"FULBAND ";Fulband$;";"
40  INPUT "ENTER IN THE CONVERSION LOSS FOR THAT BAND",Loss
50  OUTPUT 718;"CNVLOSS ";Loss;"DB;"
60  END
```

CONTS Continuous Sweep

Syntax

Figure 7-82 CONTS Syntax



Description

The CONTS command activates the continuous-sweep mode. This mode enables another sweep at the completion of the current sweep once the trigger conditions are met.

Preset State

On

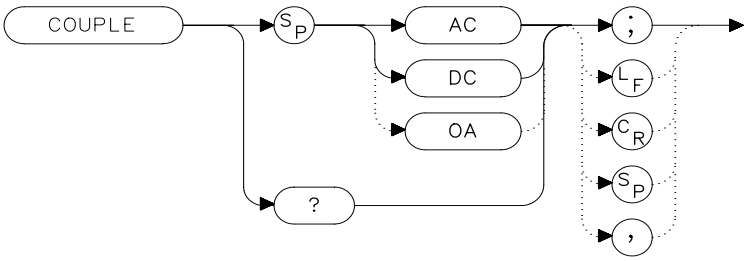
Example

```
10   OUTPUT 718;"CONTS;"
20   END
```

COUPLE Input Coupling

Syntax

Figure 7-83 COUPLE Syntax



Description

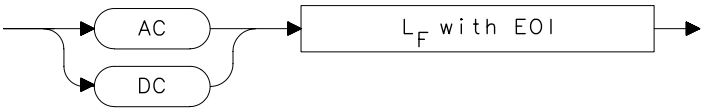
The COUPLE command sets the input coupling to ac or dc coupling. AC coupling protects the input of the analyzer from damaging dc signals, while limiting the lower frequency-range to 100 kHz (although the analyzer will tune down to 0 Hz with signal attenuation). This command is not available in an Agilent 8563E/EC, Agilent 8564E/EC or Agilent 8565E/EC; they are always dc coupled.

Preset State

AC

Query Response

Figure 7-84 COUPLE Query Response



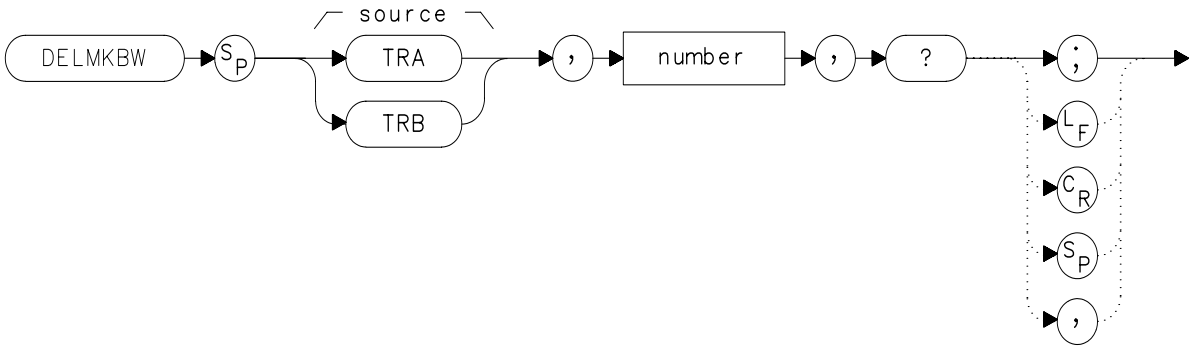
Example

```
10   OUTPUT 718;"COUPLE DC;"
20   PRINT "CAUTION:  ANALYZER IS NOW DC-COUPLED."
30   OUTPUT 718;"COUPLE?;"
40   ENTER 718;C$
50   PRINT C$
60   LOCAL 718
70   END
```

DELMKBW Occupied Power Bandwidth Within Delta Marker

Syntax

Figure 7-85 DELMKBW Syntax



xdelmkbw

Description

The DELMKBW command calculates the occupied power bandwidth with respect to the power between the displayed delta markers. The desired percent occupied power is specified with the DELMKBW command. The power between the displayed markers is then used as the reference rather than using the total power in the frequency span, as is done with the PWRBW command.

The current selected percent of the occupied power can be queried with the OCCUP command.

Parameters

number real number from 1.00 to 99.99

Query Response

Figure 7-86 DELMKBW Query Response

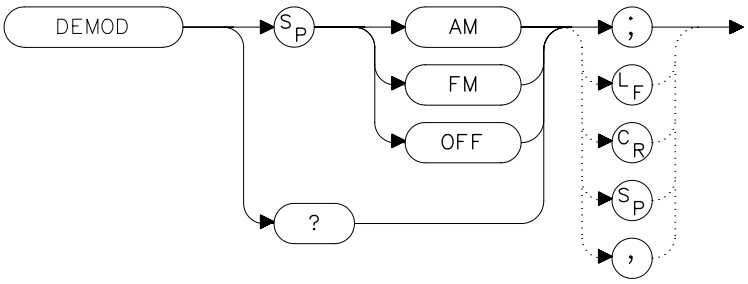
Example

```
10  REAL Percentocc
20  Percentocc = 90
30  OUTPUT 718; "DELMKBW TRA";Percentocc;",?;"
40  END
```

DEMOD Demodulation

Syntax

Figure 7-87 DEMOD Syntax



Description

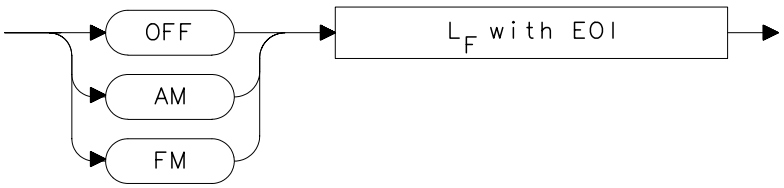
The DEMOD command activates either AM or FM demodulation, or turns the demodulation off. Place a marker on a desired signal and then activate DEMOD; demodulation takes place on this signal. If no marker is on, DEMOD automatically places a marker at the center of the trace and demodulates the frequency at that marker position. Use the volume and squelch controls to adjust the speaker and listen. DEMOD does not function for resolution bandwidths less than 300 Hz.

Preset State

Off

Query Response

Figure 7-88 DEMOD Query Response



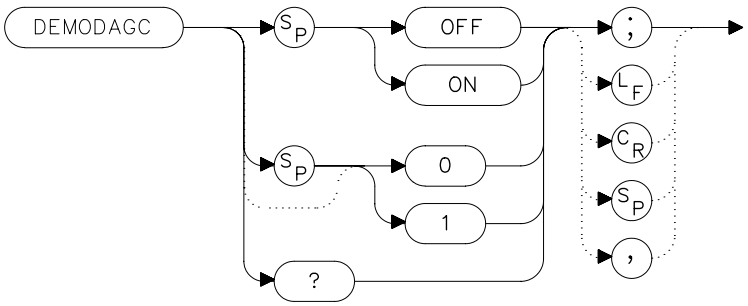
Example

```
10    OUTPUT 718;"IP;"
20    OUTPUT 718;"FA 88MHZ;FB 108MHZ;"
30    OUTPUT 718;"MKN EP;"
40    PRINT "MOVE MARKER TO SIGNAL TO BE DEMODULATED; PRESS
HOLD."
50    PRINT "THEN PRESS CONTINUE"
60    PAUSE
70    INPUT "ENTER DEMODULATION TIME (.1 SEC - 60 SEC)",Dtim
e
80    OUTPUT 718;"DEMODT ";Dtime;"S;"
90    OUTPUT 718;"DEMOD FM;"
100   LOCAL 718
110   PRINT "ADJUST VOLUME AND SQUELCH AS NECESSARY."
120   END
```

DEMODAGC Demodulation Automatic Gain Control

Syntax

Figure 7-89 DEMODAGC Syntax



Description

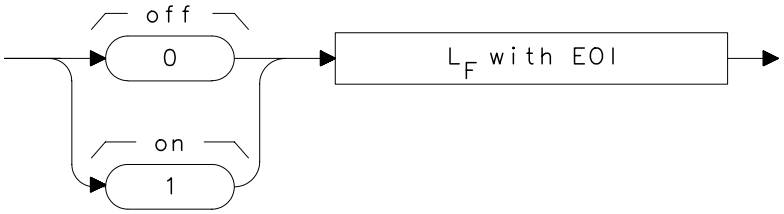
The DEMODAGC command turns the demodulation automatic gain control (AGC) on or off. The AGC keeps the volume of the speaker relatively constant during AM demodulation. AGC is available only during AM demodulation and when the frequency span is greater than 0 Hz.

Preset State

Off

Query Response

Figure 7-90 DEMODAGC Query Response



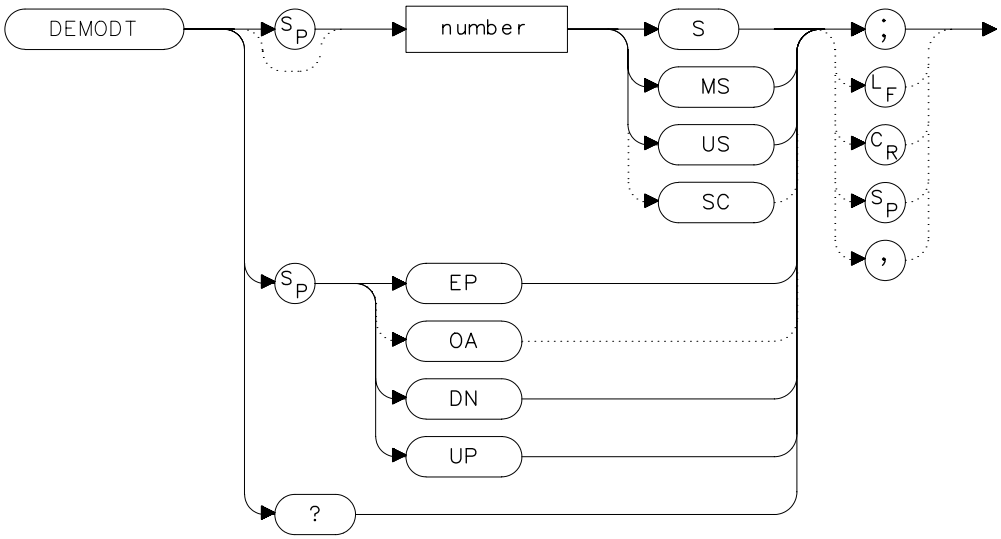
Example

```
OUTPUT 718;"IP;"
OUTPUT 718;"FA 550KHZ;FB 1600KHZ;"
OUTPUT 718;"MKN EP;"
PRINT "MOVE MARKER TO SIGNAL TO BE DEMODULATED; PRESS HOLD."
PRINT "THEN PRESS CONTINUE"
PAUSE
INPUT "ENTER DEMODULATION TIME (.1 - 60 SEC)",Dtime
OUTPUT 718;"DEMODT ";Dtime;"S;"
OUTPUT 718;"DEMOD AM;DEMODAGC ON;"
LOCAL 718
PRINT "ADJUST VOLUME AND SQUELCH AS NECESSARY."
```

DEMODT Demodulation Time

Syntax

Figure 7-91 DEMODT Syntax



Description

The DEMODT command selects the amount of time that the sweep pauses at the marker to demodulate a signal. The default value is 1 second. When the frequency span equals 0 Hz, demodulation is continuous, except when between sweeps. For truly continuous demodulation, set the frequency span to 0 Hz and the trigger mode to single sweep (see TM).

Parameters

number	real from 100E–3 to 60.
UP or DN	increments in a 1, 2, 5, 10 sequence.

Preset State

Off

Query Response

Figure 7-92 DEMODT Query Response

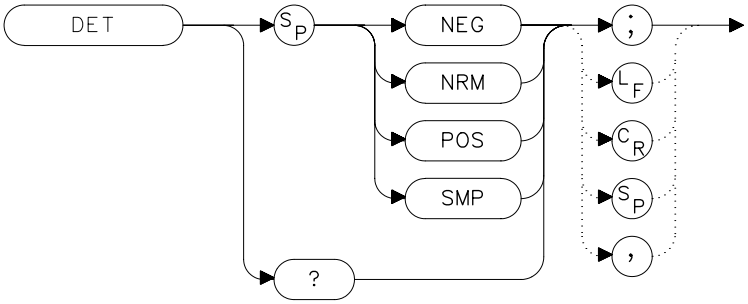
Example

```
10   OUTPUT 718;"IP;"
20   OUTPUT 718;"FA 88MHZ;FB 108MHZ;"
30   OUTPUT 718;"MKN EP;"
40   PRINT "MOVE MARKER TO SIGNAL TO BE DEMODULATED; PRESS H
OLD."
50   PRINT "THEN PRESS CONTINUE"
60   PAUSE
70   INPUT "ENTER DEMODULATION TIME (.1 SEC - 60 SEC)",Dtime
80   OUTPUT 718;"DEMODT ";Dtime;"S;"
90   OUTPUT 718;"DEMOD FM;"
100  LOCAL 718
110  PRINT "ADJUST VOLUME AND SQUELCH AS NECESSARY."
120  END
```

DET Detection Modes

Syntax

Figure 7-93 DET Syntax



Description

The DET command specifies the IF detector used for acquiring measurement data. This is normally a coupled function, in which the spectrum analyzer selects the appropriate detector mode. Four modes are available: normal, positive, negative, and sample. The modes are described below. When a mode other than normal is chosen, a "D" appears on the left side of the display.

Parameters

NEG	selects the negative peak detector. The minimum signal values are displayed.
NRM	selects the normal peak detector, which displays both positive and negative peak values. The noise floor displayed by alternately selecting positive and negative peaks. When a signal is encountered, the positive peak detector is used.
POS	selects the positive peak detector. The maximum signal values are displayed.
SMP	selects the sample mode, which places the instantaneous signal value of the analog-to-digital conversion in memory.

If no detector mode is specified, the following rules determine the chosen detector.

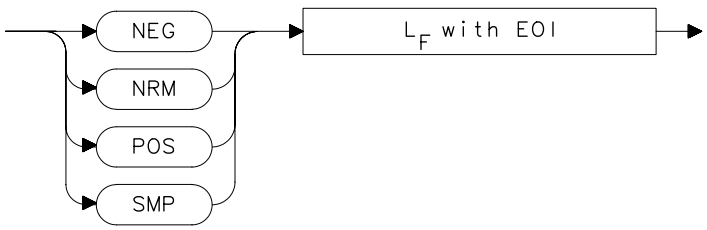
1. If video averaging or marker noise functions are on, or if the resolution bandwidth is greater than or equal to 300 Hz and the video bandwidth is less than 300 Hz, the detector is set to sample mode.
2. If the sweeptime is less than 30 ms, the detector is set to sample mode. Positive and negative peak detection are available with sweeptimes less than 30 ms if Option 007 is installed. (Sweeptimes of less than 50 ms are available only if the spectrum analyzer frequency span is set to zero.)
3. If the maximum-hold trace mode is on, the positive peak detector is used.
4. If the minimum-hold trace mode is on, the negative peak detector is used.
5. If none of the above rules apply, the normal detector is used.
6. If more than one of the above rules applies, the first rule listed determines the detector used.

Preset State

Coupled mode, normal detector

Query Response

Figure 7-94 DET Query Response



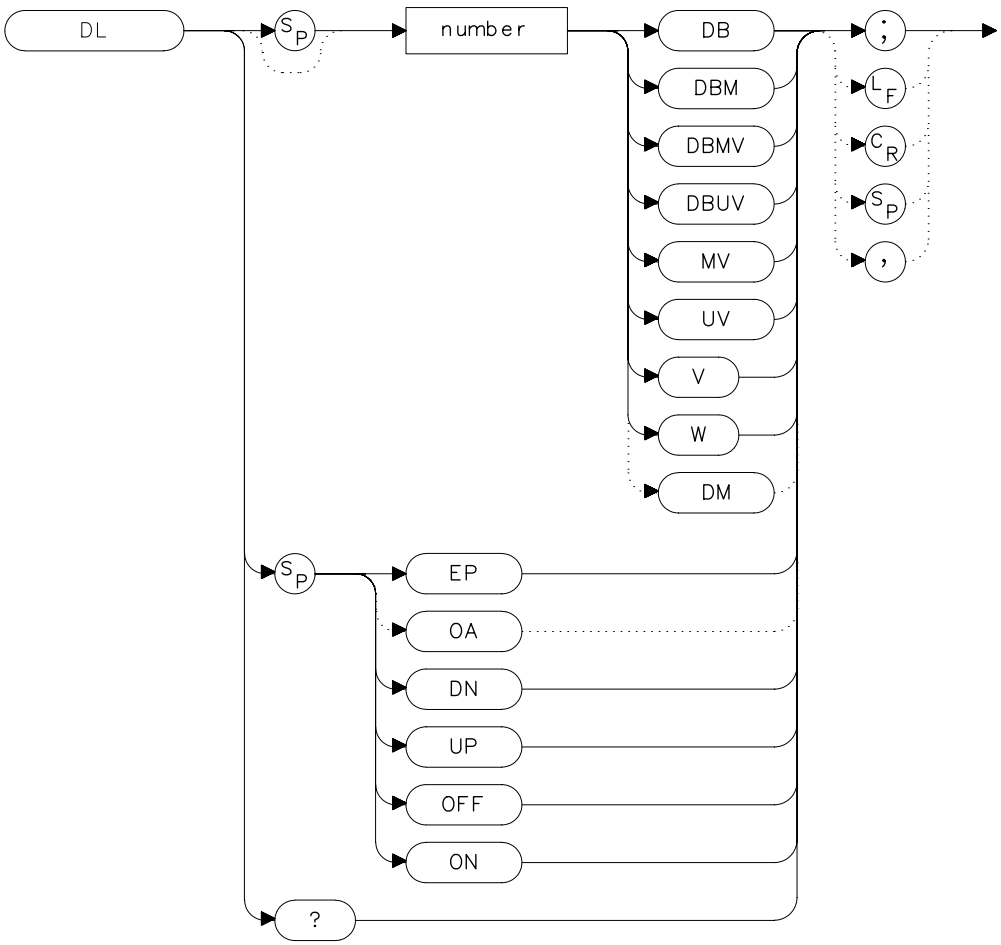
Example

```
10   INPUT "SELECT A DETECTOR MODE (NEG, NRM, POS, OR SMP)",
Det$
20   OUTPUT 718;"DET ";Det$;";"
30   PRINT "CHOSEN DETECTOR MODE IS ",Det$
40   END
```

DL Display Line

Syntax

Figure 7-95 DL Syntax



Description

The DL command activates a horizontal display line for use as a visual aid or for computational purposes. The default value is 0 dBm.

Parameters

number	real. Dependent on the selected amplitude units.
UP or DN	changes the display line by one vertical division.

Preset State

Off

Query Response

Figure 7-96 DT Query Response

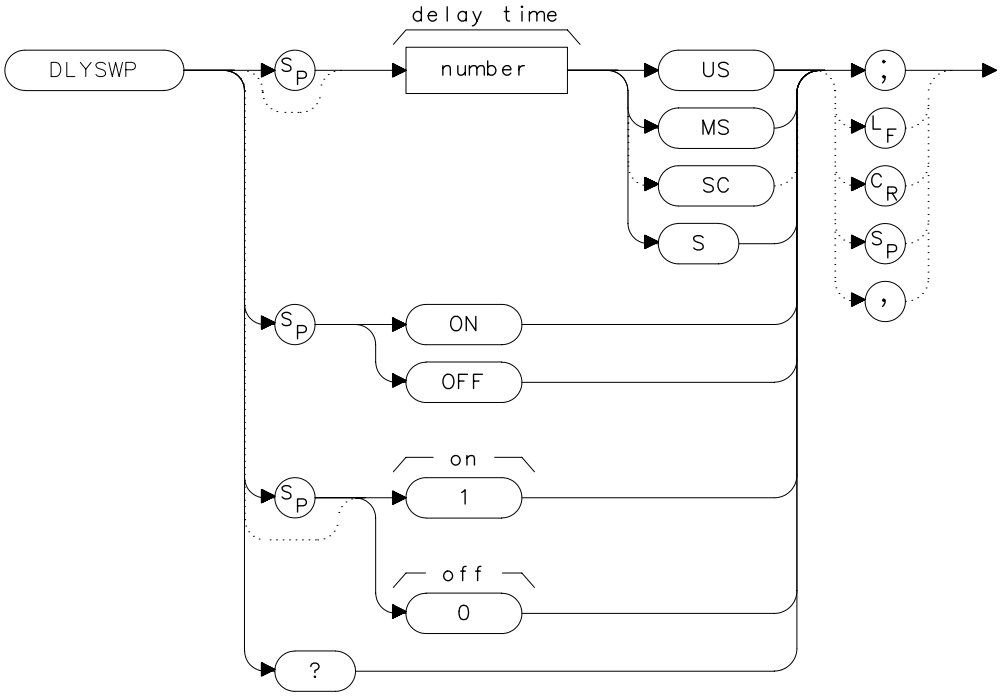
Example

```
10   INPUT "ENTER START FREQUENCY, IN MHZ",Fa
20   INPUT "ENTER STOP FREQUENCY, IN MHZ",Fb
30   OUTPUT 718;"AUNITS DBUV;"
40   OUTPUT 718;"FA ";Fa;"MHZ;"
50   OUTPUT 718;"FB ";Fb;"MHZ;"
60   OUTPUT 718;"DL 48DBUV;"
70   END
```

DLYSWP Delay Sweep

Syntax

Figure 7-97 DLYSWP Syntax



Description

DLYSWP delays the start of the sweep until the specified time elapses after the trigger event. With Option 007, and when using sweep times <30 ms, the delay function can make the sweep start before the trigger event. Executing "DLYSWP *n*;", where *n* is a non-zero number, is the same as executing "DLYSWP ON;". Executing "DLYSWP 0;" is the same as executing "DLYSWP OFF;". A positive DLYSWP value causes a delayed sweep and a negative DLYSWP value causes the sweep to pre-trigger. Querying DLYSWP either returns the value of sweep delay length in seconds, or a "0" indicating the delay sweep is turned off.

Parameters

number	real from 2 µs to 65,535 ms
non-zero	Turns on DLYSWP.
0	Turns off DLYSWP.

Range with Option 007

sweep time <100 µs –2.5 ms to 65,535 ms

sweep time <150 µs –5.0 ms to 65,535 ms

sweep time <200 µs –7.5 ms to 65,535 ms

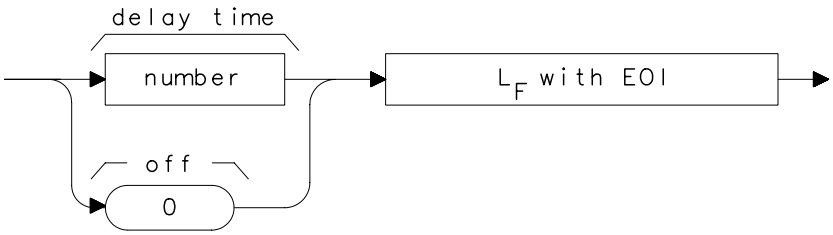
sweep time <30 ms –9.999 ms to 65,535 ms

Preset State

Off

Query Response

Figure 7-98 DLYSWP Query Response



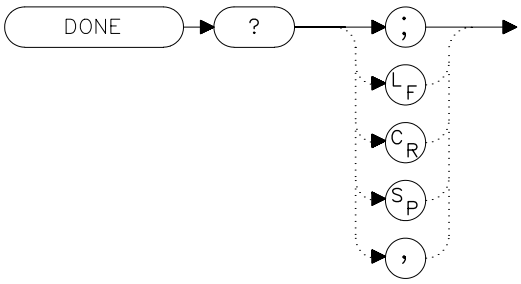
Example

```
OUTPUT 718;"DLYSWP 10US;"
Sets the sweep delay to 10
µs.
```

DONE Done

Syntax

Figure 7-99 DONE Syntax

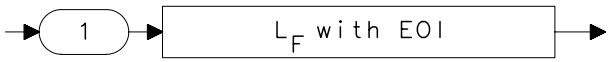


Description

The DONE command sends a "1" to the controller when all commands in a command string entered before DONE have been completed. Sending a TS command before DONE ensures that the spectrum analyzer will complete a full sweep before continuing on in a program.

Query Response

Figure 7-100 DONE Query Response



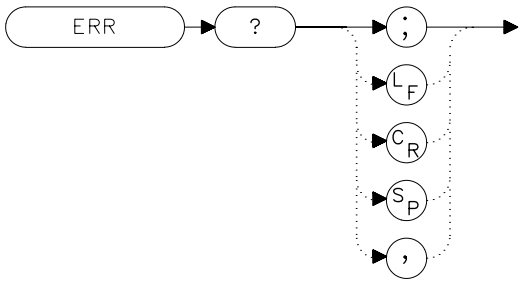
Example

```
10   OUTPUT 718;"IP;CF 1GHZ;SP 2GHZ;TS;DONE?;"
20   ENTER 718;Done
30   PRINT "COMMAND STRING IS DONE"
40   END
```

ERR Error

Syntax

Figure 7-101 ERR Syntax



Description

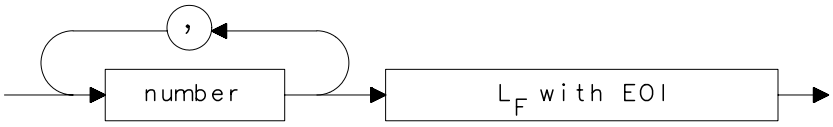
The ERR command outputs a list of errors present. An error code of "0" means there are no errors present. For a list of error codes and descriptions, refer to Chapter 9. Executing ERR clears all GPIB errors. For best results, enter error data immediately after querying for errors. Each error code is three digits long.

Preset State

Remote error list cleared. Persistent errors are reentered into the error list.

Query Response

Figure 7-102 ERR Query Response



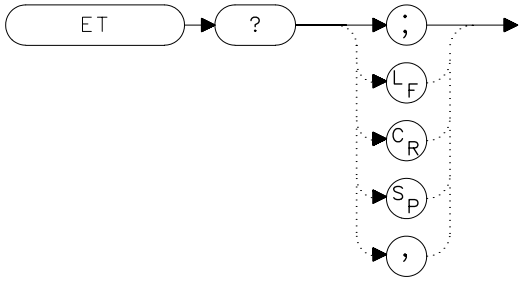
Example

```
10    DIM Err$[200]
20    OUTPUT 718;"ERR?;"
30    ENTER 718;Err$
40    PRINT Err$
50    !the following routine removes the comma between error
s in
a string
60    Position_comma=POS(Err$,",")
70    IF Position_comma>0 THEN
80      !multiple errors
90      First_error=VAL(Err$)
100     PRINT First_error
110     Err$=Err$[POS(Err$,",")+1]
120     REPEAT
130       Position_comma=POS(Err$,",")
140       Next_error=VAL(Err$)
150       PRINT Next_error
160       IF Position_comma THEN Err$=Err$[POS(Err$,",")+1]
170     UNTIL Position_comma=0
180   ELSE
190     Err=VAL(Err$)
200     IF Err<0 THEN
210       PRINT Err
220     ELSE
230       PRINT "NO ERRORS"
240     END IF
250   END IF
260     !end routine
270   END
```

ET Elapsed Time

Syntax

Figure 7-103 ET Syntax



Description

The ET command returns to the controller the elapsed time (in hours) of analyzer operation. This value can be reset only by a HAgilent Technologies service center.

Query Response

Figure 7-104 ET Query Response

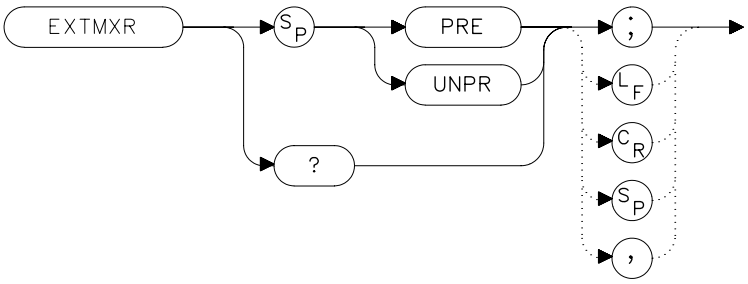
Example

```
10   OUTPUT 718;"ET?;"
20   ENTER 718;Et
30   PRINT Et
40   END
```

EXTMXR External Mixer Mode

Syntax

Figure 7-105 EXTMXR Syntax

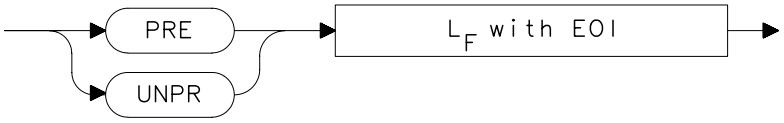


Description

The EXTMXR command specifies the external mixing mode as either preselected (PRE) or unpreselected (UNPR). This command applies only to the selection of the type of external mixer to be used. It does not switch the analyzer from internal to external mixing. This command is not available for use with an Agilent 8560E/EC Option 002.

Query Response

Figure 7-106 EXTMXR Query Response



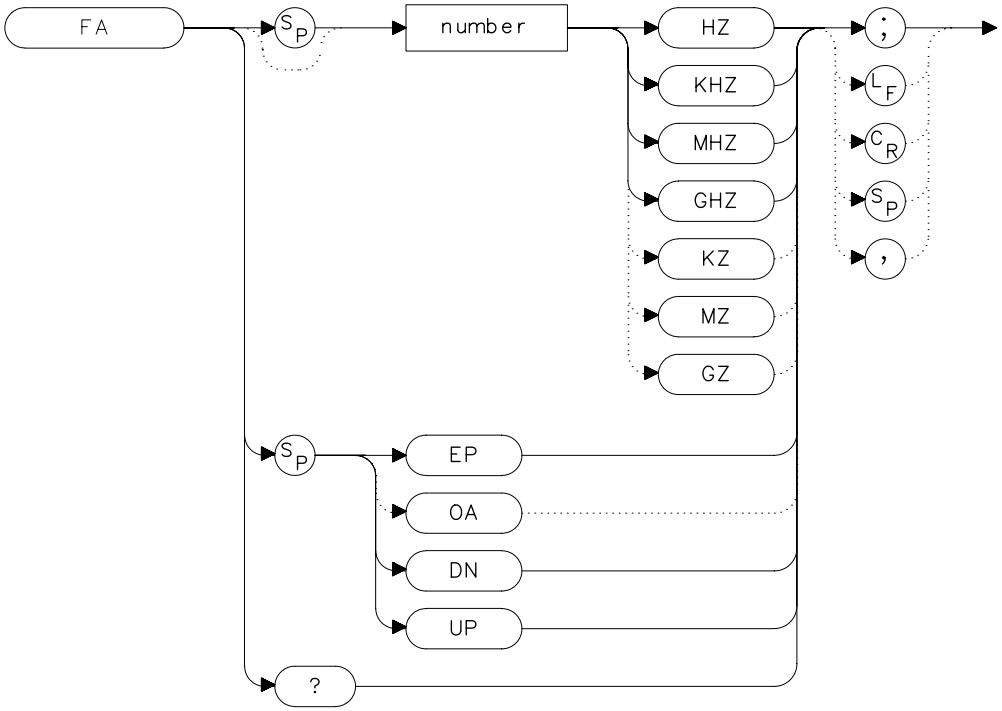
Example

```
10  OUTPUT 718;"EXTMXR PRE;"
20  END
```

FA Start Frequency

Syntax

Figure 7-107 FA Syntax



Description

The FA command sets the start frequency and sets the spectrum analyzer to start-frequency and stop-frequency mode. If the start frequency exceeds the stop frequency, the stop frequency increases to equal the start frequency plus the minimum span. The center frequency and span change with changes in the start frequency.

Parameters

number	real from 0 to 2.9E+9 (8560E/EC)
	0 to 6.5E+9 (Agilent 8561E/EC)

0 to 13.2E+9 (Agilent 8562E/EC)

0 to 26.5E+9 (Agilent 8563E/EC)

0 to 40E+9 (Agilent 8564E/EC)

0 to 50E+9 (Agilent 8565E/EC)

from 18E+9 to 325E+9 in external mixer mode.

UP or DN increments in 10 percent of span.

Preset State

- 0 Hz

Query Response

Figure 7-108 FA Query Response

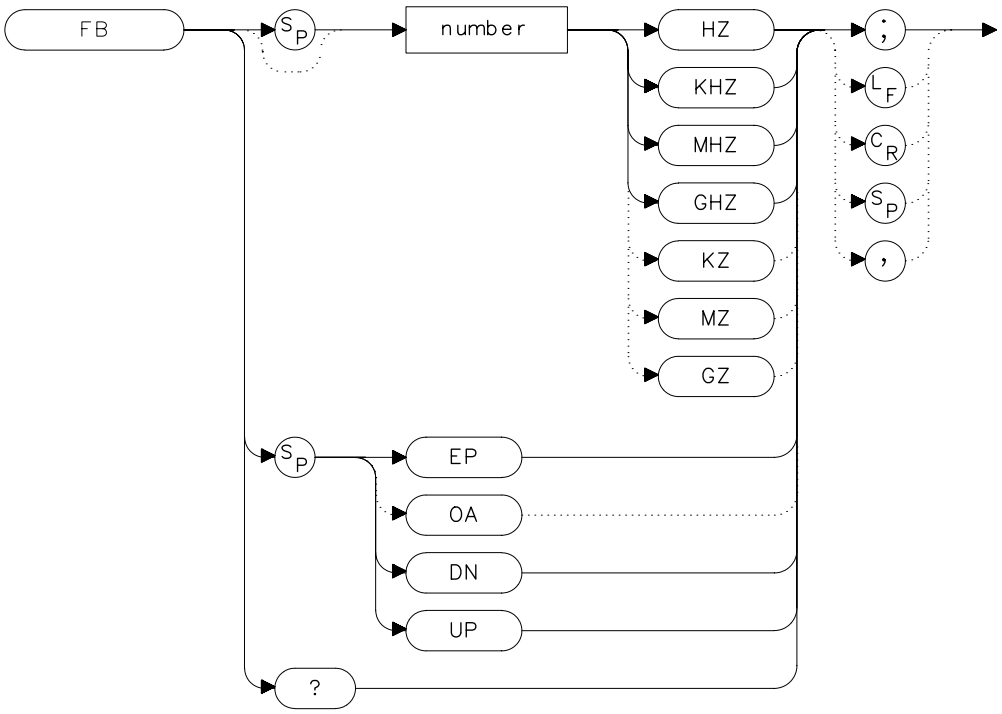
Example

```
10   OUTPUT 718;"FA 88MHZ;FB 108MHZ;"
20   OUTPUT 718;"FA?;"
30   ENTER 718;Fa
40   PRINT Fa
50   END
```

FB Stop Frequency

Syntax

Figure 7-109 FB Syntax



Description

The FB command sets the stop frequency and sets the spectrum analyzer to start-frequency and stop-frequency mode. If the stop frequency is less than the start frequency, the start frequency decreases to equal the stop frequency minus 100 Hz. The center frequency and span change with changes in the stop frequency.

Parameters

number	real from 0 to 2.9E+9 (8560E/EC)
	0 to 6.5E+9 (Agilent 8561E/EC)
	0 to 13.2E+9 (Agilent 8562E/EC)
	0 to 26.5E+9 (Agilent 8563E/EC)
	0 to 40E+9 (Agilent 8564E/EC)
	0 to 50E+9 (Agilent 8565E/EC)
	from 18E+9 to 325E+9 in external mixer mode.
UP or DN	increments in 10 percent of span.

Preset State

- 2.9 GHz (8560E/EC)
- 6.5 GHz (Agilent 8561E/EC)
- 13.2 GHz (Agilent 8562E/EC)
- 26.5 GHz (Agilent 8563E/EC)
- 40 GHz (Agilent 8564E/EC)
- 50 GHz (Agilent 8565E/EC)

Query Response

Figure 7-110 FB Query Response

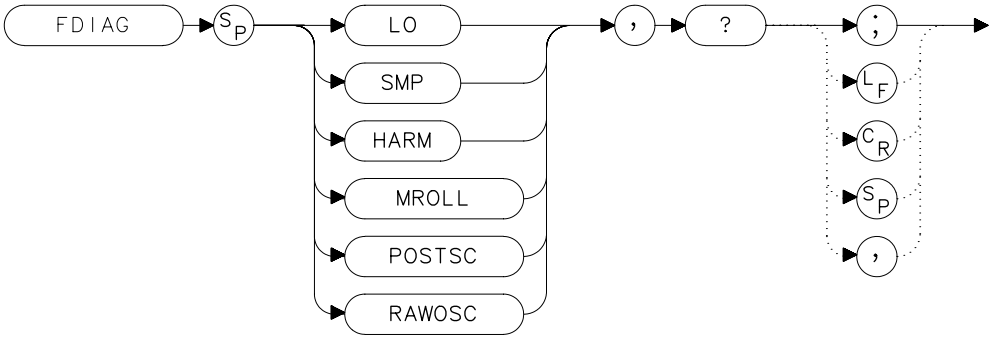
Example

```
10  OUTPUT 718;"FA 88MHZ;FB 108MHZ;"
20  OUTPUT 718;"FB?;"
30  ENTER 718;Fb
40  PRINT Fb
50  END
```

FDIAG Frequency Diagnostics

Syntax

Figure 7-111 FDIAG Syntax



Description

The FDIAG command activates the frequency diagnostic routine, which returns the frequency of the specified oscillator.

Parameters

LO	returns the first local oscillator frequency corresponding to the current start frequency.
SMP	returns the sampling oscillator frequency corresponding to the current start frequency.
HARM	returns the sampler harmonic number corresponding to the current start frequency.
MROLL	returns the frequency corresponding to the current setting of the fractional N phase locked loop.
POSTSC	returns the value of the postscaler, either 5, 6, or 7.
RAWOSC	returns the fractional N VCO frequency

NOTE In multiband sweeps, the above frequencies correspond to the band being swept when the command is executed.

$$MROLL = \frac{RAWOSC}{2 \times POSTSC}$$

Query Response

Figure 7-112 FDIAG Query Response

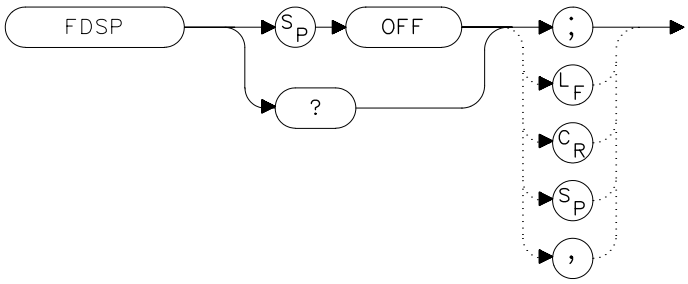
Example

```
10   OUTPUT 718;"FDIAG SMP,?;"
20   ENTER 718;Fdiag
30   PRINT "DIAGNOSTIC FREQUENCY IS ",Fdiag
40   END
```

FDSP Frequency Display Off

Syntax

Figure 7-113 FDSP Syntax



Description

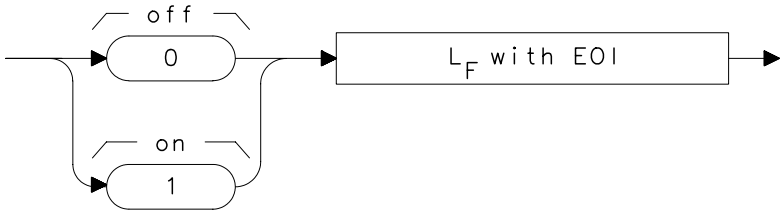
The FDSP command turns off all annotation that describes the spectrum analyzer frequency setting. This includes start and stop frequencies, center frequency, frequency span, marker readouts, center frequency step-size, and signal identification to center frequency. To retrieve the frequency data, query the spectrum analyzer. To reactivate the annotation, execute the IP command.

Preset State

On

Query Response

Figure 7-114 FDSP Query Response



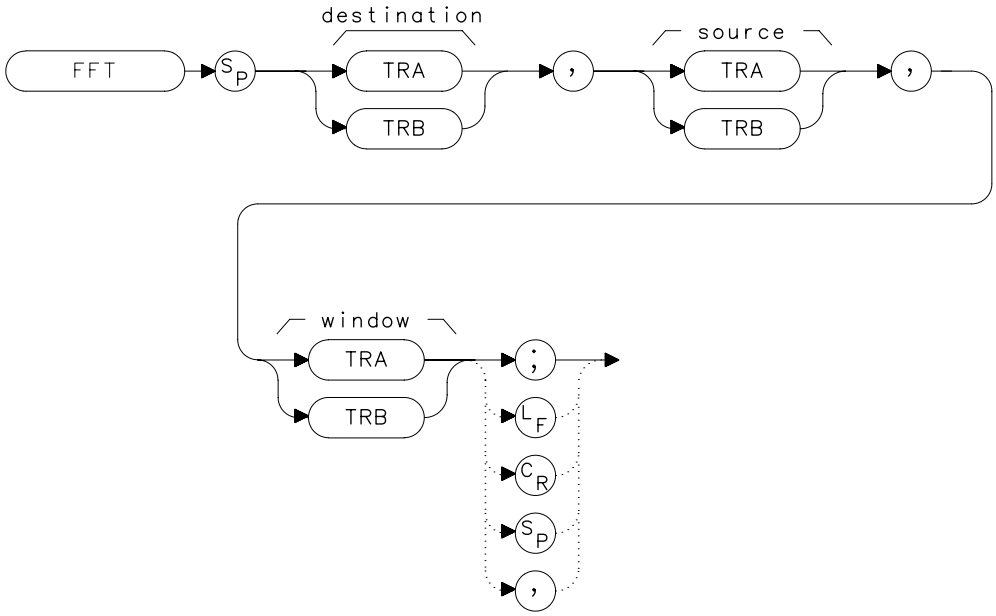
Example

```
10   OUTPUT 718;"FDSP OFF;"
20   OUTPUT 718;"FDSP?;"
30   ENTER 718;Fdsp
40   PRINT Fdsp
50   END
```

FFT Fast Fourier Transform

Syntax

Figure 7-115 FFT Syntax



Description

The FFT command performs a discrete Fourier transform on the source trace array and stores the logarithms of the magnitudes of the results in the destination array. The maximum length of any of the traces is 601 points.

FFT is designed to be used in transforming zero-span amplitude-modulation information into the frequency domain. Performing an FFT on a frequency sweep will not provide time-domain results and is not recommended.

The FFT results are displayed on the spectrum analyzer in a logarithmic amplitude scale. For the horizontal dimension, the frequency at the left side of the graticule is 0 Hz, and at the right side is F_{max}. F_{max} is equal to 300 divided by sweep time.

As an example, if the sweep time of the analyzer is 60 ms, F_{max} equals 5 kHz.

The FFT algorithm assumes that the sampled signal is periodic with an integral number of periods within the time-record length (that is, the sweep time of the analyzer). Given this assumption, the transform computed is that of a time waveform of infinite duration, formed of concatenated time records. In actual measurements, the number of periods of the sampled signal within the time record may not be integral. In this case, there is a step discontinuity at the intersections of the concatenated time records in the assumed time waveform of infinite duration. This step discontinuity causes measurement errors, both amplitude uncertainty (where the signal level appears to vary with small changes in frequency) and frequency resolution (due to filter shape factor and sidelobes). Windows are weighing functions that are applied to the input data to force the ends of that data smoothly to zero, thus reducing the step discontinuity and reducing measurement errors.

Three types of windows are available, using the TWNDOW command.

FLATTOP provides optimum amplitude accuracy.

HANNING provides an amplitude accuracy and frequency resolution compromise, which is useful for general purpose measurements, as well as noise measurements.

UNIFORM provides equal weighing of the time record for measuring transients.

Some important parameters of the three available windows are shown in the table below. In the bandwidth entries, multiply the entry by one-divided-by-sweeptime (1/sweeptime).

	FLATTOP	**HANNING**	**UNIFORM**
Noise equivalent bandwidth	3.63×	1.5×	1×
3 dB bandwidth	3.60×	1.48×	1×
Sidelobe height	<–90 dB	–32 dB	–13 dB
Amplitude uncertainty	0.10 dB	1.42 dB	3.92 dB
Shape factor (60 dB BW/3 dB BW)	2.6	9.1	>300

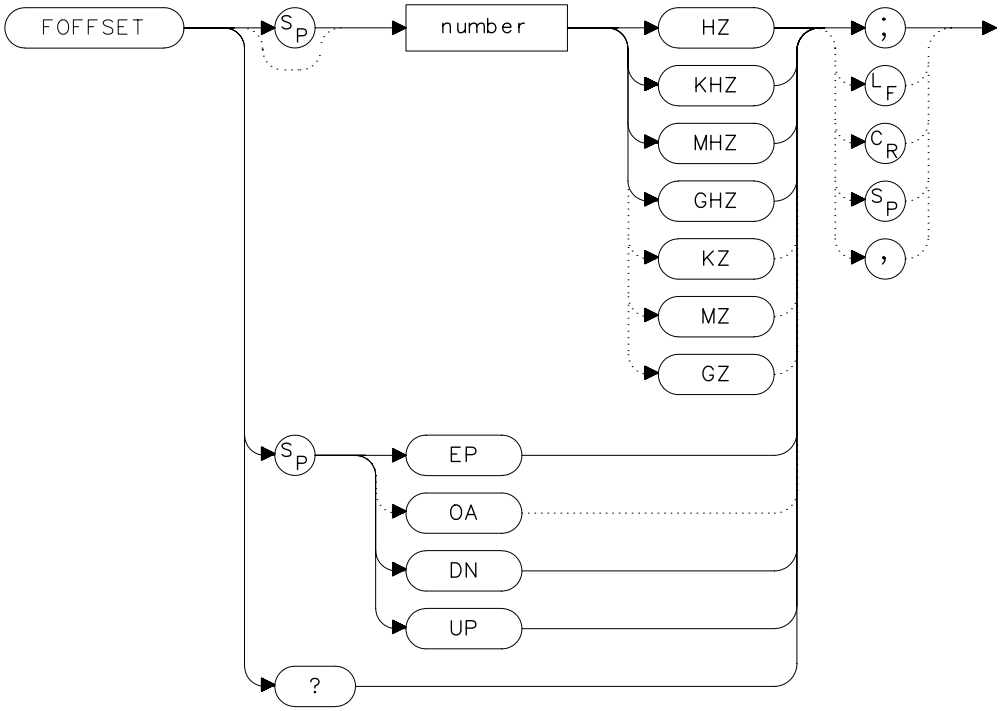
Example

```
10   OUTPUT 718;"IP;"
20   OUTPUT 718;"CF 300 MHZ;"
30   OUTPUT 718;"SP 0HZ;ST 50MS;"
40   OUTPUT 718;"TWNDOW TRA, UNIFORM;"
50   OUTPUT 718;"CLRW TRB;"
60   OUTPUT 718;"SNGLS;TS;TS;"
70   OUTPUT 718;"FFT TRA,TRB,TRA;"
80   OUTPUT 718;"BLANK TRB;"
90   OUTPUT 718;"VIEW TRA;"
100  END
```

FOFFSET Frequency Offset

Syntax

Figure 7-116 FOFFSET Syntax



Description

The FOFFSET command adds a specified offset to the displayed absolute-frequency values, including marker-frequency values. It does not affect the frequency range of the sweep, nor does it affect relative frequency readouts. When this function is active, an "F" appears on the left side of the display.

Parameters

number	real from 0 to 2.9E+9 (8560E/EC)
	real from 0 to 6.5E+9 (Agilent 8561E/EC)
	real from 0 to 13.2E+9 (Agilent 8562E/EC).
	real from 0 to 26.5E+9 (Agilent 8563E/EC).
	real from 0 to 40E+9 (Agilent 8564E/EC).
	real from 0 to 50E+9 (Agilent 8565E/EC).
UP or DN	changes by 10 percent of span.

Preset State

Off

Query Response

Figure 7-117 FOFFSET Query Response

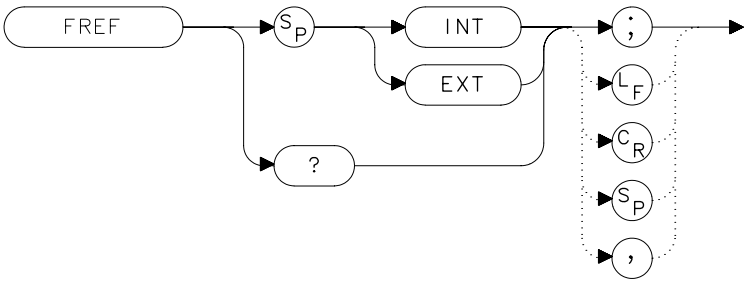
Example

```
10  INPUT "ENTER DESIRED FREQUENCY OFFSET IN HERTZ",Foffset
20  OUTPUT 718;"FOFFSET ";Foffset;"HZ;"
30  OUTPUT 718;"FOFFSET?;"
40  ENTER 718;Foffset
50  PRINT "THE FREQUENCY OFFSET IS",Foffset,"HZ"
60  END
```

FREF Frequency Reference

Syntax

Figure 7-118 FREF Syntax



Description

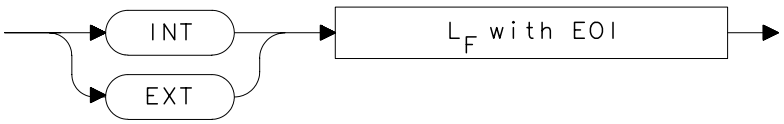
The FREF command specifies the frequency reference source. Select either the internal frequency reference (INT) or supply your own external reference (EXT). An external reference must be 10 MHz (±100 Hz) at a minimum amplitude of 0 dBm. Connect the external reference to J9 (10 MHz REF IN/OUT) on the rear panel. When the external mode is selected, an "X" appears on the left edge of the display.

Preset State

Internal

Query Response

Figure 7-119 FREF Query Response



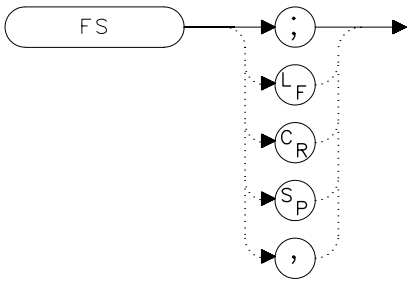
Example

```
10  INPUT "WHAT IS THE FREQUENCY REFERENCE SOURCE (INT OR
EXT)",Src$
20  OUTPUT 718;"FREF ";Src$;";"
30  PRINT "SOURCE SELECTED IS",Src$
40  END
```

FS Full Span

Syntax

Figure 7-120 FS Syntax



Description

The FS command selects the full frequency span as defined by the instrument. The full span is:

Spectrum Analyzer	Full Span
8560E/EC	2.9 GHz
Agilent 8561E/EC	6.5 GHz
Agilent 8562E/EC	13.2 GHz
Agilent 8563E/EC	26.5 GHz
Agilent 8564E/EC	40 GHz
Agilent 8565E/EC	50 GHz

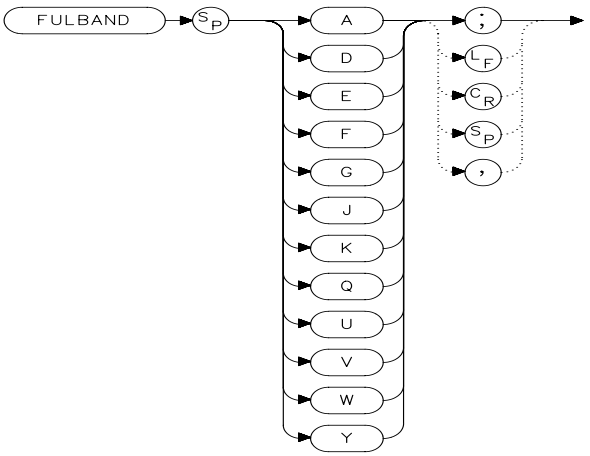
Example

```
10  OUTPUT 718;"FS;"
20  END
```

FULBAND Full Band

Syntax

Figure 7-121 FULBAND Syntax



NOTE When in preselected external mixing mode, band K is not available.

Description

The FULBAND command selects a commonly-used, external-mixer frequency band, as shown in Table 7-1 on page 372. The harmonic lock function (HNLOCK) is also set; this locks the harmonic of the chosen band. External-mixing functions are not available with an 8560E/EC Option 002.

Table 7-5 Unpreselected External-Mixer Frequency Bands

Frequency Band	Frequency Range (GHz)	Mixing Harmonic	Conversion Loss
K	18.0 to 26.5	6–	30 dB
A	26.5 to 40.0	8–	30 dB
Q	33.0 to 50.0	10–	30 dB
U	40.0 to 60.0	10–	30 dB
V	50.0 to 75.0	14–	30 dB
E	60.0 to 90.0	16–	30 dB
W	75.0 to 110.0	18–	30 dB
F	90.0 to 140.0	24–	30 dB

Table 7-5 Unpreselected External-Mixer Frequency Bands

Frequency Band	Frequency Range (GHz)	Mixing Harmonic	Conversion Loss
D	110.0 to 170.0	30–	30 dB
G	140.0 to 220.0	36–	30 dB
Y	170.0 to 260.0	44–	30 dB
J	220.0 to 325.0	54–	30 dB

Example

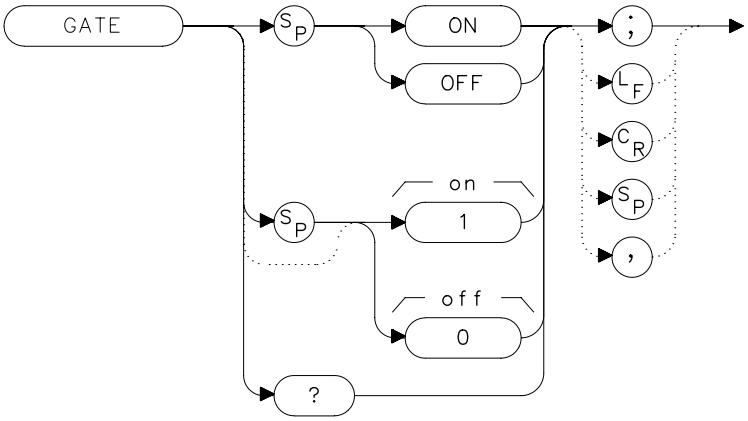
Lines 40 through 160 are only applicable with firmware revisions ≤920528 or with Option 008.

```
10   OUTPUT 718;"IP;MXRMODE EXT;"
20   INPUT "ENTER DESIRED FREQUENCY BAND (KAQUVEWFDGY OR
J)",Fulband$
30   OUTPUT 718;"FULBAND ";Fulband$;";"
40   OUTPUT 718;"MKN EP;"
50   PRINT "POSITION THE MARKER ON THE DESIRED SIGNAL."
60   PRINT "PRESS THE ANALYZER HOLD KEY, THEN PRESS CONTINUE
."
70   PAUSE
80   OUTPUT 718;"SNGLS;TS;SIGID AUTO;DONE?;"
90   ENTER 718;Done
100  OUTPUT 718;"IDFREQ?;"
110  ENTER 718;Idfreq
120    IF Idfreq<0 THEN
130    PRINT Idfreq
140    ELSE
150    PRINT "NO SIGNAL FOUND"
160    END IF
170  OUTPUT 718;"CONTS;"
180  LOCAL 718
190  END
```

GATE Gate

Syntax

Figure 7-122 GATE Syntax



Description

The GATE command turns on or off the time-gating function. When the time-gating function is turned on, the spectrum analyzer activates the time gate circuitry according to the parameters controlled by gate length (GL), gate delay (GD), and the gate trigger input.

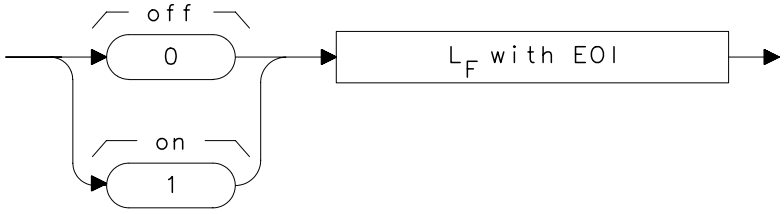
Preset State

Off

Query Response

A "0" is returned if the time-gate function is off, a "1" is returned if the time-gate function is on.

Figure 7-123 GATE Query Response



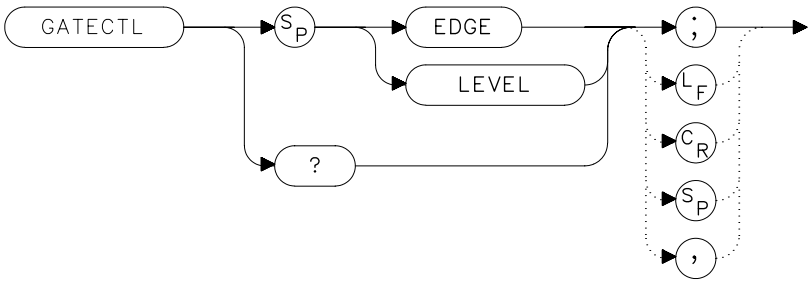
Example

```
OUTPUT 718;"GATE ON;"
Turns on the gating.
```

GATECTL Gate Control

Syntax

Figure 7-124 GATECTL Syntax



Description

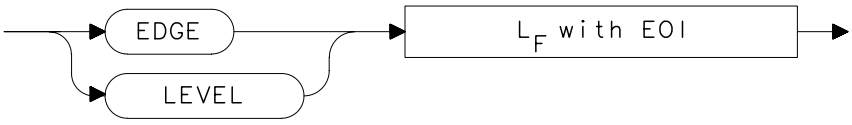
The GATECTL command selects between the edge and the level mode for time-gate function. In the edge mode, a specified trigger edge starts the gate delay timer that in turn starts the gate length timer. In the level mode, the gate follows the trigger input level. The gate polarity (GP), gate delay time (GD), and gate time length (GL) are operational in the edge mode, but not in the level mode.

Preset State

Edge

Query Response

Figure 7-125 GATECTL Query Response



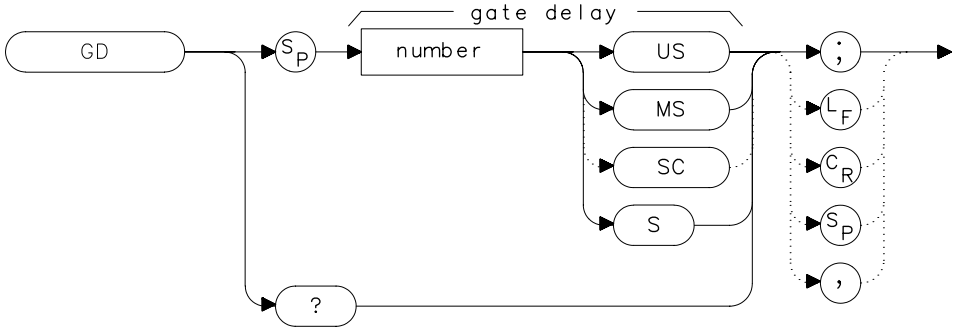
Example

```
OUTPUT 718;"GATECTL LEVEL;"
```

GD Gate Delay

Syntax

Figure 7-126 GD Syntax



Description

The GD command sets the delay time from when the gate trigger occurs to when the gate is turned on. GD applies only if GATECTL is set to EDGE.

Parameters

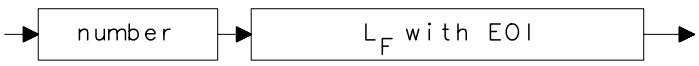
number real from 3 µs to 65.535 ms

Preset State

3 µs

Query Response

Figure 7-127 GD Query Response



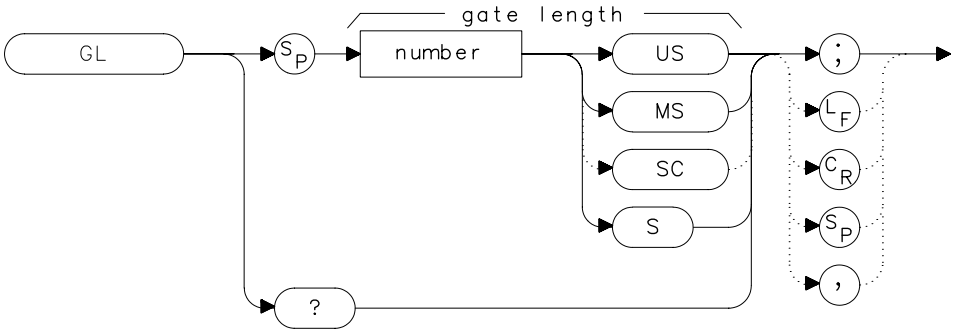
Example

```
OUTPUT 718;"GD 20US;"
Sets the gate delay to 20 µs.
```

GL Gate Length

Syntax

Figure 7-128 GL Syntax



Description

The GL command sets the length of time the time gate is turned on. GL applies only if GATECTL is set to EDGE.

Parameters

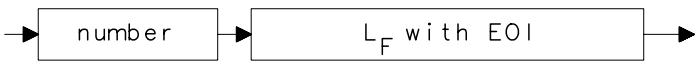
number real from 1 µs to 65.535 ms

Preset State

1 µs

Query Response

Figure 7-129 GL Query Response



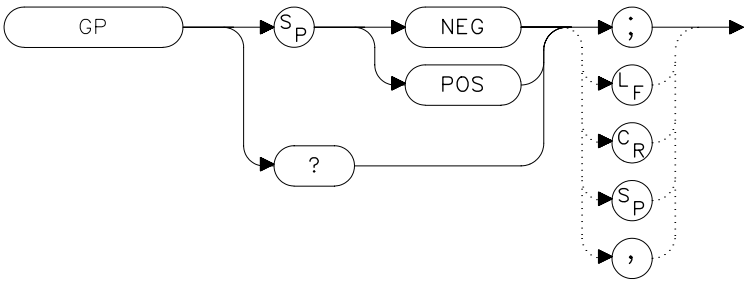
Example

```
OUTPUT 718;"GL 15US;"
Sets the gate length to 15 µs.
```

GP Gate Polarity

Syntax

Figure 7-130 GP Syntax



Description

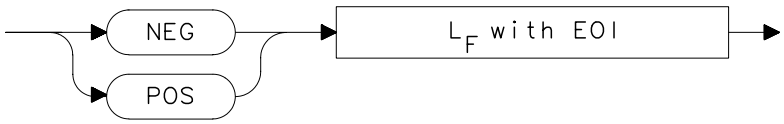
The GP command sets the polarity (positive or negative) for the gate trigger. If the gate control (GATECTL) is in the edge mode, the gate delay timer can be triggered on either a positive or negative edge of the trigger input. If the gate control is in level mode and positive is chosen, the gate will be on when the trigger input is high. If the gate control is in level mode and negative is chosen, the gate will be on when the trigger input is low.

Preset State

Positive

Query Response

Figure 7-131 GP Query Response



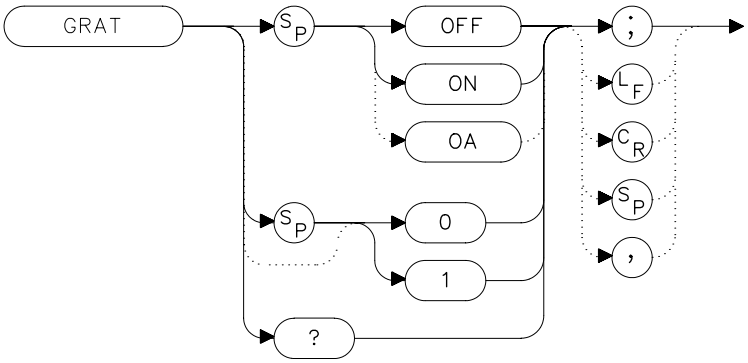
Example

```
OUTPUT 718;"GP POS;"
```

GRAT Graticule On/Off

Syntax

Figure 7-132 GRAT Syntax



Description

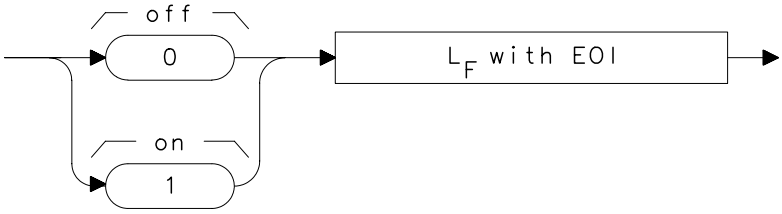
The GRAT command turns the display graticule on or off.

Preset State

On

Query Response

Figure 7-133 GRAT Query Response



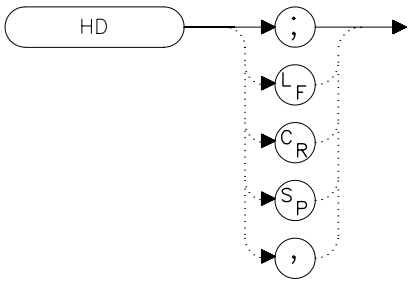
Example

```
10   OUTPUT 718;"GRAT OFF;"
20   OUTPUT 718;"GRAT?;"
30   ENTER 718;Grat
40   PRINT Grat
50   END
```

HD Hold

Syntax

Figure 7-134 HD Syntax



Description

The HD command freezes the active function at its current value. If no function is active, no operation takes place.

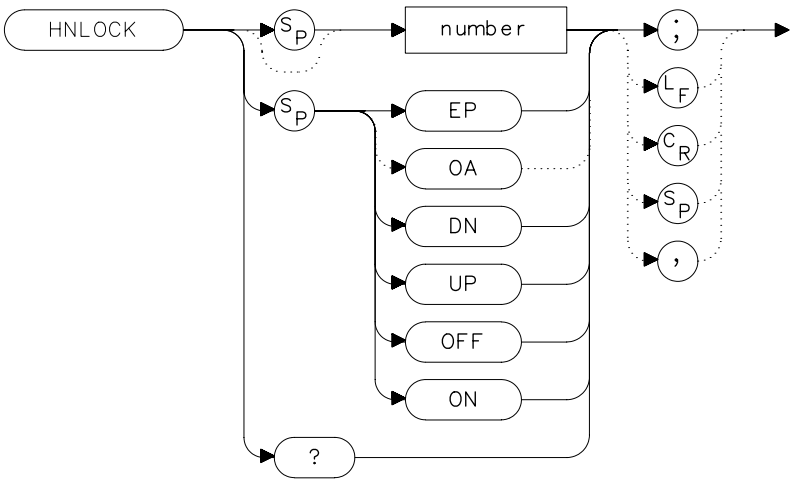
Example

```
10   OUTPUT 718;"IP;CF 300MHZ;SP 20MHZ;HD;"
20   END
```

HNLOCK Harmonic Number Lock

Syntax

Figure 7-135 HNLOCK Syntax



Description

The HNLOCK command locks a chosen harmonic so only that harmonic is used to sweep an external frequency band. To select a frequency band, use the FULBAND command; it selects an appropriate harmonic for the desired band. To change the harmonic number, use HNLOCK. Table 7-6 on page 490 shows the frequency bands and the harmonics that sweep each band. Note that HNLOCK also works in internal-mixing modes.

Once FULBAND or HNLOCK are set, only center frequencies and spans that fall within the frequency band of the current harmonic can be entered. When the FS command is activated, the span is limited to the frequency band of the selected harmonic. This command is not available with an 8560E/EC Option 002.

Table 7-6 Frequency Bands and the Corresponding LO Harmonic For Unpreselected Mixers

Frequency Range (GHz)	Mixing Harmonic
18.00 to 26.50	6–
26.50 to 40.00	8–
33.00 to 50.00	10–
40.00 to 60.00	10–
50.00 to 75.00	14–
60.00 to 90.00	16–
75.00 to 110.00	18–
40.00 to 140.00	24–
110.00 to 170.00	30–
140.00 to 220.00	36–
170.00 to 260.00	44–
220.00 to 325.00	54–

Parameters

number integer from 1 to 54 (for best results, choose from harmonic numbers shown in Table 7-1 on page 372).

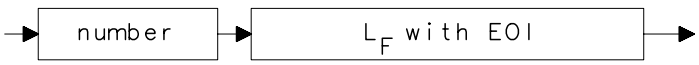
UP or DN increments of 1.

Preset State

Off

Query Response

Figure 7-136 HNLOCK Query Response



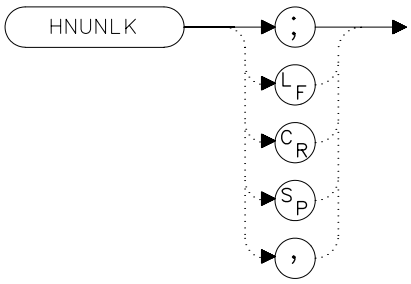
Example

```
10   OUTPUT 718;"IP;MXRMODE EXT;"
20   INPUT "SELECT THE START FREQUENCY, IN GHZ",Fa
30   INPUT "SELECT THE STOP FREQUENCY, IN GHZ",Fb
40   INPUT "ENTER HARMONIC DESIRED TO SWEEP RANGE",Harm
50   OUTPUT 718;"FA ";Fa;"GHZ;"
60   OUTPUT 718;"FB ";Fb;"GHZ;"
70   OUTPUT 718;"HNLOCK ";Harm;";"
80   END
```

HNUNLK Unlock Harmonic Number

Syntax

Figure 7-137 HNUNLK Syntax



Description

The HNUNLK command unlocks the harmonic number, allowing you to select frequencies and spans outside the range of the locked harmonic number. Also, when HNUNLK is executed, more than one harmonic can then be used to sweep across a desired span. For example, sweep a span from 18 GHz to 40 GHz. In this case, the analyzer will automatically sweep first using 6– mixing harmonic, then using 8– mixing harmonic. This command is not available with an 8560E/EC Option 002.

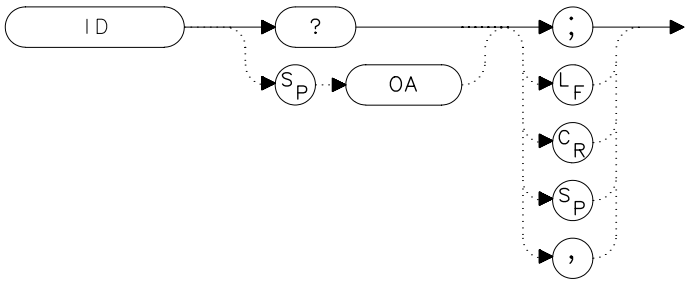
Example

```
10  OUTPUT 718;"IP;MXRMODE EXT;FULBAND Q;"
20  OUTPUT 718;"FA 18GHZ;FB 40GHZ;"
30  OUTPUT 718;"HNUNLK;"
40  END
```

ID Output Identification

Syntax

Figure 7-138 ID Syntax

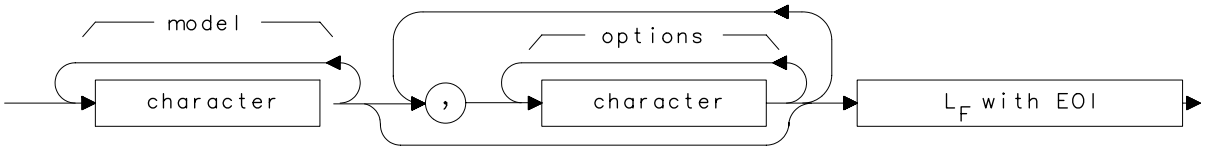


Description

The ID command returns the model number of the spectrum analyzer (for example, HP8563E/EC) and any options installed.

Query Response

Figure 7-139 ID Query Response



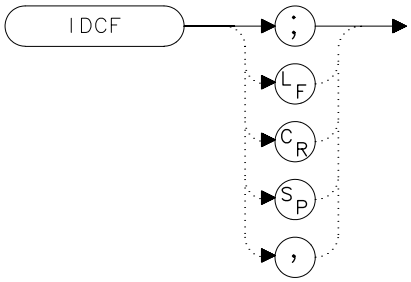
Example

```
10  DIM Id$[80]
20  OUTPUT 718;"ID?;"
30  ENTER 718;Id$
40  PRINT Id$
50  END
```

IDCF Signal Identification to Center Frequency

Syntax

Figure 7-140 IDCF Syntax



Description

The IDCF command sets the center frequency to the frequency obtained from the command SIGID. SIGID must be in AUTO mode and have found a valid result for this command to execute properly. Use SIGID on signals when in external mixing mode. IDCF only applies to spectrum analyzers with firmware revisions ≤920528 or with Option 008. The command does not apply to an 8560E/EC Option 002 or when the spectrum analyzer is configured to use preselected external mixers.

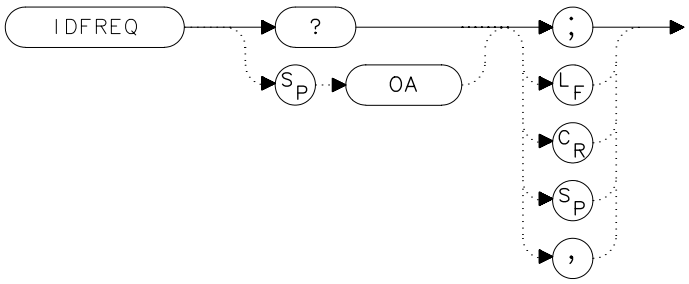
Example

```
10   OUTPUT 718;"SIGID AUTO;"
20   OUTPUT 718;"IDCF;"
30   OUTPUT 718;"CF?;"
40   ENTER 718;Cf
50   PRINT Cf
60   END
```

IDFREQ Signal Identified Frequency

Syntax

Figure 7-141 IDFREQ Syntax



Description

The IDFREQ command returns the frequency of the last identified signal. After an instrument preset or an invalid signal identification, IDFREQ returns a "0." IDFREQ only applies to spectrum analyzers with firmware revisions ≤920528 or with Option 008. The command does not apply to an 8560E/EC Option 002 or when the spectrum analyzer is configured to use preselected external mixers.

Query Response

Figure 7-142 IDFREQ Query Response

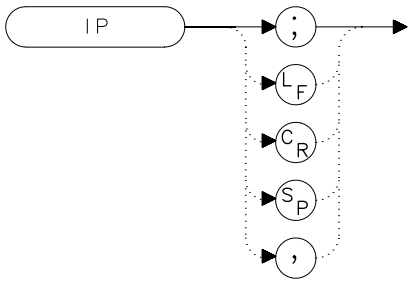
Example

```
10  OUTPUT 718;"IDFREQ?;"
20  ENTER 718;Idfreq
30  PRINT Idfreq
40  END
```

IP Instrument Preset

Syntax

Figure 7-143 IP Syntax



Description

The IP command sets the spectrum analyzer to a known, predefined state, shown in Table 7-1 on page 372. IP does not affect the contents of any data or trace registers or stored preselector data. IP does not clear the input or output data buffers; to clear these, execute the statement CLEAR 718. Include the TS command after IP when the next command will operate on trace data (such as TRA).

Table 7-7 8560 E-Series and EC-Series Preset States

Function	State
10 MHz REF	INTERNAL
A–B → A	OFF
A–B+DISPLAY LINE → A	OFF
AGC	OFF
ANNOTATION	ON
AUTO IF ADJUST	ON
BAND LOCK	OFF
CENTER FREQUENCY	1.45 GHz (8560E/EC) 3.25 GHz (Agilent 8561E/EC) 6.6 GHz (Agilent 8562E/EC) 13.25 GHz (Agilent 8563E/EC) 20 GHz (Agilent 8564E/EC) 25 GHz (Agilent 8565E/EC)
CF STEP	290 MHz (8560E/EC) 650 MHz (Agilent 8561E/EC) 1.32 GHz (Agilent 8562E/EC) 2.65 GHz (Agilent 8563E/EC) 4.0 GHz (Agilent 8564E/EC) 5.0 GHz (Agilent 8565E/EC)
DELAY SWEEP	2 µs, OFF

Table 7-7 8560 E-Series and EC-Series Preset States

Function	State
DEMODULATION	FM OFF; AM OFF
DEMODULATION TIME	1 second
DETECTOR	NORMAL
DISPLAY LINE	0 dBm, OFF
EXT MIXER BIAS	0 mA, OFF
EXT MIXER LO HARMONIC	6
FREQUENCY COUNTER	OFF
FREQUENCY COUNTER RESOLUTION	10 kHz
FREQUENCY DISPLAY	ON
FREQUENCY MODE	CENTER-SPAN
FREQUENCY OFFSET	0 Hz
GATE	OFF
GATE CONTROL	EDGE
GATE DELAY	3 µS
GATE LENGTH	1 µS
GATE POLARITY	Positive
GRATICULE	ON
INPUT ATTENUATION	10 dB, AUTO
MARKER MODE	OFF
MAX MIXER LEVEL	–10 dBm
MIXER	INT
MIXER CONV LOSS	30.0 dBm, OFF
NOISE MARKER	OFF
PEAK EXCURSION	6 dB
PEAK THRESHOLD	–130 dBm
PRESELECTOR PEAK TABLE	FACTORY DATA (not for 8560E/EC)
RBW to SPAN RATIO	0.011
REFERENCE LEVEL	0 dBm
REFERENCE LEVEL OFFSET	0 dB, OFF
RESOLUTION BW	1 MHz, AUTO
SIGNAL IDENTIFICATION	OFF
SIGNAL TRACK	OFF
SPAN	2.9 GHz (8560E/EC) 6.5 GHz (Agilent 8561E/EC) 13.2 GHz (Agilent 8562E/EC) 26.5 GHz (Agilent 8563E/EC) 40 GHz (Agilent 8564E/EC) 50 GHz (Agilent 8565E/EC)

Table 7-7 8560 E-Series and EC-Series Preset States

Function	State
SQUELCH	OFF
SQUELCH LEVEL	–120 dBm
SWEEP TIME	60 ms, AUTO (8560E/EC) 200 ms, AUTO (Agilent 8561E/EC) 264 ms, AUTO (Agilent 8562E/EC) 530 ms, AUTO (Agilent 8563E/EC) 800 ms, AUTO (Agilent 8564E/EC) 1 s, AUTO (Agilent 8565E/EC)
THRESHOLD	–90 dBm, OFF
TRACE A	CLEAR-WRITE
TRACE B	BLANK
TRACE-DATA	FORMAT P
TRIGGER MODE	CONTINUOUS
TRIGGER POLARITY	Positive
TRIGGER SOURCE	FREE-RUN
UNITS	dBm, AUTO
VERTICAL SCALE	10 dB per DIV
VBW to RBW RATIO	1
VIDEO BW	1 MHz, AUTO
VIDEO AVERAGE	100, OFF
VIDEO TRIG LEVEL	0 dBm

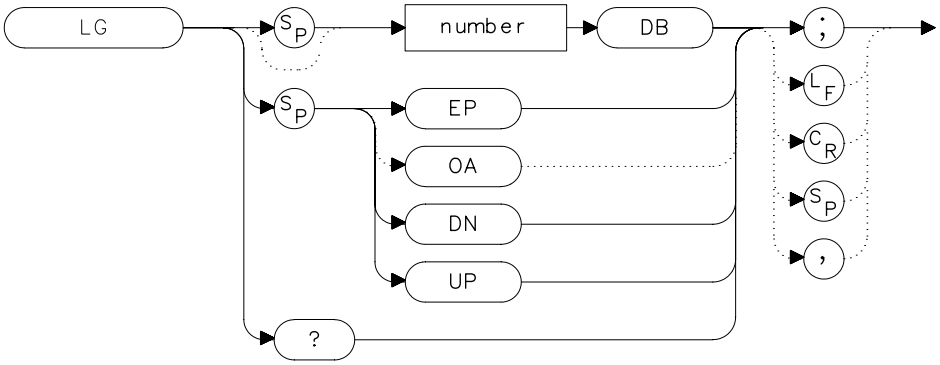
Example

```
10  OUTPUT 718;"IP;SNGLS;"
20  END
```

LG Logarithmic Scale

Syntax

Figure 7-144 LG Syntax



Description

The LG command selects a 1, 2, 5, or 10 dB logarithmic amplitude scale. When in linear mode, querying LG returns a "0". The 1 dB per division and 5 dB per division scales are not available for sweep times less than 30 ms.

Parameters

number	1, 2, 5, or 10.
UP or DN	increments in a 1, 2, 5, 10 sequence.

Preset State

10 dB per division

Query Response

Figure 7-145 LG Query Response

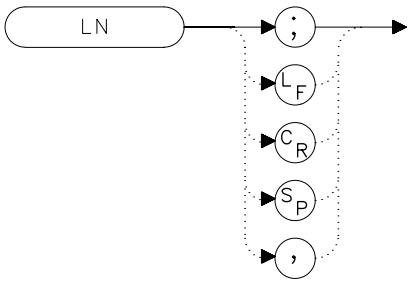
Example

```
10   OUTPUT 718;"LG 10DB;"
20   OUTPUT 718;"AUNITS DBMV;"
30   OUTPUT 718;"TS;MKPK HI;MKRL;"
40   OUTPUT 718;"LG 2DB;"
50   END
```

LN Linear Scale

Syntax

Figure 7-146 LN Syntax



Description

The LN command selects a linear amplitude scale. Measurements made on a linear scale can be read out in any amplitude units.

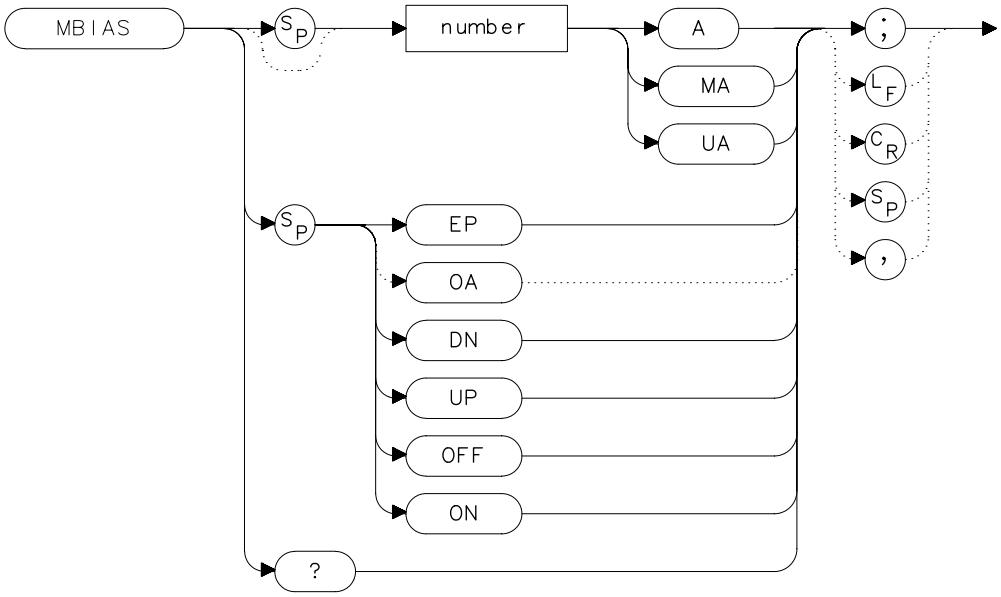
Example

```
10   OUTPUT 718;"LN;"
20   END
```

MBIAS Mixer Bias

Syntax

Figure 7-147 MBIAS Syntax



Description

The MBIAS command sets the bias for an external mixer that requires diode bias for efficient mixer operation. The bias, which is provided on the center conductor of the IF input, is activated when MBIAS is executed. A + or – appears on the left edge of the spectrum analyzer display, indicating that positive or negative bias is on. When the bias is turned off, MBIAS is set to 0. Default units are in milliamps. This function does not apply to an 8560E/EC Option 002.

CAUTION The open-circuit voltage can be as great as ±3.5 V through a source resistance of 300 ohms. Such voltage may appear when recalling an instrument state in which an active bias has been stored.

NOTE The bias value that appears on the spectrum analyzer display is expressed in terms of short-circuit current (the amount of current that would flow if the IF line were shorted to ground). The actual amount of current flowing into the mixer will be less.

Parameters

number	real from 0.01 mA to –0.01 mA.
UP or DN	increments of 0.1 mA.

Preset State

Off

Query Response

Figure 7-148 MBIAS Query Response

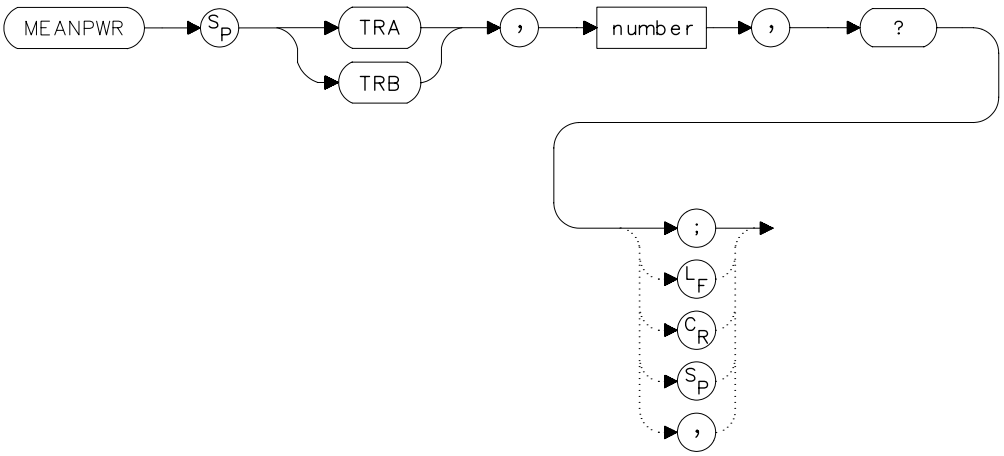
Example

```
10   OUTPUT 718;"IP;MXRMODE EXT;FULBAND U;"
20   OUTPUT 718;"MKN EP;"
30   PRINT "MOVE THE MARKER TO THE DESIRED SIGNAL"
40   PRINT "PRESS HOLD THEN PRESS CONTINUE"
50   PAUSE
60   INPUT "ENTER THE BIAS VALUE, IN MA",Bias
70   OUTPUT 718;"MBIAS ";Bias;"MA;"
80   OUTPUT 718;"MBIAS EP;"
90   PRINT "ADJUST BIAS IF NECESSARY"
100  PRINT "PRESS HOLD THEN PRESS CONTINUE"
110  PAUSE
120  OUTPUT 718;"SIGID AUTO;TS;DONE?;"
130  ENTER 718;Done
140  PRINT Done
150  END
```

MEANPWR Mean Power Measurement

Syntax

Figure 7-149 MEANPWR Syntax



Description

The MEANPWR command measures the average power of the carrier during that portion of the time when it is on. The on state is defined as the time when the signal is within a selected number of dB of its peak level. The range of amplitudes that is defined as the on state can be set with the command. The amplitude range is set relative to the peak value of the signal. The CARRON command is similar except that it doesn't allow definition the range of powers that are the on state.

The reference level and input attenuation are set automatically based on the measured power level of the carrier. Several sweeps are used to measure the true mean carrier power. True mean carrier power is calculated by measuring the time waveform of the RF envelope, converting the trace data from dB to power units, and then averaging the power trace data.

Parameters

number	0.01 dB to 100 dB

Query Response

Figure 7-150 MEANPWR Query Response

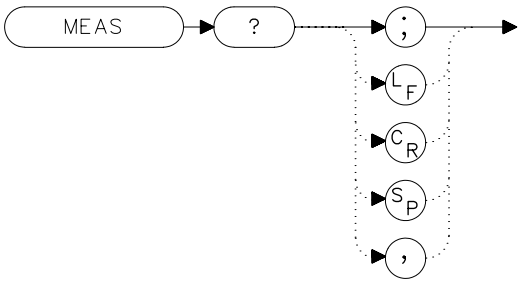
Example

```
10  REAL Onrange
20  Onrange = 10
30  OUTPUT 718;"MEANPWR TRB,";Onrange;"DB,?;"
```

MEAS Measurement Status

Syntax

Figure 7-151 MEAS Syntax



Description

The MEAS command query returns the current sweep status. If the spectrum analyzer is set to sweep and make measurements continuously, the command returns CONTS. If it is set to make a single sweep with a single measurement, it returns SNGLS.

The spectrum analyzer can be set to single sweep and continuous sweep using the SNGLS and CONTS commands.

Parameters

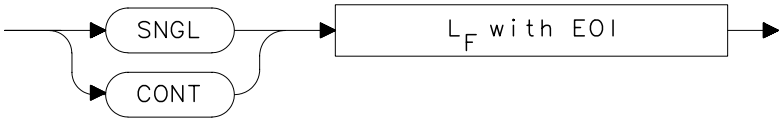
SNGLS, CONTS

Example

FILLER TEXT

Query Response

Figure 7-152 MEAS Query Response

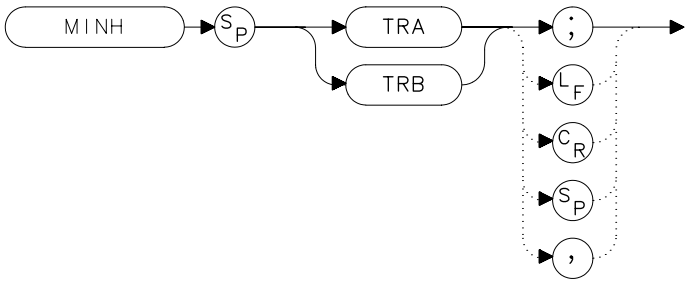



```
10  OUTPUT 718;"MEAS?;"
20  ENTER 718;Sweepstat$
```

MINH Minimum Hold

Syntax

Figure 7-153 MINH Syntax



Description

The MINH command updates the chosen trace with the minimum signal level detected at each trace-data point from subsequent sweeps. This function employs the negative peak detector (refer to the DET command).

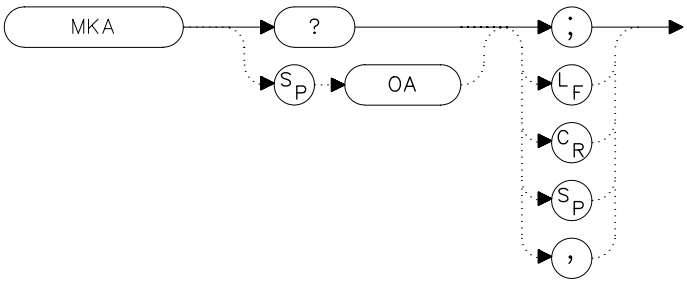
Example

```
10   OUTPUT 718;"IP;SNGLS;"
20   INPUT "ENTER START FREQUENCY, IN MHZ",Fa
30   INPUT "ENTER STOP FREQUENCY, IN MHZ",Fb
40   OUTPUT 718;"FA ";Fa;"MHZ;"
50   OUTPUT 718;"FB ";Fb;"MHZ;"
60   OUTPUT 718;"TS;MINH TRA;"
70   OUTPUT 718;"TS;MKPK HI;MKD;"
80   OUTPUT 718;"TS;MKPK NH;MKA?;AUNITS?;"
90   ENTER 718 USING "K";Difference,Aunits$
100  PRINT "DIFFERENCE IN AMPLITUDE IS ",Difference,Aunits$
110  LOCAL 718
120  END
```

MKA Marker Amplitude

Syntax

Figure 7-154 MKA Syntax



Description

The MKA command returns the amplitude of the active marker. If no marker is active, MKA places a marker at the center of the trace and returns that amplitude value.

Query Response

Figure 7-155 MKA Query Response

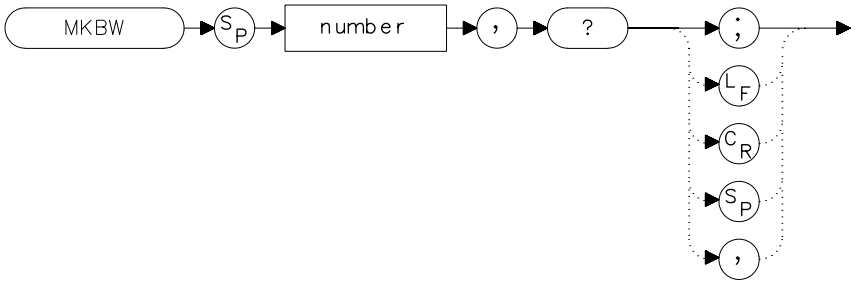
Example

```
10   OUTPUT 718;"IP;SNGLS;"
20   INPUT "ENTER IN DESIRED CENTER FREQUENCY, IN MHZ",Cf
30   INPUT "ENTER IN DESIRED FREQUENCY SPAN, IN MHZ",Sp
40   OUTPUT 718;"CF ";Cf;"MHZ;"
50   OUTPUT 718;"SP ";Sp;"MHZ;"
60   OUTPUT 718;"TS;MKPK HI;"
70   OUTPUT 718;"MKA?;AUNITS?;"
80   ENTER 718 USING "K";Mka,Aunits$
90   PRINT "HIGHEST PEAK IS",Mka,Aunits$
100  END
```

MKBW Marker Bandwidth

Syntax

Figure 7-156 MKBW Syntax



Description

When used remotely, the MKBW command finds the signal bandwidth at the power level in dB below the on-screen marker (if a marker is present) or the signal peak (if no on-screen marker is present). When the command is used manually, a peak search is automatically performed, and the bandwidth of the largest signal on-screen is displayed in the message area.

Parameter

integer	any valid negative integer (0 to the amplitude of the noise floor).

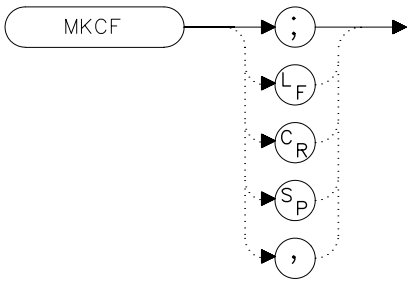
Example

```
10    OUTPUT 718;"IP;"
20    OUTPUT 718;"CF 300MHZ;SP 100MHZ;SNGLS;"
30    OUTPUT 718;"TS;MKPK HI;"
40    OUTPUT 718;"MKBW -3,?;"
50    ENTER 718;Mkbw
60    END
```

MKCF Marker to Center Frequency

Syntax

Figure 7-157 MKCF Syntax



Description

The MKCF command sets the center frequency to the frequency value of an active marker.

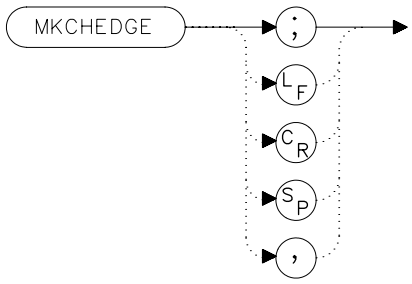
Example

```
10    OUTPUT 718;"IP;SNGLS;"
20    INPUT "ENTER IN DESIRED START FREQUENCY, IN MHZ",Fa
30    INPUT "ENTER IN DESIRED STOP FREQUENCY, IN MHZ",Fb
40    OUTPUT 718;"FA ";Fa;"MHZ;"
50    OUTPUT 718;"FB ";Fb;"MHZ;"
60    OUTPUT 718;"TS;MKPK HI;MKCF;TS;"
70    END
```

MKCHEDGE Marker to Channel Edges

Syntax

Figure 7-158 MKCHEDGE Syntax



Description

The MKCHEDGE command moves the markers to ±0.5 channel spacings from the current center frequency. This command can be used with the MKDELCHBW command to make power measurements within a channel while multiple channels are being shown on the display.

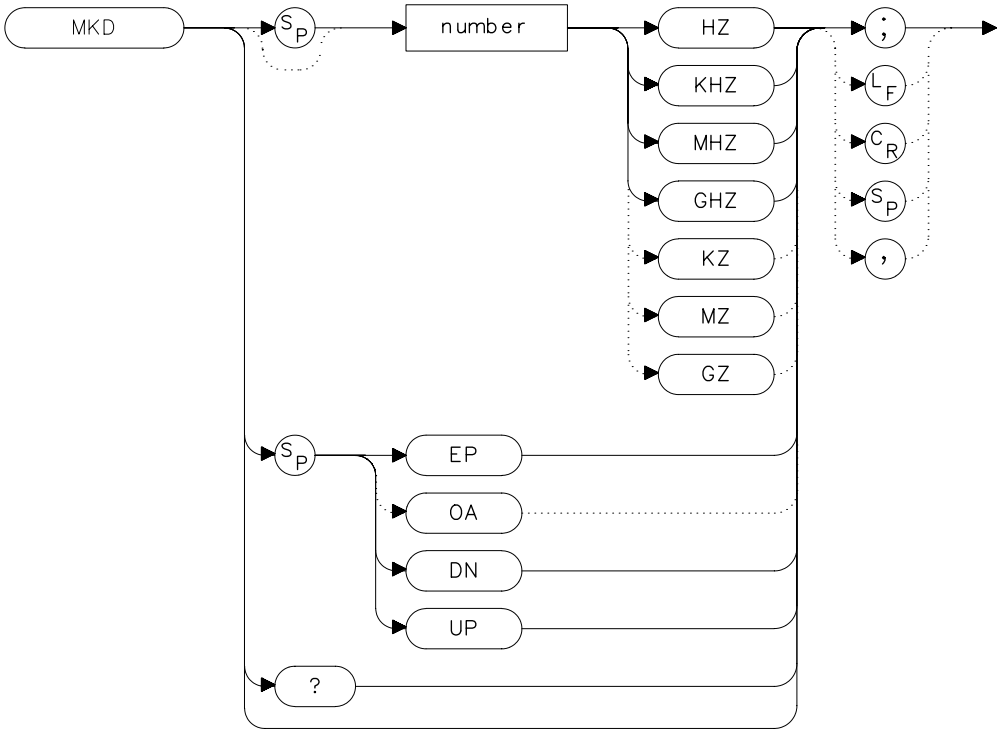
Example

```
10  OUTPUT 718;"MKCHEDGE;"
```

MKD Marker Delta

Syntax

Figure 7-159 MKD Syntax



Description

The MKD command places a second marker on the trace. The number specifies the distance in frequency or time (when the spectrum analyzer is in zero span) between the two markers. When using zero span, data entered or output is always interpreted as microseconds (US).

Parameters

number	dependent upon the chosen span.
UP or DN	increments in 10 percent of span.

Query Response

Figure 7-160 MKD Query Response

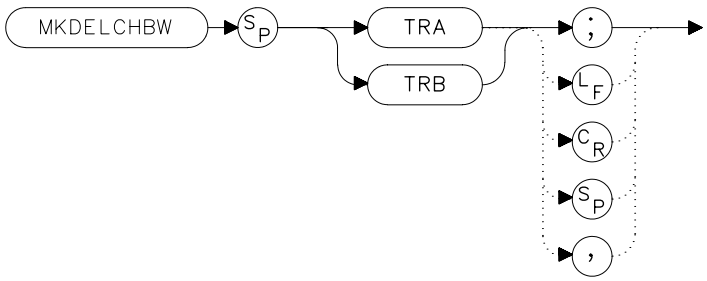
Example

```
10    OUTPUT 718;"IP;CF 450MHZ;SP 400MHZ;"
20    OUTPUT 718;"TS;MKPK HI;MKD 300MHZ;"
30    OUTPUT 718;"MKPK HI;MKD;MKPK NH;MKD?;"
40    ENTER 718;Mkd
50    PRINT Mkd
60    END
```

MKDELCHBW Delta Markers to Channel Power Bandwidth

Syntax

Figure 7-161 MKDELCHBW Syntax



Description

The MKDELCHBW command sets the channel power bandwidth to the value of the frequency difference between the current delta markers. This command is useful when making the occupied channel power measurements. Use the MKDELCHBW command to change the desired channel power to the power between the current delta markers. The MKMCF command can then be used to center this bandwidth on the display for making further measurements.

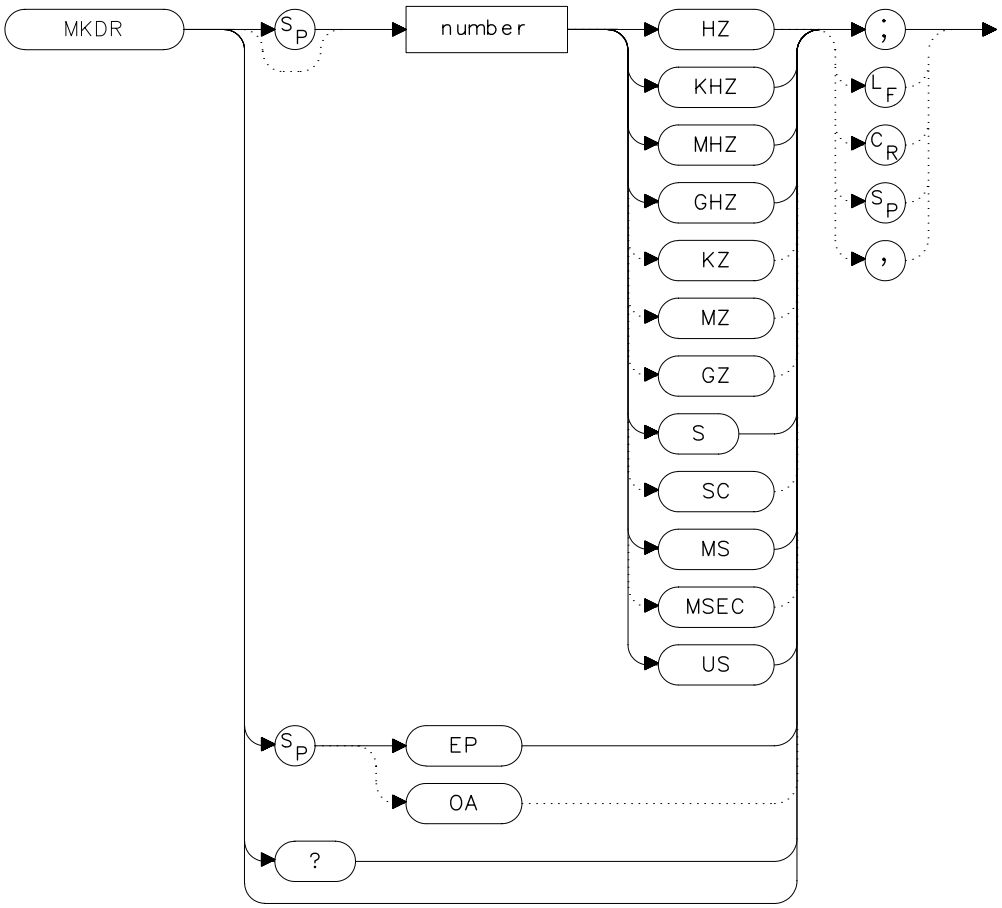
Example

```
10  OUTPUT 718; "MKDELCHBW TRA;"
```

MKDR Reciprocal of Marker Delta

Syntax

Figure 7-162 MKDR Syntax



Description

The MKDR command displays the reciprocal of the frequency or time (when in zero span) difference between two markers.

Parameter

number from 10E–12 to 20E+3.

Query Response

Figure 7-163 MKDR Query Response

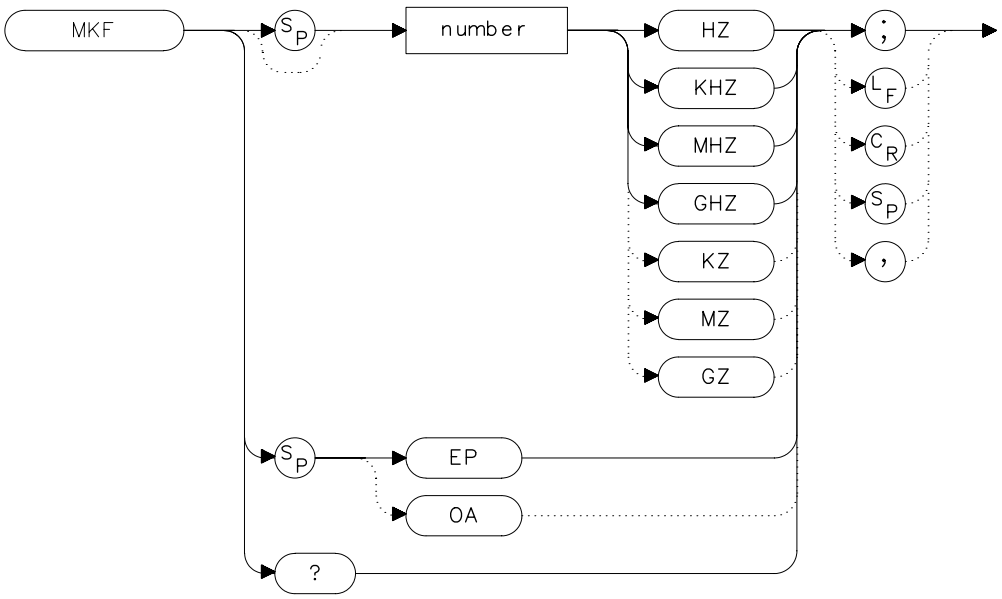
Example

```
10   OUTPUT 718;"CF 300MHZ;SP 200MHZ;"
20   OUTPUT 718;"TS;MKPK HI;MKD;MKPK NH;MKDR?;"
30   ENTER 718;Period
40   PRINT "THE TIME PERIOD IS ",Period
50   END
```

MKF Marker Frequency

Syntax

Figure 7-164 MKF Syntax



Description

The MKF command places an active marker on the chosen frequency or can be queried to return the frequency of the active marker. Default units are in hertz.

Parameter

number	real from 0 to 2.9E+9 (8560E/EC)
	0 to 6.5E+9 (Agilent 8561E/EC)
	0 to 13.2E+9 (Agilent 8562E/EC)
	0 to 26.5E+9 (Agilent 8563E/EC)
	0 to 40E+9 (Agilent 8564E/EC)
	0 to 50E+9 (Agilent 8565E/EC)

from 18E+9 to 325E+9 in external mixer mode.

Query Response

Figure 7-165 MKF Query Response

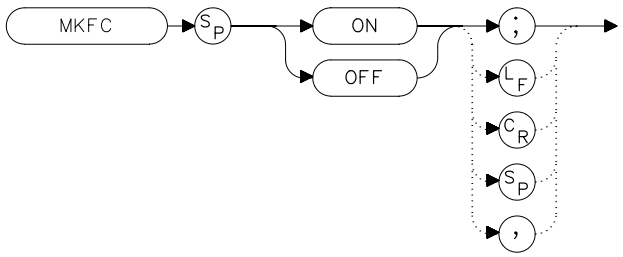
Example

```
10   OUTPUT 718;"CF 300MHZ;SP 20MHZ;MKF 290MHZ;"
20   OUTPUT 718;"TS;MKPK HI;MKF?;"
30   ENTER 718;Marker_freq
40   PRINT Marker_freq
50   END
```

MKFC Frequency Counter

Syntax

Figure 7-166 MKFC Syntax



Description

The MKFC command activates a frequency counter that counts the frequency of the active marker or the difference in frequency between two markers. If no marker is active, MKFC places a marker at the center of the trace and counts that marker frequency. The frequency counter provides a more accurate frequency reading; it completes a sweep, zooms in on the marked signal, goes into zero span, counts the value, and then starts a new sweep. To adjust the frequency counter resolution, use the MKFCR command. To return the counter value, use the MKF command.

Preset State

Offf

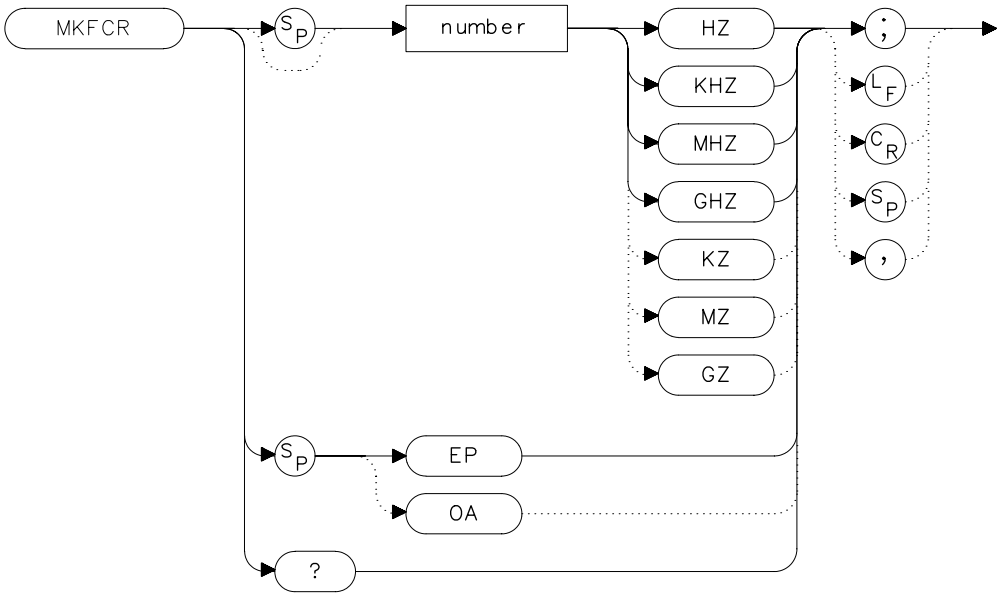
Example

```
10   INPUT "ENTER IN THE DESIRED CENTER FREQUENCY, IN MHZ",F
req
20   INPUT "ENTER IN THE DESIRED FREQUENCY SPAN,IN MHZ",Span
30   OUTPUT 718;"IP;CF ";Freq;"MHZ;"
40   OUTPUT 718;"SP ";Span;"MHZ;"
50   INPUT "ENTER DESIRED FREQUENCY-COUNTER RESOLUTION, IN
HZ",Resolution
60   OUTPUT 718;"MKFCR ";Resolution;"HZ;",
70   OUTPUT 718;"MKN EP;"
80   PRINT "PLACE THE MARKER ON THE DESIRED SIGNAL."
90   PRINT "PRESS HOLD ON THE ANALYZER, THEN PRESS CONTINUE.
"
100  PAUSE
110  OUTPUT 718;"MKFC ON;"
120  END
```

MKFCR Frequency Counter Resolution

Syntax

Figure 7-167 MKFCR Syntax



Description

The MKFCR command specifies the resolution of the frequency counter. Refer to the MKFC command. The default value is 10 kHz.

Parameter

number 1 Hz to 1 MHz, in powers of ten.

Query Response

Figure 7-168 MKFCR Query Response

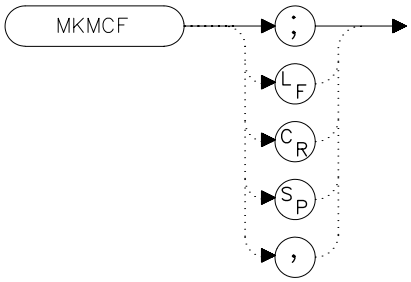
Example

```
10   INPUT "ENTER IN THE DESIRED CENTER FREQUENCY, IN MHZ",F
req
20   INPUT "ENTER IN THE DESIRED FREQUENCY SPAN, IN MHZ",Spa
n
30   OUTPUT 718;"IP;CF ";Freq;"MHZ;"
40   OUTPUT 718;"SP ";Span;"MHZ;"
50   INPUT "ENTER DESIRED FREQUENCY-COUNTER RESOLUTION, IN
HZ",Resolution
60   OUTPUT 718;"MKFCR ";Resolution;"HZ;",
70   OUTPUT 718;"MKN EP;"
80   PRINT "PLACE THE MARKER ON THE DESIRED SIGNAL."
90   PRINT "PRESS HOLD ON THE ANALYZER, THEN PRESS CONTINUE.
"
100  PAUSE
110  OUTPUT 718;"MKFC ON;"
120  OUTPUT 718;"MKF?;"
130  ENTER 718;Freq_count
140  PRINT "FREQUENCY IS",Freq_count,"HZ"
150  END
```

MKMCF Marker Mean to the Center Frequency

Syntax

Figure 7-169 MKMCF Syntax



Description

The MKMCF command moves the midpoint of the two displayed markers to the spectrum analyzer center frequency. This command is useful when making occupied channel power measurements. Use the MKDELCHBW command to change the desired channel power to the power between the current delta markers. The MKMCF command can then be used to center this bandwidth on the display for making further measurements.

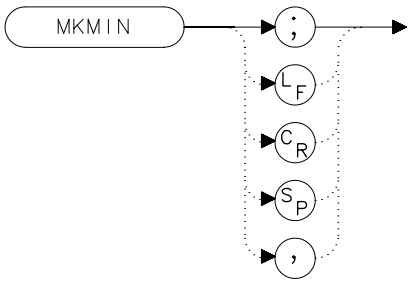
Example

```
10  OUTPUT 718;"MKMCF;"
```

MKMIN Marker to Minimum

Syntax

Figure 7-170 MKMIN Syntax



Description

The MKMIN command places an active marker on the minimum signal detected on a trace.

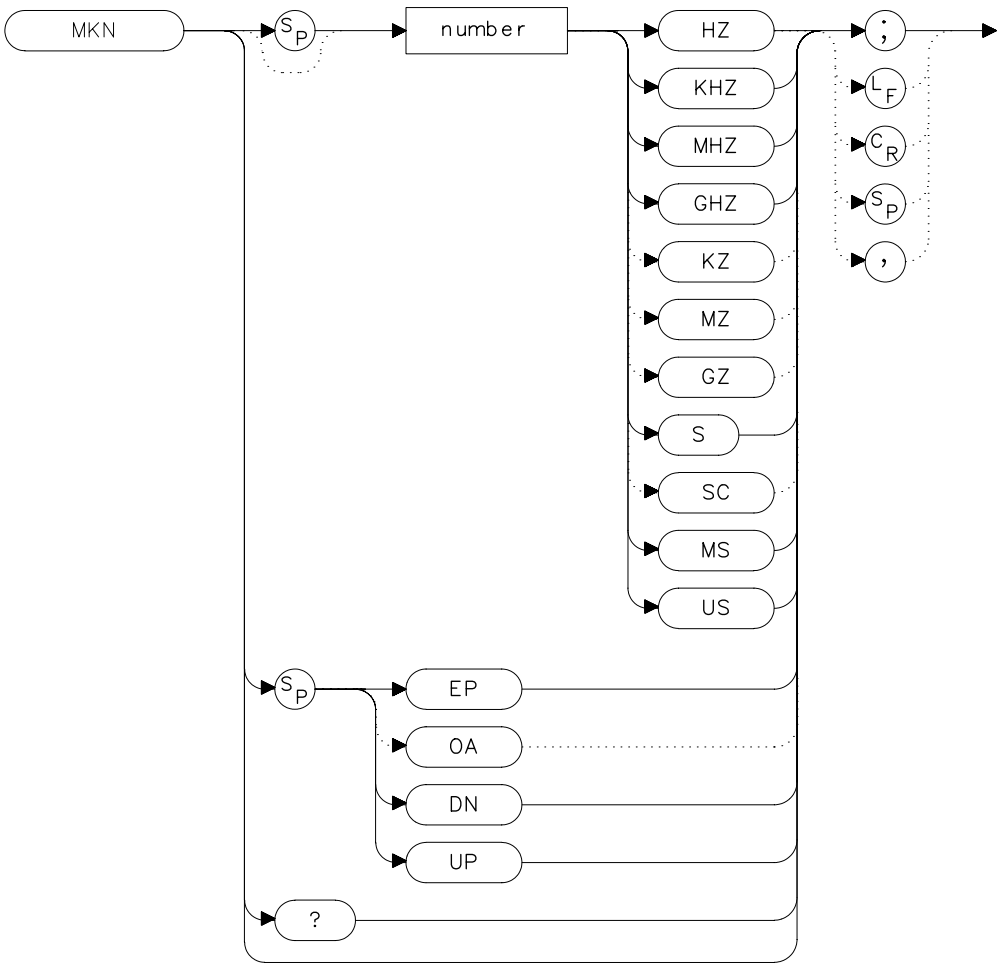
Example

```
10   OUTPUT 718;"IP;SNGLS;"
20   INPUT "ENTER IN THE START FREQUENCY, IN MHZ",Start_freq
30   INPUT "ENTER IN THE STOP FREQUENCY, IN MHZ",Stop_freq
40   OUTPUT 718;"FA ";Start_freq;"MHZ"
50   OUTPUT 718;"FB ";Stop_freq;"MHZ"
60   OUTPUT 718;"TS;MKPK HI;MKD;MKMIN;MKF?;"
70   ENTER 718;Delta_freq
80   OUTPUT 718;"MKA?;"
90   ENTER 718;Delta_amp
100  PRINT "DIFFERENCE IN FREQUENCY IS ",Delta_freq,"HZ"
110  PRINT "DIFFERENCE IN AMPLITUDE IS",Delta_amp,"DB"
120  END
```

MKN Marker Normal

Syntax

Figure 7-171 MKN Syntax



Description

The MKN command places an active marker on the specified frequency. If no frequency is specified, MKN places the marker at the center of the trace. When in zero span, querying MKN returns the center frequency.

Parameters

number	real from 0 to 2.9E+9 (8560E/EC)
	0 to 6.5E+9 (Agilent 8561E/EC)
	0 to 13.2E+9 (Agilent 8562E/EC)
	0 to 26.5E+9 (Agilent 8563E/EC)
	0 to 40E+9 (Agilent 8564E/EC)
	0 to 50E+9 (Agilent 8565E/EC)
	from 18E+9 to 325E+9 in external mixer mode.
UP or DN	increments in 10 percent of span.

Query Response

Figure 7-172 MKN Query Response

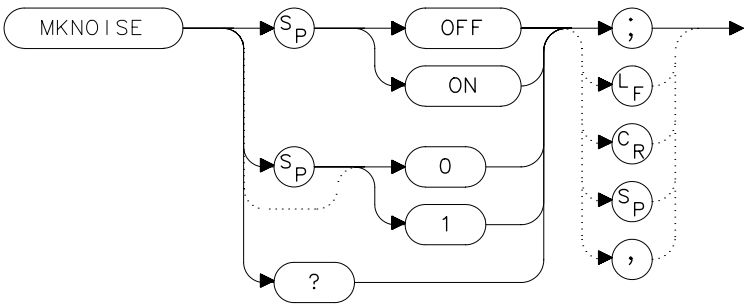
Example

```
10    INPUT "ENTER IN THE START FREQUENCY, IN MHZ",Start_fre
q
20    INPUT "ENTER IN THE STOP FREQUENCY, IN MHZ",Stop_freq
30    OUTPUT 718;"IP;FA ";Start_freq;"MHZ"
40    OUTPUT 718;"FB ";Stop_freq;"MHZ;"
50    OUTPUT 718;"MKN EP;"
60    PRINT "PLACE THE MARKER ON THE DESIRED SIGNAL."
70    PRINT "PRESS HOLD, THEN PRESS CONTINUE."
80    PAUSE
90    OUTPUT 718;"MKN?;"
100   ENTER 718;Mkn
110   PRINT "MARKER FREQUENCY IS ",Mkn,"HZ"
120   END
```

MKNOISE Marker Noise

Syntax

Figure 7-173 MKNOISE Syntax

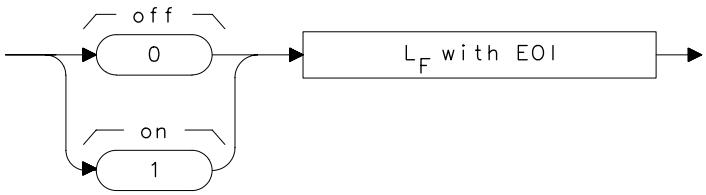


Description

The MKNOISE command sets the detector mode to sample and computes the average of 33 data points (16 points to the left of the marker, the marker itself, and 16 points to the right of the marker). This average is corrected for effects of the log or linear amplifier, bandwidth shape, IF detector, and resolution bandwidth. If two markers are on (whether in marker delta mode or 1/marker delta mode), MKNOISE works on the active marker and not on the anchor marker. This allows you to measure signal-to-noise density directly. To query the value, use the MKA command.

Query Response

Figure 7-174 MKNOISE Query Response



Example

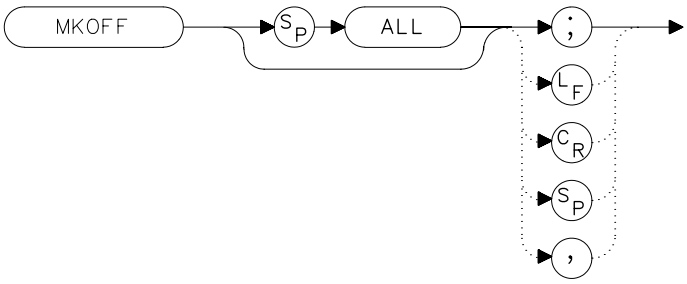
```
10   OUTPUT 718;"CF 300MZ;SP 10MZ;DET SMP;TS;MKPK HI;MKA?;"
```

```
20   ENTER 718;Amp_1
30   OUTPUT 718;"MKD UP UP;MKNOISE ON;MKA?;MKNOISE OFF;"
40   ENTER 718;Amp_2
50   DISP Amp_2
60   C_to_n=Amp_1-Amp_2
70   PRINT "CARRIER TO NOISE RATIO IN 1 HZ BANDWIDTH IS
";C_to_n;" DB"
80   END
```

MKOFF Marker Off

Syntax

Figure 7-175 MKOFF Syntax



Description

The MKOFF command turns off the active marker. Executing `MKOFF ALL;` turns off all markers.

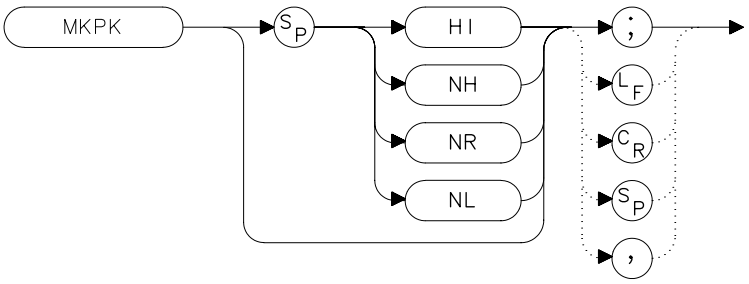
Example

```
10   OUTPUT 718;"MKOFF ALL;"
20   END
```

MKPK Peak Search

Syntax

Figure 7-176 MKPK Syntax



Description

The MKPK command places a marker on the highest point on a trace, the next-highest point, the next-left peak, or the next-right peak. The default is HI (highest point). If the NH, NR, or NL parameter is specified, the trace peaks must meet the criteria of the marker threshold and peak excursion functions in order for a peak to be found. If no parameter (or the HI parameter) is specified, only the peak threshold criteria must be met for a peak to be found. If no peak is found, the marker will appear on the trace at the center of the display. See also the MKPT and MKPX commands.

Parameters

HI	finds the highest point on a trace.
NH	finds the next-highest point on a trace.
NR	finds the next-right peak.
NL	finds the next-left peak.

Example

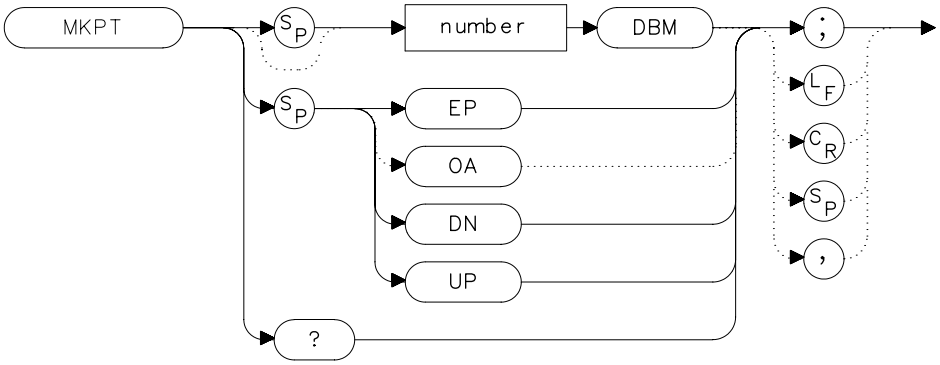
```
10   OUTPUT 718;"IP;SNGLS;"
20   INPUT "ENTER START FREQUENCY, IN MHZ",Start_freq
30   INPUT "ENTER STOP FREQUENCY, IN MHZ",Stop_freq
40   OUTPUT 718;"FA ";Start_freq;"MHZ;"
50   OUTPUT 718;"FB ";Stop_freq;"MHZ;"
```

```
60   OUTPUT 718;"TS;MKPK HI;MKD;MKPK NH;"
70   OUTPUT 718;"MKA?;"
80   ENTER 718;Delta_amplitude
90   OUTPUT 718;"MKF?;"
100  ENTER 718;Delta_freq
110  PRINT "DIFFERENCE IN FREQUENCY IS ",Delta_freq,"HZ"
120  PRINT "DIFFERENCE IN AMPLITUDE IS ",Delta_amplitude,"DB
"
130  END
```

MKPT Marker Threshold

Syntax

Figure 7-177 MKPT Syntax



Description

The MKPT command sets the minimum amplitude level from which a peak on the trace can be detected. The default value is –130 dBm. See also the MKPX command.

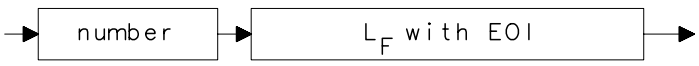
Any portion of a peak that falls below the peak threshold is used to satisfy the peak excursion criteria. For example, a peak that is equal to 3 dB above the threshold when the peak excursion is equal to 6 dB will be found if the peak extends an additional 3 dB or more below the threshold level.

Parameters

number	real from –200 to 30.
UP or DN	increments of 10 dB.

Query Response

Figure 7-178 MKPT Query Response



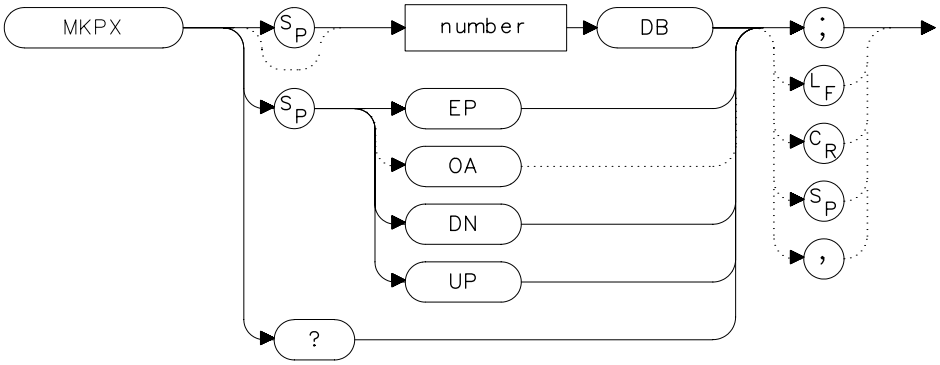
Example

```
10   OUTPUT 718;"IP;SNGLS;"
20   INPUT "ENTER START FREQUENCY, IN MHZ",Start_freq
30   INPUT "ENTER STOP FREQUENCY, IN MHZ",Stop_freq
40   INPUT "ENTER IN MARKER THRESHOLD, IN DB",Thresh
50   OUTPUT 718;"FA ";Start_freq;"MHZ;"
60   OUTPUT 718;"FB ";Stop_freq;"MHZ;"
70   OUTPUT 718;"MKPT ";Thresh;"DBM;"
80   OUTPUT 718;"TS;MKPK HI;"
90   END
```

MKPX Peak Excursion

Syntax

Figure 7-179 MKPX Syntax

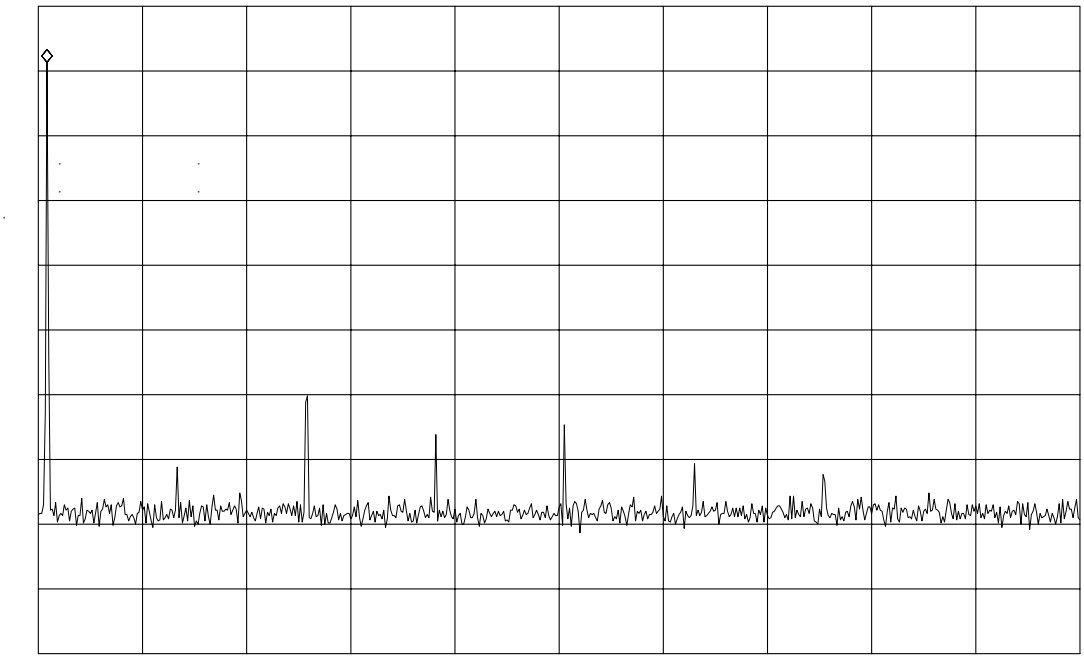


Description

The MKPX command defines what constitutes a peak on a trace. The chosen value specifies the amount that a trace must increase monotonically, then decrease monotonically, in order to be a peak. For example, if the peak excursion is 10 dB, the amplitude of the sides of a candidate peak must descend at least 10 dB in order to be considered a peak. See Figure 7-180 on page 533. The default value is 6 dB. In linear mode, enter the marker peak excursion as a unitless number of divisions.

Any portion of a peak that falls below the peak threshold is also used to satisfy the peak excursion criteria. For example, a peak that is equal to 3 dB above the threshold when the peak excursion is equal to 6 dB will be found if the peak extends an additional 3 dB or more below the threshold level.

Figure 7-180 MKPX Determines Which Signals are Considered Peaks

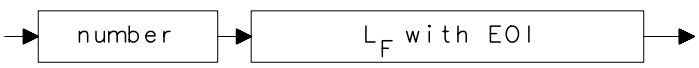


Parameters

number	real from 0.1 to 10 in linear mode; 0 to 30 in log mode.
UP or DN	1 vertical division of the display.

Query Response

Figure 7-181 MKPX Query Response



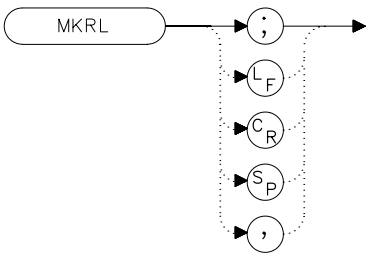
Example

```
10   OUTPUT 718;"IP;FA 250MHZ;FB 1300MHZ;"
20   INPUT "ENTER IN PEAK EXCURSION, IN DB ",Excursion
30   OUTPUT 718;"MKPX ";Excursion;"DB;"
40   OUTPUT 718;"TS;MKPK HI;MKA?;"
50   ENTER 718;Mka
60   OUTPUT 718;"MKF?;"
70   ENTER 718;Mkf
80   PRINT "PEAK FOUND AT ",Mkf
90   PRINT "PEAK AMPLITUDE IS",Mka
100  END
```

MKRL Marker to Reference Level

Syntax

Figure 7-182 MKRL Syntax



xmk

Description

The MKRL command sets the reference level to the amplitude of an active marker. If no marker is active, MKRL places a marker at the center of the trace and uses that marker amplitude to set the reference level. This command is not available when in delta marker mode.

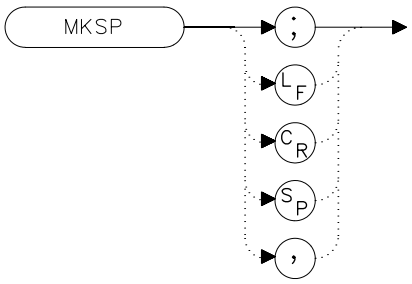
Example

```
10   OUTPUT 718;"IP;SNGLS;CF 300MHZ;SP 20MHZ;"
20   OUTPUT 718;"TS;MKPK HI;MKRL;TS;"
30   OUTPUT 718;"RL?;AUNITS?;"
40   ENTER 718 USING "K";Ref_level,Aunits$
50   PRINT "REFERENCE LEVEL IS",Ref_level,Aunits$
60   END
```

MKSP Marker Delta to Span

Syntax

Figure 7-183 MKSP Syntax



Description

The MKSP command sets the frequency span equal to the frequency difference between two markers on a trace. The start frequency is set equal to the frequency of the left-most marker and the stop frequency is set equal to the frequency of the right-most marker.

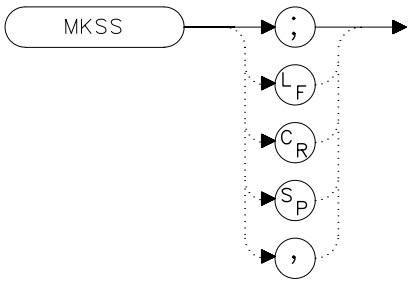
Example

```
10   INPUT "CONNECT THE 300 MHZ CALIBRATOR TO THE INPUT",Ans
$
20   OUTPUT 718;"IP;SNGLS;FA 270MHZ;FB 1275MHZ;TS;"
30   OUTPUT 718;"MKPK HI;MKD;MKPK NH;TS;MKSP;TS;"
40   END
```

MKSS Marker to Center Frequency Step-Size

Syntax

Figure 7-184 MKSS Syntax



Description

The MKSS command sets the center frequency step-size equal to the frequency value of the active marker.

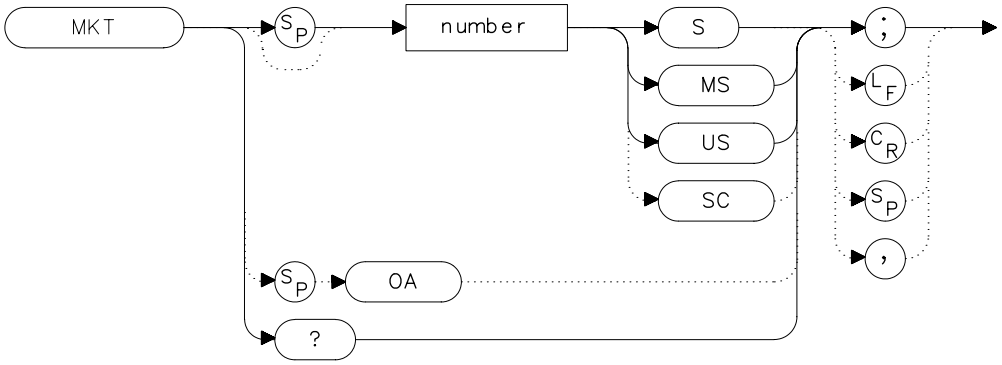
Example

```
10    INPUT "CONNECT THE 300 MHZ CALIBRATOR TO THE INPUT",An
s$
20    OUTPUT 718;"IP;SNGLS;CF 300MHZ;SP 20MHZ;TS;"
30    OUTPUT 718;"MKPK HI;MKSS;MKD;CF UP;TS;MKPK HI;"
40    OUTPUT 718;"MKA?;"
50    ENTER 718;Delta_amplitude
60    OUTPUT 718;"MKF?;"
70    ENTER 718;Delta_freq
80    PRINT "DIFFERENCE IN AMPLITUDE IS",Delta_amplitude,"DB
"
90    PRINT "DIFFERENCE IN FREQUENCY IS ",Delta_freq,"HZ"
100   END
```

MKT Marker Time

Syntax

Figure 7-185 MKT Syntax



Description

The MKT command places a marker at a position that corresponds to a specified point in time during the sweep. Default units are seconds.

Parameter

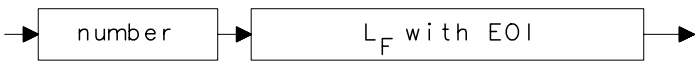
number real from 0 to the current sweep time.

Preset State

Off

Query Response

Figure 7-186 MKT Query Response



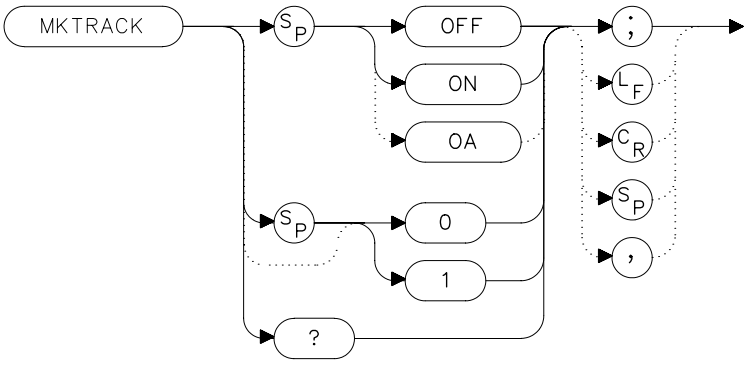
Example

```
10   OUTPUT 718;"ST 2S;MKT 1.6S;"
20   END
```

MKTRACK Signal Track

Syntax

Figure 7-187 MKTRACK Syntax



Description

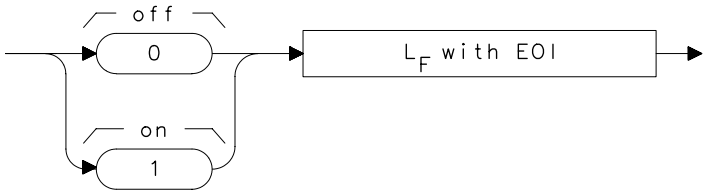
The MKTRACK command locates the active marker and sets the center frequency to the marker value. After every successive sweep, MKTRACK performs a peak search (MKPK), and then changes the center frequency of the spectrum analyzer to the frequency of the peak, thus maintaining the marker value at the center frequency. This allows you to "zoom in" quickly from a wide span to a narrow one, without losing the signal from the screen. Or, use MKTRACK to keep a slowly drifting signal centered on the display. When this function is active, a K appears on the left edge of the display.

Preset State

Off

Query Response

Figure 7-188 MKTRACK Query Response



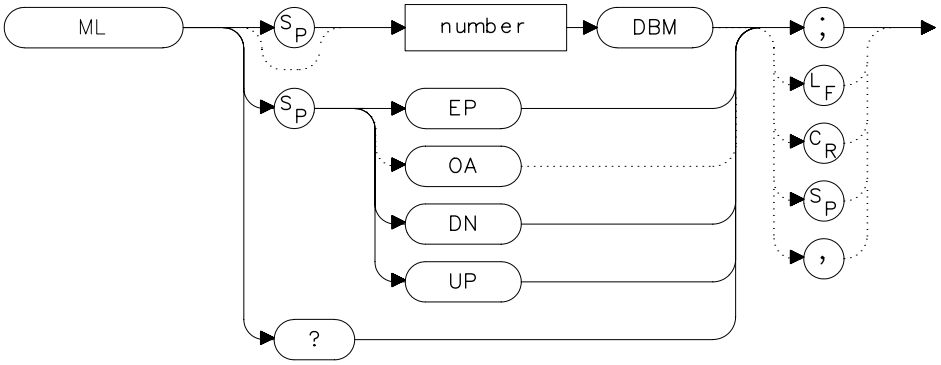
Example

```
10   INPUT "ENTER IN CENTER FREQUENCY, IN MHZ",Freq
20   INPUT "ENTER IN FREQUENCY SPAN, IN MHZ",Span
30   OUTPUT 718;"IP;"
40   OUTPUT 718;"CF ";Freq;"MHZ;TS;"
50   OUTPUT 718;"MKTRACK ON;"
60   OUTPUT 718;"SP ";Span;"MHZ;TS;"
70   OUTPUT 718;"MKTRACK OFF;"
80   END
```

ML Mixer Level

Syntax

Figure 7-189 ML Syntax



Description

The ML command specifies the maximum signal level that is at the input mixer. The attenuator automatically adjusts to ensure that this level is not exceeded for signals less than the reference level.

Parameters

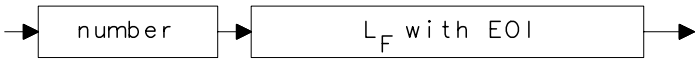
number	integer from –80 to –10, in decade increments. Numbers round down to the nearest decade.
UP or DN	increments by 10 dB.

Preset State

–10 dBm

Query Response

Figure 7-190 ML Query Response



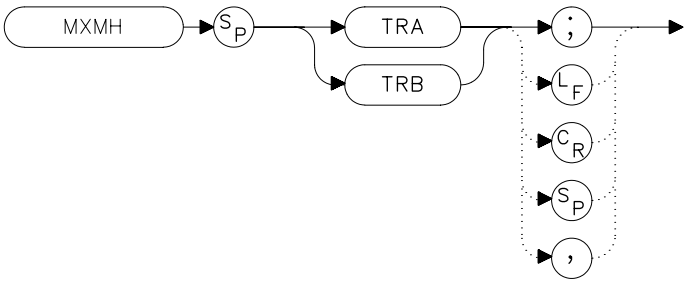
Example

```
10    OUTPUT 718;"ML –40DBM;"
20    OUTPUT 718;"ML?;"
30    ENTER 718;Ml
40    PRINT Ml
50    END
```

MXMH Maximum Hold

Syntax

Figure 7-191 MXMH Syntax



Description

The MXMH command updates the chosen trace with the maximum signal level detected at each trace-data point from subsequent sweeps. This function employs the positive peak detector (refer to the DET command). The detector mode can be changed, if desired, after maximum hold is initialized.

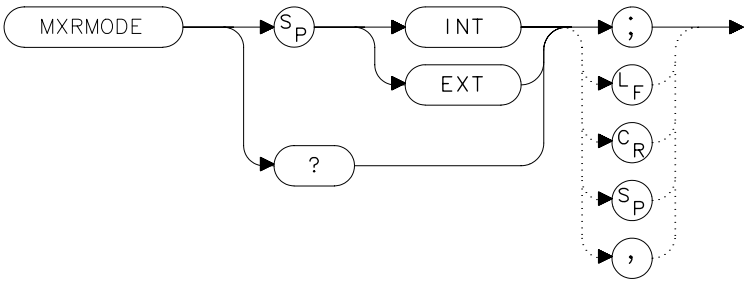
Example

```
10   OUTPUT 718;"BLANK TRA;CLRW TRB;MXMH TRB;"
20   END
```

MXRMODE Mixer Mode

Syntax

Figure 7-192 MXRMODE Syntax



Description

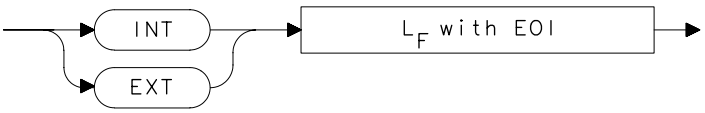
The MXRMODE command specifies the mixer mode. You can select either the internal mixer (INT) or an external mixer (EXT). This command does not apply to an 8560E/EC Option 002.

Preset State

Internal

Query Response

Figure 7-193 MXRMODE Query Response



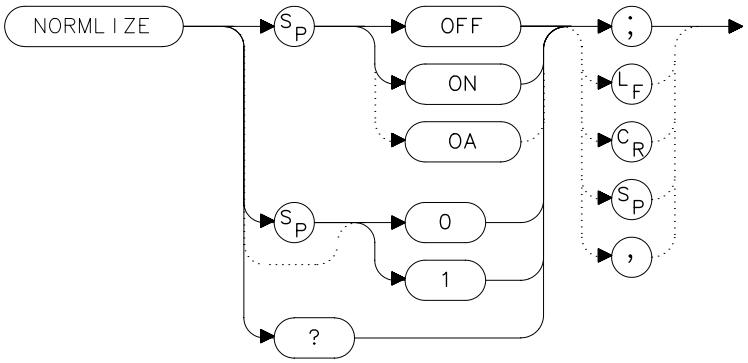
Example

```
10   INPUT "ENTER THE MIXER MODE (INT OR EXT)",Mode$
20   OUTPUT 718;"MXRMODE ";Mode$;";"
30   END
```

NORMLIZE Normalize Trace Data

Syntax

Figure 7-194 NORMALIZE Syntax



Description

The NORMLIZE command activates or deactivates the normalization routine for stimulus-response measurements. This function subtracts trace B from trace A, offsets the result by the value of the normalized reference position (NRL), and displays the result in trace A. NORMLIZE is intended for use with the STOREOPEN and STORESHORT or STORETHRU commands. These functions are used to store a reference trace into trace B. Refer to the respective command descriptions for more information.

Normalization is not available when using linear mode. Accurate normalization occurs only if the reference trace and the measured trace are on-screen. If any of these traces are off-screen, an error message will be displayed. If the error message `ERR 903 A > DLMT` is displayed, the range level (RL) can be adjusted to move the measured response within the displayed measurement range of the analyzer. If `ERR 904 B > DLMT` is displayed, the calibration is invalid and a thru or open/short calibration must be performed.

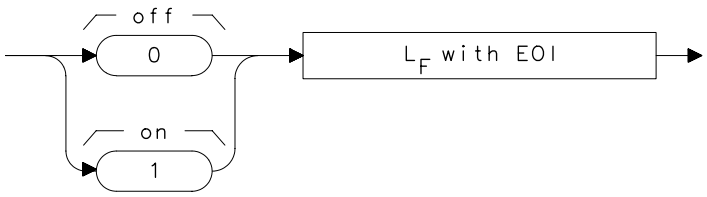
If active (ON), the NORMLIZE command is automatically turned off with an instrument preset (IP) or at power on.

Preset State

Off

Query Response

Figure 7-195 NORMALIZE Query Response



Example

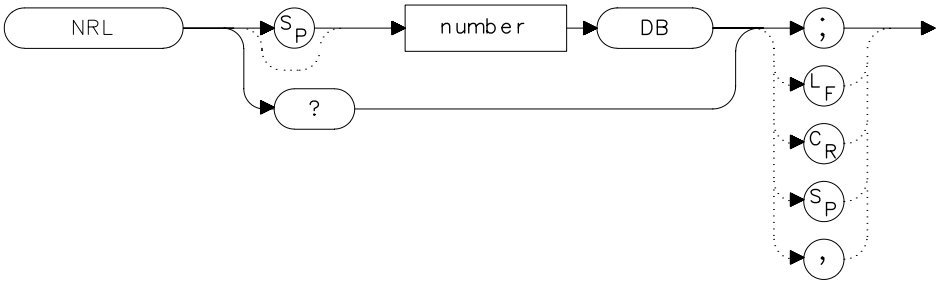
The following example is for use with an 8560E/EC Option 002 only.

```
10   OUTPUT 718;"IP;SNGLS;"
20   OUTPUT 718;"FA 300KHZ;FB 1GHZ;"
30   OUTPUT 718;"SRCPWR ON;"
40   OUTPUT 718;"SWPCPL SR;"
50   OUTPUT 718;"RB 100KHZ;"
60   OUTPUT 718;"SRCTKPK;DONE?;"
70   ENTER 718;Done
80   PRINT "CONNECT THRU. PRESS CONTINUE WHEN READY TO STORE
."
90   PAUSE
100  OUTPUT 718;"TS;DONE?;"
110  ENTER 718;Done
120  OUTPUT 718;"STORETHRU;"
130  OUTPUT 718;"TS;DONE?;"
140  ENTER 718;Done
150  OUTPUT 718;"NORMLIZE ON;"
160  OUTPUT 718;"TS;DONE?;"
170  ENTER 718;Done
180  LOCAL 718
190  END
```

NRL Normalized Reference Level

Syntax

Figure 7-196 NRL Syntax



Description

The NRL command sets the normalized reference level. It is intended to be used with the NORMLIZE command. When using NRL, the input attenuator and IF step gains are not affected. This function is a trace-offset function enabling the user to offset the displayed trace without introducing hardware-switching errors into the stimulus-response measurement. The unit of measure for NRL is dB.

In absolute power mode (dBm), reference level (RL) affects the gain and RF attenuation settings of the instrument, which affects the measurement or dynamic range. In normalized mode (relative power or dB-measurement mode), NRL offsets the trace data on-screen and does not affect the instrument gain or attenuation settings. This allows the displayed normalized trace to be moved without decreasing the measurement accuracy due to changes in gain or RF attenuation. If the measurement range must be changed to bring trace data on-screen, then the *range level* (see RL) should be adjusted. Adjusting the range-level in normalized mode has the same effect on the instrument settings as does reference level in absolute power mode (normalize off).

A normalization error will occur when the NRL command is executed if the current spectrum analyzer state is not the same as the state stored by the last execution of the STORETHRU or STORESHORT command. This can happen when several open/short or thru calibrations are performed.

The NRL command recalls the last calibration run. If one of the earlier short or thru states has been recalled just before executing the NRL command then the current and recalled states don't match and the error occurs. To avoid this error, update the STORETHRU or STORESHORT state register with the current state before turning NRL on. The STORETHRU state register is state register 9. The STORESHORT state register is state register 8. It is a good idea to take a sweep (TS command) prior to saving the state using the SAVES 8 or SAVES 9 command.

Parameters

number real from –100 to +100.

Preset State

0 dB

Query Response

Figure 7-197 NRL Query Response

Example

The following example is for use with an 8560E/EC Option 002.

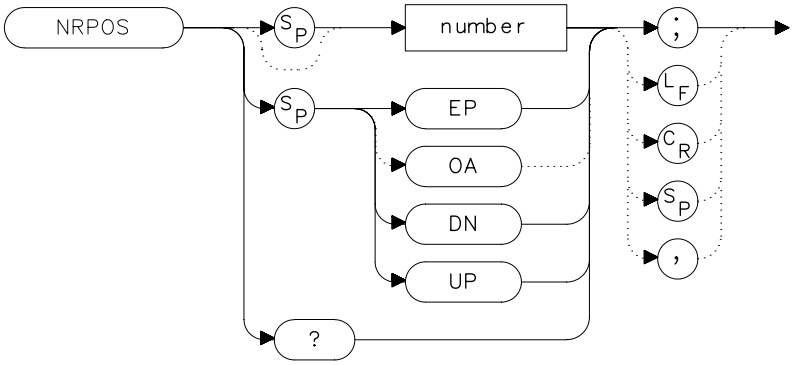
```
10   OUTPUT 718;"IP;SNGLS;"
20   OUTPUT 718;"FA 300KHZ;FB 1GHZ;"
30   OUTPUT 718;"SRCPWR ON;"
40   OUTPUT 718;"SWPCPL SR;"
50   OUTPUT 718;"SRCTKPK;DONE?;"
60   ENTER 718;Done
70   PRINT "CONNECT THRU.  PRESS CONTINUE WHEN READY TO STOR
E."
80   PAUSE
90   OUTPUT 718;"TS;DONE?;"
100  ENTER 718;Done
110  OUTPUT 718;"STORETHRU;"
120  OUTPUT 718;"TS;DONE?;"
130  ENTER 718;Done
140  OUTPUT 718;"NORMLIZE ON;"
150  OUTPUT 718;"TS;DONE?;"
160  ENTER 718;Done
170  OUTPUT 718;"NRPOS 5;TS;"
180  PRINT "RECONNECT DUT.  PRESS CONTINUE WHEN READY."
190  PAUSE
200  OUTPUT 718;"NRL -10DB;"
```

```
210  OUTPUT 718;"TS;DONE?;"
220  ENTER 718;Done
230  LOCAL 718
240  END
```

NRPOS Normalized Reference Position

Syntax

Figure 7-198 NRPOS Syntax



Description

The NRPOS command adjusts the normalized reference-position that corresponds to the position on the graticule where the difference between the measured and calibrated traces resides. The dB value of the normalized reference-position is equal to the normalized reference level. The normalized reference-position can be adjusted between 0.0 and 10.0, corresponding to the bottom and top graticule lines, respectively.

Parameters

number	real from 0.0 to 10.0.
UP or DN	increments by 1.0.

Preset State

10.0 (top graticule line)

Query Response

Figure 7-199 NRPOS Query Response

Example

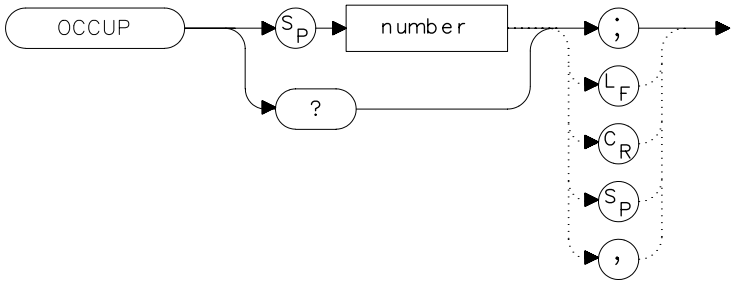
The following example is for use with an 8560E/EC Option 002 only.

```
10   OUTPUT 718;"IP;SNGLS;"
20   OUTPUT 718;"FA 300KHZ;FB 1GHZ;"
30   OUTPUT 718;"SRCPWR ON;"
40   OUTPUT 718;"SWPCPL SR;"
50   OUTPUT 718;"SRCTKPK;DONE?;"
60   ENTER 718;Done
70   PRINT "CONNECT THRU.  PRESS CONTINUE WHEN READY TO STOR
E."
80   PAUSE
90   OUTPUT 718;"TS;DONE?;"
100  ENTER 718;Done
110  OUTPUT 718;"STORETHRU;"
120  OUTPUT 718;"TS;DONE?;"
130  ENTER 718;Done
140  OUTPUT 718;"NORMLIZE ON;"
150  OUTPUT 718;"TS;DONE?;"
160  ENTER 718;Done
170  OUTPUT 718;"NRPOS 5;TS;"
180  PRINT "RECONNECT DUT.  PRESS CONTINUE WHEN READY."
190  PAUSE
200  OUTPUT 718;"NRL -10DB;"
210  OUTPUT 718;"TS;DONE?;"
220  ENTER 718;Done
230  LOCAL 718
240  END
```

OCCUP Percent Occupied Power Bandwidth

Syntax

Figure 7-200 OCCUP Syntax



Description

The OCCUP command is used to query the current value of the percent occupied power. This percentage is set by the DELMKBW and PWRBW commands. The OCCUP command can also be used to set the percent occupied power.

Parameters

number real from 1.00 to 99.99

Query Response

Figure 7-201 OCCUP Query Response

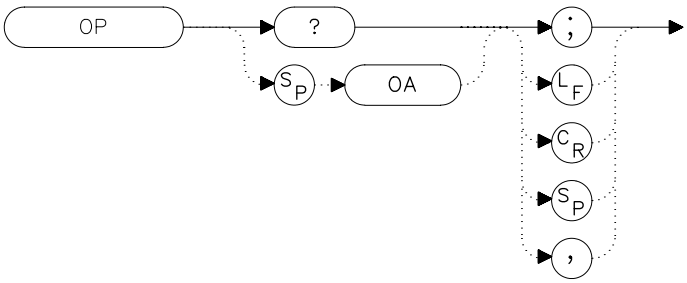
Example

```
10  OUTPUT 718;"OCCUP?;"
20  ENTER 718;Percent_pwr
```

OP Output Display Parameters

Syntax

Figure 7-202 OP Syntax

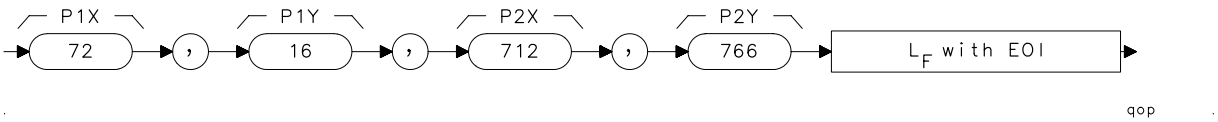


Description

The OP command requests the location of the lower left (P1) and upper right (P2) vertices of the display window.

Query Response

Figure 7-203 OP Query Response



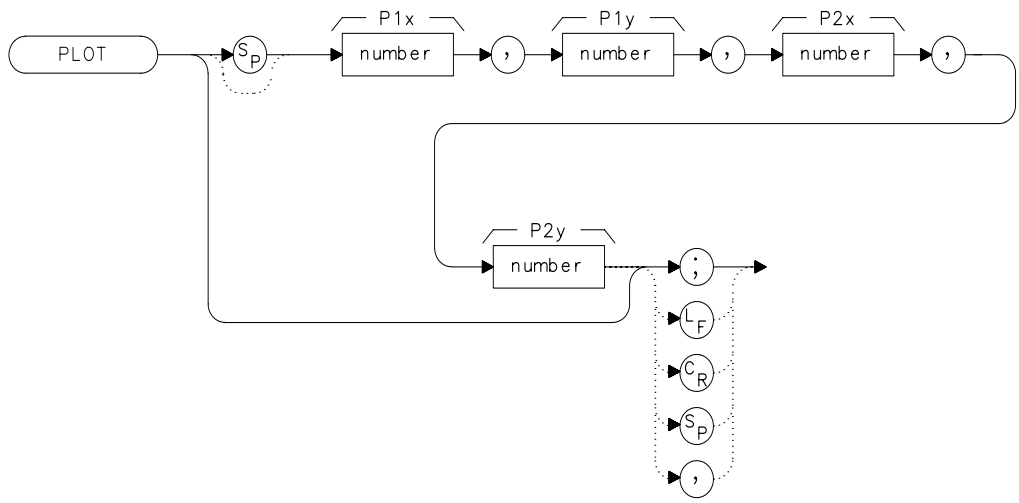
Example

```
10   OUTPUT 718;"OP?;"
20   ENTER 718;X$
30   PRINT X$
40   END
```

PLOT Plot Display

Syntax

Figure 7-204 PLOT Syntax



Description

The PLOT command copies the specified display contents onto any HP-GL plotter. Set the plotter address to 5, select the P1 and P2 positions, and then execute the plot command. P1 and P2 correspond to the lower-left and upper-right plotter positions, respectively. If P1 and P2 are not specified, default values (either preloaded from power-up or sent in via a previous plot command) are used. Once PLOT is executed, no subsequent commands are executed until PLOT is done. For more information, refer to Chapter 5.

Parameters

P1X, P1Y	plotter-dependent values that specify the lower-left plotter position.
P2X, P2Y	plotter-dependent values that specify the upper-right plotter position.

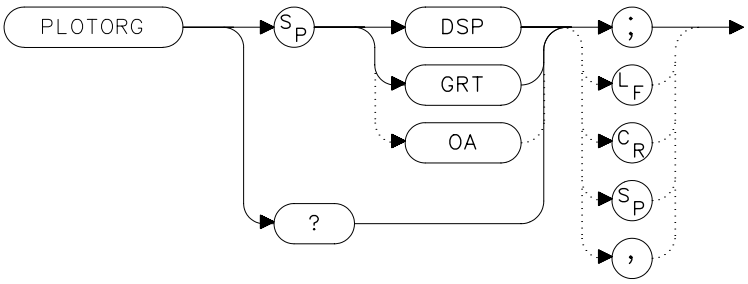
Example

```
10   OUTPUT 705;"OP;"
20   ENTER 705;P1x,P1y,P2x,P2y
30   ON INTR 7 GOTO Done
40   ENABLE INTR 7;2
50   OUTPUT 718;"PLOT ";P1x;",";P1y;",";P2x;",";P2y;";"
60   OUTPUT 718;"RQS 16;"
70   SEND 7;UNL LISTEN 5 TALK 18 DATA
80   Idle:  GOTO Idle
90   Done:  S_poll=SPOLL(718)
100         OUTPUT 718;"RQS 0;"
110         PRINT "COMMAND IS COMPLETE"
120  END
```

PLOTORG Display Origins

Syntax

Figure 7-205 PLOTORG Syntax



Description

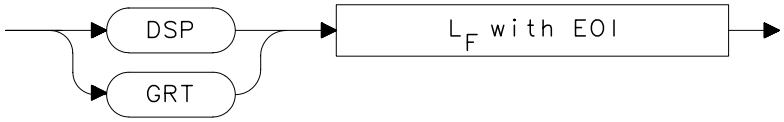
The PLOTORG command specifies whether the P1 and P2 plotter settings are the origin for the display graticule or for the entire display. GRT allows you to position the output plot, such as trace A, on a preprinted graticule (obtained from the PLOTSRC command) and to save plotting time. For more information on P1 and P2 settings, see the PLOT command, or refer to Chapter 5.

Parameters

DSP	references P1 and P2 to the corners of the entire display.
GRT	references P2 and P2 to the corners of the graticule.

Query Response

Figure 7-206 PLOTORG Query Response



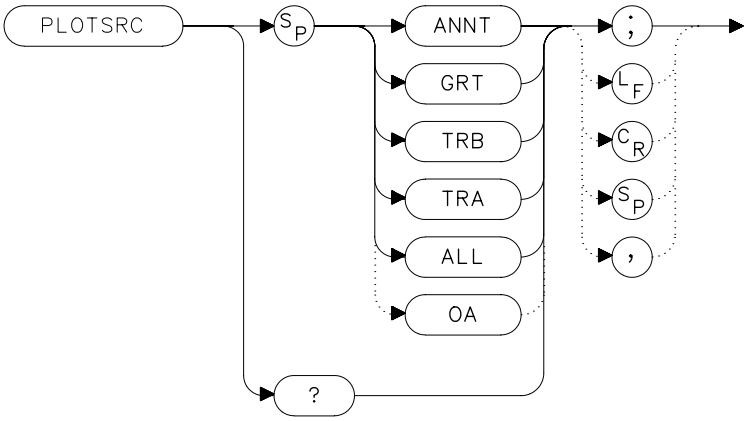
Example

```
10   OUTPUT 705;"OP;"
20   ENTER 705;P1x,P1y,P2x,P2y
30   OUTPUT 718;"PLOTORG GRT;"
40   OUTPUT 718;"PLOT ";P1x;",";P1y;",";P2x;",";P2y;";"
50   SEND 7;UNL LISTEN 5 TALK 18 DATA
60   END
```

PLOTSRC Plot Source

Syntax

Figure 7-207 PLOTSRC Syntax



Description

The PLOTSRC command specifies the source for the PLOT command.

Parameters

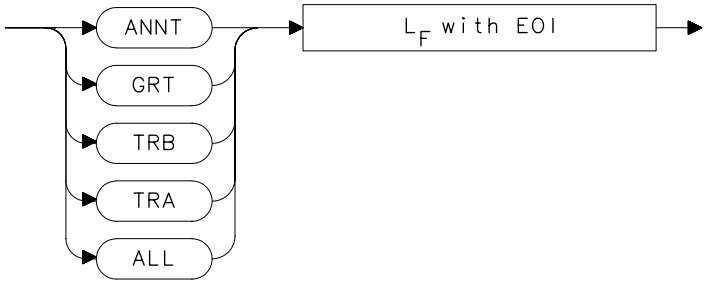
ANNT	plots only the annotation.
GRT	plots only the graticule.
TRA	plots only trace A.
TRB	plots only trace B.
ALL	plots the entire display.

Preset State

All

Query Response

Figure 7-208 PLOT SRC Query Response



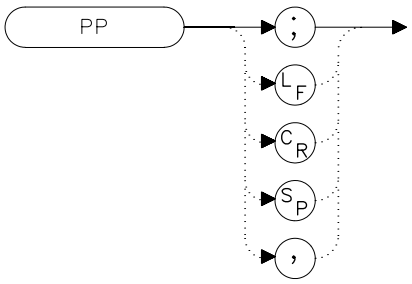
Example

```
10   OUTPUT 705;"OP;"
20   ENTER 705;P1x,P1y,P2x,P2y
30   OUTPUT 718;"PLOTSRC TRA;RQS 16;PLOT
";P1x;",";P1y;",";P2x;",";P2y;";RQS 0;"
40   Done=0
50     IF Done=0 THEN GOSUB Wait_plot
60     Done=0
70   OUTPUT 718;"PLOTSRC ANNT;RQS 16;PLOT
";P1x;",";P1y;",";P2x;",";P2y;";RQS 0;"
80     IF Done=0 THEN GOSUB Wait_plot
90     PRINT "COMMAND IS COMPLETE"
100    STOP
110  Wait_plot:  Done=1
120              ON INTR 7 GOTO Go_back
130              ENABLE INTR 7;2
140              SEND 7;UNL LISTEN 5 TALK 18 DATA
150  Idle:   GOTO Idle
160  Go_back:  S_poll=SPOLL(718)
170            RETURN
180  END
```

PP Preselector Peak

Syntax

Figure 7-209 PP Syntax



Description

The PP command peaks the preselector in the Agilent 8561E/EC, Agilent 8562E/EC, Agilent 8563E/EC, Agilent 8564E/EC and Agilent 8565E/EC or when using the spectrum analyzer with a preselected external mixer. Make sure the entire frequency span is in high band (greater than 2.9 GHz), set the desired trace to clear-write mode, place a marker on a desired signal, then execute PP. The peaking routine zooms to zero span, peaks the preselector tracking, then returns to the original position. To read the new preselector peaking number, use the PSDAC command. Commands following PP are not executed until after the analyzer has finished peaking the preselector.

NOTE Preselector peaking is not available if the spectrum analyzer resolution bandwidth is less than or equal to 100 Hz.

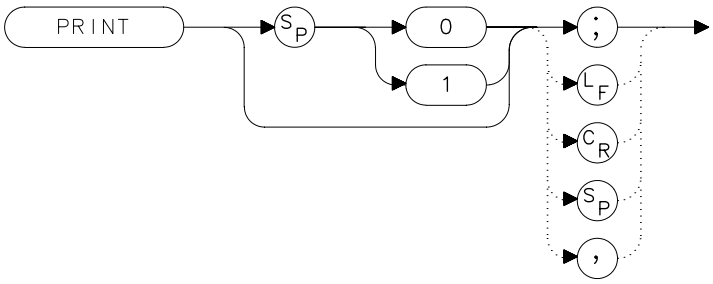
Example

```
10   OUTPUT 718;"CF 3GHZ;SP 500KHZ;"
20   OUTPUT 718;"TS;MKPK HI;MKCF;TS;PP;"
30   END
```

PRINT Print

Syntax

Figure 7-210 PRINT Syntax



Description

The PRINT command initiates an output of the screen data to the remote interface. With appropriate GPIB commands, the GPIB can be configured to route the data to an external printer. The data is output in HP raster graphics format. PRINT or PRINT 0 produces a monochrome printout. PRINT 1 produces a "color format" output, if an HP PaintJet printer (or a compatible printer) is used.

The PRINT command must be followed by the program line listed below with the correct values added in place of the variables:

```
SEND Sel_code; UNT UNL LISTEN Prt_addr TALK Sa_addr DATA
```

where:	Sel_code is the interface select code
	Prt_addr is the printer address on that select code
	Sa_addr is the analyzer address on that select code

Parameters

- 0: monochrome output
- 1: color format output

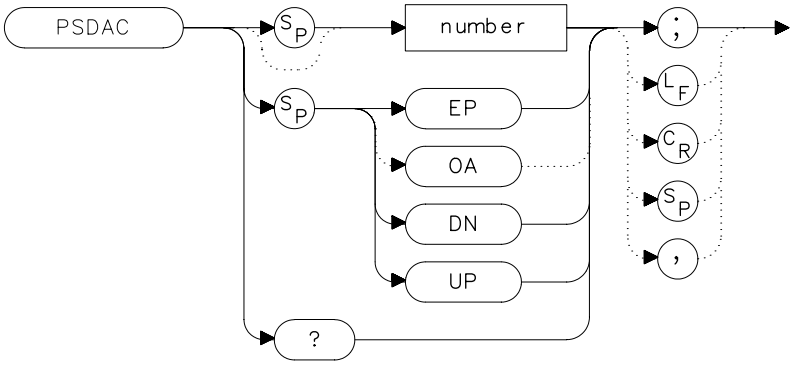
Example

```
10   OUTPUT 718;"IP;"
20   OUTPUT 718;"CF 300MHZ;SP 1MHZ;TS;DONE?;"
30   ENTER 718;Done
40   ON INTR 7 GOTO Finish
50   ENABLE INTR 7;2
60   OUTPUT 718;"PRINT 0;RQS 16;"
70   SEND 7;UNT UNL LISTEN 1 TALK 18 DATA
80   Idle:  GOTO Idle
90   Finish:  S_poll=SPOLL(718)
100           OUTPUT 718;"RQS 0;"
110  PRINT "PRINT IS COMPLETE"
120  END
```

PSDAC Preselector DAC Number

Syntax

Figure 7-211 PSDAC Syntax



Description

The PSDAC command adjusts or returns the preselector peak DAC number. For use with Agilent 8561E/EC, Agilent 8562E/EC, Agilent 8563E/EC, Agilent 8564E/EC and Agilent 8565E/EC spectrum analyzers and when using preselected external mixers.

When setting PSDAC to a given value, the hardware is not set until the end of the sweep. Therefore, trace data does not reflect the current instrument hardware settings until another TS command is done.

Parameters

number	integer from 0 to 255.
UP or DN	increments of 1.

Query Response

Figure 7-212 PSDAC Query Response

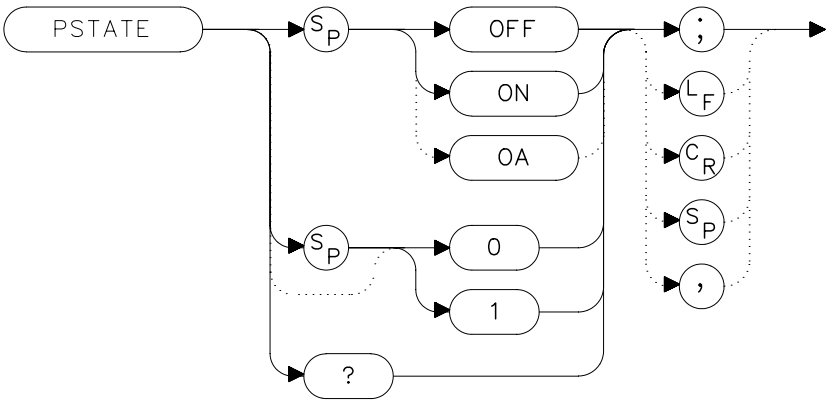
Example

```
10   OUTPUT 718;"CF 3GHZ;SP 500KHZ;"
20   OUTPUT 718;"TS;MKPK HI;MKCF;TS;PP;"
30   OUTPUT 718;"PSDAC?;"
40   ENTER 718;Dac_number
50   PRINT "PRESELECTOR DAC NUMBER IS",Dac_number
60   END
```

PSTATE Protect State

Syntax

Figure 7-213 PSTATE Syntax



Description

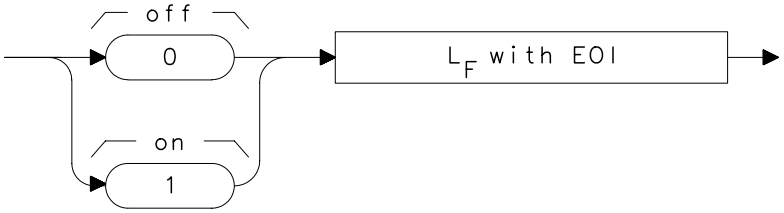
The PSTATE command prevents storing any new data in the state or trace registers. When PSTATE is on, the registers are "locked"; the data in them cannot be erased or overwritten, although the data can be recalled. To "unlock" the registers, and store new data, set PSTATE to off by selecting `0` or `OFF` as the parameter.

Preset State

Off

Query Response

Figure 7-214 PSTATE Query Response



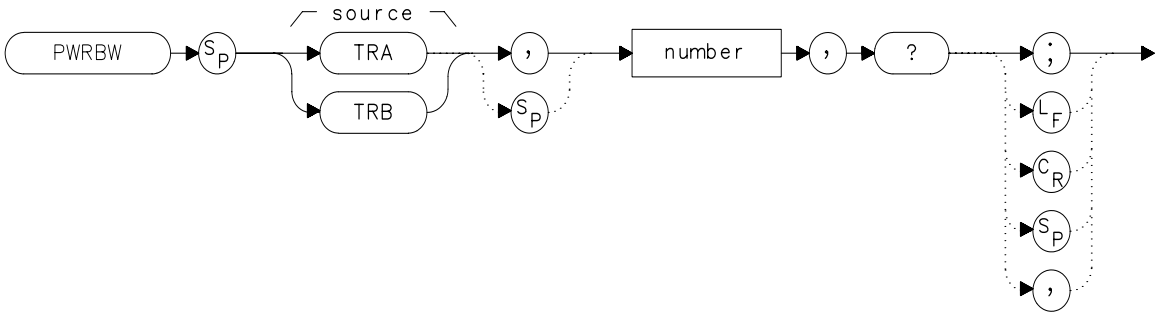
Example

```
10   OUTPUT 718;"PSTATE ON;"
20   OUTPUT 718;"PSTATE?;"
30   ENTER 718;State
40   PRINT State
50   OUTPUT 718;"PSTATE OFF;"
60   END
```

PWRBW Power Bandwidth (Full Trace)

Syntax

Figure 7-215 PWRBW Syntax



xpwrbw

Description

The PWRBW command first computes the combined power of all signal responses contained in a trace array. The command then computes the bandwidth equal to a percentage of the total power.

For example, if 100 percent is specified, the power bandwidth equals the current frequency span. If 50 percent is specified, trace elements are eliminated from either end of the array, until the combined power of the remaining trace elements equals half of the total power computed. The frequency span of these remaining trace elements is the power bandwidth output to the controller.

Parameter

number real from 0.00 to 100.00.

Query Response

Figure 7-216 PWRBW Query Response

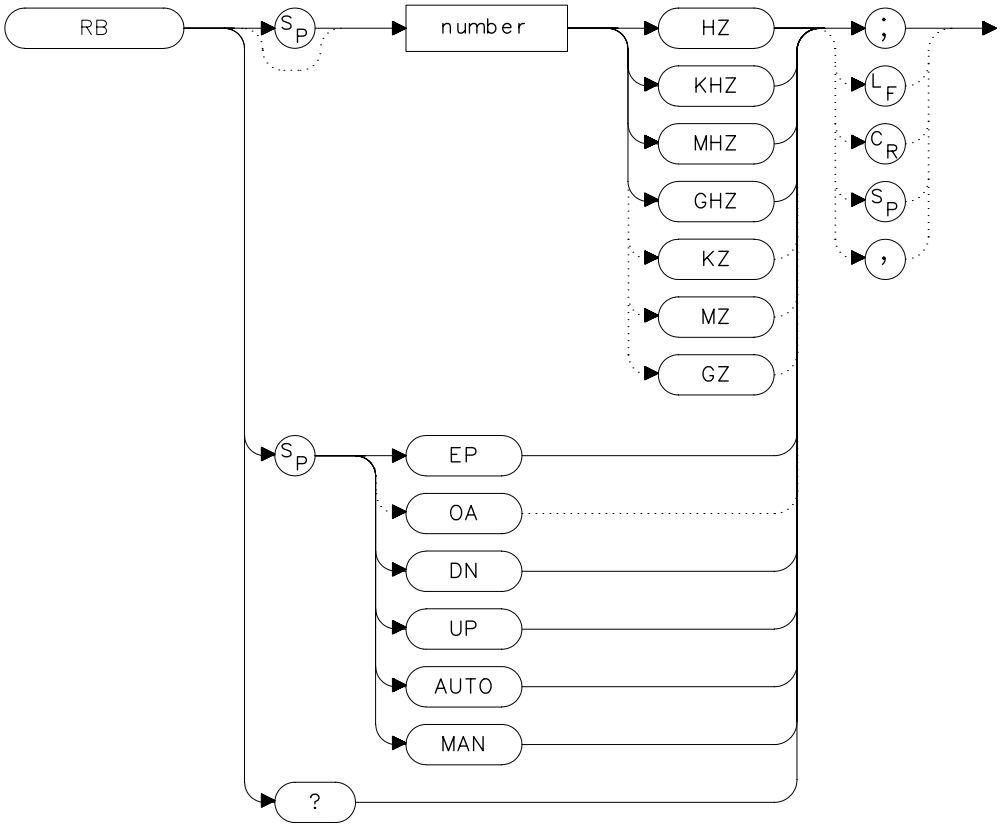
Example

```
10   DISP "CONNECT CAL OUT TO INPUT"
20   OUTPUT 718;"IP;"
30   OUTPUT 718;"SNGLS;"
40   OUTPUT 718;"CF 300MHZ;SP 1MHZ;RB 300KHZ;"
50   OUTPUT 718;"MXMH TRA;TS;TS;TS;TS;"
60   OUTPUT 718;"PWRBW TRA, 99.0,?;"
70   ENTER 718;P
80   DISP "THE POWER BANDWIDTH AT 99 PERCENT IS";P/1.0E+3;"k
Hz"
90   END
```

RB Resolution Bandwidth

Syntax

Figure 7-217 RB Syntax



Description

The RB command sets the resolution bandwidth. This is normally a coupled function that is selected by the span setting according to the ratio selected by the RBR command. If no ratio is selected, a default ratio (0.011) is used. The bandwidth, which ranges from 1 Hz to 2 MHz (or 10 Hz to 2 MHz for Option 103), can also be selected manually.

Parameters

number	integer from 1 to 2E+6, or 10 to 2E+6 for Option 103. Numbers are rounded to the nearest bandwidth.
UP or DN	increments in a 1, 3, 10 sequence.

Preset State

Coupled mode, 1 MHz

Query Response

Figure 7-218 RB Query Response

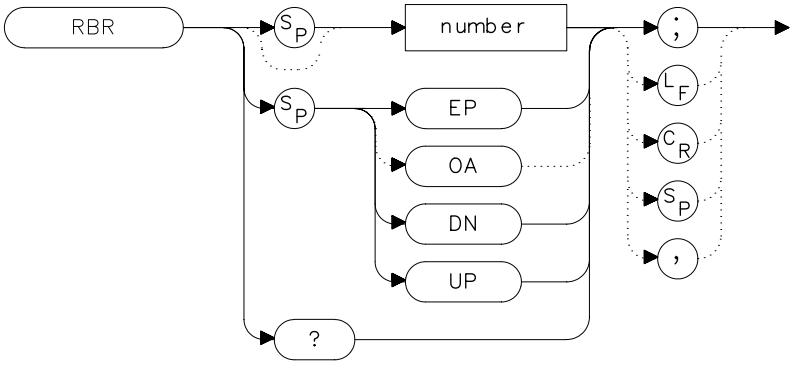
Example

```
10   OUTPUT 718;"IP;"
20   OUTPUT 718;"CF 1.2GHZ;SP 2GHZ;"
30   INPUT "SELECT THE RESOLUTION BANDWIDTH, IN KHZ",B_width
40   OUTPUT 718;"RB ";B_width;"KHZ;"
50   OUTPUT 718;"RB?;"
60   ENTER 718;B_width
70   PRINT "SELECTED BANDWIDTH IS ",B_width,"KHZ"
80   END
```

RBR Resolution Bandwidth to Span Ratio

Syntax

Figure 7-219 RBR Syntax



Description

The RBR command specifies the coupling ratio between the resolution bandwidth and the frequency span. When the frequency span is changed, the resolution bandwidth is changed to satisfy the selected ratio.

Parameters

number	real from 0.002 to 0.10.
UP or DN	increments in a 1, 2, 5 sequence.

Preset State

0.011

Query Response

Figure 7-220 RBR Query Response

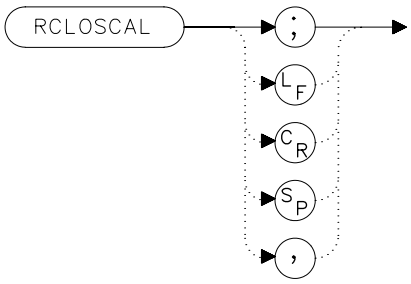
Example

```
10   OUTPUT 718;"IP;"
20   OUTPUT 718;"CF 1.2GHZ;SP 200MHZ;"
30   INPUT "SELECT THE RESOLUTION BANDWIDTH TO SPAN
RATIO",B_ratio
40   OUTPUT 718;"RBR ";B_ratio;";"
50   OUTPUT 718;"RB?;"
60   ENTER 718;B_width
70   PRINT "SELECTED BANDWIDTH IS ",B_width,"KHZ"
80   END
```

RCLOSCAL Recall Open/Short Average

Syntax

Figure 7-221 RCLOSCAL Syntax



Description

The RCLOSCAL command recalls the internally stored open/short average reference trace into trace B. The instrument state is also set to the stored open/short reference state.

Example

The following example applies only to an 8560E/EC Option 002. However, the RCLOSCAL command can be used on the 8560 E-Series and EC-Series spectrum analyzers when they are being used with an Agilent 85640A tracking generator, or an Agilent 85644A/645A tracking source.

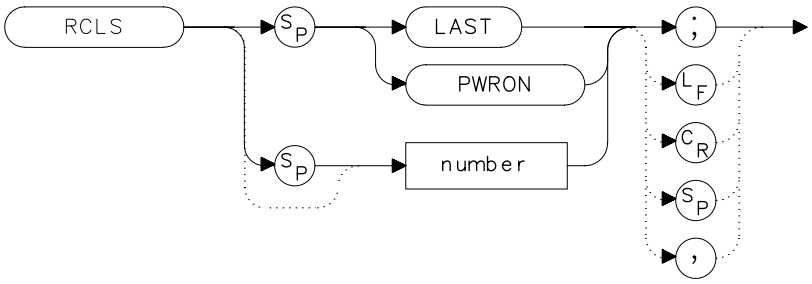
```
10   OUTPUT 718;"IP;SNGLS;"
20   OUTPUT 718;"FA 300 KHZ;FB 1GHZ;"
30   OUTPUT 718;"SRCPWR ON;"
40   OUTPUT 718;"SWPCPL SR;"
50   OUTPUT 718;"SRCTKPK;DONE?;"
60   ENTER 718;Done
70   PRINT "CONNECT OPEN.  PRESS CONTINUE WHEN READY TO STOR
E."
80   PAUSE
90   OUTPUT 718;"TS;DONE?;"
100  ENTER 718;Done
110  OUTPUT 718;"STOREOPEN;TS;DONE?;"
120  ENTER 718;Done
130  PRINT "CONNECT SHORT.  PRESS CONTINUE WHEN READY
TO STORE AND AVERAGE."
140  PAUSE
150  OUTPUT 718;"STORESHORT;TS;DONE?;"
```

```
160  ENTER 718;Done
170  PRINT "RECONNECT DUT. PRESS CONTINUE WHEN READY."
180  PAUSE
190  OUTPUT 718;"NORMLIZE ON;"
200  OUTPUT 718;"TS;DONE?;"
210  ENTER 718;Done
220  OUTPUT 718;"NRPOS 8;TS;"
230  !demonstrate recall of open/short average trace
240  OUTPUT 718;"IP;"
250  OUTPUT 718;"RCLOSCAL;TS;DONE?;"
260  ENTER 718;Done
270  !instrument state is returned to calibrated state
280  OUTPUT 718;"NORMLIZE ON;"
290  OUTPUT 718;"TS;DONE?;"
300  ENTER 718;Done
310  OUTPUT 718;"NRPOS 8;"
320  OUTPUT 718;"TS;DONE?;"
330  !end recall
340  LOCAL 718
350  END
```

RCLS Recall State

Syntax

Figure 7-222 RCLS Syntax



Description

The RCLS command recalls to the display a previously saved instrument state. See SAVES.

Parameters

number	integer from 0 to 9. Registers 8 and 9 are used by the normalization routine. Numbers less than zero default to zero; numbers greater than nine default to nine.
LAST	recalls the instrument state that existed previous to executing the IP command or switching the spectrum analyzer off.
PWRON	sets the instrument state to the same state that occurred when the spectrum analyzer was switched on. This state was originally saved using the SAVES command.

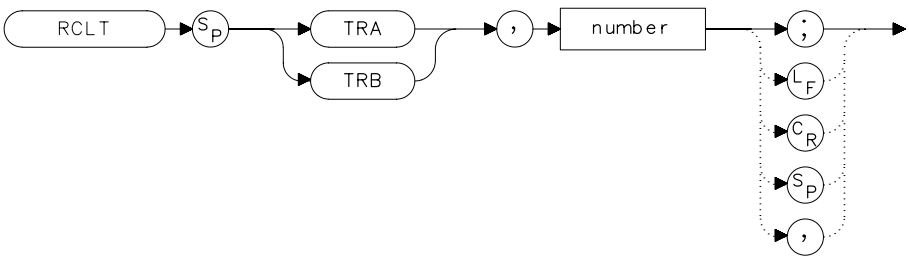
Example

```
10   OUTPUT 718;"SAVES 7;"
20   OUTPUT 718;"IP;"
30   OUTPUT 718;"RCLS 7;"
40   END
```

RCLT Recall Trace

Syntax

Figure 7-223 RCLT Syntax



Description

The RCLT command recalls previously saved trace data to the display. See SAVET.

Parameters

TRA	recalls the trace data to trace A.
TRB	recalls the trace data to trace B.
number	integer from 0 to 7. If a Agilent 85620A mass memory module is attached to the spectrum analyzer, trace registers 5, 6, and 7 are used by the Agilent 85620A mass memory module. Numbers less than zero default to zero; numbers greater than seven default to seven.

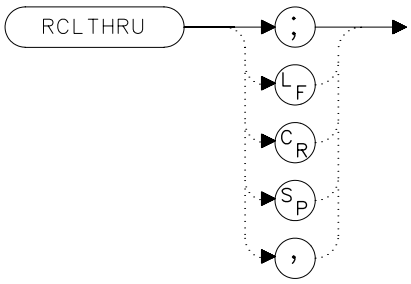
Example

```
10   OUTPUT 718;"IP;CF 300MHZ;SP 20MHZ;"
20   OUTPUT 718;"SAVET TRA,7;"
30   OUTPUT 718;"IP;"
40   OUTPUT 718;"RCLT TRB,7;"
50   END
```

RCLTHRU Recall Thru

Syntax

Figure 7-224 RCLTHRU Syntax



Description

The RCLTHRU command recalls the internally stored thru-reference trace into trace B. The instrument state is also set to the stored thru-reference state.

Example

The following example applies only to an 8560E/EC Option 002. However, the RCLTHRU command can be used on the 8560 E-Series and EC-Series spectrum analyzers when they are being used with an Agilent 85640A tracking generator, an Agilent 85644A tracking source, or Agilent 85645A tracking source.

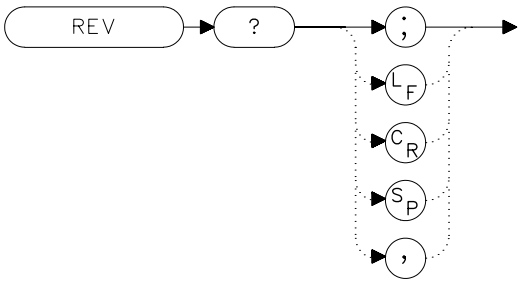
```
10    OUTPUT 718;"IP;SNGLS;"
20    OUTPUT 718;"FA 300 KHZ;FB 1GHZ;"
30    OUTPUT 718;"SRCPWR ON;"
40    OUTPUT 718;"SWPCPL SR;"
50    OUTPUT 718;"SRCTKPK;DONE?;"
60    OUTPUT 718;"ENTER 718;Done
70    PRINT "CONNECT THRU.  PRESS CONTINUE WHEN READY TO STO
RE."
80    PAUSE
90    OUTPUT 718;"TS;DONE?;"
100   ENTER 718;Done
110   OUTPUT 718;"STORETHRU;TS;DONE?;"
120   ENTER 718;Done
130   PRINT "RECONNECT DUT.  PRESS CONTINUE WHEN READY."
140   PAUSE
150   OUTPUT 718;"NORMLIZE ON;"
160   OUTPUT 718;"TS;DONE?;"
```

```
170   ENTER 718;Done
180   OUTPUT 718;"NRPOS 8;TS;"
190   PAUSE
200   !demonstrate recall of thru trace
210   OUTPUT 718;"IP;"
220    OUTPUT 718;"RCLTHRU;TS;DONE?;"
230    ENTER 718;Done
240    !instrument state is returned to calibrated state
250    OUTPUT 718;"NORMLIZE ON;"
260    OUTPUT 718;"TS;DONE?;"
270    ENTER 718;Done
280    OUTPUT 718;"NRPOS 8;"
290    OUTPUT 718;"TS;DONE?;"
300    ENTER 718;Done
310    !end recall
320    LOCAL 718
330    END
```

REV Revision Number

Syntax

Figure 7-225 REV Syntax

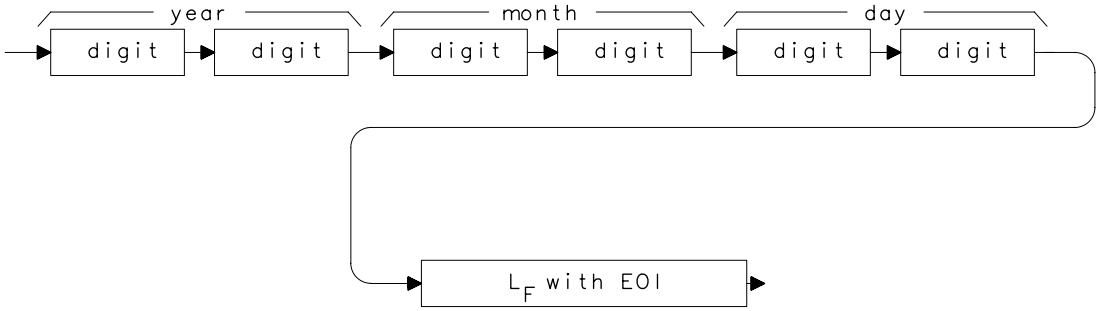


Description

The REV command sends to the computer the revision date code of the spectrum analyzer firmware.

Query Response

Figure 7-226 REV Query Response



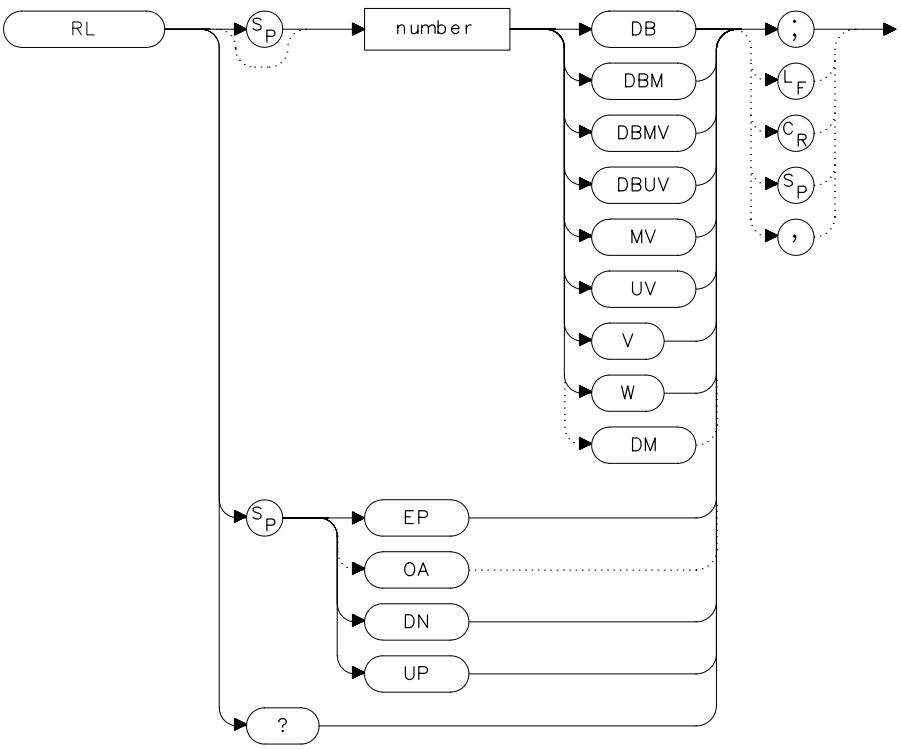
Example

```
10    DIM A$[6]
20    OUTPUT 718;"REV?;"
30    ENTER 718;A$
40    PRINT A$
50    END
```

RL Reference/Range Level

Syntax

Figure 7-227 RL Syntax



Description

The RL command sets the reference level, or range level when in normalized mode. (Range level functions the same as reference level.) The reference level is the top horizontal line on the graticule. For best measurement accuracy, place the peak of a signal of interest on the reference-level line. The spectrum analyzer input attenuator is coupled to the reference level and automatically adjusts to avoid compression of the input signal. Table 7-1 on page 372 shows the minimum reference level for each band and amplitude scale. Refer also to AUNITS.

Table 7-8 Frequency Ranges and Minimum Reference Level (0 dB Input Attenuation)

	Minimum Reference Level	
Band	**Log Scale**	**Linear Scale**
8560E/EC:		
30 Hz to 2.9 GHz	–120.0 dBm	2.2 µV
Agilent 8561E/EC:		
30 Hz to 2.9 GHz	–120.0 dBm	2.2 µV
2.9 GHz to 6.5 GHz	–120.0 dBm	2.2 µV
Agilent 8562E/EC:		
30 Hz to 2.9 GHz	–120.0 dBm	2.2 µV
2.9 GHz to 6.46 GHz	–120.0 dBm	2.2 µV
6.76 GHz to 13.2 GHz	–120.0 dBm	2.2 µV
Agilent 8563E/EC:		
30 Hz to 2.9 GHz	–120.0 dBm	2.2 µV
2.9 GHz to 6.46 GHz	–120.0 dBm	2.2 µV
6.46 GHz to 13.2 GHz	–120.0 dBm	2.2 µV
13.2 GHz to 26.5 GHz	–120.0 dBm	2.2 µV
Agilent 8564E/EC:		
30 Hz to 2.9 GHz	–120.0 dBm	2.2 µV
2.9 GHz to 6.46 GHz	–120.0 dBm	2.2 µV
6.46 GHz to 13.2 GHz	–120.0 dBm	2.2 µV
13.2 GHz to 26.8 GHz	–120.0 dBm	2.2 µV
26.8 GHz to 31.15 GHz	–120.0 dBm	3.98 µV
31.15 GHz to 40 GHz	–115.0 dBm	3.98 µV
Agilent 8565E/EC:		
30 Hz to 2.9 GHz	–120.0 dBm	2.2 µV
2.9 GHz to 6.46 GHz	–120.0 dBm	2.2 µV
6.46 GHz to 13.2 GHz	–120.0 dBm	2.2 µV
13.2 GHz to 26.8 GHz	–120.0 dBm	2.2 µV
26.8 GHz to 31.15 GHz	–120.0 dBm	2.2 µV
31.15 GHz to 40 GHz	–115.0 dBm	3.98 µV
40 GHz to 50 GHz	–115.0 dBm	3.98 µV

Parameters

number	dependent on the chosen amplitude units.
UP or DN	increments by one vertical division in log mode, and in a 1, 2, 5, 10 sequence in linear mode.

Query Response

Figure 7-228 RL Query Response

Preset State

0 dBm

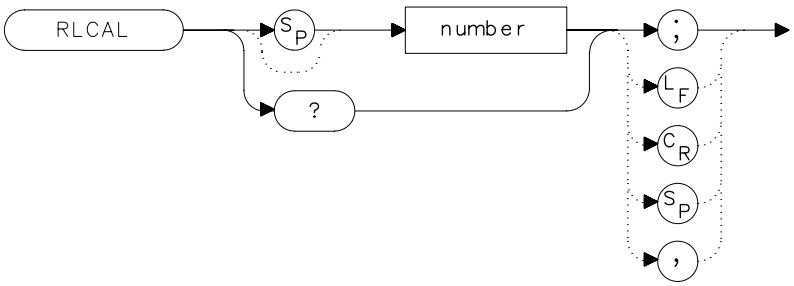
Example

```
10   OUTPUT 718;"IP;SNGLS;CF 300MHZ;SP 20MHZ;"
20   OUTPUT 718;"TS;MKPK HI;MKRL;TS;"
30   OUTPUT 718;"RL?;"
40   ENTER 718;Ref_level
50   PRINT "REFERENCE LEVEL IS",Ref_level,"DB"
60   END
```

RLCAL Reference Level Calibration

Syntax

Figure 7-229 RLCAL Syntax



Description

The RLCAL command allows you to calibrate the reference level remotely or check the current calibration. To calibrate the reference level, connect the 300 MHz calibration signal to the RF input. Set the center frequency to 300 MHz, the frequency span to 20 MHz, and the reference level to –10 dBm. Use the RLCAL command to move the input signal to the reference level. When the signal peak falls directly on the reference-level line, the reference level is calibrated. Storing this value in the analyzer in EEROM can be done only from the front panel. The RLCAL command, when queried, returns the current value.

Parameter

number integer from –528 to 528.

(–33 to +33 for firmware revisions ≤920528)

Example

```
10   INTEGER Rlcal,Fw_rev
20   DIM Model$[80]
30   OUTPUT 718;"Revision?;"
40   ENTER 718;Fw_rev
50   OUTPUT 718;"ID string?;"
40   ENTER 718;Model$
50   INPUT "CONNECT CAL SIGNAL TO RF INPUT AND PRESS CONTINU
E",A$
60   OUTPUT 718;"IP;TS;CF 300MHZ;SP 100KHZ;RL 0DBM;TS;"
70   OUTPUT 718;"MKPK HI;MKA?;"
80   ENTER 718;Mkamptd
90   OUTPUT 718;"RLCAL?;"
100  ENTER 718;Rlcal
110  IF POS(Model$,"E")=7 AND Fw_rev>=930226 THEN   ! 8560E/
EC-Series
     with newer firmware
120    Dac_sens=0.01   ! Dac sensitivity is 0.01 dB/step
130  ELSE              ! Non-8560 E-Series and older E-Serie
s
140    Dac_sens=0.17   ! Dac sensitivity is 0.17 dB/step
150  END IF
160  Rlcal=Rlcal-INT((Mkamptd+10)/Dac_sens)
170  OUTPUT 718;"RLCAL ";Rlcal;";"
180  END
```

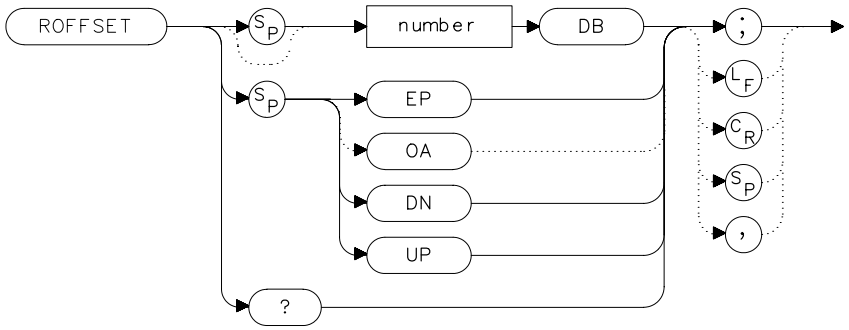
For firmware revisions ≤920528, use .17 rather than .01. See below:

```
80   Rlcal=Rlcal-INT((Mkamptd+10)/.17)
```

ROFFSET Amplitude Reference Offset

Syntax

Figure 7-230 ROFFSET Syntax



xro

Description

The ROFFSET command introduces an offset to all amplitude readouts (for example, the reference level and marker amplitude). The offset is in dB, regardless of the selected scale and units. The offset can be useful to account for gains or losses in accessories connected to the input of the analyzer. When this function is active, an R appears on the left edge of the display.

Parameters

number	real from –100 to 100.
UP or DN	increments of one vertical division.

Preset State

0

Query Response

Figure 7-231 ROFFSET Query Response

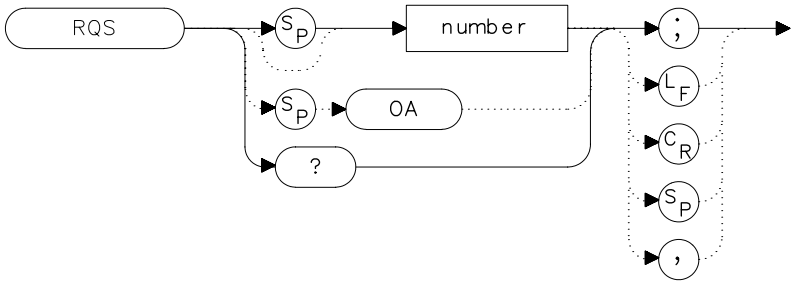
Example

```
10    INPUT "ENTER REFERENCE LEVEL OFFSET",Roffset
20    OUTPUT 718;"ROFFSET ";Roffset;"DB;"
30    OUTPUT 718;"ROFFSET?;"
40    ENTER 718;Roffset
50    PRINT "AMPLITUDE OFFSET IS ",Roffset
60    END
```

RQS Request Service Conditions

Syntax

Figure 7-232 RQS Syntax



Description

The RQS command sets a bit mask that specifies which service requests can interrupt a program sequence. Each service request has a corresponding bit number and decimal equivalent of that bit number, as shown in Table 7-1 on page 372. Use the decimal equivalents to set the bit mask. For example, to set a mask for bits 4 and 5, add the decimal equivalents (16 + 32 = 48), then send the command RQS 48. For more service request information, refer to Chapter 5.

Table 7-9 Status Register

BIT NUMBER	DECIMAL EQUIVALENT	ANALYZER STATE	DESCRIPTION
7	128		Not used
6	64	RQS	Request service
5	32	ERROR PRESENT	Set when error present
4	16	COMMAND COMPLETE	Any command is completed
3	8		Not used
2	4	END OF SWEEP	Set when any sweep is completed
1	2	MESSAGE	Set when display message appears
0	1	TRIGGER	Trigger is activated

Query Response

Figure 7-233 RQS Query Response

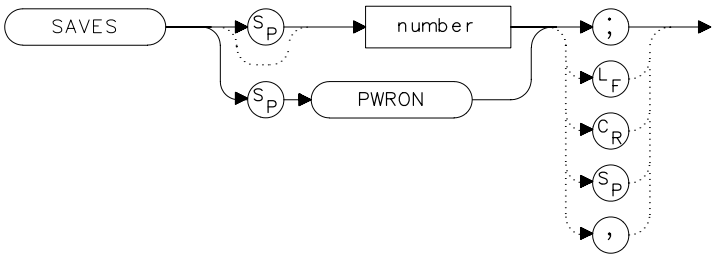
Example

```
10    OUTPUT 718;"IP;SNGLS;CF 300MHZ;SP 20MHZ;TS;"
20    OUTPUT 718;"RQS 16;"
30    ON INTR 7 GOTO Srq
40    ENABLE INTR 7;2
50    OUTPUT 718;"SRQ 16;"
60    Idle:  GOTO Idle
70    Srq:   Sbyte=SPOLL(718)
80    PRINT Sbyte
90    PRINT "INTERRUPT GENERATED"
100   OUTPUT 718;"RQS 0;"
110   LOCAL 718
120   END
```

SAVES Save State

Syntax

Figure 7-234 SAVES Syntax



xsa

Description

The SAVES command saves the currently displayed instrument state in the specified state register.

Parameters

number	integer from 0 to 9. Registers 8 and 9 are used by the normalization routine. Numbers less than zero default to zero; numbers greater than nine default to nine.
PWRON	sets the spectrum analyzer to the current state when the spectrum analyzer is turned on.

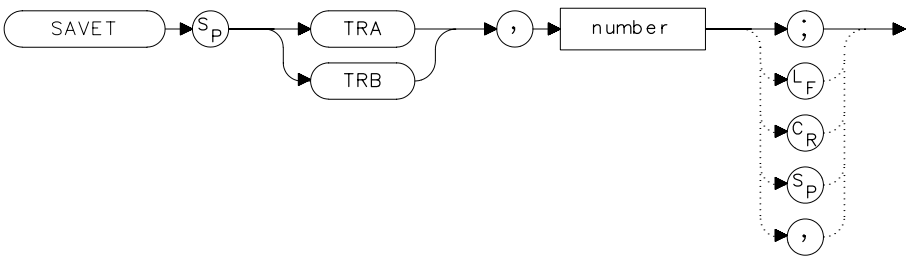
Example

```
10      OUTPUT 718;"IP;CF 300MHZ;SP 20MHZ;"
20      OUTPUT 718;"SAVES PWRON;"
30      END
```

SAVET Save Trace

Syntax

Figure 7-235 SAVET Syntax



xsa

Description

The SAVET command saves the selected trace in the specified trace register. There is a total of eight save-trace registers in which to store trace data from traces A and B. Be careful not to overwrite previously saved trace data.

Parameters

TRA	stores the contents of trace A.
TRB	stores the contents of trace B.
number	integer from 0 to 7. If a Agilent 85620A mass memory module is attached to the spectrum analyzer, trace registers 5, 6, and 7 are used by the Agilent 85620A mass memory module. Numbers less than zero default to zero; numbers greater than seven default to 7.

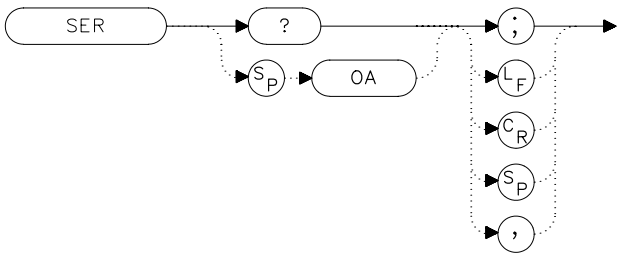
Example

```
10    INPUT "SELECT THE TRACE YOU WISH TO SAVE (TRA OR
TRB)",Save_trace$
20    INPUT "SELECT THE REGISTER NUMBER",Reg_number
30    OUTPUT 718;"SAVET ";Save_trace$;", ";Reg_number;";"
40    END
```

SER Serial Number

Syntax

Figure 7-236 SER Syntax



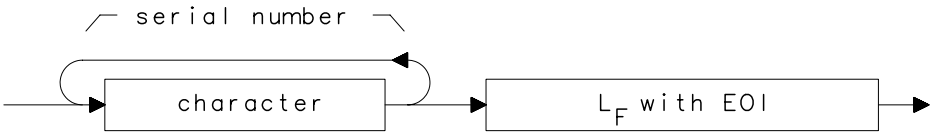
xse

Description

The SER command returns the spectrum analyzer serial number to the computer.

Query Response

Figure 7-237 SER Query Response



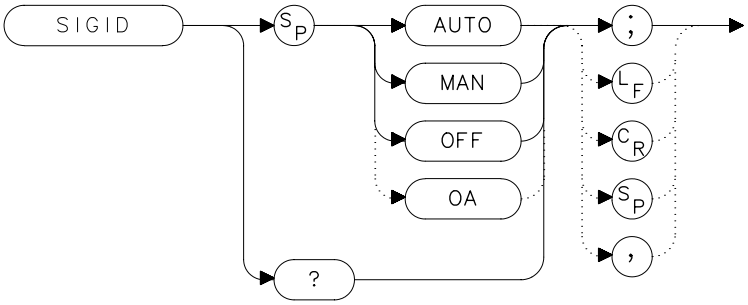
Example

```
10      DIM Ser$[10]
20      OUTPUT 718;"SER?;"
30      ENTER 718;Ser$
40      PRINT Ser$
50      END
```

SIGID Signal Identification

Syntax

Figure 7-238 SIGID Syntax



Description

The SIGID command identifies signals primarily for the external mixing frequency bands, when using unpreselected external mixers. SIGID only applies to spectrum analyzers with firmware revisions ≤920528 or with Option 008.

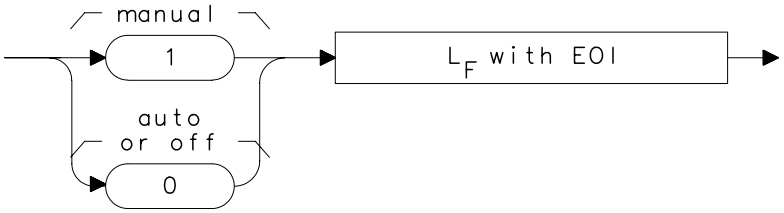
Two signal identification methods are available. AUTO employs the image response method for locating correct mixer responses. Place a marker on the desired signal, then activate SIGID AUTO. The frequency of a correct response appears in the active function block. Use this mode before executing the IDCF command.

The second method of signal identification, MAN, shifts responses both horizontally and vertically. A correct response is shifted horizontally by less than 80 kHz.

To ensure accuracy in MAN mode, limit the frequency span to less than 20 MHz. This command is not available with an 8560E/EC Option 002.

Query Response

Figure 7-239 SIGID Query Response



where 1 = manual mode is active and 0 = auto mode is active or SIGID is off.

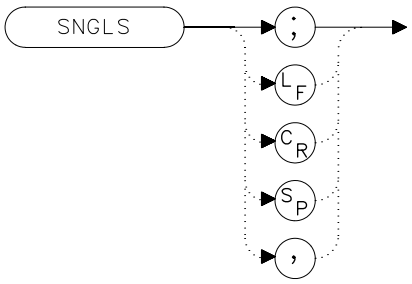
Example

```
10    OUTPUT 718;"SIGID AUTO;"
20    OUTPUT 718;"IDCF;"
30    OUTPUT 718;"CF?;"
40    ENTER 718;Cf
50    PRINT Cf
60    END
```

SNGLS Single Sweep

Syntax

Figure 7-240 SNGLS Syntax



Description

The SNGLS command selects the single-sweep mode. This mode allows only one sweep when trigger conditions are met. When this function is active, an S appears on the left edge of the display.

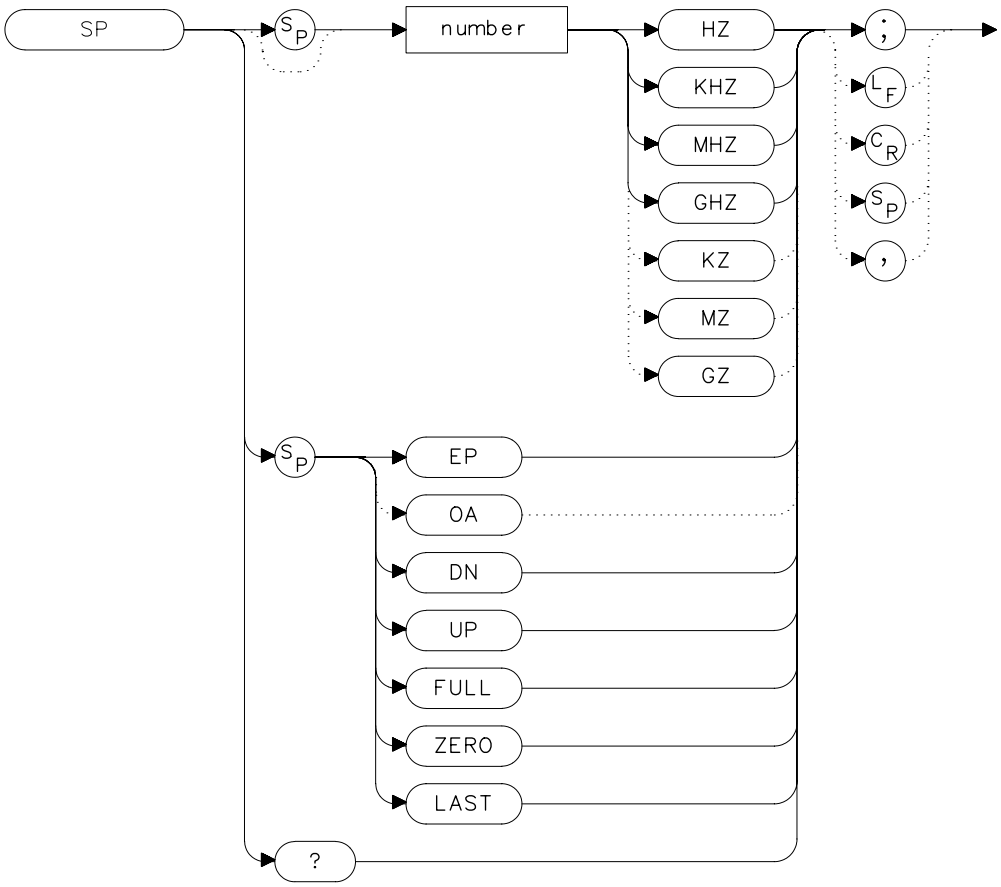
Example

```
10    OUTPUT 718;"IP;SNGLS;"
20    END
```

SP Frequency Span

Syntax

Figure 7-241 SP Syntax



Description

The SP command sets the frequency span. The center frequency does not change with changes in the frequency span; start and stop frequencies do change. Setting the frequency span to 0 Hz effectively allows an amplitude-versus-time mode in which to view signals. This is especially useful for viewing modulation. Querying SP will leave the analyzer in center frequency and span mode.

Parameters

number	real from 0 to 2.9E+9 (8560E/EC)
	0 to 6.5E+9 (Agilent 8561E/EC)
	0 to 13.2E+9 (Agilent 8562E/EC)
	0 to 26.5E+9 (Agilent 8563E/EC)
	0 to 40E+9 (Agilent 8564E/EC)
	0 to 50E+9 (Agilent 8565E/EC)
	0 to 307E+9 in external mixer mode.
UP or DN	increments in a 1, 2, 5 sequence.

Preset State

- Full span, 2.9 GHz (8560E/EC)
- Full span, 6.5 GHz (Agilent 8561E/EC)
- Full span, 13.2 GHz (Agilent 8562E/EC)
- Full span, 26.5 GHz (Agilent 8563E/EC)
- Full span, 40 GHz (Agilent 8564E/EC)
- Full span, 50 GHz (Agilent 8565E/EC)

Query Response

Figure 7-242 SP Query Response

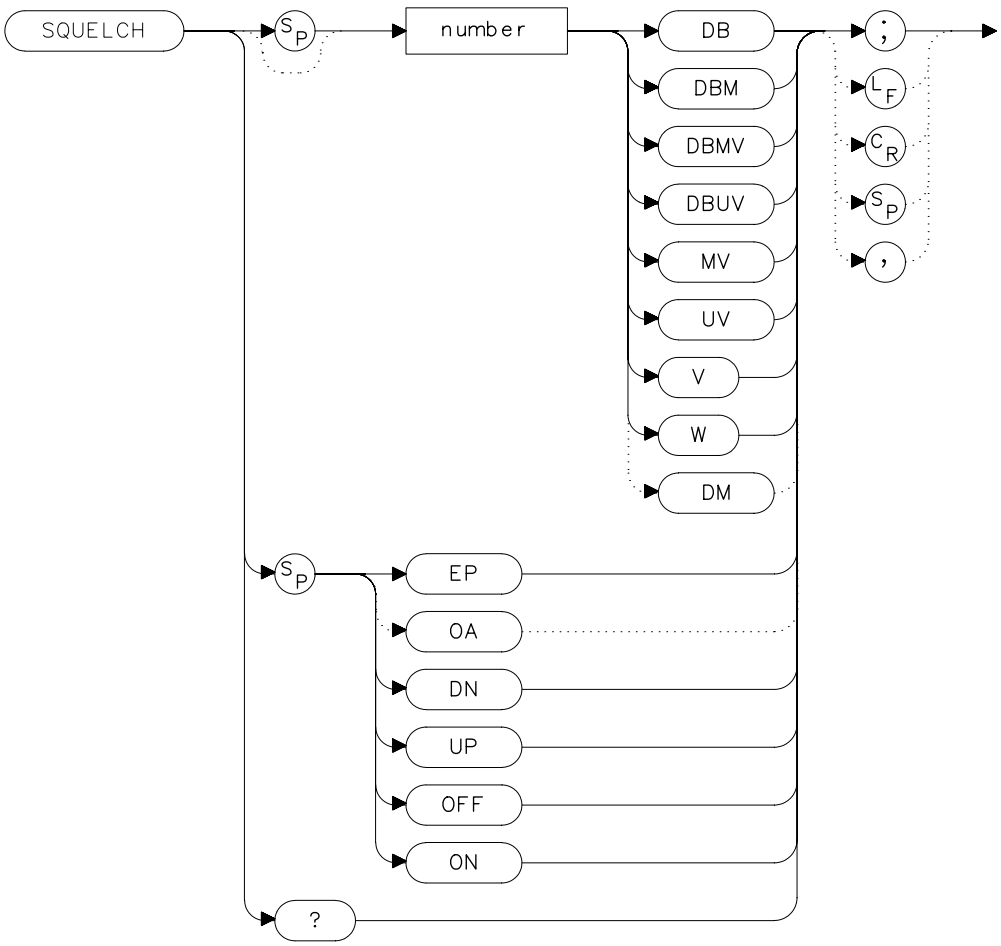
Example

```
10    OUTPUT 718;"IP;CF 300MHZ;SP 20MHZ;"
20    OUTPUT 718;"SP UP;SP?;"
30    ENTER 718;Span
40    PRINT Span
50    END
```

SQUELCH Squelch

Syntax

Figure 7-243 SQUELCH Syntax



Description

The SQUELCH command adjusts the squelch level for demodulation. When this function is on, a dashed line indicating the squelch level appears on the display. A marker must be active and above the squelch line for demodulation to occur. Refer to the DEMOD command. The default value is –120 dBm.

Parameters

number	real from –220 to 30.
UP or DN	increments by 1 vertical division.

Preset State

Off

Query Response

Figure 7-244 SQUELCH Query Response

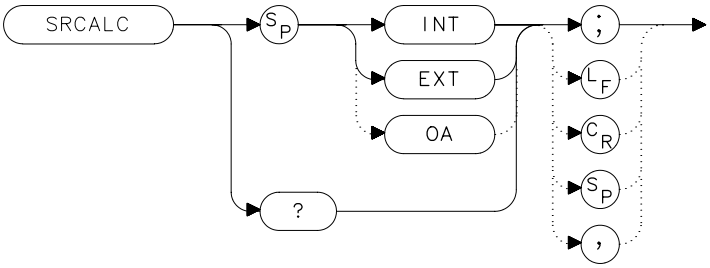
Example

```
10    OUTPUT 718;"IP;"
20    OUTPUT 718;"FA 88MHZ;FB 108MHZ;"
30    OUTPUT 718;"MKN EP;"
40    PRINT "MOVE MARKER TO SIGNAL TO BE DEMODULATED"
50    PRINT "PRESS HOLD; THEN PRESS CONTINUE"
60    PAUSE
70    INPUT "ENTER DEMODULATION TIME (.1 SEC - 60 SEC)",Dtim
e
80    OUTPUT 718;"DEMODT ";Dtime;"S;"
90    OUTPUT 718;"SQUELCH EP;"
100   INPUT "ADJUST SQUELCH AS NECESSARY; PRESS HOLD, THEN
ENTER",A$
110   OUTPUT 718;"DEMOD FM;"
120   LOCAL 718
130   END
```

SRCALC Source Leveling Control

Syntax

Figure 7-245 SRCALC Syntax

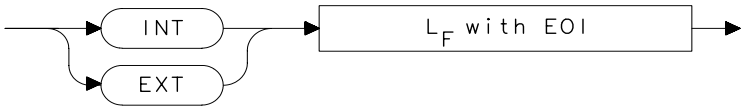


Description

The SRCALC command selects internal (INT) or external (EXT) leveling for use with the built-in tracking generator. This function is available only with an 8560E/EC Option 002.

Query Response

Figure 7-246 SRCALC Query Response



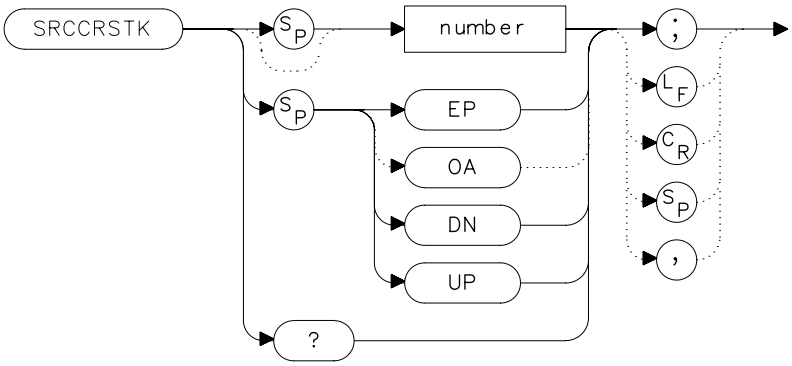
Example

```
10     OUTPUT 718;"IP;SNGLS;TS;CF 300 MHZ;SP 1MHZ;"
20     OUTPUT 718;"SRCPWR ON;SRCPWR -5DBM;TS;"
30     PRINT "CONNECT EXTERNAL LEVELING LOOP. PRESS CONTINUE
 WHEN
READY."
40     PAUSE
50     OUTPUT 718;"SRCALC EXT;TS;"
60     WAIT 1
70     OUTPUT 718;"ERR?;"
80     ENTER 718;Err
90     IF Err=900 THEN
100    PRINT "UNLEVELED CONDITION.  CHECK LEVELING LOOP."
110    END IF
120    LOCAL 718
130    END
```

SRCCRSTK Coarse Tracking Adjust

Syntax

Figure 7-247 SRCCRSTK Syntax



Description

The SRCCRSTK command controls the coarse adjustment to the frequency of the built-in tracking-generator oscillator. Once enabled, this adjustment is made in digital-to-analog-converter (DAC) values from 0 to 255. For fine adjustment, refer to the SRCFINTK command description.

SRCCRSTK is available only with an 8560E/EC Option 002.

Parameters

number	integer from 0 to 255.
UP or DN	increments by 1.

Preset State

32

Query Response

Figure 7-248 SRCCRSTK Query Response

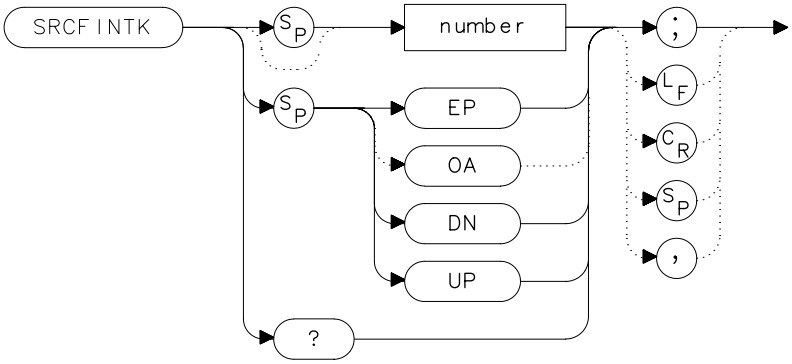
Example

```
10      OUTPUT 718;"IP;"
20      OUTPUT 718;"FA 300KHZ;FB 1GHZ;"
30      OUTPUT 718;"SRCPWR ON;"
40      OUTPUT 718;"SWPCPL SR;RB 10KHZ;"
50      OUTPUT 718;"TS;DONE?;"
60      ENTER 718;Done
70      OUTPUT 718;"SRCCRSTK EP;"
80      PRINT "ADJUST TRACKING (coarse adjust) USING KNOB ON
              ANALYZER."
90      PRINT "PRESS [HOLD], THEN CONTINUE WHEN READY."
100     PAUSE
110     OUTPUT 718;"TS;DONE?;"
120     ENTER 718;Done
130     OUTPUT 718;"SRCFINTK EP;"
140     PRINT "ADJUST TRACKING (fine adjust) USING KNOB ON
              ANALYZER."
150     PRINT "PRESS [HOLD], THEN CONTINUE WHEN READY."
160     PAUSE
170     OUTPUT 718;"TS;DONE?;"
180     ENTER 718;Done
190     PRINT "CONNECT THRU.  PRESS CONTINUE WHEN READ TO STO
RE."
200     PAUSE
210     OUTPUT 718;"STORETHRU;"
220     OUTPUT 718;"TS;DONE?;"
230     ENTER 718;Done
240     OUTPUT 718;"NORMLIZE ON;"
250     OUTPUT 718;"TS;DONE?;"
260     ENTER 718;Done
270     OUTPUT 718;"NRPOS 8;TS;"
280     PRINT "RECONNECT DUT.  PRESS CONTINUE WHEN READY."
290     PAUSE
300     LOCAL 718
310     END
```

SRCFINTK Fine Tracking Adjust

Syntax

Figure 7-249 SRCFINTK Syntax



Description

The SRCFINTK command controls the fine adjustment of the frequency of the built-in tracking-generator oscillator. Once enabled, this adjustment is made in digital-to-analog-converter (DAC) values from 0 to 255. For coarse adjustment, refer to the SRCCRSTK command description. SRCFINTK is available only with an 8560E/EC Option 002.

Parameters

number	integer from 0 to 255.
UP or DN	increments by 1.

Preset State

128

Query Response

Figure 7-250 SRCFINTK Query Response

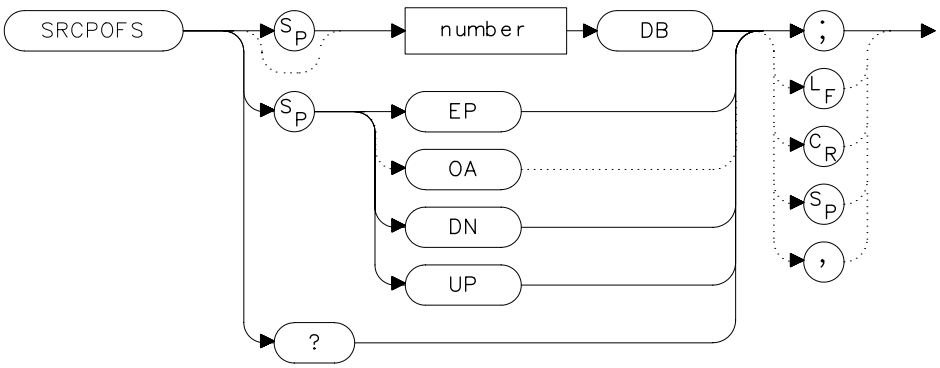
Example

```
10      OUTPUT 718;"IP;"
20      OUTPUT 718;"FA 300KHZ;FB 1GHZ;"
30      OUTPUT 718;"SRCPWR ON;"
40      OUTPUT 718;"SWPCPL SR;RB 10KHZ;"
50      OUTPUT 718;"TS;DONE?;"
60      ENTER 718;Done
70      OUTPUT 718;"SRCCRSTK EP;"
80      PRINT "ADJUST TRACKING (coarse adjust) USING KNOB ON
              ANALYZER."
90      PRINT "PRESS [HOLD], THEN CONTINUE WHEN READY."
100     PAUSE
110     OUTPUT 718;"TS;DONE?;"
120     ENTER 718;Done
130     OUTPUT 718;"SRCFINTK EP;"
140     PRINT "ADJUST TRACKING (fine adjust) USING KNOB ON
              ANALYZER."
150     PRINT "PRESS [HOLD], THEN CONTINUE WHEN READY."
160     PAUSE
170     OUTPUT 718;"TS;DONE?;"
180     ENTER 718;Done
190     PRINT "CONNECT THRU.  PRESS CONTINUE WHEN READ TO STO
RE."
200     PAUSE
210     OUTPUT 718;"STORETHRU;"
220     OUTPUT 718;"TS;DONE?;"
230     ENTER 718;Done
240     OUTPUT 718;"NORMLIZE ON;"
250     OUTPUT 718;"TS;DONE?;"
260     ENTER 718;Done
270     OUTPUT 718;"NRPOS 8;TS;"
280     PRINT "RECONNECT DUT.  PRESS CONTINUE WHEN READY."
290     PAUSE
300     LOCAL 718
310     END
```

SRCPOFS Source Power Offset

Syntax

Figure 7-251 SRCPOFS Syntax



Description

The SRCPOFS command offsets the displayed power of the built-in tracking generator. This function can be used to take into account system losses (for example, cable loss) or gains (for example, preamplifier gain) reflecting the actual power delivered to the device under test. SRCPOFS is available only with an 8560E/EC Option 002.

Parameters

number	real from –100 dB to +100 dB.
UP or DN	increments in steps equal to the value set by SRCPSTP.

Preset State

0.0 dB

Query Response

Figure 7-252 SRCPOFS Query Response

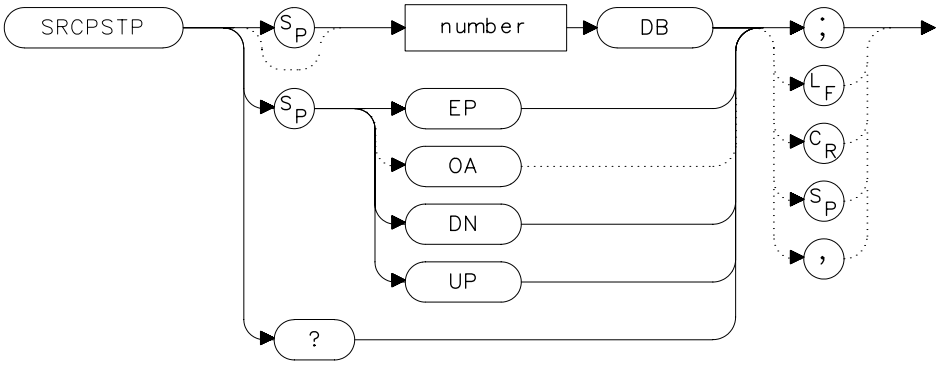
Example

```
OUTPUT 718;"IP;SNGLS;"
OUTPUT 718;"CF 300MHZ;SP 0HZ;TS;"
OUTPUT 718;"SRCPWR ON;SRCPWR -10DBM;"
OUTPUT 718;"SRCPSWP ON;SRCPSWP 10DB;TS;"
INPUT "ENTER GAIN OF PREAMPLIFIER UNDER TEST",Gain
OUTPUT 718;"SRCPOFS ";Gain;"DB;"
OUTPUT 718;"TS;MKPK HI;MKD;MKMIN;"
```

SRCPSTP Source Power Step

Syntax

Figure 7-253 SRCPSTP Syntax



Description

The SRCPSTP command sets the step size of the source power level, source power offset, and power-sweep range functions. This function is available only with an 8560E/EC Option 002.

Parameters

number	real from 0.1 dB to 12.75 dB; 0.05 dB resolution via GPIB.
UP or DN	0.1 dB steps.

Preset State

1.0 dB

Query Response

Figure 7-254 SRCPSTP Query Response

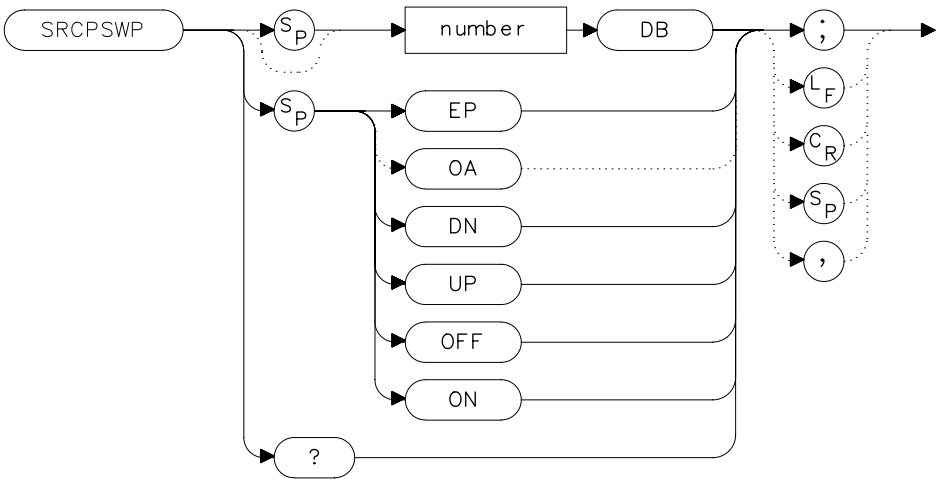
Example

```
10      OUTPUT 718;"IP;SNGLS;"
20      OUTPUT 718;"CF 300MHZ;SP 0HZ;TS;"
30      OUTPUT 718;"SRCPWR ON;SRCPWR -10DBM;"
40      OUTPUT 718;"SRCPSTP 1.0DB;"
50      OUTPUT 718;"SRCPWR UP;"
60      OUTPUT 718;"SRCPWR?;"
70      ENTER 718;Pwr
80      END
```

SRCPSWP Source Power Sweep

Syntax

Figure 7-255 SRCPSWP Syntax



Description

The SRCPSWP command activates and deactivates the power-sweep function, where the output power of the tracking generator is swept over the power-sweep range chosen. The starting source power level is set using the SRCPWR command. The output power of the tracking generator is swept according to the sweep rate of the spectrum analyzer.

SRCPSWP is available only with an 8560E/EC Option 002.

Parameters

number	real from 0 dB to 12.75 dB; 0.05 dB resolution via GPIB.
UP or DN	increments in steps equal to the value set by SRCPSTP.

Preset State

10 dB

Query Response

Figure 7-256 SRCPSWP Query Response

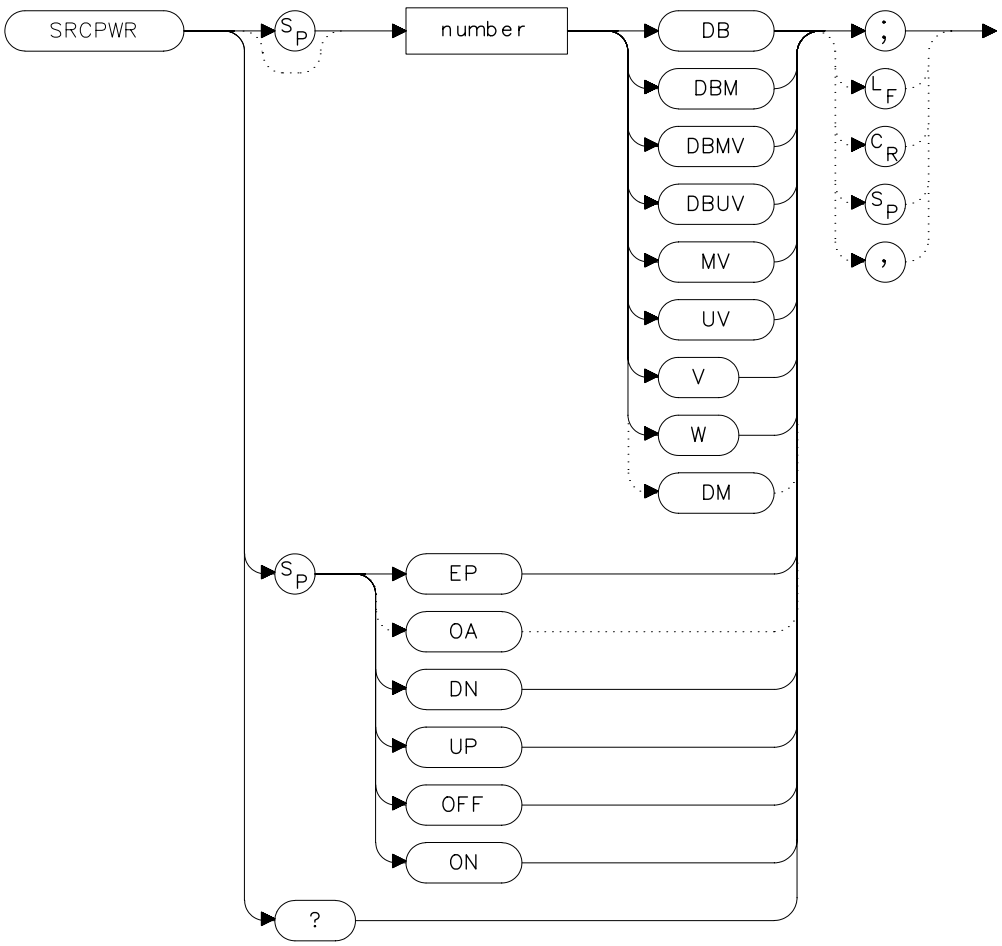
Example

```
10      OUTPUT 718;"IP;SNGLS;"
20      OUTPUT 718;"CF 300MHZ;SP 0HZ;TS;"
30      OUTPUT 718;"SRCPWR ON;SRCPWR -10DBM;"
40      OUTPUT 718;"SRCPSWP ON;SRCPSWP 10DB;TS;"
50      OUTPUT 718;"MKPK HI;MKD;MKMIN;TS;"
60      END
```

SRCPWR Source Power

Syntax

Figure 7-257 SRCPWR Syntax



Description

The SRCPWR command turns the built-in tracking generator on and off and adjusts the output power. This function is available only with an 8560E/EC Option 002.

Parameters

number	real from –10 dBm to +2.8 dBm; 0.05 dB resolution via GPIB.
UP or DN	increments in steps equal to the value set by SRCPSTP.

Preset State

–10 dBm

Query Response

Figure 7-258 SRCPWR Query Response

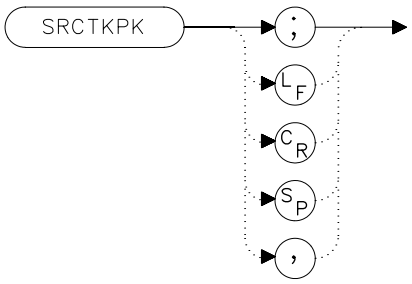
Example

```
10    OUTPUT 718;"IP;SNGLS;"
20    OUTPUT 718;"FA 300KHZ;FB 1GHZ;"
30    OUTPUT 718;"SRCPWR ON;"
40    OUTPUT 718;"SWPCPL SR;"
50    PRINT "CONNECT THRU.  PRESS CONTINUE WHEN READY TO STO
RE."
60    PAUSE
70    OUTPUT 718;"SRCTKPK;DONE?;"
80    ENTER 718;Done
90    OUTPUT 718;"TS;DONE?;"
100   ENTER 718;Done
110   OUTPUT 718;"STORETHRU;"
120   OUTPUT 718;"TS;DONE?;"
130   ENTER 718;Done
140   OUTPUT 718;"NORMLIZE ON;"
150   OUTPUT 718;"TS;DONE?;"
160   ENTER 718;Done
170   OUTPUT 718;"NRPOS 5;TS;"
180   PRINT "RECONNECT DUT.  PRESS CONTINUE WHEN READY."
190   PAUSE
200   OUTPUT 718;"NRL -10DB;"
210   OUTPUT 718;"TS;DONE?;"
220   ENTER 718;Done
230   LOCAL 718
240   END
```

SRCTKPK Source Tracking Peak

Syntax

Figure 7-259 SRCTKPK Syntax



Description

The SRCTKPK command activates a routine that automatically adjusts both the coarse- and fine-tracking adjustments to obtain the peak response of the tracking generator on the spectrum-analyzer display. Tracking peak is not necessary for resolution bandwidths greater than or equal to 300 kHz. A thru connection should be made prior to peaking in order to ensure accuracy.

SRCTKPK is available only with an 8560E/EC Option 002.

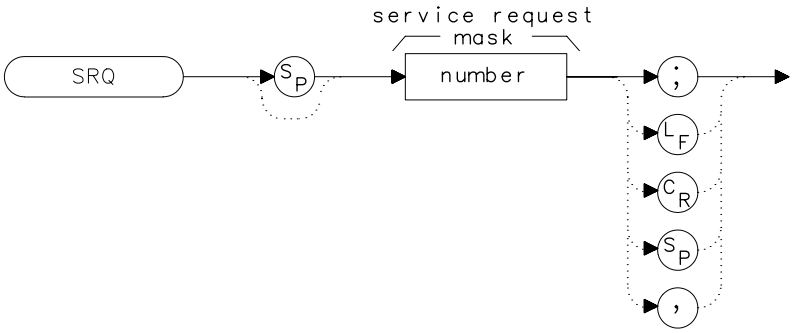
Example

```
10    OUTPUT 718;"IP;SNGLS;"
20    OUTPUT 718;"FA 300KHZ;FB 1GHZ;"
30    OUTPUT 718;"SRCPWR ON;"
40    OUTPUT 718;"SWPCPL SR;"
50    OUTPUT 718;"RB 100KHZ;"
50    OUTPUT 718;"SRCTKPK;DONE?;"
60    ENTER 718;Done
70    LOCAL 718
80    END
```

SRQ Service Request

Syntax

Figure 7-260 SRQ Syntax



Description

The SRQ command triggers a service request. This command allows you to force a service request and test a program designed to handle service requests. However, the service request can be triggered only if it is first masked using the RQS command. For more service request information, refer to "Monitoring System Operation" in Chapter 5, "Programming."

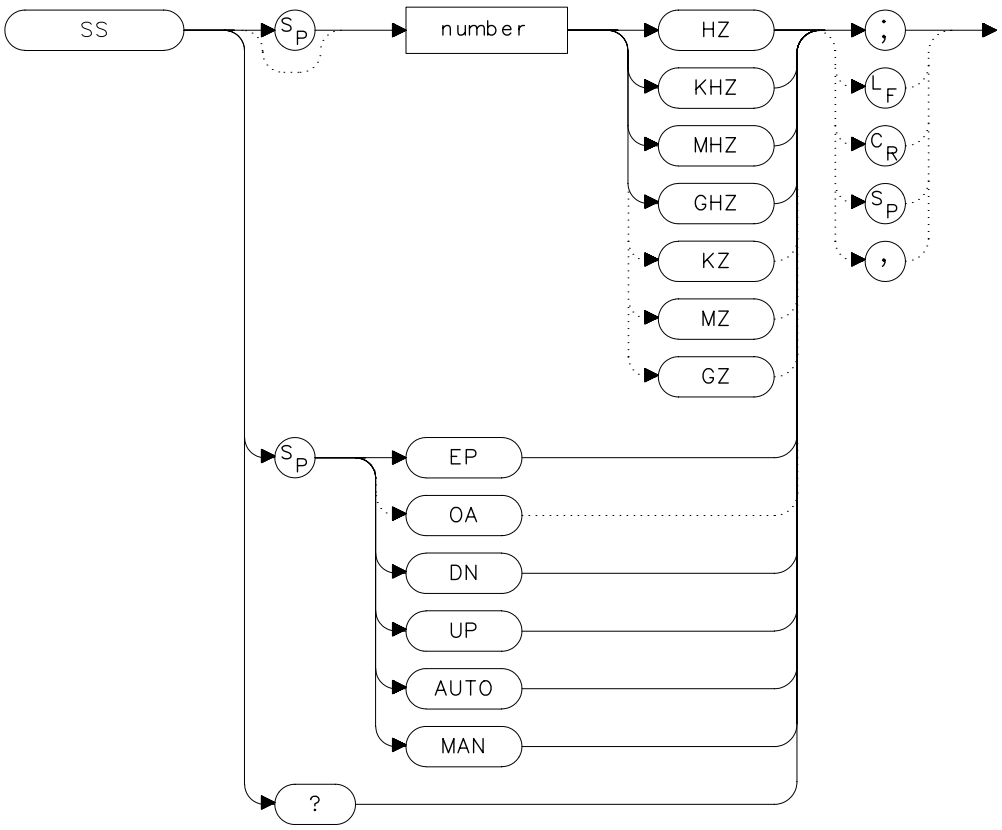
Example

```
10    OUTPUT 718;"IP;SNGLS;CF 300MHZ;TS;"
20    OUTPUT 718;"RQS 16;"
30    ON INTR 7 GOTO Srq
40    ENABLE INTR 7;2
50    OUTPUT 718;"SRQ 16;"
60    Idle:  GOTO Idle
70    Srq:   Sbyte=SPOLL(718)
80           PRINT Sbyte
90           PRINT "INTERRUPT GENERATED"
100   OUTPUT 718;"RQS 0;"
110   LOCAL 718
120   END
```

SS Center Frequency Step-Size

Syntax

Figure 7-261 SS Syntax



Description

The SS command sets the center frequency step-size. This is normally a coupled function. After entering a step size, execute the CF command using the UP or DN parameter. The center frequency is adjusted by the selected step size. This function is useful for quickly tuning to the harmonics of an input signal. The default value is 10 percent of span. When the span is 0 Hz, the default value is one-fourth of the resolution bandwidth.

Parameters

number	real from 25 to 26.50E+9 (hardware dependent).
UP or DN	increments in a 1, 2, 5, 10 sequence.

Preset State

- 290 MHz, AUTO (8560E/EC)
- 650 MHz, AUTO (Agilent 8561E/EC)
- 1.32 GHz, AUTO (Agilent 8562E/EC)
- 2.65 GHz, AUTO (Agilent 8563E/EC)
- 4.0 GHz, AUTO (Agilent 8564E/EC)
- 5.0 GHz, AUTO (Agilent 8565E/EC)

Query Response

Figure 7-262 SS Query Response

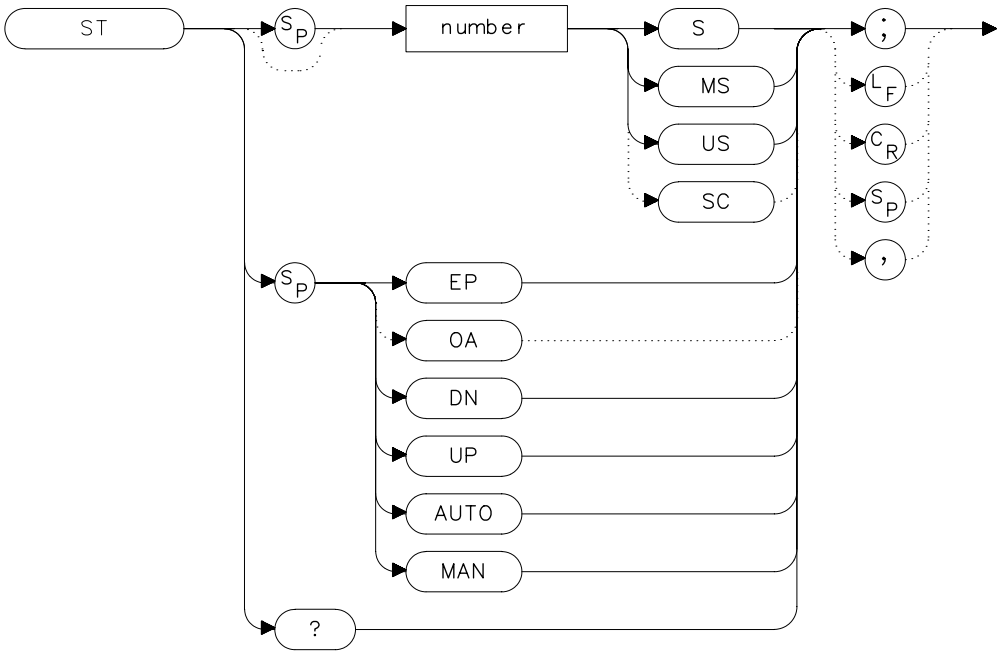
Example

```
10   CLEAR 718
20   OUTPUT 718;"IP;SNGLS;CF300MHZ;SP 20MZ;TS;"
30   OUTPUT 718;"MKPK HI;MKRL;TS;MKF?;MKA?;"
40   ENTER 718 USING "K";Mk_freq,Mk_amp
50   OUTPUT 718;"SS ";Mk_freq;"HZ"
60   OUTPUT 718;"CF UP;TS;MKPK HI;MKA?;"
70   ENTER 718;Mk_ampl
80   PRINT "The fundamental is ";Mk_amp-MK_ampl;" db above t
he
first harmonic."
90   END
```

ST Sweep Time

Syntax

Figure 7-263 ST Syntax



Description

The ST command sets the sweep time. This is normally a coupled function that is automatically set to the optimum value allowed by the current instrument settings. Alternatively, you can specify the sweep time. Note that when the specified sweep time is too fast for the current instrument settings, the instrument is no longer calibrated and the message MEAS UNCAL appears on the display.

Parameters

number	real from 50 ms to 100s with spans greater than 0 Hz (50 ms to 2000s for Agilent 8562E/EC, Agilent 8564E/EC, Agilent 8565E/EC; and Agilent 8560E/EC, Agilent 8561E/EC, and Agilent 8563E/EC with serial number prefix ≥3424A). real from 50 µs to 6000s when the span equals 0 Hz (50 µs to 100 s for firmware revision 920528).
UP or DN	increments in a 1, 2, 5, 10 sequence.

Preset State

- AUTO

Query Response

Figure 7-264 ST Query Response

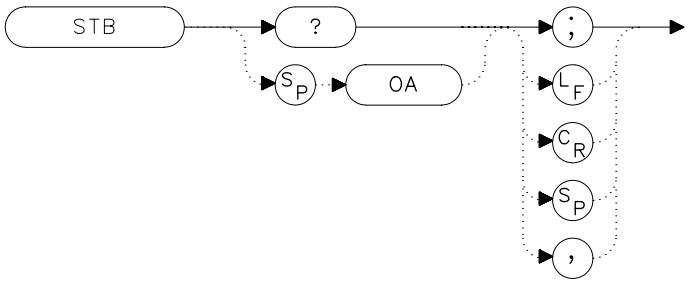
Example

```
10    OUTPUT 718;"ST 500MS;"
20    OUTPUT 718;"ST DN;"
30    OUTPUT 718;"ST?;"
40    ENTER 718;St
50    PRINT St
60    END
```

STB Status Byte Query

Syntax

Figure 7-265 STB Syntax



Description

The STB command returns to the controller the decimal equivalent of the bits set in the status byte (see the RQS and SRQ commands). STB is equivalent to a serial poll command. The RQS and associated bits are cleared in the same way that a serial poll command would clear them. For more information, refer to Chapter 5.

Bit	Decimal	Definition
7	—	Not used
6	64	Request service
5	32	Error present in error register
4	16	Command complete
3	—	Not used
2	4	End of sweep
1	2	Message occurred
0	0	Cleared

Query Response

Figure 7-266 STB Query Response

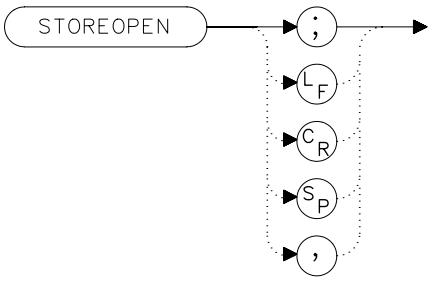
Example

```
10    OUTPUT 718;"IP;SNGLS;CF 300MHZ;SP 20MHZ;TS;"
20    OUTPUT 718;"VAVG 10;RQS 16;"
30    ON INTR 7 GOTO Srq
40    ENABLE INTR 7;2
50    OUTPUT 718;"TS;"
60    Idle:  GOTO Idle
70    Srq:   OUTPUT 718;"STB?;"
80           ENTER 718;Sbyte
90           PRINT Sbyte
100   PRINT "VIDEO AVERAGING IS COMPLETE"
110   OUTPUT 718;"RQS 0;"
120   LOCAL 718
130   END
```

STOREOPEN Store Open

Syntax

Figure 7-267 STOREOPEN Syntax



Description

The STOREOPEN command saves the current instrument state and trace A into nonvolatile memory. This command must be used in conjunction with the STORESHORT command and must precede the STORESHORT command. The data obtained during the STOREOPEN procedure is averaged with the data obtained during the STORESHORT procedure to provide an open/short calibration. The instrument state (that is, instrument settings) must *not* change between the STOREOPEN and STORESHORT operations in order for the open/short calibration to be valid. Refer to the STORESHORT command description for more information.

NOTE The STOREOPEN command is intended primarily for use with a tracking generator.

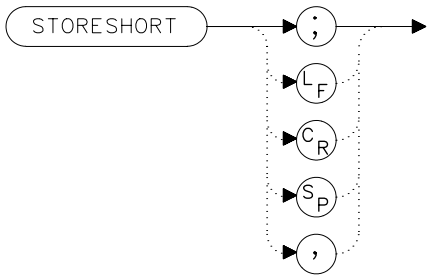
Example

```
10    OUTPUT 718;"IP;SNGLS;"
20    OUTPUT 718;"FA 300KHZ;FB 1GHZ;"
30    OUTPUT 718;"SRCPWR ON;"      !8560E Option 002 only.
40    OUTPUT 718;"SWPCPL SR;"
50    PRINT "CONNECT OPEN.  PRESS CONTINUE WHEN READY TO STO
RE."
60    PAUSE
70    OUTPUT 718;"TS;DONE?;"
80    ENTER 718;Done
90    OUTPUT 718;"STOREOPEN;"
100   PRINT "CONNECT SHORT.  PRESS CONTINUE WHEN READY
TO STORE AND AVERAGE."
110   PAUSE
120   OUTPUT 718;"TS;DONE?;"
130   ENTER 718;Done
140   OUTPUT 718;"STORESHORT;"
150   OUTPUT 718;"TS;DONE?;"
160   ENTER 718;Done
170   OUTPUT 718;"NORMLIZE ON;"
180   OUTPUT 718;"TS;DONE?;"
190   ENTER 718;Done
200   LOCAL 718
210   END
```

STORESHORT Store Short

Syntax

Figure 7-268 STORESHORT Syntax



Description

The STORESHORT command takes currently displayed trace A data and averages this data with previously stored open data, and stores it in trace B. This command is used in conjunction with the STOREOPEN command and must be preceded by it for proper operation. Refer to the STOREOPEN command description for more information. The state of the open/short average trace is stored in state register number 8.

NOTE The STORESHORT command is primarily intended for use with a tracking generator.

A normalization error will occur when the NRL command is executed if the current spectrum analyzer state is not the same as the state stored by the last execution of the STORETHRU or STORESHORT command. This can happen when several open/short or thru calibrations are performed.

The NRL command recalls the last calibration run. If one of the earlier short or thru states has been recalled just before executing the NRL command, then the current and recalled states don't match and the error occurs. To avoid this error, update the STORETHRU or STORESHORT state register with the current state before turning NRL on. The STORETHRU state register is state register 9. The STORESHORT state register is state register 8. It is a good idea to take a sweep (TS command) prior to saving the state using the SAVES 8 or SAVES 9 command.

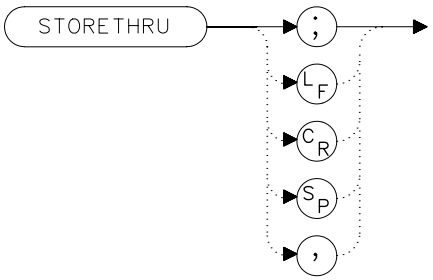
Example

```
10    OUTPUT 718;"IP;SNGLS;"
20    OUTPUT 718;"FA 300KHZ;FB 1GHZ;"
30    OUTPUT 718;"SRCPWR ON;"      !8560E/EC Option 002 only
.
40    OUTPUT 718;"SWPCPL SR;"
50    PRINT "CONNECT OPEN.  PRESS CONTINUE WHEN READY TO STO
RE."
60    PAUSE
70    OUTPUT 718;"TS;DONE?;"
80    ENTER 718;Done
90    OUTPUT 718;"STOREOPEN;"
100   PRINT "CONNECT SHORT.  PRESS CONTINUE WHEN READY
TO STORE AND AVERAGE."
110   PAUSE
120   OUTPUT 718;"TS;DONE?;"
130   ENTER 718;Done
140   OUTPUT 718;"STORESHORT;"
150   OUTPUT 718;"TS;DONE?;"
160   ENTER 718;Done
170   OUTPUT 718;"NORMLIZE ON;"
180   OUTPUT 718;"TS;DONE?;"
190   ENTER 718;Done
200   LOCAL 718
210   END
```

STORETHRU Store Thru

Syntax

Figure 7-269 STORETHRU Syntax



Description

The STORETHRU command stores a thru-calibration trace into trace B and into the nonvolatile memory of the spectrum analyzer.

The state of the thru information is stored in state register number 9.

NOTE The STORETHRU command is primarily intended for use with a tracking generator.

A normalization error will occur when the NRL command is executed if the current spectrum analyzer state is not the same as the state stored by the last execution of the STORETHRU or STORESHORT command. This can happen when several open/short or thru calibrations are performed.

The NRL command recalls the last calibration run. If one of the earlier short or thru states has been recalled just before executing the NRL command, then the current and recalled states don't match and the error occurs. To avoid this error, update the STORETHRU or STORESHORT state register with the current state before turning NRL on. The STORETHRU state register is state register 9. The STORESHORT state register is state register 8. It is a good idea to take a sweep (TS command) prior to saving the state using the SAVES 8 or SAVES 9 command.

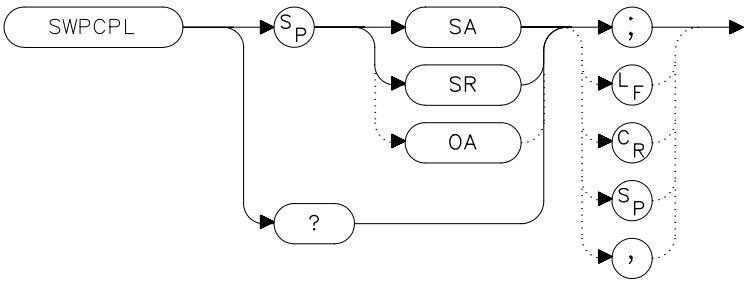
Example

```
10   OUTPUT 718;"IP;SNGLS;"
20   OUTPUT 718;"FA 300KHZ;FB 1GHZ;"
30   OUTPUT 718;"SRCPWR ON;"     !8560E Option 002 only.
40   OUTPUT 718;"SWPCPL SR;"
50   OUTPUT 718;"RB 300KHZ;TS;"
60   PRINT "CONNECT THRU. PRESS CONTINUE WHEN READY TO STORE
."
70   PAUSE
80   OUTPUT 718;"SRCTKPK;DONE?;"
90   ENTER 718;Done
100  OUTPUT 718;"TS;DONE?;"
110  ENTER 718;Done
120  OUTPUT 718;"STORETHRU;"
130  OUTPUT 718;"TS;DONE?;"
140  ENTER 718;Done
150  OUTPUT 718;"NORMLIZE ON;"
160  OUTPUT 718;"TS;DONE?;"
170  ENTER 718;Done
180  LOCAL 718
190  END
```

SWPCPL Sweep Couple

Syntax

Figure 7-270 SWPCPL Syntax



Description

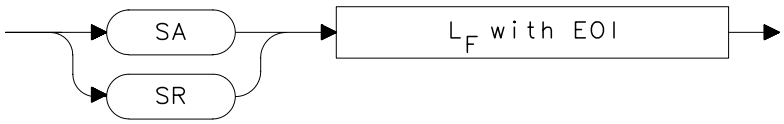
The SWPCPL command selects either a stimulus-response (SR) or spectrum-analyzer (SA) auto-coupled sweep time. In stimulus-response mode, auto-coupled sweep times are usually much faster for swept-response measurements. Stimulus-response auto-coupled sweep times are typically valid in stimulus-response measurements when the system frequency span is less than 20 times the bandwidth of the device under test.

Preset State

SA (spectrum analyzer mode)

Query Response

Figure 7-271 SWPCPL Query Response



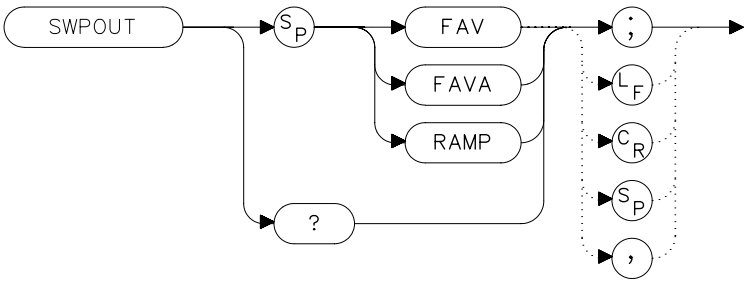
Example

```
10    OUTPUT 718;"IP;SNGLS;"
20    OUTPUT 718;"FA 300KHZ;FB 1GHZ;"
30    OUTPUT 718;"SRCPWR ON;"   !8560E Option 002 only.
40    OUTPUT 718;"SWPCPL SR;"
50    OUTPUT 718;"SRCTKPK;DONE?;"  !8560E Option 002 only.
60    ENTER 718;Done
70    LOCAL 718
80    END
```

SWPOUT Sweep Output

Syntax

Figure 7-272 SWPOUT Syntax



Description

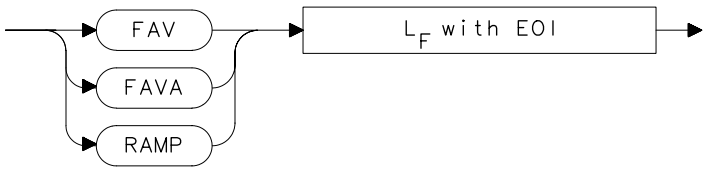
The SWPOUT command selects the sweep-related signal that is available from connector J8 (labeled LO SWP | FAV OUTPUT) on the rear panel.

FAV	(frequency analog voltage) provides a voltage nominally equal to 0.5 V/GHz of the tuned frequency when in internal mixing.
FAVA	(frequency analog voltage attenuated) provides a voltage nominally equal to 0.25 V/GHz of the tuned frequency when in internal mixing. *For Agilent 8564E/EC and Agilent 8565E/EC only.*
RAMP	provides a 0 to 10 V ramp corresponding to the sweep ramp that tunes the first local oscillator (LO). In multiband sweeps, one sweep ramp is provided for each frequency band.

When configured to use preselected external mixers, the 0.5 V/GHz signal is automatically selected. The 0.5 V/GHz signal is increased to 1.5 V/GHz and the external mixer preselector DAC value is summed with it before it is output. This means that with preselected external mixers, the 0.5 V/GHz output provides a signal of approximately 1.5 V/GHz of LO frequency to control the mixer.

Query Response

Figure 7-273 SWPOUT Query Response



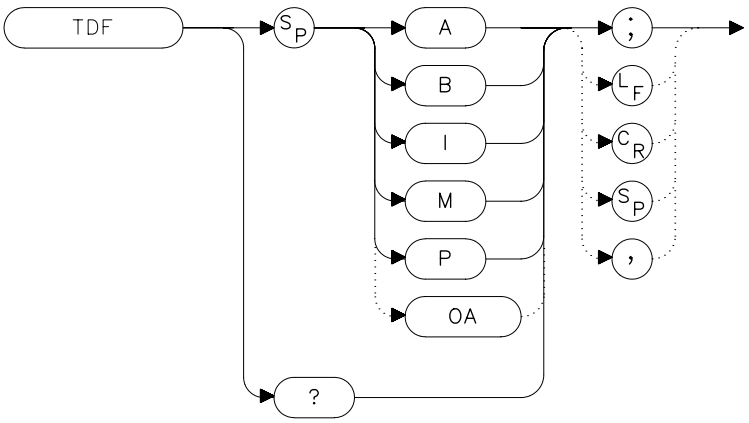
Example

```
10    INPUT "SELECT THE SIGNAL OUTPUT OF J8 (RAMP OR
FAV)",Sig_out$
20    OUTPUT 718;"SWPOUT ";Sig_out$;";"
30    OUTPUT 718;"SWPOUT?;"
40    ENTER 718;Sig_out$
50    PRINT "SELECTED SIGNAL OUTPUT IS ",Sig_out$
60    END
```

TDF Trace Data Format

Syntax

Figure 7-274 TDF Syntax



Description

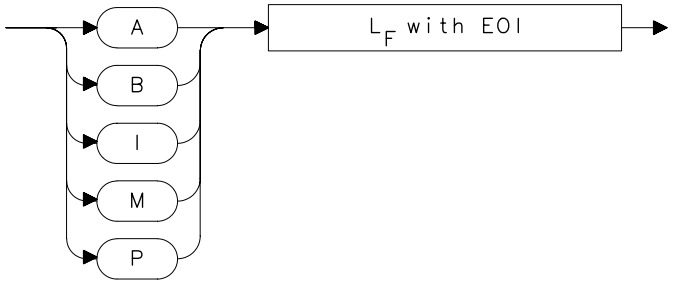
The TDF command selects the format used to input and output trace data (see the TRA/TRB command or refer to Chapter 5 for more information about trace data formats). You must specify the desired format when transferring data from the spectrum analyzer to a computer; this is optional when transferring data to the analyzer.

Parameters

A	specifies A-block data format.
B	specifies binary data format.
I	specifies I-block data format.
M	specifies ASCII data format.
P	specifies parameter data format. Numbers are in Hz, volts, watts, dBm, dBmV, dBµV, dBV, or seconds.

Query Response

Figure 7-275 TDF Query Response



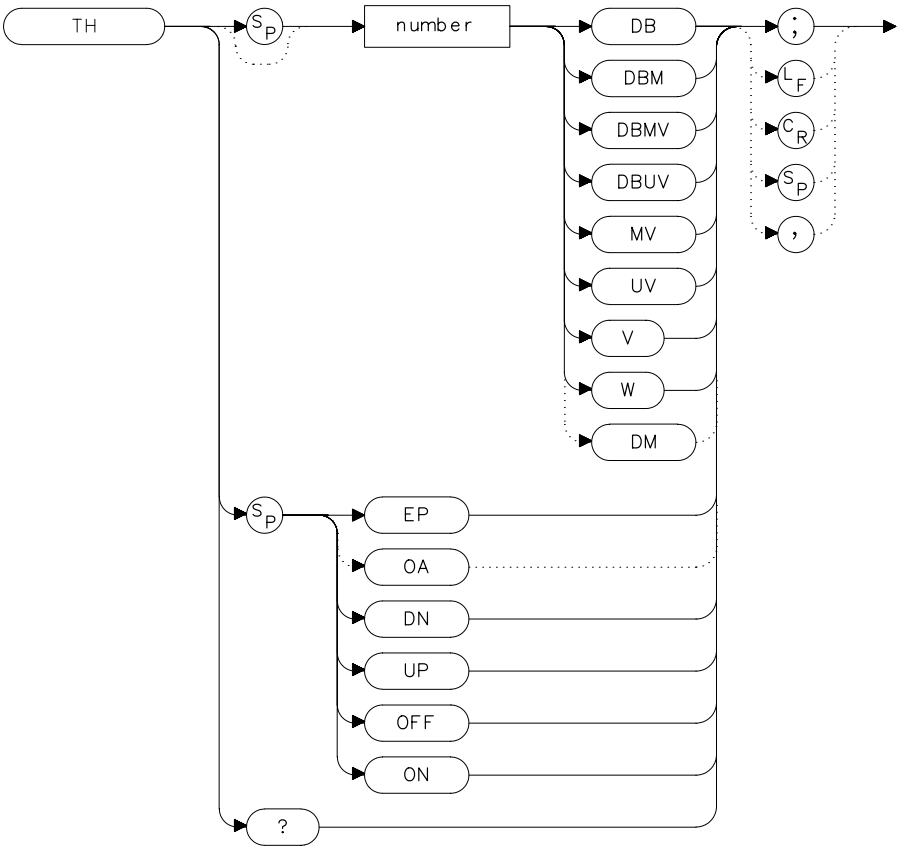
Example

```
10    REAL A(1:601)
20    OUTPUT 718;"IP;CF 300MHZ;SP 20MHZ;SNGLS;TS;"
30    CALL Get_data(Fa,Fb,Rl,Rb,Vb,St,Lg,Aunits$)
40    OUTPUT 718;"TDF P;TRA?;"
50    ENTER 718;A(*)
60    PRINT "PRESS CONTINUE TO RETURN DATA TO THE ANALYZER."
70    PAUSE
80    OUTPUT 718;"IP;TDF P;TS;VIEW TRA;"
90    CALL Enter_data(Fa,Fb,Rl,Rb,Vb,St,Lg,Aunits$)
100   OUTPUT 718;"TRA ";
110     FOR I=1 TO 600
120     OUTPUT 718;A(I);"DBM,"
130     NEXT I
140   OUTPUT 718;A(601);"DBM;"
150   END
160   SUB Enter_data(Fa,Fb,Rl,Rb,Vb,St,Lg,Aunits$)
170   OUTPUT 718;"FA ";Fa;"HZ;"
180   OUTPUT 718;"FB ";Fb;"HZ;"
190   OUTPUT 718;"AUNITS ";Aunits$;";"
200   OUTPUT 718;"RB ";Rb;"HZ;"
210   OUTPUT 718;"VB ";Vb;"HZ;"
220   OUTPUT 718;"ST ";St;"S;"
230   IF Lg=0 THEN
240     OUTPUT 718;"LN;"
250   ELSE
260     OUTPUT 718;"LG ";Lg;"DB;"
270     END IF
280   SUBEND
290   SUB Get_data(Fa,Fb,Rl,Rb,Vb,St,Lg,Aunits$)
300   OUTPUT 718;"FA?;FB?;RL?;RB?;VB?;ST?;LG?;AUNITS?;"
310   ENTER 718 USING "K";Fa,Fb,Rl,Rb,Vb,St,Lg,Aunits$
320   PRINT Fa,Fb,Rl,Rb,Vb,St,Lg,Aunits$
330   SUBEND
```

TH Threshold

Syntax

Figure 7-276 TH Syntax



Description

The TH command sets the minimum amplitude level and clips data at this value. Default value is –90 dBm. See also MKPT. MKPT does not clip data below its threshold.

NOTE When a trace is in max-hold mode, if the threshold is raised above any of the trace data, the data below the threshold will be permanently lost.

Parameters

number	dependent upon the chosen amplitude units.
UP or DN	increments by one vertical division.

Preset State

Off

Query Response

Figure 7-277 TH Query Response

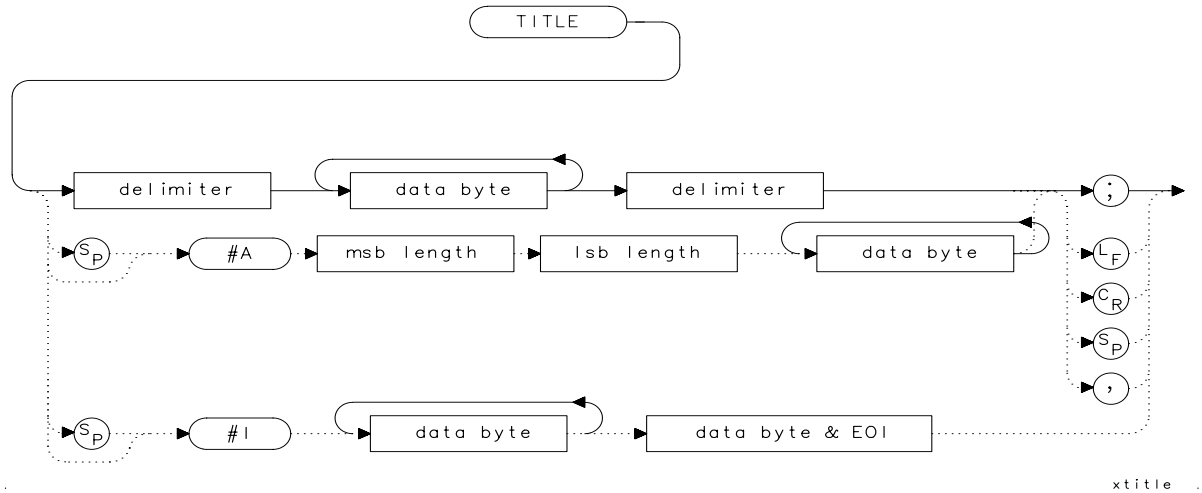
Example

```
10   OUTPUT 718;"TH EP;"
20   PRINT "SELECT THE THRESHOLD ON THE ANALYZER"
30   PRINT "PRESS HOLD THEN PRESS CONTINUE"
40   PAUSE
50   END
```

TITLE Title Entry

Syntax

Figure 7-278 TITLE Syntax



Description

The TITLE command places character data in the title area of the display, which is in the upper-right corner. A title can be up to two rows of sixteen characters each and can include the special characters shown in Table 7-1 on page 372. Carriage return and line feed characters are not recommended. For more information on creating titles, refer to Chapter 5 of this manual.

Special Characters

The characters shown in the following table can be included in a title. To include the special characters within a title, you should:

1. End the title entry by inserting a quote mark and a semicolon.
2. After the semicolon, insert "CHR$", a left parenthesis, the code for the special character, and then a right parenthesis.
3. Insert a semicolon and then a quote mark and then continue with the title entry.

See the programming example for an example of a title with a special character in it.

Table 7-10 Special Printing Characters

Code	Character
60	<
62	>
168	←
169	→
225	α
226	β
237	μ
240	π
241	θ
242	ρ
243	σ
244	τ
247	ω
249	Δ

Parameter

msb length and lsb length represent the length of the title as two 8-bit bytes.

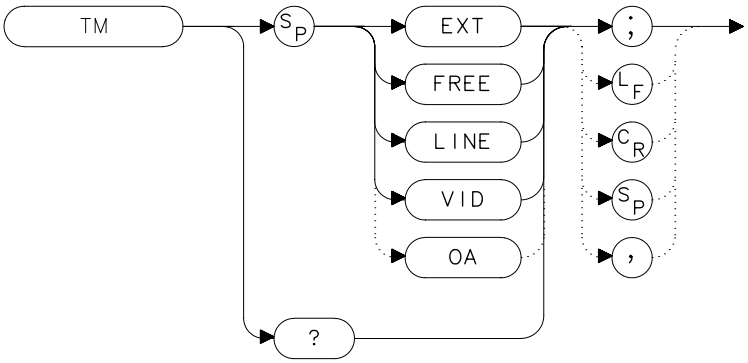
Example

```
10   OUTPUT 718;"TITLE@This is a title@;"
Displays "This is a
title" as the screen title.

20   OUTPUT 718;"TITLE@This is a ";
CHR$(249);" within a title@;"
Displays "This is a Δ
within a title" as the screen title.

30   END
```

TM Trigger Mode

Syntax

Figure 7-279 TM Syntax



Description

The TM command selects a trigger mode. Selected trigger conditions must be met in order for a sweep to occur. The available trigger modes are listed below. When any trigger mode other than free run is selected, a T appears on the left edge of the display.

Parameters

EXT	selects the external mode. Connect an external trigger source to J5 EXT/GATE TRIG INPUT on the rear panel of the spectrum analyzer. The source must range from 0 to 5 V (TTL). The trigger occurs on the rising, positive edge of the signal (about 1.5 V).
FREE	selects the free-run mode. Sweep triggers occur as fast as the spectrum analyzer will allow.
LINE	selects the line mode. Sweep triggers occur at intervals synchronized to the line frequency.
VID	selects the video mode. Sweep triggers occur whenever the positively-sloped part of the input signal passes through the video trigger level. This trigger level can be changed (refer to the VTL command), and a dashed line appears on the screen to denote (approximately) the

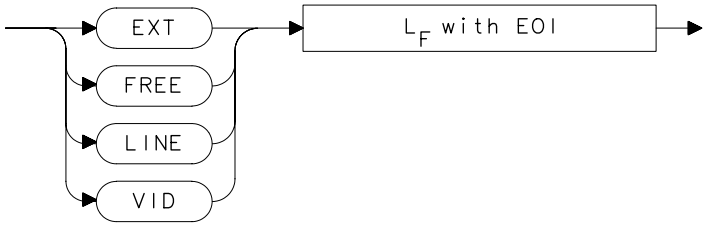
selected level. Video triggering is not available for resolution bandwidths ≤100 Hz.

Preset State

Free-run mode

Query Response

Figure 7-280 TM Query Response



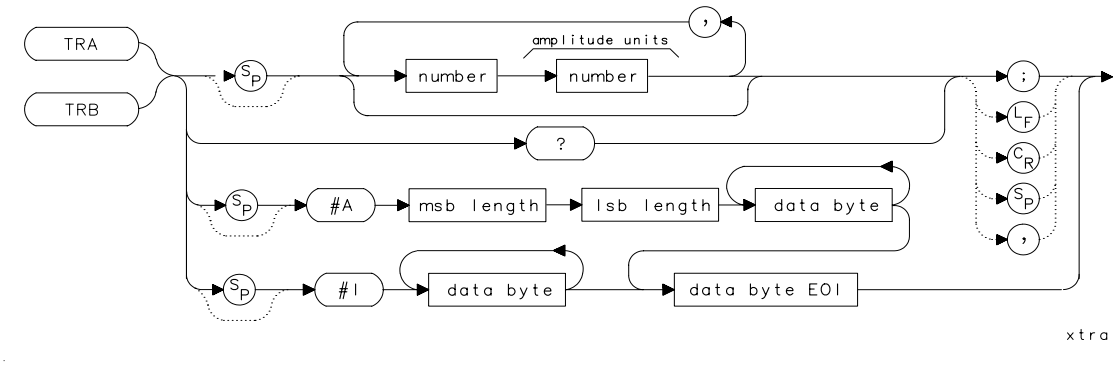
Example

```
10    OUTPUT 718;"TM VID;"
20    OUTPUT 718;"VTL –20DBM;"
30    END
```

TRA/TRB Trace Data Input/Output

Syntax

Figure 7-281 TRA/TRB Syntax



Description

The TRA and TRB commands provide a method for transferring trace data to or from a computer. The available data formats are parameter (P) format, binary (B) format, A-block format, I-block format, or measurement units (M) format. Transfers to the computer must be completed within 30 seconds or the transfer will be aborted. For instructions on transferring data and more examples, refer to Chapter 5, "Programming."

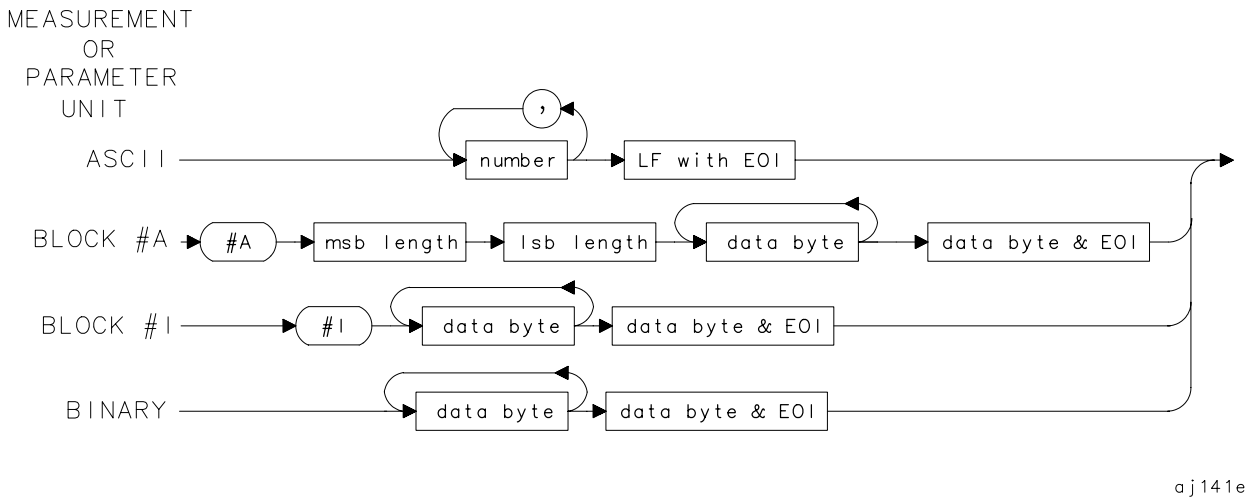
Option 007, Fast Digitized Time Domain, is necessary to obtain trace data with sweep times <30 ms. Without Option 007, sweep times <30 ms are not digitized. If a sweep time <30 ms is selected and Option 007 is not installed, the trace data returned is the last trace data taken with a sweep time ≥30 ms.

Parameter

msb and lsb length represents the length of the trace as two 8-bit bytes.

Query Response

Figure 7-282 TRA/TRB Query Response



Example

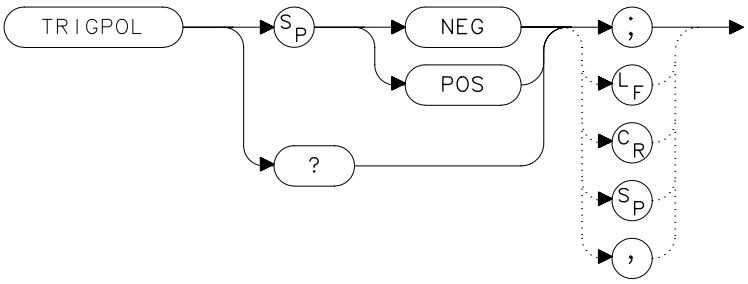
```
10    REAL A(1:601)
20    OUTPUT 718;"IP;CF 300MHZ;SP 20MHZ;SNGLS;TS;"
30    CALL Get_data(Fa,Fb,Rl,Rb,Vb,St,Lg,Aunits$)
40    OUTPUT 718;"TDF P;TRA?;"
50    ENTER 718;A(*)
60    PRINT "PRESS CONTINUE TO RETURN DATA TO THE ANALYZER."
70    PAUSE
80    OUTPUT 718;"IP;TDF P;TS;VIEW TRA;"
90    CALL Enter_data(Fa,Fb,Rl,Rb,Vb,St,Lg,Aunits$)
100   OUTPUT 718;"TRA ";
110     FOR I=1 TO 600
120     OUTPUT 718;A(I);"DBM,"
130     NEXT I
140   OUTPUT 718;A(601);"DBM;"
150   END
160   SUB Enter_data(Fa,Fb,Rl,Rb,Vb,St,Lg,Aunits$)
170   OUTPUT 718;"FA ";Fa;"HZ;"
180   OUTPUT 718;"FB ";Fb;"HZ;"
190   OUTPUT 718;"AUNITS ";Aunits$;";"
200   OUTPUT 718;"RB ";Rb;"HZ;"
210   OUTPUT 718;"VB ";Vb;"HZ;"
220   OUTPUT 718;"ST ";St;"S;"
230   IF Lg=0 THEN
240     OUTPUT 718;"LN;"
250   ELSE
260     OUTPUT 718;"LG ";Lg;"DB;"
```

```
270     END IF
280   SUBEND
290   SUB Get_data(Fa,Fb,Rl,Rb,Vb,St,Lg,Aunits$)
300   OUTPUT 718;"FA?;FB?;RL?;RB?;VB?;ST?;LG?;AUNITS?;"
310   ENTER 718 USING "K";Fa,Fb,Rl,Rb,Vb,St,Lg,Aunits$
320   PRINT Fa,Fb,Rl,Rb,Vb,St,Lg,Aunits$
330   SUBEND
```

TRIGPOL Trigger Polarity

Syntax

Figure 7-283 TRIGPOL Syntax



Description

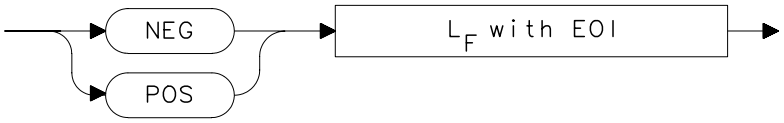
Selects the edge (positive or negative) of the trigger input that causes the trigger event. TRIGPOL is available in all trigger modes. The trigger polarity (TRIGPOL) will always match the gate polarity. For example, if you set GP to positive, TRIGPOL will automatically be set to positive also.

Preset State

Positive

Query Response

Figure 7-284 TRIGPOL Query Response



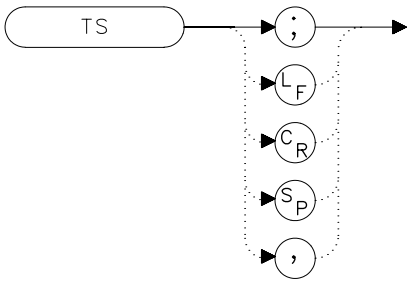
Example

```
OUTPUT 718;"TRIGPOL POS;"
```

TS Take Sweep

Syntax

Figure 7-285 TS Syntax



Description

TS commands the spectrum analyzer to take one full sweep across the trace display. Commands following TS are not executed until after the analyzer has finished the trace sweep. (This ensures that the instrument is set to a known condition before subsequent commands are executed.) For information on how to synchronize a program using TS and the DONE command, refer to Chapter 5.

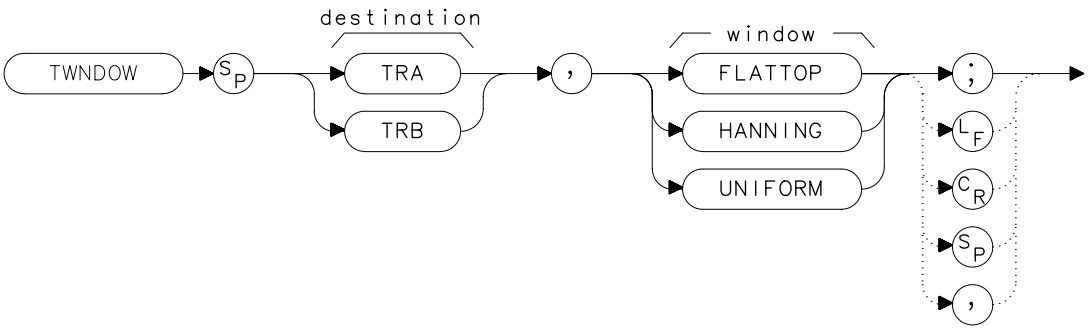
Example

```
10    OUTPUT 718;"IP;SNGLS;"
20    OUTPUT 718;"TS;DONE?;"
30    ENTER 718;Done
40    PRINT Done
50    END
```

TWNDOW Trace Window

Syntax

Figure 7-286 TWNDOW Syntax



NOTE The destination trace is not currently used, but it must be supplied for future compatibility.

Description

The TWNDOW command creates a window trace array for the fast Fourier transform (FFT) function. The trace-window function creates a trace array according to three built-in algorithms: UNIFORM, HANNING, and FLATTOP. When used with the FFT command, the three algorithms give resultant passband shapes that represent a compromise among amplitude uncertainty, sensitivity, and frequency resolution. Refer to the FFT command description for more information.

The three types of windows that are available when using the TWNDOW command are:

FLATTOP	provides optimum amplitude accuracy.
HANNING	provides an amplitude accuracy and frequency resolution compromise, which is useful for general purpose measurements, as well as noise measurements.
UNIFORM	provides equal weighing of the time record for measuring transients.

Preset State

HANNING

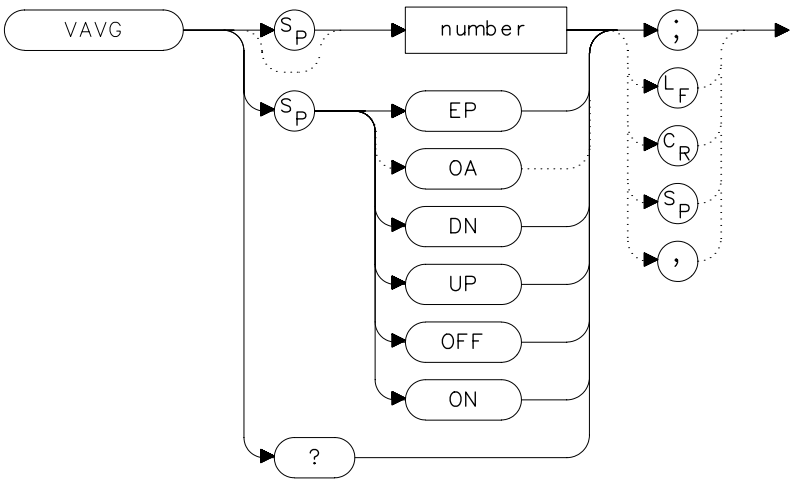
Example

```
10    OUTPUT 718;"IP;"
20    OUTPUT 718;"CF 300 MHZ;"
30    OUTPUT 718;"SP 0HZ;ST 50MS;"
40    OUTPUT 718;"TWNDOW TRA, UNIFORM;"
50    OUTPUT 718;"CLRW TRB;"
60    OUTPUT 718;"SNGLS;TS;TS;"
70    OUTPUT 718;"FFT TRA,TRB,TRA;"
80    OUTPUT 718;"BLANK TRB;"
90    OUTPUT 718;"VIEW TRA;"
100   END
```

VAVG Video Average

Syntax

Figure 7-287 VAVG Syntax



Description

The VAVG command activates the video averaging function. Video averaging smooths the displayed trace without using a narrow bandwidth. VAVG sets the IF detector to sample mode (see the DET command) and smooths the trace by averaging successive traces with each other. If desired, you can change the detector mode during video averaging.

Video averaging is available only for trace A, and trace A must be in clear-write mode for VAVG to operate. After VAVG is executed, the number of sweeps that have been averaged appears at the top of the analyzer screen.

Using video averaging allows you to view changes to the entire trace much faster than using narrow video filters. Narrow video filters require long sweep times, which may not be desired. Video averaging, though requiring more sweeps, uses faster sweep times; in some cases, it can produce a smooth trace as fast as a video filter.

Parameters

number	integer from 1 to 999.
UP or DN	increments by 1.

Preset State

100, off

Query Response

Figure 7-288 VAVG Query Response

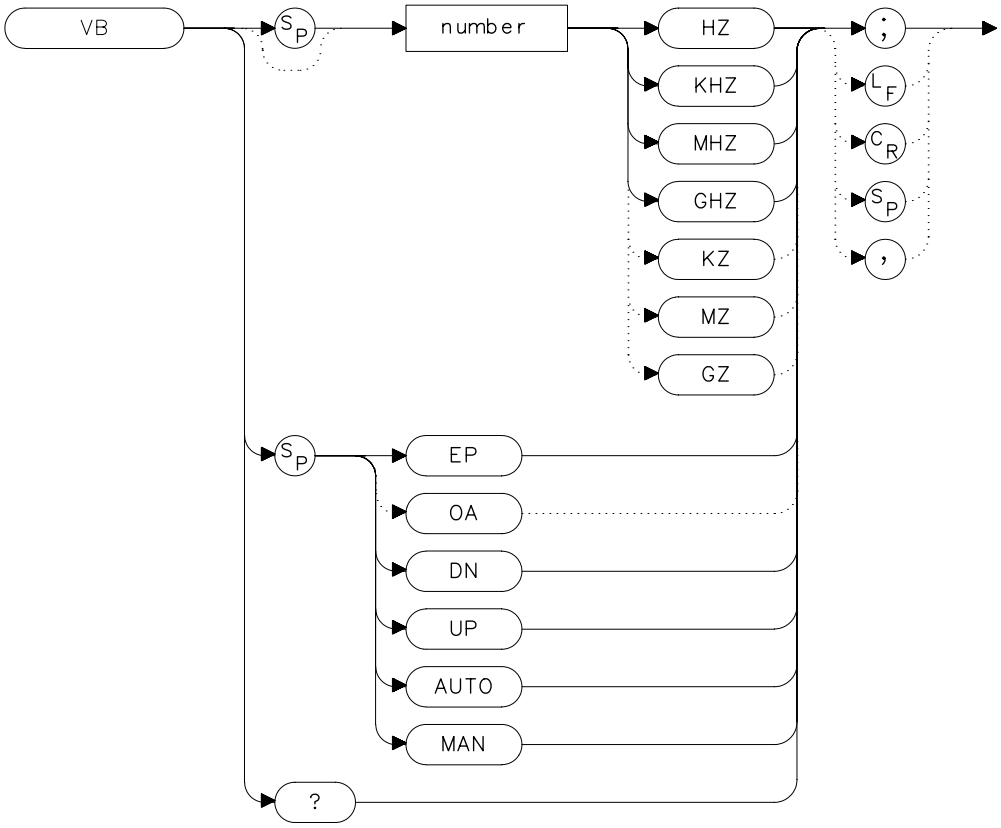
Example

```
10   OUTPUT 718;"SNGLS;VAVG 20;TS;"
20   END
```

VB Video Bandwidth

Syntax

Figure 7-289 VB Syntax



Description

The VB command specifies the video bandwidth. Video bandwidths filter (or smooth) post-detected video information. This is normally a coupled function that is selected according to the ratio selected by the VBR command. (If no ratio is selected, a default ratio of 1.0 is used.) The bandwidths, which range from 1 Hz to 3 MHz, can also be selected manually. If the specified video bandwidth is less than 300 Hz, and the resolution bandwidth is greater than or equal to 300 Hz, the IF detector is set to sample mode.

When the sweep time is <30 ms and the resolution bandwidth is ≥300 Hz, then the narrowest video bandwidth available is 300 Hz. If the resolution bandwidth is ≤100 Hz and the span is zero, video filtering does not occur.

Reducing the video bandwidth or increasing the number of video averages will usually smooth the trace by about as much for the same total measurement time. Reducing the video bandwidth to one-third or less of the resolution bandwidth is desirable when the number of video averages is above 25. For the case where the number of video averages is very large, and the video bandwidth is equal to the resolution bandwidth, internal mathematical limitations allow about 0.4 dB overresponse to noise on the logarithmic scale. The overresponse is negligible (less than 0.1 dB) for narrower video bandwidths.

Parameters

number	integer from 1 to 3E+6.
UP or DN	increments in a 1, 3, 10 sequence.

Preset State

Coupled mode, 1 MHz

Query Response

Figure 7-290 VB Query Response

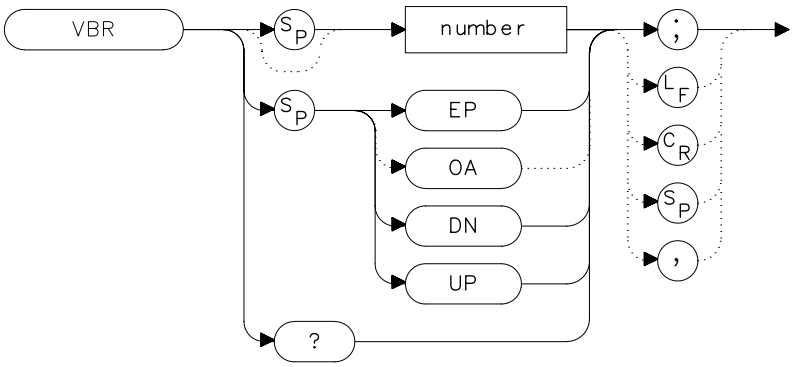
Example

```
10    OUTPUT 718;"IP;"
20    OUTPUT 718;"CF 1.2GHZ;SP 2GHZ;"
30    INPUT "SELECT THE VIDEO BANDWIDTH, IN KHZ",B_width
40    OUTPUT 718;"VB ";B_width;"KHZ;"
50    OUTPUT 718;"VB?;"
60    ENTER 718;B_width
70    PRINT "SELECTED BANDWIDTH IS ",B_width,"HZ"
80    END
```

VBR Video Bandwidth to Resolution Bandwidth Ratio

Syntax

Figure 7-291 VBR Syntax



Description

The VBR command specifies the coupling ratio between the video bandwidth and the resolution bandwidth. Thus, when the resolution bandwidth is changed, the video bandwidth changes to satisfy the ratio. When a new ratio is selected, the video bandwidth changes to satisfy the new ratio — the resolution bandwidth does not change value.

Parameters

number	real from 0.003 to 3.
UP or DN	increments in a 1, 3, 10 sequence.

Preset State

1

Query Response

Figure 7-292 VBR Query Response

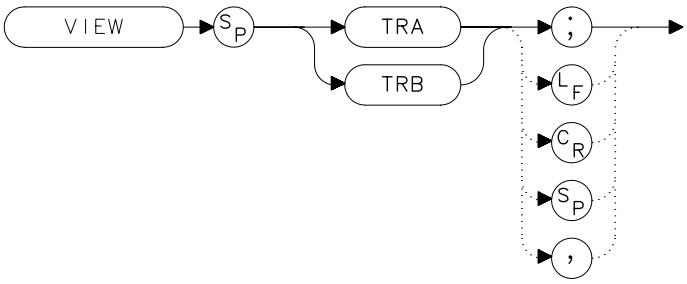
Example

```
10   OUTPUT 718;"IP;"
20   OUTPUT 718;"CF 1.2GHZ;SP 200MHZ;"
30   INPUT "SELECT THE VIDEO BANDWIDTH TO RESOLUTION BANDWID
TH
RATIO",B_ratio
40   OUTPUT 718;"VBR ";B_ratio;";"
50   INPUT "SELECT THE RESOLUTION BANDWIDTH, IN KHZ",B_width
60   OUTPUT 718;"RB ";B_width;"KHZ;"
70   OUTPUT 718;"VB?;"
80   ENTER 718;B_width
90   PRINT "THE VIDEO BANDWIDTH IS ",B_width,"HZ"
100  END
```

VIEW View Trace

Syntax

Figure 7-293 VIEW Syntax



Description

The VIEW command displays the current contents of the selected trace, but does not update the contents. View mode can be executed before a sweep is complete when SNGLS and TS are not used. For more information on using SNGLS and TS, refer to Chapter 5.

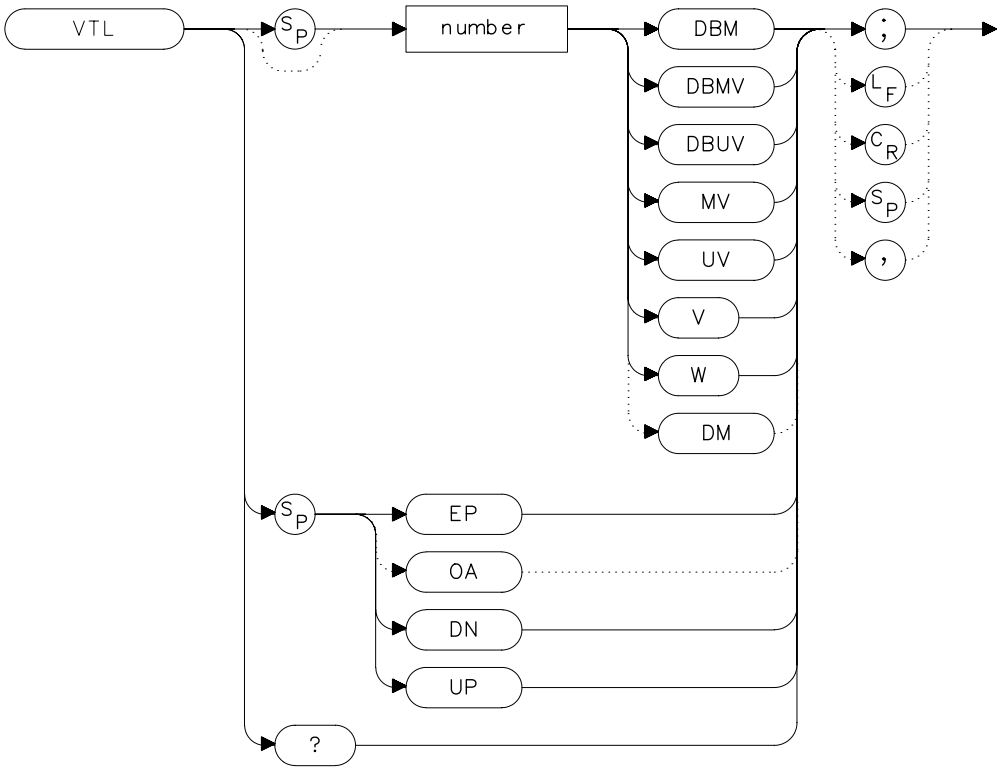
Example

```
10    OUTPUT 718;"CLRW TRA;TS;VIEW TRA;"
20    END
```

VTL Video Trigger Level

Syntax

Figure 7-294 VTL Syntax



Description

The VTL commands sets the video trigger level when the trigger mode is set to VIDEO (refer to the TM command). A dashed line appears on the display to indicate the approximate level. The default value is 0 dBm.

Parameters

number	real from –220 to 30.
UP or DN	increments by 1 vertical division.

Preset State

0 dBm

Query Response

Figure 7-295 VTL Query Response

Example

```
10    OUTPUT 718;"TM VID;"
20    OUTPUT 718;"VTL –20DBM;"
30    END
```

8 Options and Accessories

Options

Options tailor the spectrum analyzer to your needs. Order options by the option number when you order the analyzer. Some options are available as kits, which may be ordered and installed after you receive your instrument.

Second IF output (Option 001) provides an output for the second IF (310.7 MHz) at rear-panel connector J10. Not available with Option 327.

Tracking generator (Option 002) provides a built-in 300 kHz to 2.9 GHz source that tracks the spectrum analyzer sweep. Option 002 is only available on the Agilent 8560E and the 8560EC. It is not available with Option 005.

Alternate sweep output (Option 005) provides a 0 V to 10 V sweep ramp with 0 V corresponding to the left portion of the display and 10 V corresponding to the right portion of the display. Option 005 is not available with Option 002 or Option 327.

Frequency coverage down to 30 Hz (Option 006) extends the frequency range of the Agilent 8563E/EC, Agilent 8564E/EC, and Agilent 8565E/EC from the standard 9 kHz down to 30 Hz.

Fast time domain sweeps (Option 007) allows digitized sweep times as fast as 50 µs in spans of 0 Hz. Not available with Option 327.

Signal identification (Option 008) provides signal identification capability for use with unpreselected external mixers. Not available with Option 327.

APC 3.5 mm input connector (Option 026) provides an APC 3.5 mm input connector on the Agilent 8563E/EC.

Soft carrying case (Option 042) provides a soft carrying case with a strap and a pouch for accessories. It is used to provide additional protection during travel.

Delete precision frequency reference (Option 103) deletes the ovenized oscillator used for improved frequency accuracy and replaces it with a temperature compensated crystal oscillator (TCXO). The minimum resolution bandwidth is changed from 1 Hz to 10 Hz.

Delete mass memory module (Option 104) deletes the module used to expand user memory which allows storage and execution of downloadable programs (DLPs) and limit lines.

Delete IF input and video output (Option 327) deletes the front-panel IF input connector and the rear-panel video output connector.

Refurbished 8560 E-Series (Option 8ZE) provides refurbished spectrum analyzers at a reduced cost.

Rack-mount flange kit (Option 908) provides the parts necessary to mount the analyzer in an Agilent System II cabinet in a standard 19 inch (482.6 mm) equipment rack. Option 908 is also available as a kit (part number 5062-4841). The instrument dimensions, without handles or flanges, are 222 mm (h) × 422 mm (d) × 425 mm (w).

Rack-mount flange kit with handles (Option 909) is the same as Option 908 but includes front handles for added convenience. Option 909 is also available as a kit (part number 5062-4840). The instrument dimensions, without handles or flanges, are 222 mm (h) × 422 mm (d) × 425 mm (w).

Additional manual set (Option 910) provides an additional manual set shipped with the analyzer. This option includes a copy of the Installation and Verification Manual, the Operating and Programming Manual, the Mass Memory Module Manual, and the Quick Reference Guide. To order additional manuals after initial shipment, use manual part numbers that appear on the title page.

Service documentation (Option 915) provides service guide and component level information for troubleshooting and repair of the analyzer.

Additional quick reference guide (Option 916) provides an additional copy of the Quick Reference Guide. To obtain a copy of the Quick Reference Guide after initial shipment, order by the manual part number, which appears on the title page.

MIL 45662A calibration (Option 1BN) spectrum analyzer ships with a MIL STD 45662A calibration certificate.

MIL 45662A calibration with test data (Option 1BP) spectrum analyzer is shipped with a MIL STD 45662A calibration certificate that includes the calibration test data.

Commercial calibration with test data (Option UK6) spectrum analyzer is shipped with a commercial calibration certificate and the calibration test data.

Three years return-to-Agilent service (Option W30) extends the factory warranty for three years of customer return repair service.

Three years return-to-Agilent calibration (Option W32) provides three years of Agilent Technologies calibration service at Agilent Technologies Customer Service Centers.

Five years return-to-Agilent service (Option W50) extends the factory warranty for five years of customer return repair service.

Five years return-to-Agilent calibration (Option W52) provides five years of Agilent Technologies calibration service at Agilent Technologies Customer Service Centers.

Accessories Available

A number of accessories are available from Agilent Technologies to help you configure the spectrum analyzer for your specific needs.

Agilent 85629B test and adjustment module *Not available for the Agilent 8564E/EC or Agilent 8565E/EC.* The Agilent 85629B adds four test and repair procedures to the 8560E/EC, Agilent 8561E/EC, Agilent 8562E/EC, and Agilent 8563E/EC spectrum analyzers:

- Functional Tests.
- Adjustment Procedures.
- Diagnostic (troubleshooting) Procedures.
- Automatic Alignment Routines.

When connected to the rear panel of the spectrum analyzer, the module displays menus, procedures, and results on the display of the spectrum analyzer . While testing with the module, the spectrum analyzer controls other instruments over GPIB, reads data, and formats that data for the user. In addition to a large program stored in ROM, the module has the necessary hardware for troubleshooting, including dc signal injection and detection. The Agilent 8562E/TAM Interface Software is required when using the TAM with the Agilent 8562E or Agilent 8562EC spectrum analyzer.

Agilent 85640A portable tracking generator adds scalar analysis capability from 300 kHz to 2.9 GHz. Measure gain, frequency response, compression, flatness, and return loss on components and subsystems. A built-in attenuator provides an output power range of –80 to 0 dBm.

Agilent 8721A directional bridge has a frequency range of 100 kHz to 100 MHz. This bridge is used in return-loss measurements. It has 6 dB insertion loss and is 6 dB coupled to the auxiliary arm. Frequency response is +0.5 dB (0.1 to 110 MHz); directivity is greater than 40 dB (1 to 110 MHz); load-port return loss is less than 0.03; maximum input power is +20 dBm.

Agilent 86205A RF bridge has a frequency range of 300 kHz to 6 GHz. This general-purpose, 50Ω bridge is used for reflection measurements and signal leveling applications. It has 1.5 dB + 0.1 dB/GHz of insertion loss and approximately 3 dB coupling factor. The directivity varies from 40 dB to 16 dB over the specified operating range. The maximum input power is +25 dBm.

Agilent 11852B Option C04 50 to 75 ohm minimum-loss pad is a low-VSWR device required for measurements on 75-ohm devices.

Agilent 11974A preselected millimeter mixer is a preselected mixer from 26.5 GHz to 40 GHz. Preselection reduces mixer overload from broadband signals and reduces radiation of local oscillator harmonics back to the device under test.

Agilent 11974Q preselected millimeter mixer is a preselected mixer from 33 GHz to 50 GHz. Preselection reduces mixer overload from broadband signals and reduces radiation of local oscillator harmonics back to the device under test.

Agilent 11974U preselected millimeter mixer is a preselected mixer from 40 GHz to 60 GHz. Preselection reduces mixer overload from broadband signals and reduces radiation of local oscillator harmonics back to the device under test.

Agilent 11974V preselected millimeter mixer is a preselected mixer from 50 GHz to 75 GHz. Preselection reduces mixer overload from broadband signals and reduces radiation of local oscillator harmonics back to the device under test.

Agilent 11970K millimeter harmonic mixer is a broadband harmonic mixer used to extend the frequency range from 18 GHz to 26.5 GHz.

Agilent 11970A millimeter harmonic mixer is a broadband harmonic mixer used to extend the frequency range from 26.5 GHz to 40 GHz.

Agilent 11970Q millimeter harmonic mixer is a broadband harmonic mixer used to extend the frequency range from 33 GHz to 50 GHz.

Agilent 11970U millimeter harmonic mixer is a broadband harmonic mixer used to extend the frequency range from 40 GHz to 60 GHz.

Agilent 11970V millimeter harmonic mixer is a broadband harmonic mixer used to extend the frequency range from 50 GHz to 77 GHz.

Agilent 11970W millimeter harmonic mixer is a broadband harmonic mixer used to extend the frequency range from 75 GHz to 110 GHz.

Agilent 83006A Amplifier provides 20 dB gain from 10 MHz to 26.5 GHz in a small package which fits easily into existing systems.

Agilent 83017A Amplifier provides 25 dB gain from 500 MHz to 26.5 GHz in a small package which fits easily into existing systems. It includes internal directional detectors for external leveling applications.

Agilent 83018A Amplifier provides 27 dB gain from 2 GHz to 26.5 GHz in a small package which fits easily into existing systems. It includes internal directional detectors for external leveling applications.

Agilent 83020A Amplifier provides 30 dB gain from 2 GHz to 26.5 GHz in a small package which fits easily into existing systems. It includes internal directional detectors for external leveling applications.

Agilent 83050A Amplifier provides 23 dB gain from 2 GHz to 50 GHz in a small package which fits easily into existing systems.

Agilent 83051A Preamplifier provides 23 dB gain from 45 MHz to 50 GHz in a small package which fits easily into existing systems.

Agilent 8447A preamplifier provides 20 dB gain from 100 kHz to 400 MHz to enhance measurements of very low-level signals.

Agilent 8447D preamplifier provides a minimum of 26 dB gain from 100 kHz to 1.3 GHz to enhance measurements of very low-level signals.

Agilent 8449B preamplifier provides a minimum of 28 dB gain from 1 to 26.5 GHz to enhance measurements of very low-level signals.

Agilent 10855A preamplifier provides a minimum of 22 dB gain from 2 MHz to 1.3 GHz to enhance measurements of very low-level signals. It operates conveniently from the PROBE POWER output of the spectrum analyzer.

Agilent 85671A Phase Noise Measurement Utility is a software measurement utility that makes it easy to use the spectrum analyzer to make phase noise measurements.

Agilent 85672A Spurious Response Measurements Utility is a software measurement utility that makes it easy to use the spectrum analyzer to make TOI/IMD, harmonics, general spurious, sidebands, and mixer measurements.

Agilent 85700A RAM memory card provides 32 Kbytes of RAM memory; the Agilent 85702A provides 128 Kbytes of RAM memory.

Agilent 85710A Digital Radio Personality is a software measurement personality that makes it easy to use the spectrum analyzer to make measurements on digital radio systems. It is simple to characterize spectral occupancy on microwave terrestrial links, to do mask comparisons, to measure frequency response, and to do transient analysis.

Agilent 11940A and Agilent 11941A close field probes are small, hand-held, electromagnetic-field sensors. The Agilent 11940A close-field probe provides repeatable, absolute, magnetic-field measurements from 30 MHz to 1 GHz (9 kHz to 30 MHz with the Agilent 11941A). When attached to a source, the probe generates a localized magnetic field for electromagnetic interference (EMI) susceptibility testing.

Agilent 11945A close field probe set includes both the Agilent 11940A and Agilent 11941A probes for full coverage from 9 kHz to 1 GHz. Option E51 adds the Agilent 8447F Option H64 dual preamplifier, a 36 inch (914 mm) Type-N cable, and a carrying bag for storage and protection of the entire set.

Agilent 11687A 75 to 50 ohm adapter allows you to make measurements in 75-ohm systems. Amplitude calibration is retained by using the reference level offset to compensate for the loss through the pad. It is effective over a frequency range of dc to 1.3 GHz.

Agilent 11693A microwave limiter protects the spectrum analyzer input circuits from damage due to high power levels and operates over a frequency range of 0.4 to 12.4 GHz.

Agilent 11742A dc blocking capacitor protects the spectrum analyzer input circuits from damage due to the presence of dc voltages on the input signal. It blocks up to 50 Vdc at frequencies from 10 MHz to 26.5 GHz.

part number 8120-6164 50 GHz RF cable is used for connecting the device under test to the RF input of the spectrum analyzer. This 50 Ω cable has less than 5.7 dB of loss at 50 GHz. It is 1 meter long with 2.4 mm (male) and 2.4 mm (female) connectors.

Agilent 10833A/B/C/D GPIB cable is used for connecting GPIB devices.

ITEL-45CHVUB (U.S. and CAN) and ITEL-45CHVEB (International) GPIB to Centronics converters convert GPIB to Centronics interface allowing a GPIB instrument or computer to print data, text, and graphics to HP Centronics parallel printers.

Controllers The spectrum analyzer is fully GPIB programmable. The preferred controllers are HP 9000 Series 300 computers. Consult your local Agilent Technologies service representative for other recommended controllers and available software.

HP ColorPro 7440A graphics plotter adds color printout capability to the analyzer for permanent records of important measurements. The eight-pen HP ColorPro produces color plots with 0.025 mm (0.001 in) resolution on either 8.5- by 11-inch paper or transparency film. Other GPIB plotters are available from Agilent Technologies.

Printers The HP 2225A ThinkJet or the HP 3630A PaintJet printers may be used with the spectrum analyzer.

Agilent 85901A portable AC power source can be used as a standalone battery for over one hour of operation at 100 W continuous load, or can be connected to an external 12 Vdc source for longer use. It can be recharged in six hours or less.

Agilent 41800A active probe is a high-input impedance probe that covers the frequency from 5 Hz to 500 MHz. It can be used to perform signal analysis of circuits in audio, video, HF, and VHF band.

Agilent 85024A high frequency probe permits high-frequency probing from 300 kHz to 3 GHz without adverse loading of the circuit under test.

Rack slide kit (p/n 1494-0060) provides the hardware to adapt rack mount kits (Options 908 and 909) for mounting the analyzer in an Agilent system II cabinet.

Agilent 1182A testmobile provides a sturdy, mobile platform for your analyzer.

Transit case (p/n 9211-5604) provides extra protection for frequent travel situations. The transit case protects your instrument from hostile environments, shock, vibration, moisture, and impact while providing a secure enclosure for shipping.

Soft Carrying Bag (p/n 1540-1130) provides a soft carrying bag that is used to provide additional protection when transporting your instrument.

9 If You Have a Problem

What You'll Find in This Chapter

This chapter provides information for troubleshooting and adjusting the spectrum analyzer, and returning it to Agilent Technologies for service.

- Spectrum Analyzer Problems
- Replacing the Battery
- Power Requirements
- Adjustment and Troubleshooting Procedures
- Servicing the Spectrum Analyzer Yourself
- Calling Agilent Technologies Sales and Service Offices
- Returning Your Spectrum Analyzer for Service
- Serial Numbers
- Electrostatic Discharge
- Error Messages

Read the Warranty

The warranty for your spectrum analyzer is printed 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.

Spectrum Analyzer Problems

If you need additional information, or want to order parts, options, accessories, or service documentation, contact your Agilent Technologies sales and service office. See Table 9-3 on page 683.

There are different types of problems:

- **Blank screen** Refer to "Blank Display" following this section.
- **Error message** Refer to "Error Messages" at the end of this chapter. You may also refer to "Check the Basics" to help eliminate an error message.
- **Unexpected behavior** Continue with "Check the Basics".
- **Memory loss** Refer to "Replacing the Battery".

Blank Display

If your display is blank, before calling Agilent Technologies or returning the analyzer for service, please make the checks listed below. The "Power Requirements" section includes more detailed information about making these checks.

- Is the analyzer plugged into the proper ac power source? Does the line socket have power?
- Is the rear-panel voltage selector switch set correctly?
- Is the line fuse good?
- Is the analyzer turned on?
- Check that the LED over the power switch is lit and the fan is on. If the spectrum analyzer has power applied but the display is still blank, you may have a hardware failure. See "Servicing the Spectrum Analyzer Yourself" in this chapter.

Check the Basics

Unexpected behavior can have many different causes. Perform the checks below and then refer to the list of symptoms and suggestions. These checks may eliminate the problem altogether, or may give a clearer idea of its cause. If you determine that there is a hardware problem refer to the "Hardware Problems" section.

- If other equipment, cables, and connectors are being used with the spectrum analyzer, are they connected properly and operating correctly?
- Often problems may be solved by repeating what was being done when the problem occurred.

- Review the test procedure that was being used when the problem occurred. Are all the settings correct?
- Are the measurements that are being performed and the expected results within the specifications and capabilities of the spectrum analyzer? Refer to the calibration guide for specifications.

Table 9-1 Problems and Possible Causes

Symptoms	Things to Check
GPIB doesn't work	• Check that GPIB cable is connected and cable is good. • Check that GPIB address is set correctly. (See "GPIB Address Selection") • Disconnect equipment from GPIB one instrument at a time and retry.
Doesn't plot/print	Refer to "Plotting and Printing Directly".
Can't find signal	• Check for the local oscillator signal at 0 Hz which indicates that the hardware is probably good. • Narrow the resolution bandwidth in case the signal is being obscured.
Signal amplitude is wrong	• Refer to "Reference Level Calibration". • Increase input attenuation, since the signal may be in compression.
Amplitude dropouts	Mating a K connector with APC 3.5 results in moding near 32 GHz. Power holes exist at other frequencies when using adapters and cables beyond their specified range.

Hardware Problems

Some of the procedures in this chapter may clear hardware problems.

- Trace Alignment
- Reference Level Calibration
- Realigning the LO and IF

If the necessary test equipment is available, perform the verification tests in the calibration guide. Record all results in the performance test record.

If you have an Agilent 85629B Test and Adjustment Module, you can use its automatic fault isolation routine to troubleshoot your Agilent 8560E/EC, Agilent 8561E/EC, or Agilent 8563E/EC. Refer to "Running the Automatic Fault Isolation Routine" in this chapter.

If there is a hardware problem, you can repair it yourself or return the analyzer to Agilent Technologies for repair. See "Returning Your Spectrum Analyzer For Service" for more information.

Agilent 85629B Test and Adjustment Module

The test and adjustment module (TAM) can be used with the 8560E/EC, Agilent 8561E/EC and Agilent 8563E/EC. A powerful feature of the TAM is the automatic fault isolation routine. If a problem with the spectrum analyzer is suspected, in most cases automatic fault isolation can determine whether or not a fault exists in the analyzer. There are some problems, such as excessive residual FM, that automatic fault isolation cannot detect. As a minimum, the display and keyboard must be operational to execute automatic fault isolation.

Running the Automatic Fault Isolation Routine

To start the automatic fault isolation routine, press **MODULE** and DIAGNOSE. Rotate the front-panel knob until the arrow points to Automatic Fault Isolation. Press **EXECUTE**. The CAL OUTPUT must be connected to the INPUT 50Ω. A BNC cable and Type N-to-BNC adapter is shipped with each analyzer in the front cover. Press CONTINUE, and the automatic fault isolation routine begins.

The automatic fault isolation routine performs checks of five sections of the analyzer. Progress of the routine is displayed on the screen. The routine stops as soon as it detects a failure. If no failures are detected, the automatic fault isolation routine takes about 90 seconds to complete.

If a failure is detected, either continue troubleshooting using the service guide or return the analyzer to the nearest Agilent Technologies service center as described in "Returning Your Analyzer for Service" in this chapter. If a GPIB printer is properly connected and configured, a hard-copy printout of the automatic fault isolation results can be obtained by pressing **PRINT PAGE**. Include a copy of this printout with the analyzer if it is being returned to an Agilent Technologies service center for repair.

Agilent 85620A Mass Memory Module

If the mass memory module functions are missing when you press the **MODULE** key, check the rear panel of the spectrum analyzer. In this case, the message `MODULE NOT FOUND` will appear on the display. The mass memory module should be attached to the rear panel. When it is attached, the spectrum analyzer has internal memory and a broader range of commands available. The additional commands are documented in the Agilent 85620A manual.

It is possible to get a different set of functions from a given mass memory module, depending on the firmware revision of the host spectrum analyzer. In spectrum analyzers with firmware revision >941028, the firmware that controls the mass memory module actually resides in the host spectrum analyzer and contains a more recent set of features and functionality. If that same mass memory module is installed on a host spectrum analyzer with firmware revision 941028 or earlier, the firmware that resides in the mass memory module (revision A, B, or C) will control the features and functionality of the module.

To check the mass memory module firmware version, press the **MODULE** key. An earlier spectrum analyzer displays firmware revision 910116 or earlier. A later spectrum analyzer displays firmware revision 950829 or later.

Replacing the Battery

If the battery that maintains the spectrum analyzer random access memory is deteriorating, stored states and traces will only be retained for a short time after the instrument is powered off. When the voltage across the battery drops to +2.6 V, its life and use are limited and the output voltage will deteriorate quickly. The battery for maintaining the memory can be accessed through the rear panel.

There are two ways to avoid loss of the calibration constants.

- Remove and replace the battery in less than 10 minutes.
- Power on the spectrum analyzer before removing the battery.

Replace the battery using the following steps:

1. If an option module is attached to the rear panel, turn the spectrum analyzer off and remove the module. Then, if necessary, turn the spectrum analyzer on.
2. Remove the two screws securing the small panel labeled with a battery. Do not remove the bottom screw.
3. Remove the battery and replace it, observing proper polarity. Use the following Agilent Technologies battery, part number:

Battery Information	
Battery part number	1420-0341
Voltage	3 V
Amps	1.2 A
Typical life	3 to 5 years
Type	non-rechargeable

WARNING **The battery contains lithium polycarbon monofluoride. Do not incinerate or puncture this battery. Dispose of discharged battery in a safe manner.**

Power Requirements

The power requirements for the spectrum analyzer are listed in Table 9-2.

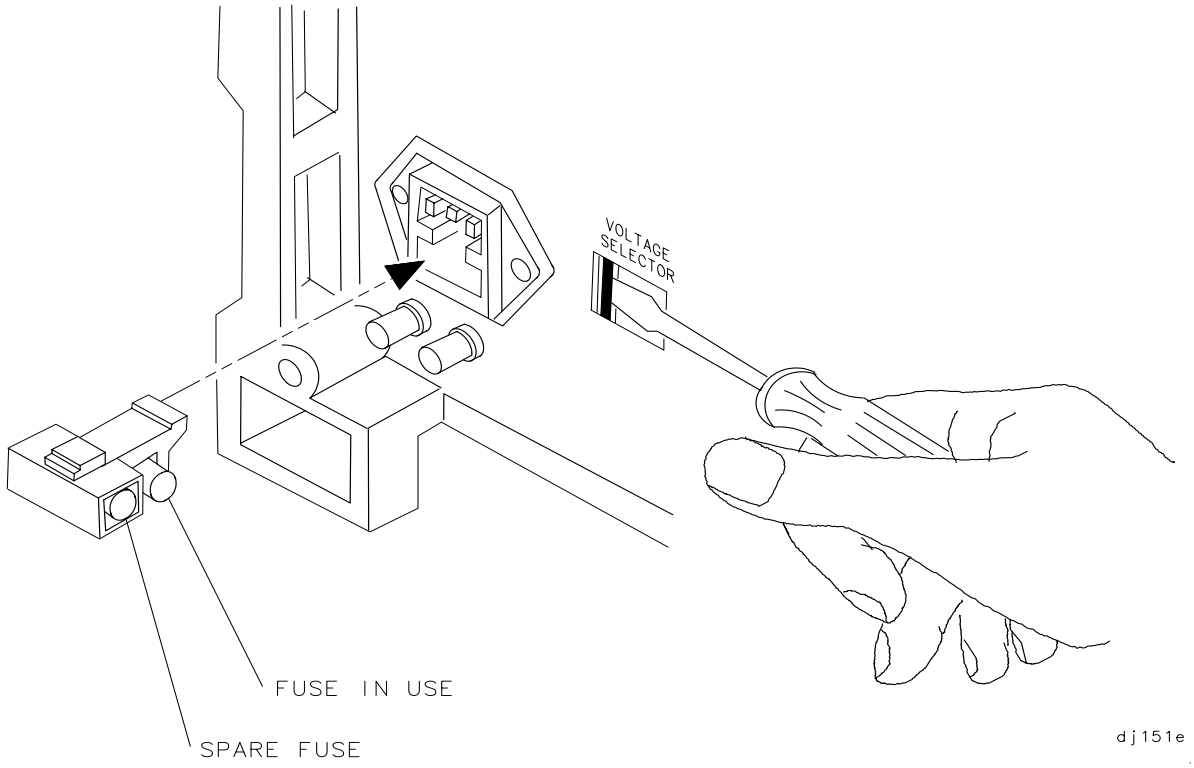
Table 9-2 Operating Power Requirements

Line Input	Power Requirements	
	115 V ac Operation	**230 V ac Operation**
Line Voltage	90 V to 140 V rms	180 V to 250 V rms
Current	3.2 A rms max	1.8 A rms max
Frequency	47 Hz to 440 Hz	47 Hz to 66 Hz

Setting the Line-Voltage Selector Switch

Set the instrument rear-panel voltage selector switch to the line voltage range (115 V or 230 V) corresponding to the available ac voltage. See Figure 9-1 on page 672. Insert a small screwdriver or similar tool in the slot and slide the switch until the proper voltage label is visible.

Figure 9-1 Voltage Selection Switch and Line Fuse Locations



Checking the Fuse

The type of ac line input fuse depends on the input line voltage. Use the following fuses:

115 V operation:	5 A 125 V UL/CSA (part number 2110-0756)
230 V operation:	5 A 250 V IEC (part number 2110-0709)

The line fuse is housed in a small container located on the rear-panel power connector. The container provides space for storing a spare fuse, as shown in the Figure 9-1 on page 672.

To check the fuse, use the tip of a screwdriver inserted into the container slot to gently pry the cover off. Verify that replacement fuses are installed in the correct position as illustrated in the Figure 9-1 on page 672.

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

Power Cable

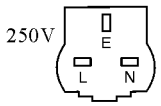
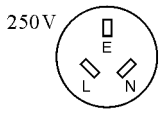
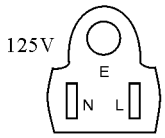
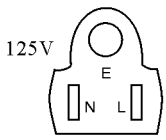
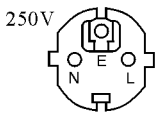
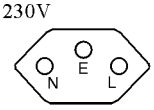
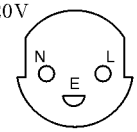
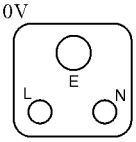
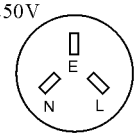
The spectrum analyzer is equipped with a three-wire power cable, in accordance with international safety standards. When connected to an appropriate power source outlet, this cable grounds the instrument cabinet.

WARNING **The spectrum analyzer is a safety Class 1 product. Failure to ground the instrument properly can result in personal injury. Before turning on the spectrum 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 socket.

Various power cables are available for the power outlets unique to specific geographic areas. The appropriate cable is included with the instrument when it is shipped to an area requiring one of these cables. You can order additional ac power cables listed in Figure 9-2 on page 674 for use in different areas. Figure 9-2 also illustrates the plug configurations and identifies the geographic area in which each cable is appropriate.

Figure 9-2 AC Power Cables Available

Plug Type [a]	HP Cable Part Number	Plug [b] Description	Length cm (in.)	Cable Color	For Use in Country
	8120-8705 8120-8709	Straight BS 1363A 90°	229 (90) 229 (90)	Mint Gray Mint Gray	Option 900 United Kingdom, Hong Kong, Cyprus, Nigeria, Singapore, Zimbabwe
	8120-1369 8120-0696	Straight AS 3112 90°	210 (79) 200 (78)	Gray Gray	Option 901 Argentina, Australia, New Zealand, Mainland China
	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
	8120-4753 8120-4754	Straight NEMA 5-15P 90°	229 (90) 229 (90)	Gray Gray	Option 918 Japan
	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
	8120-2104 8120-2296	Straight SEV Type 12 90°	200 (78) 200 (78)	Gray Gray	Option 906 Switzerland
	8120-2956 8120-2957	Straight SR 107-2-D 90°	200 (78) 200 (78)	Gray Gray	Option 912 Denmark
	8120-4211 8120-4600	Straight IEC 83-B1 90°	200 (78) 200 (78)	Mint Gray Mint Gray	Option 917 South Africa, India
	8120-5182 8120-5181	Straight SI 32 90°	200 (78) 200 (78)	Jade Gray Jade Gray	Option 919 Israel

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.

formt118

Procedures

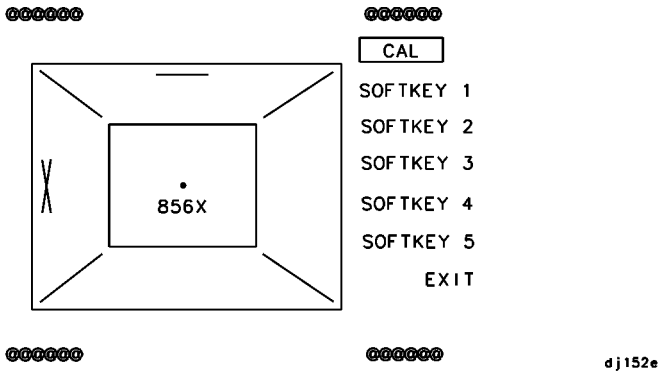
The following adjustment and troubleshooting procedures are included here.:

- Trace Alignment - used for 8560 E-Series instruments only
- Reference Level Calibration
- GPIB Address Selection
- Plotting And Printing Directly

Trace Alignment (8560 E-series)

1. Press **PRESET CAL, MORE 1 OF 2, CRT ADJ PATTERN**.
2. Adjust the rear-panel TRACE ALIGN until the leftmost line of the test pattern is parallel with the CRT bezel. See Figure 9-3 on page 675.
3. Adjust the rear-panel X POSN until the leftmost @ characters and the softkey labels appear just inside the left and right edges of the CRT bezel.
4. Adjust the rear-panel Y POSN until the softkey labels align with the appropriate softkeys.
5. Press **PRESET** to return the analyzer to normal operation.

Figure 9-3 CRT Adjustment Pattern



Reference Level Calibration

1. Press **PRESET**.
2. Connect a 50Ω coaxial cable (such as Agilent 10503A) between the front-panel CAL OUTPUT and INPUT 50Ω connectors.
3. Set the analyzer center frequency to 300 MHz by pressing **FREQUENCY** 300 **MHz**.
4. Set the analyzer span to 20 MHz by pressing **SPAN** 20 **MHz**.
5. Press **PEAK SEARCH**.
6. Set the analyzer reference level to –10 dBm by pressing **AMPLITUDE** 10 –**dBm**.
7. Press **CAL**, **REF LVL ADJ**.
8. Rotate the analyzer front-panel knob until the MKR reading is –10.00 dBm ±0.17 dB. There is a slight delay in time between adjusting the knob and the change in marker value. Notice that the displayed REF LEVEL CAL value changes. The REF LVL CAL value should range between –528 and +528 (–33 to +33 with firmware revisions ≤920528).
9. Press **STORE REF LVL**.
10. Press **PRESET**.

GPIB Address Selection

1. The GPIB address for the analyzer is preset at the factory to a decimal value of 18. Valid addresses range from 0 to 30. To view the GPIB address, press **PRESET CONFIG**, **ANALYZER ADDRESS**.
2. To change the address value, enter the new address number using the front-panel data keys. Terminate the entry by pressing a units key. For example, enter an address of 18 by pressing the **PRESET CONFIG**, **ANALYZER ADDRESS**, 18 **Hz**.
3. Press **STORE HPIB ADR**.
4. Press **PRESET**.

With the GPIB address set and trace alignment and reference level calibration procedures successfully completed, the analyzer is ready for normal operation.

Plotting and Printing Directly

1. The printer or plotter must be connected to the spectrum analyzer GPIB bus.
2. No other controller can be on the bus when doing direct plotter or printer dumps.
3. The printer or plotter cannot be set to a listen only mode, it must be addressable.
4. Printing is selected by pressing **CONFIG** and **COPY DEV PRNT PL**T so that PRNT is underlined. Plotting is selected by pressing the key so that PLT is underlined.
5. The factory default GPIB address for a printer is 01. For a plotter, it is 05. This address can be changed by pressing **CONFIG** and either **PRINTER CONFIG** or **PLOTTER CONFIG** to access the address functions.

Servicing the Spectrum Analyzer Yourself

If you want to service the spectrum analyzer yourself after warranty expiration, a service guide and component-level information is available. Full performance tests are included in the calibration guide to identify problems and verify the repair. Contact your Agilent Technologies Sales and Service Office to obtain the most current test and maintenance information.

A Product Support Kit, part number 08562-60021, is available through the sales and service office. The kit contains the following accessories:

- PC board prop
- power line switch assembly
- power line assembly
- SMB cable puller
- option module extender cable
- two test cables, BNC to SMB
- contact extractor tool

Calling Agilent Technologies Sales and Service Offices

Agilent Technologies has sales and service offices around the world to provide complete support for your spectrum analyzer. To obtain servicing information or to order replacement parts, contact the nearest Agilent Technologies Sales and Service Office listed in Table 9-3 on page 683.

In any correspondence or telephone conversations, refer to the spectrum analyzer by its model number, full serial number, and firmware date. With this information, the Agilent Technologies representative can quickly determine whether your unit is still within its warranty period and can provide accurate service information.

- If the spectrum analyzer is still under warranty or covered by a Agilent Technologies maintenance contract, it is repaired based on the terms of the warranty or maintenance contract (the warranty is printed in the front of this manual).
- If the spectrum analyzer is no longer under warranty, Agilent Technologies offers several maintenance plans to service your spectrum analyzer. Call your Agilent Technologies sales and service office for full details.
- If the spectrum analyzer is no longer under warranty or covered by a Agilent Technologies maintenance contract, Agilent Technologies will notify you of the cost of the repair after examining the unit.

Returning Your Spectrum Analyzer for Service

If you are returning the 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.

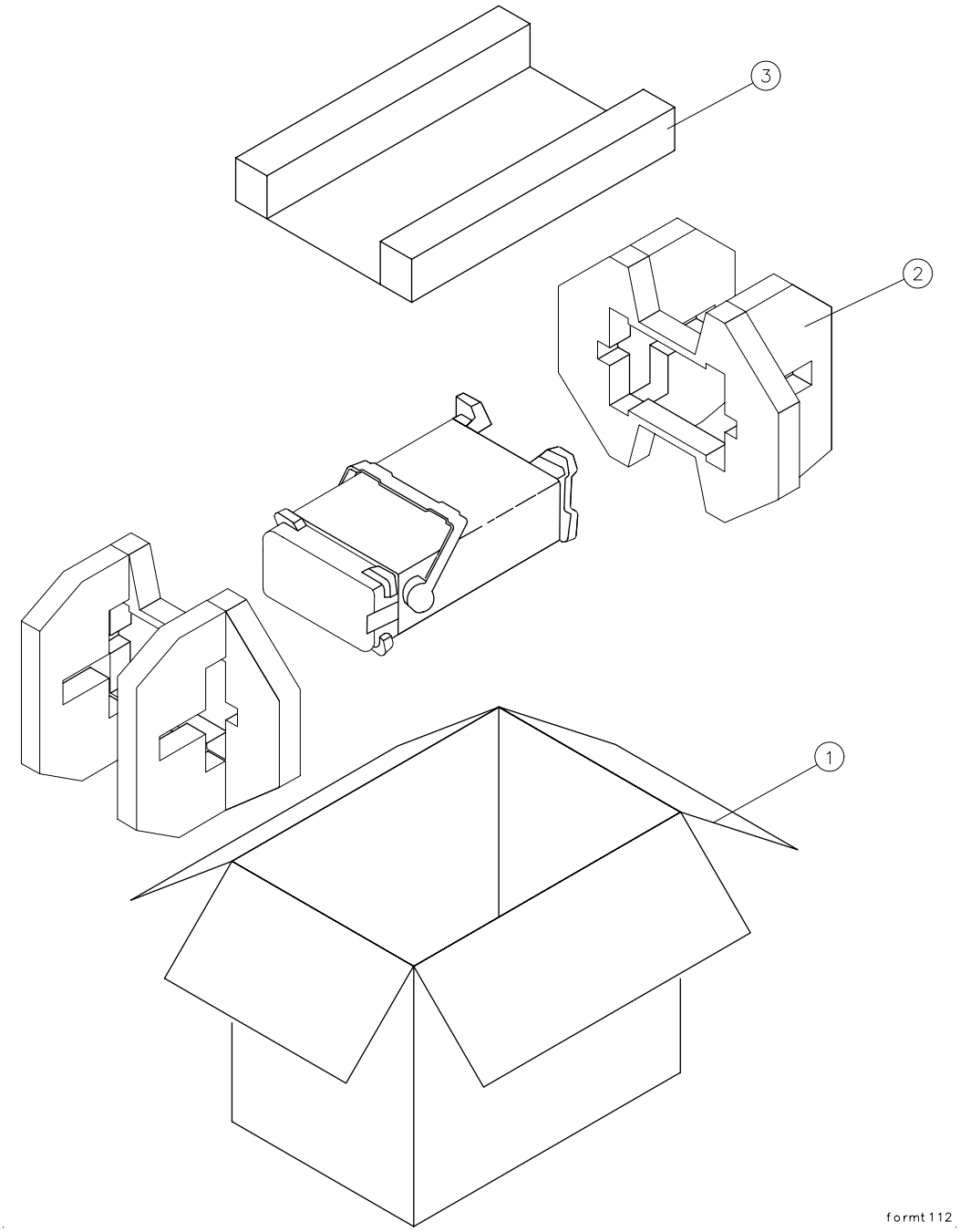
Please be as specific as possible about the nature of the problem. Please send a copy of any or all of the following information:

- any recorded error messages that appeared on the screen
- completed performance test record
- other specific data on the performance of the analyzer

Original Packaging

Before shipping, pack the unit in the original factory packaging materials if they are available. If the original materials are unavailable, identical packaging materials may be acquired through any Agilent Technologies sales and service office. Descriptions of the packaging materials are listed in Figure 9-4 on page 681.

Figure 9-4 Shipping Container and Cushioning Materials



Item	Description	Part Number
1	9211-6969	Outer Carton
2	9220-5073	Pads (2)
3	9220-5072	Top Tray

Other Packaging

CAUTION Spectrum 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 fan.

Repackage the analyzer in the original packaging materials or with commercially available materials described in steps 4 and 5, below.

1. Attach a completed service tag to the instrument.
2. Install the front-panel cover on the instrument.
3. Wrap the instrument in antistatic plastic to reduce the possibility of damage caused by electrostatic discharge.
4. Use the original materials or a strong shipping container that is double-walled, corrugated cardboard carton with 159 kg (350 lb) bursting strength. The carton must be both large enough and strong enough to accommodate the analyzer and allows at least 3 to 4 inches on all sides of the analyzer for packing material.
5. Surround the equipment with at least 3 to 4 inches of packing material, or enough to prevent the equipment from moving in the carton. If packing foam is unavailable, the best alternative is SD-240 Air Cap™ from Sealed Air Corporation (Commerce, CA 90001). Air Cap looks like a plastic sheet covered with 1-1/4 inch air-filled bubbles. Use the pink-colored Air Cap to reduce static electricity. Wrap the equipment several times in this material to both protect the equipment and prevent it from moving in the carton.
6. Seal the shipping container securely with strong nylon adhesive tape.
7. Mark the shipping container "FRAGILE, HANDLE WITH CARE" to assure careful handling.
8. Retain copies of all shipping papers.

Table 9-3 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		
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Serial Numbers

Agilent Technologies makes frequent improvements to its products to enhance their performance, usability, or reliability. Agilent Technologies service personnel have access to complete records of design changes to each type of equipment, based on the equipment serial number. Whenever you contact Agilent Technologies about your spectrum analyzer, have the complete serial number available to ensure obtaining the most complete and accurate information possible.

The serial number label is attached to the rear of the spectrum analyzer. The serial number has two parts: the prefix (the first four numbers and a letter), and the suffix (the last five numbers). See Figure 9-5.

The first four numbers of the prefix are a code identifying the date of the last major design change incorporated in your spectrum analyzer. The letter identifies the country in which the unit was manufactured. The five-digit suffix is a sequential number and is different for each unit. Whenever you list the serial number or refer to it in obtaining information about your spectrum analyzer, be sure to use the complete number, including the full prefix and the suffix.

Figure 9-5 Serial Number Label Example

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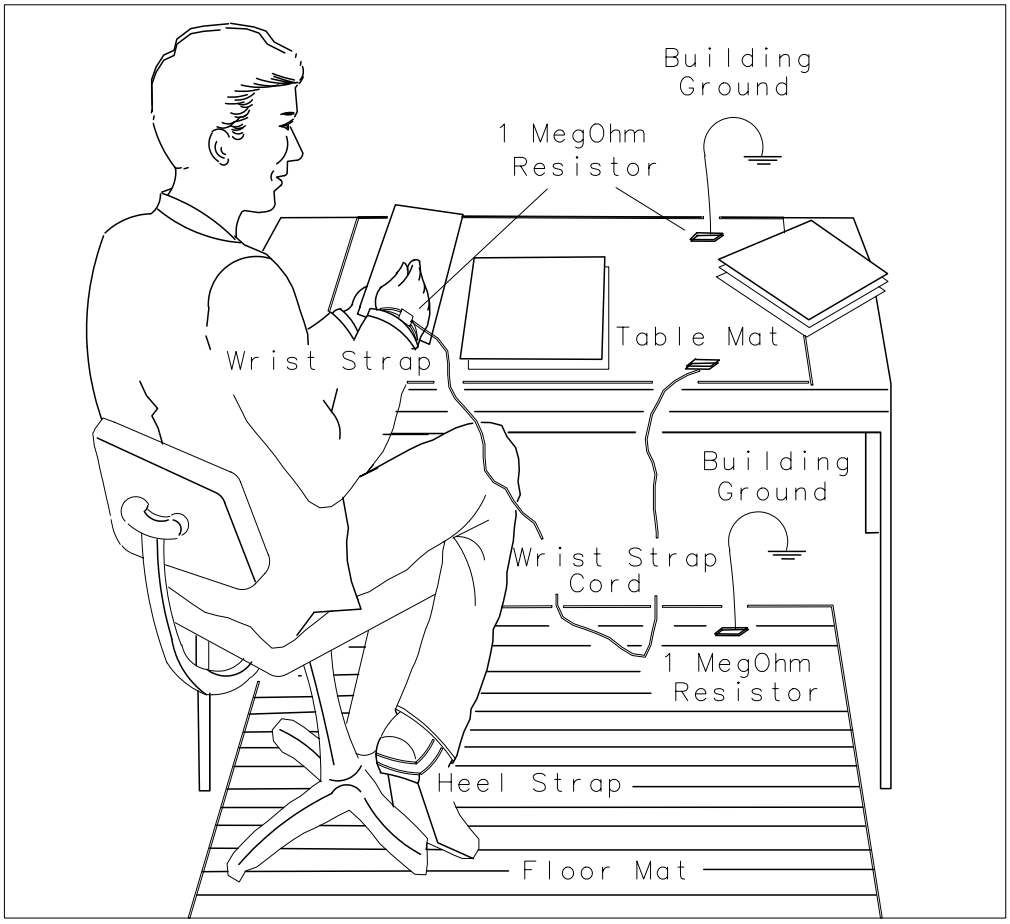
Electrostatic Discharge

Electrostatic discharge (ESD) can damage or destroy electronic components. Therefore, all work performed on assemblies consisting of electronic components should be done at a static-free work station. Figure 9-6 is an example of a static-safe work station using two kinds of ESD protection:

- conductive table mat and wrist-strap combination
- conductive floor mat and heel-strap combination

These methods may be used together or separately.

Figure 9-6 Example of a Static-Safe Workstation



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Reducing Potential for ESD Damage

The suggestions that follow may help reduce ESD damage that occurs during instrument testing and servicing.

- Before connecting any coaxial cable to an analyzer connector for the first time each day, momentarily ground the center and outer connectors of the cable.
- Personnel should be grounded with a resistor-isolated wrist strap before touching the center in of any connector and before removing any assembly from the unit.
- Be sure all instruments are properly earth-grounded to prevent buildup of static discharge.

Static-Safe Accessories

Table 9-1 lists static-safe accessories that can be obtained from Agilent Technologies by ordering the part numbers shown. Contact your nearest Agilent Technologies Sales Office for more information on ordering these accessories.

Table 9-4 Static-Safe Accessories

Accessory	Description	Part Number
Static-control mat and ground wire	Set includes: 3M static-control mat, 0.6 m × 1.2 m (2 ft × 4 ft) ground wire, 4.6 m (15 ft) (The wrist strap and wrist-strap cord are *not* included. They must be ordered separately.)	9300-0797
Wrist-strap cord	1.5 m (5 ft)	9300-0980
Wrist strap	Black, stainless steel with four adjustable links and 7-mm post-type connector (The wrist-strap cord is *not* included.)	9300-1367
ESD heel strap	Reusable 6 to 12 months	9300-1308

Error Messages

Error messages are displayed in the lower right-hand corner of the analyzer display. These error codes are provided for service personnel who troubleshoot the spectrum analyzer. However, they also alert the user to errors in spectrum analyzer function or use. Error codes are set up in these categories:

100 to 199	Programming errors
200 to 299	ADC failures
300 to 399	LO or RF failures
400 to 599	IF failures
600 to 699	Display failures
700 to 799	Digital failures
800 to 899	Option module failures
900 to 999	User generated errors

If returning the analyzer for repair is necessary, include a list of any error codes and messages that appeared when the trouble began. These codes and messages provide troubleshooting information for the service person working on the spectrum analyzer.

Viewing Multiple Messages

The spectrum analyzer displays only one error message at a time. More error messages may exist, since one problem can cause several errors. Check for more error messages and find the one that is the most likely cause.

1. Press **RECALL**, then **MORE 1 OF 2**.
2. Press **RECALL ERRORS**. An error message is displayed in the active function block on the analyzer display.
3. Use the ⇓ and ⇓ keys to scroll through any other error messages which might exist, making note of each error code.

Eliminating Error Messages

It might be possible to eliminate some error messages by running the LO and IF realignment procedure below, or by running the procedures described in "Hardware Problems". If an error message remains displayed, the following actions are suggested:

Error	Action
100 to 199	Programming error detected. Refer to chapters 3 and 7 in the user's guide for information on programming the spectrum analyzer.
200 to 799	The instrument is in need of service. Refer to this chapter for information about calling Agilent Technologies.
800 to 899	Option module failures detected. Refer to the appropriate option-module for an explanation of these errors.
900 to 999	User generated errors. Information entered incorrectly or an attempt to use the spectrum analyzer inappropriately.

Realigning the LO and IF

The LO and IF realignment procedure may eliminate error conditions.

1. Press **SAVE**, then **SAVE STATE**.
2. Store the current state in a convenient STATE register.
3. Press **PRESET**, **CAL**, then **REALIGN LO &IF**. Wait for the sequence to finish.
4. Press **RECALL**, then **RECALL STATE**.
5. Recall the previously stored STATE.

Error Code Listing

Error codes and their associated messages are listed in numeric order below. **Error codes 100 to 199 relate to incorrect spectrum analyzer programming**

ERR 100	NO PWRON	Power-on state is invalid; default state is loaded.
ERR 101	NO STATE	State to be RECALLed not valid or not SAVEd.
ERR 102	# ARGMTS	Command does not have enough arguments.
ERR 103	# ARGMTS	Command does not have enough arguments.
ERR 104	# ARGMTS	Command does not have enough arguments.
ERR 105	# ARGMTS	Command does not have enough arguments.
ERR 106	ABORTED!	Current operation is aborted; GPIB parser reset.
ERR 107	HELLO ??	No GPIB listener is present.
ERR 108	TIME OUT	Analyzer timed out when acting as controller.
ERR 109	CtrlFail	Analyzer unable to take control of the bus.
ERR 110	NOT CTRL	Analyzer is not system controller.
ERR 111	# ARGMTS	Command does not have enough arguments.
ERR 112	??CMD??	Unrecognized command.
ERR 113	FREQ NO!	Command cannot have frequency units.
ERR 114	TIME NO!	Command cannot have time units.
ERR 115	AMPL NO!	Command cannot have amplitude units.
ERR 116	?UNITS??	Unrecognizable units.
ERR 117	NOP NUM	Command cannot have numeric units.
ERR 118	NOP EP	Enable parameter cannot be used.
ERR 119	NOP UPDN	UP/DN are not valid arguments for this command.
ERR 120	NOP ONOF	ON/OFF are not valid arguments for this command.
ERR 121	NOP ARG	AUTO/MAN are not valid arguments for this command.
ERR 122	NOP TRC	Trace registers are not valid for this command.
ERR 123	NOP ABLK	A-block format not valid here.

ERR 124 NOP IBLK I-block format not valid here.

ERR 125 NOP STRNG Strings are not valid for this command.

ERR 126 NO ? This command cannot be queried.

ERR 127 BAD DTMD Not a valid peak detector mode.

ERR 128 PK WHAT? Not a valid peak search parameter.

ERR 129 PRE TERM Premature A-block termination.

ERR 130 BAD TDF Arguments are only for TDF command.

ERR 131 ?? AM/FM AM/FM are not valid arguments for this command.

ERR 132 !FAV/RMP FAV/RAMP are not valid arguments for this command.

ERR 133 !INT/EXT INT/EXT are not valid arguments for this command.

ERR 134 ??? ZERO ZERO is not a valid argument for this command.

ERR 135 ??? CURR CURR is not a valid argument for this command.

ERR 136 ??? FULL FULL is not a valid argument for this command.

ERR 137 ??? LAST LAST is not a valid argument for this command.

ERR 138 !GRT/DSP GRT/DSP are not valid arguments for this command.

ERR 139 PLOTONLY Argument can only be used with PLOT command.

ERR 140 ?? PWRON PWRON is not a valid argument for this command.

ERR 141 BAD ARG Argument can only be used with FDIAG command.

ERR 142 BAD ARG Query expected for FDIAG command.

ERR 143 NO PRESL No preselector hardware to use command with.

ERR 144 COUPL?? Invalid COUPLING argument, expected AC or DC.

Error codes 200 through 299 relate to ADC hardware/firmware failures. Instrument service is required.

ERR 200 SYSTEM ADC Driver/ADC hardware/firmware interaction; check for other errors.

ERR 201 SYSTEM ADC Controller/ADC hardware/firmware interaction; check for other errors.

ERR 202 FADC CAL Linear offset search failed.

This error applies applies only to EC-series analyzers and E-series analyzers with fast ADC (Option 007)

ERR 203 FADC CAL Log offset search failed.

This error applies applies only to EC-series analyzers and E-series analyzers with fast ADC (Option 007)

ERR 204 FADC CAL Log 2× expand offset search failed.

This error applies applies only to EC-series analyzers and E-series analyzers with fast ADC (Option 007)

ERR 205 FADC CAL Linear slope calibration is out of range.

This error applies applies only to EC-series analyzers and E-series analyzers with fast ADC (Option 007)

ERR 206 FADC CAL Log slope calibration is out of range.

This error applies applies only to EC-series analyzers and E-series analyzers with fast ADC (Option 007)

ERR 207 FADC CAL Log 2× expand slope calibration is out of range.

This error applies applies only to EC-series analyzers and E-series analyzers with fast ADC (Option 007)

ERR 250 OUTOF RG ADC input is outside of ADC range.

ERR 251 NO IRQ Microprocessor not receiving interrupt from ADC.

Error codes 300 through 399 relate to LO and RF hardware/firmware failures. Instrument service is required.

ERR 300 YTO UNLK YTO (1ST LO) phase-locked loop (PLL) is unlocked.

ERR 301 YTO UNLK YTO PLL is unlocked.

ERR 302 OFF UNLK Offset roller oscillator PLL is unlocked.

ERR 303 XFR UNLK Transfer roller oscillator PLL is unlocked.

ERR 304 ROL UNLK Main roller oscillator PLL is unlocked.

ERR 305 FREQ ACC Coarse adjust DAC cannot bring MAINSENSE close to zero.

ERR 306 FREQ ACC Fine adjust DAC cannot bring MAINSENSE close to zero.

ERR 307 FREQ ACC Transfer oscillator pretune DAC out of range.

ERR 308 FREQ ACC Offset oscillator pretune DAC not within prescribed limits at low frequency.

ERR 309 FREQ ACC Offset oscillator pretune DAC not within prescribed limits at high frequency.

ERR 310 FREQ ACC Main roller pretune DAC set to 255 before MAINSENSE changes to negative polarity.

ERR 311 FREQ ACC Main roller pretune DAC set to 255 before MAINSENSE changes to negative polarity.

ERR 312 FREQ ACC Fine adjust DAC cannot bring MAINSENSE close to zero.

ERR 313 FREQ ACC The combination of sampler oscillator and roller oscillator frequencies do not correspond to the required YTO start frequency.

ERR 314 FREQ ACC Span calibration problems. An unlocked main roller loop or lack of a sweep ramp.

ERR 315 FREQ ACC Span calibration problems. Roller span attenuator DAC is out of range.

ERR 316 FREQ ACC Sensitivity of the main roller DAC is zero.

ERR 317 FREQ ACC Main coil coarse DAC at limits.

ERR 318 FREQ ACC Main coil fine DAC at limits.

ERR 319 WARN COA The YTO coarse tune DAC is near its limits.

ERR 320 WARN FIN The YTO fine tune DAC is near its limits.

ERR 321 FREQ ACC Main roller tuning sensitivity is not greater than zero.

ERR 322 FREQ ACC Main roller pretune DAC value set greater than 255.

ERR 324 FREQ ACC Coarse adjust DAC cannot bring MAINSENSE close to zero.

ERR 325 FREQ ACC Fine adjust DAC cannot bring MAINSENSE close to zero.

ERR 326 FREQ ACC Fine adjust DAC near the end of range.

ERR 327 OFF UNLK Offset roller oscillator PLL is unlocked.

ERR 328 FREQ ACC Roller fine adjust DAC sensitivity less than or equal to zero.

ERR 329 FREQ ACC Roller coarse adjust DAC sensitivity less than or equal to zero.

ERR 331 FREQ ACC Invalid YTO frequency.

ERR 333 600 UNLK 600 MHz reference oscillator PLL is unlocked.

ERR 334 LO AMPL 1st LO distribution amplifier is unleveled. The front panel LO OUTPUT must be terminated in a 50Ω load.

ERR 335 SMP UNLK Sampling oscillator PLL is unlocked.

ERR 336 10 MHz Ref Cal oscillator failed to lock when going to internal 10 MHz reference.

ERR 337 FN UNLK Fractional N circuitry is unable to lock.

ERR 338 LOMA AGC The LOMA (local oscillator multiplier amplifier) main loop AGC is unleveled.

ERR 339 SBTX AGC The LOMA SBTX (switched barium-tuned mixer) loop AGC is unleveled.

ERR 340 SAMP AGC The LOMA (local oscillator multiplier amplifier) sampler loop AGC is unleveled.

ERR 351 SETL FLD The YTO error voltage is not settling.

ERR 352 TWID FLD Unable to bring error voltage DACs to quiescent point.

ERR 353 SRCH FLD No acceptable YTO DAC value found.

ERR 354 LK ITERS Cannot lock. Lock iteration routine terminated.

ERR 355 SMP CAL Sampler unlock condition during calibration routine. This error remains until a successful recalibration is performed.

ERR 356 SPAC CAL Sweep data problem finding "bucket 1" of the span accuracy calibration sweep.

ERR 357 SPAC CAL Cannot find the "x" intersection for "bucket 1" of the span accuracy calibration sweep.

ERR 358 SPAC CAL Cannot find "bucket 2" of the span accuracy calibration sweep.

ERR 359 SPAC CAL Cannot find the "x" intersection for "bucket 2" of the span accuracy calibration sweep.

ERR 360 SPAC CAL The start bucket correction is out of range.

ERR 361 SPAC CAL The percent of span correction is out of range.

Error codes 400 through 599 relate to IF failures. Instrument service is required These errors are generated when the automatic IF adjustment routine detects a fault. These errors are designed to assist service personnel in IF problem isolation, however, an instrument will function if the suspect functional parameters are not required. This routine adjusts amplitude parameters first, then resolution bandwidths in this sequence: 300 kHz, 1 MHz, 2 MHz, 100 kHz, 30 kHz, 10 kHz, 3 kHz, 1 kHz, 300 Hz, 100 Hz, 30 Hz, 10 Hz, 3 Hz, and 1 Hz. The routine restarts from the beginning if a fault is detected. Resolution bandwidth filters adjusted after the routine begins and before the fault is detected should be acceptable; resolution bandwidth filters adjusted later in the sequence are suspect. If the fault is detected before the first resolution bandwidth (300 kHz) is adjusted, all IF performance is suspect.

ERR 400 AMPL<300 Unable to adjust less than 300 Hz RES BW amplitude.

ERR 401 AMPL 300 Unable to adjust amplitude of 300 Hz RES BW.

ERR 402 AMPL 1K Unable to adjust amplitude of 1 kHz RES BW.

ERR 403 AMPL 3K Unable to adjust amplitude of 3 kHz RES BW.

ERR 404 AMPL 10K Unable to adjust amplitude of 10 kHz RES BW.

ERR 405 RBW 10K Unable to adjust 10 kHz RES BW pole 1.

ERR 406 RBW 10K Unable to adjust 10 kHz RES BW pole 2.

ERR 407 RBW 10K Unable to adjust 10 kHz RES BW pole 3.

ERR 408 RBW 10K Unable to adjust 10 kHz RES BW pole 4.

ERR 409 RBW 10K Unable to adjust 10 kHz RES BW pole 1.

ERR 410 RBW 10K Unable to adjust 10 kHz RES BW pole 2.

ERR 411 RBW 10K Unable to adjust 10 kHz RES BW pole 3.

ERR 412 RBW 10K Unable to adjust 10 kHz RES BW pole 4.

ERR 413 RBW 10K Unable to adjust 10 kHz RES BW pole 1.

ERR 414 RBW 10K Unable to adjust 10 kHz RES BW pole 2.

ERR 415 RBW 10K Unable to adjust 10 kHz RES BW pole 3.

ERR 416 RBW 10K Unable to adjust 10 kHz RES BW pole 4.

ERR 417 RBW 3K Unable to adjust 3 kHz RES BW pole 1.

ERR 418 RBW 3K Unable to adjust 3 kHz RES BW pole 2.

ERR 419 RBW 3K Unable to adjust 3 kHz RES BW pole 3.

ERR 420 RBW 3K Unable to adjust 3 kHz RES BW pole 4.

ERR 421 RBW 10K Unable to adjust 10 kHz RES BW pole 1.

ERR 422 RBW 10K Unable to adjust 10 kHz RES BW pole 2.

ERR 423 RBW 10K Unable to adjust 10 kHz RES BW pole 3.

ERR 424 RBW 10K Unable to adjust 10 kHz RES BW pole 4.

ERR 425 RBW 3K Unable to adjust 3 kHz RES BW pole 1.

ERR 426 RBW 3K Unable to adjust 3 kHz RES BW pole 2.

ERR 427 RBW 3K Unable to adjust 3 kHz RES BW pole 3.

ERR 428 RBW 3K Unable to adjust 3 kHz RES BW pole 4.

ERR 429 RBW <300 Unable to adjust less than 300 Hz RES BW.

ERR 430 RBW 300 Unable to adjust 300 Hz RES BW.

ERR 431 RBW 1K Unable to adjust 1 kHz RES BW.

ERR 432 RBW 3K Unable to adjust 3 kHz RES BW.

ERR 433 RBW 10K Unable to adjust 10 kHz RES BW.

ERR 434 RBW 300 Unable to adjust 300 Hz RES BW pole 1.

ERR 435 RBW 300 Unable to adjust 300 Hz RES BW pole 2.

ERR 436 RBW 300 Unable to adjust 300 Hz RES BW pole 3.

ERR 437 RBW 300 Unable to adjust 300 Hz RES BW pole 4.

ERR 438 RBW 1K Unable to adjust 1 kHz RES BW pole 1.

ERR 439 RBW 1K Unable to adjust 1 kHz RES BW pole 2.

ERR 440 RBW 1K Unable to adjust 1 kHz RES BW pole 3.

ERR 441 RBW 1K Unable to adjust 1 kHz RES BW pole 4.

ERR 442 RBW 3K Unable to adjust 3 kHz RES BW pole 1.

ERR 443 RBW 3K Unable to adjust 3 kHz RES BW pole 2.

ERR 444 RBW 3K Unable to adjust 3 kHz RES BW pole 3.

ERR 445 RBW 3K Unable to adjust 3 kHz RES BW pole 4.

ERR 446 RBW 10K Unable to adjust 10 kHz RES BW pole 1.

ERR 447 RBW 10K Unable to adjust 10 kHz RES BW pole 2.

ERR 448 RBW 10K Unable to adjust 10 kHz RES BW pole 3.

ERR 449 RBW 10K Unable to adjust 10 kHz RES BW pole 4.

ERR 450 IF SYSTM IF hardware failure. Check other error messages.

ERR 451 IF SYSTM IF hardware failure. Check other error messages.

ERR 452 IF SYSTM IF hardware failure. Check other error messages.

ERR 454 AMPL Unable to adjust step gain amplifiers.

ERR 455 AMPL Unable to adjust step gain amplifiers.

ERR 456 AMPL Unable to adjust step gain amplifiers.

ERR 457 AMPL Unable to adjust step gain amplifiers.

ERR 458 AMPL Unable to adjust step gain amplifiers.

ERR 459 AMPL Unable to adjust step gain amplifiers.

ERR 460 AMPL Unable to adjust step gain amplifiers.

ERR 461 AMPL Unable to adjust step gain amplifiers.

ERR 462 AMPL Unable to adjust step gain amplifiers.

ERR 463 AMPL Unable to adjust step gain amplifiers.

ERR 464 AMPL Unable to adjust step gain amplifiers.

ERR 465 AMPL Unable to adjust step gain amplifiers.

ERR 466 LIN AMPL Unable to adjust linear amplitude scale.

ERR 467 LOG AMPL Unable to adjust log amplitude scale.

ERR 468 LOG AMPL Unable to adjust log amplitude scale.

ERR 469 LOG AMPL Unable to adjust log amplitude scale.

ERR 470 LOG AMPL Unable to adjust log amplitude scale.

ERR 471 RBW 30K Unable to adjust 30 kHz RES BW.

ERR 472 RBW 100K Unable to adjust 100 kHz RES BW.

ERR 473 RBW 300K Unable to adjust 300 kHz RES BW.

ERR 474 RBW 1M Unable to adjust 1 MHz RES BW.

ERR 475 RBW 30K Unable to adjust 30 kHz RES BW.

ERR 476 RBW 100K Unable to adjust 100 kHz RES BW.

ERR 477 RBW 300K Unable to adjust 300 kHz RES BW.

ERR 478 RBW 1M Unable to adjust 1 MHz RES BW.

ERR 483 RBW 10K Unable to adjust 10 kHz RES BW.

ERR 484 RBW 3K Unable to adjust 3 kHz RES BW.

ERR 485 RBW 1K Unable to adjust 1 kHz RES BW.

ERR 486 RBW 300 Unable to adjust 300 Hz RES BW.

ERR 487 RBW 100 Unable to adjust 100 Hz RES BW.

ERR 488 RBW 100 Unable to adjust 100 Hz RES BW.

ERR 489 RBW 100 Unable to adjust 100 Hz RES BW.

ERR 490 RBW 100 Unable to adjust 100 Hz RES BW.

ERR 491 RBW <300 Unable to adjust less than 300 Hz RES BW.

ERR 492 RBW 300 Unable to adjust 300 Hz RES BW.

ERR 493 RBW 1K Unable to adjust 1 kHz RES BW.

ERR 494 RBW 3K Unable to adjust 3 kHz RES BW.

ERR 495 RBW 10K Unable to adjust 10 kHz RES BW.

ERR 496 RBW 100 Unable to adjust 100 Hz RES BW.

ERR 497 RBW 100 Unable to adjust 100 Hz RES BW.

ERR 498 RBW 100 Unable to adjust 100 Hz RES BW.

ERR 499 CAL UNLK Cal oscillator is unlocked.

ERR 500 AMPL 30K Unable to adjust amplitude of 30 kHz RES BW.

ERR 501 AMPL .1M Unable to adjust amplitude of 100 kHz RES BW.

ERR 502 AMPL .3M Unable to adjust amplitude of 300 kHz RES BW.

ERR 503 AMPL 1M Unable to adjust amplitude of 1 MHz RES BW.

ERR 504 AMPL 30K Unable to adjust amplitude of 30 kHz RES BW.

ERR 505 AMPL .1M Unable to adjust amplitude of 100 kHz RES BW.

ERR 506 AMPL .3M Unable to adjust amplitude of 300 kHz RES BW.

ERR 507 AMPL 1M Unable to adjust amplitude of 1 MHz RES BW.

ERR 508 AMPL 30K Insufficient gain during LC BW Cal of 30 kHz RES BW.

ERR 509 AMPL .1M Insufficient gain during LC BW Cal of 100 kHz RES BW.

ERR 510 AMPL .3M Insufficient gain during LC BW Cal of 300 kHz RES BW.

ERR 511 AMPL 1M Insufficient gain during LC BW Cal of 1 MHz RES BW.

ERR 512 RBW <300 Insufficient gain during crystal BW Cal of less than 300 Hz RES BW.

ERR 513 RBW 300 Insufficient gain during crystal BW Cal of 300 Hz RES BW.

ERR 514 RBW 1K Insufficient gain during crystal BW Cal of 1 kHz RES BW.

ERR 515 RBW 3K Insufficient gain during crystal BW Cal of 3 kHz RES BW.

ERR 516 RBW 10K Insufficient gain during crystal BW Cal of 10 kHz RES BW.

ERR 517 RBW 100 Unable to adjust 100 Hz RES BW.

ERR 518 RBW 300 Unable to adjust 300 Hz RES BW.

ERR 519 RBW 1K Unable to adjust 1 kHz RES BW.

ERR 520 RBW 3K Unable to adjust 3 kHz RES BW.

ERR 521 RBW 10K Unable to adjust 10 kHz RES BW.

ERR 522 RBW 10K Unable to adjust 10 kHz RES BW symmetry of pole 1.

ERR 523 RBW 10K Unable to adjust 10 kHz RES BW symmetry of pole 2.

ERR 524 RBW 10K Unable to adjust 10 kHz RES BW symmetry of pole 3.

ERR 525 RBW 10K Unable to adjust 10 kHz RES BW symmetry of pole 4.

ERR 526 RBW <300 Unable to adjust less than 300 Hz RES BWs. Timeout during data sampling.

ERR 527 RBW <300 Step gain correction failed for less than 300 Hz RES BW.

ERR 528 RBW <300 Unable to adjust less than 300 Hz RES BWs. DC level at ADC cannot be calibrated.

ERR 529 RBW <300 Unable to adjust less than 300 Hz RES BWs. Demod data for calibration is bad.

ERR 530 RBW <300 Unable to adjust less than 300 Hz RES BWs. Narrow BW VCXO Calibration failed.

ERR 531 RBW <300 Flatness correction data not acceptable for less than 300 Hz RES BWs.

ERR 532 RBW <300 Absolute gain data for less than 300 Hz RES BWs not acceptable.

ERR 533 RBW <300 Unable to adjust less than 300 Hz RES BWs. Timeout during data sampling narrow BW chunk.

ERR 534 RBW <300 Unable to adjust less than 300 Hz RES BWs. Frequency count of CAL OSC using IF downconverter failed.

ERR 535 RBW <300 Unable to adjust less than 300 Hz RES BWs. Inadequate FM demod range for 500Hz IF filter measurement.

ERR 536 RBW <300 Unable to adjust less than 300 Hz RES BWs. Unable to autorange the chirp signal.

ERR 537 RBW <300 Unable to adjust less than 300 Hz RES BWs. CW CAL OSC not autoranging.

ERR 538 RBW <300 Unable to adjust less than 300 Hz RES BWs. Noisy shape of 500 Hz IF filter.

ERR 539 RBW <300 Unable to adjust less than 300 Hz RES BWs. CW CAL OSC not autoranging.

ERR 540 RBW <300 Unable to adjust less than 300 Hz RES BWs. No SIGLOCK on CW CAL OSC during pretune.

ERR 550 IDCALOSC CAL Oscillator ID. Indicates incompatible hardware. Cal oscillator not expected.

ERR 551 ID LOGBD LOG Board ID. Indicates incompatible hardware. Log board not expected.

ERR 552 LOG AMPL Unable to adjust amplitude of log scale.

ERR 553 LOG AMPL Unable to adjust amplitude of log scale.

ERR 554 LOG AMPL Unable to adjust amplitude of log scale.

ERR 555 LOG AMPL Unable to adjust amplitude in log scale.

ERR 556 LOG AMPL Unable to adjust amplitude in log scale.

ERR 557 LOG AMPL Unable to adjust amplitude in log scale.

ERR 558 LOG AMPL Unable to adjust amplitude in log scale.

ERR 559 LOG AMPL Unable to adjust amplitude in log scale.

ERR 560 LOG AMPL Unable to adjust amplitude in log scale.

ERR 561 LOG AMPL Unable to adjust amplitude in log scale.

ERR 562 LOG AMPL Unable to adjust amplitude in log scale.

ERR 563 LOG AMPL Unable to adjust amplitude in log scale. Third Step Gain range problem.

ERR 564 LOG AMPL Unable to adjust amplitude in log scale.

ERR 565 LOG AMPL Unable to adjust amplitude in log scale.

ERR 566 LOG AMPL Unable to adjust amplitude in log scale.

ERR 567 LOG AMPL Unable to adjust amplitude in log scale.

ERR 568 LOG AMPL Unable to adjust amplitude in log scale.

ERR 569 LOG AMPL Unable to adjust amplitude in log scale.

ERR 570 LOG AMPL Unable to adjust amplitude in log scale.

ERR 571 AMPL Unable to adjust step gain amplifiers.

ERR 572 AMPL 1M Unable to adjust amplitude of 1 MHz RES BW.

ERR 573 LOG AMPL Unable to adjust amplitude in log scale.

ERR 574 LOG AMPL Unable to adjust amplitude in log scale.

ERR 575 LOG AMPL Unable to adjust amplitude in log scale.

ERR 576 LOG AMPL Unable to adjust amplitude in log scale.

ERR 577 LOG AMPL Unable to adjust amplitude in log scale.

ERR 578 LOG AMPL Limiter calibration error from DC logger calibration.

ERR 579 LOG AMPL Attenuator CAL level error from DC logger calibration.

ERR 580 LOG AMPL Calibration level error from DC logger fidelity calibration.

ERR 581 AMPL Unable to adjust 100 kHz resolution bandwidth and resolution bandwidths less than or equal to 10 kHz.

ERR 582 AMPL Unable to adjust 100 kHz resolution bandwidth and resolution bandwidths less than or equal to 10 kHz. Bad CALOSC calibration of sweep rate.

ERR 583 RBW 30K Unable to adjust 30 kHz RES BW.

ERR 584 RBW 100K Unable to adjust 100 kHz RES BW.

ERR 585 RBW 300K Unable to adjust 300 kHz RES BW.

ERR 586 RBW 1M Unable to adjust 1 MHz RES BW.

ERR 587 RBW 30K Unable to adjust 30 kHz RES BW.

ERR 588 RBW 100K Unable to adjust 100 kHz RES BW.

ERR 589 RBW 300K Unable to adjust 300 kHz RES BW.

ERR 590 RBW 1M Unable to adjust 1 MHz RES BW.

ERR 591 LOG AMPL Unable to adjust amplitude in log scale.

ERR 592 LOG AMPL Unable to adjust amplitude in log scale.

ERR 593 LOG TUNE LIMIT Cal tune error from DC logger calibration.

ERR 594 LOG OFST Attenuator calibration offset error from DC logger calibration.

ERR 595 LOG ATTN Attenuator calibration absolute error from DC logger calibration.

ERR 596 LOG FID Fidelity error from DC logger calibration.

ERR 597 LOG OFST Fidelity offset error from DC logger calibration.

ERR 598 LOG OFST Fidelity offset unstable from DC logger calibration.

ERR 599 LOG GAIN Fidelity gain error from DC logger calibration.

Error codes 600 through 699 relate to system failures. Instrument service is required.

ERR 600 SYSTEM Hardware/firmware interaction; check other errors.

ERR 601 SYSTEM Hardware/firmware interaction; check other errors.

ERR 650 OUTOF RG ADC input is outside of the ADC range.

ERR 651 NO IRQ Microprocessor is not receiving interrupt from ADC.

Error codes 700 through 799 relate to digital and checksum failures. Instrument service is required.

ERR 700 EEROM Checksum error of EEROM A2U501.

ERR 701 AMPL CAL Checksum error of frequency response correction data.

ERR 702 ELAP TIM Checksum error of elapsed time data.

ERR 703 AMPL CAL Checksum error of frequency response correction data.

ERR 704 PRESELCT Checksum error of customer preselector peak data; external preselector data recalled in internal mode; or internal preselector data recalled in external mode.

ERR 705 ROM U306 Checksum error of program ROM A2U306.

ERR 706 ROM U307 Checksum error of program ROM A2U307.

ERR 707 ROM U308 Checksum error of program ROM A2U308.

ERR 708 ROM U309 Checksum error of program ROM A2U309.

ERR 709 ROM U310 Checksum error of program ROM A2U310.

ERR 710 ROM U311 Checksum error of program ROM A2U311.

ERR 711 RAM U303 Checksum error of system RAM A2U303.

ERR 712 RAM U302 Checksum error of system RAM A2U302.

ERR 713 RAM U301 Checksum error of system RAM A2U301.

ERR 714 RAM U300 Checksum error of system RAM A2U300.

ERR 715 RAM U305 Checksum error of system RAM A2U305.

ERR 716 RAM U304 Checksum error of system RAM A2U304.

ERR 717 BAD uP!! Microprocessor is not fully operational.

ERR 718 BATTERY? Nonvolatile RAM is not working; check battery.

ERR 719 MODEL #? Cannot identify the model number.

ERR 720 OPTION #? Cannot identify an option number.

ERR 721 AMPC RAM Checksum error of the ampcor function correction data.

ERR 750 SYSTEM Hardware/firmware interaction, zero divide; check other errors.

ERR 751 SYSTEM Hardware/firmware interaction, floating overflow; check other errors.

ERR 752 SYSTEM Hardware/firmware interaction, floating underflow; check other errors.

ERR 753 SYSTEM Hardware/firmware interaction, LOG error; check other errors.

ERR 754 SYSTEM Hardware/firmware interaction, Integer overflow; check other errors.

ERR 755 SYSTEM Hardware/firmware interaction, squareroot error; check other errors.

ERR 756 SYSTEM Hardware/firmware interaction, Triple overflow; check other errors.

ERR 757 SYSTEM Hardware/firmware interaction, BCDL overflow; check other errors.

ERR 758 SYSTEM Unknown system error.

ERR 759 SYSTEM Hardware/firmware interaction. Code invoked for wrong instrument.

ERR 760 NO FADC The power-on read of the fast analog to digital converter hardware is failing.

This error applies applies only to EC-series analyzers and E-series analyzers with fast ADC (Option 007)

Error codes 800 through 899, MODULE, are reserved for option modules, such as the Agilent 85629B test and adjustment module or the Agilent 85620A mass memory module. Refer to the option module manual for a list of product-specific error messages.

Error codes 900 to 910 relate to user-generated errors. These errors occur if the operator has entered information incorrectly, or is attempting to use the analyzer inappropriately.

ERR 900 TG UNLVL Tracking generator output is unleveled.

ERR 901 TGFrqLmt Tracking generator output unleveled because START FREQ is set below tracking generator frequency limit (300 kHz).

ERR 902 BAD NORM A normalization error will occur if the current spectrum analyzer state is not the same as the state stored by the last execution of the STORETHRU or STORESHORT command.

This will happen when several open/short or thru calibrations are performed. The NORMLIZE function recalls the last calibration run. If one of the earlier SHORT or THRU states has been recalled just before turning the NORMLIZE function on, then the current and recalled states don't match and the error occurs. To avoid this error, update the STORETHRU or STORESHORT state register with the current state before turning NORMLIZE on. The STORETHRU state register is state register 9. The STORESHORT state register is state register 8. It is a good idea to take a sweep (TS command) prior to saving the state using the SAVES 8 or SAVES 9 command.

ERR 903 A > DLMT Unnormalized trace A is off screen with trace math or normalization on.

ERR 904 B > DLMT Calibration trace (trace B) is off screen with trace math or normalization on.

ERR 905 EXT REF Unable to lock cal oscillator when set to external reference. Check that external reference is within tolerance.

ERR 906 OVENCOLD The oven controlled crystal oscillator (OCXO) oven is cold.

ERR 907 DO IFCAL Unit is still performing IF calibration, or is in need of IF calibration which were not done due to an OVENCOLD condition.

ERR 908 BW>>SPCG Channel bandwidth is too wide, compared to the channel spacing, for a meaningful computation.

ERR 909 SPAN<ACP The frequency span is too small to obtain a valid ACP measurement.

ERR 910 SPAN>ACP The frequency span is too wide, compared to the channel bandwidth, to obtain a valid ACP measurement.

ERR 911 ACP STATE The adjacent channel power measurement has been compromised (invalid measurement parameters).

ERR 919 SP <CHBW The channel spacing is too narrow, compared to the channel bandwidth, to obtain a valid channel power bandwidth measurement.

ERR 920 RBW>CHBW The resolution bandwidth is too wide, compared to the channel bandwidth, to obtain a valid channel power bandwidth measurement. The resolution bandwidth should be much less than the channel bandwidth (<0.1×channel BW).

ERR 921 ↑AMPCOR↑ Measurement data which would normally be displayed above the top graticule, and therefore has unspecified accuracy, has been corrected by ampcor the amplitude correction function (ampcor) to appear between the top and bottom graticule.

ERR 922 ↓AMPCOR↓ Measurement data which would normally be displayed below the bottom graticule, and therefore has unspecified accuracy, has been corrected by ampcor the amplitude correction function (ampcor) to appear between the top and bottom graticule.

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