Errata

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HP References in this Manual

This manual may contain references to HP or Hewlett-Packard. Please note that Hewlett-Packard's former test and measurement, semiconductor products and chemical analysis businesses are now part of Agilent Technologies. We have made no changes to this manual copy. The HP XXXX referred to in this document is now the Agilent XXXX. For example, model number HP8648A is now model number Agilent 8648A.

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Operation and Programming Manual

HP 8561A and HP 8562A/B Portable Spectrum Analyzers

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How to Use This Manual

The Operating and Programming Manual contains detailed descriptions of all spectrum analyzer functions and remote operation commands, and provides instruction in remote operation.

If you are familiar with spectrum analyzers:

- Skim Chapter 1, "Instrument Overview," for a brief introduction to the HP 8561A and HP 8562A/B spectrum analyzers.
- Analyzer function descriptions and menus are discussed in Chapter 2, "Operation Reference." To find a description of a particular analyzer function, consult the index at the end of the manual.

If you are not familiar with spectrum analyzers (and your spectrum analyzer has already been unpacked and installed):

- Read Chapter 1, "Instrument Overview," which introduces you to the HP 8561A and HP 8562A/B analyzers, leads you through a simple spectrum analyzer measurement, and shows how to make more accurate measurements.
- After successfully making your first measurement, continue to Chapter 3, "Common Measurements," to gain experience with spectrum analyzer measurements.

Caution

To prevent damage to your spectrum analyzer, **DO NOT EXCEED THE MAXIMUM INPUT POWER.** The maximum input power is: +30 dBm (1 watt) continuous; 0 volts dc.

Figures

Tables

1. Overview

1

Overview

This chapter introduces the front- and rear-panel keys and connectors on the HP 8561A and HP 8562A/B Spectrum Analyzers. Complete descriptions of each front-panel function appear in Chapter 2. The following topics are discussed:

Chapter 2 describes the functions available from the front panel.

Chapter 3 provides examples of common measurements using the spectrum analyzer.

Chapter 4 documents programming techniques and examples.

Chapter 5 documents each spectrum analyzer programming command.

Appendixes provides additional information and references.

Note

In this manual the frequency range of HP 8562A/B instruments is listed as 9 kHz to 22 GHz. However, the frequency range of HP 8562A/B instruments serial prefixed below 2929A is 1 kHz to 22 GHz.

The Front Panel

The following paragraphs briefly describe the groups of front-panel keys shown in Figure 1-1.

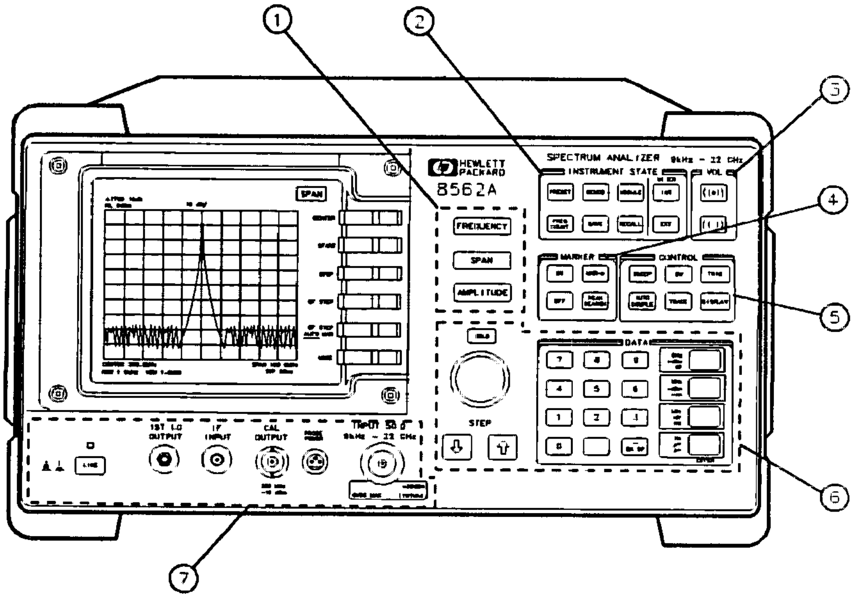


Figure 1-1. HP 8562A Front Panel

1. FREQUENCY, SPAN, and AMPLITUDE are the fundamental functions for most measurements.
2. INSTRUMENT STATE functions generally affect the state of the entire spectrum analyzer, not just of a single function.
3. VOL functions control the volume of the speaker in the spectrum analyzer. (((O))) increases volume, ((o)) decreases it.
4. MARKER functions read out frequencies and amplitudes along the spectrum analyzer trace, allow you to make relative measurements, automatically locate the signal of highest amplitude on a trace, and tune the analyzer to track a signal automatically.
5. CONTROL functions allow you to adjust the resolution and video bandwidths, the sweep time, and the display, and to vary other functions that control spectrum analyzer measurement capabilities.
6. Data keys, step keys, and the knob allow you to change the numeric value of an active function. Use the data keys to enter an exact value or to move quickly from one end of the frequency range to the other. 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. The (HOLD) key freezes the active function and holds it at a set value until the function key is pressed again. (HOLD) also blanks the key menu.

7. The signal connections provide an RF input, active-probe power, a 300 MHz calibrator signal, a 310.7 MHz IF input, and a first LO output. These functions are described more fully in Table 1-1. The (LINE) button turns on the spectrum analyzer. The LED above indicates whether or not ac power is applied to the spectrum analyzer.

Caution

The maximum input level to the RF input is +30 dBm with a minimum of 10 dB input attenuation. Maximum dc voltage to the RF input is 0 V. Exceeding either of these levels can damage the input attenuator and the input mixer.

Table 1-1. Front-Panel Connector Data

Connector	Frequency Range	Amplitude/ Voltage Limits
INPUT 50Ω	HP 8561A: 1 kHz to 6.5 GHz HP 8562A/B: 9 kHz to 22 GHz (External mixers supported)	0 Vdc Max. +10 dBm Max
PROBE POWER	—	+15V, −12.6V (150 mA max.)
CAL OUTPUT	300 MHz	−10 dBm
IF INPUT (for use with external mixers)	310.7 MHz	0 Vdc max.
1ST LO OUTPUT	3.0 GHz to 6.81 GHz	+16.5 dBm ±2.0 dB

Display Annotation

Figure 1-2 illustrates the display annotation.

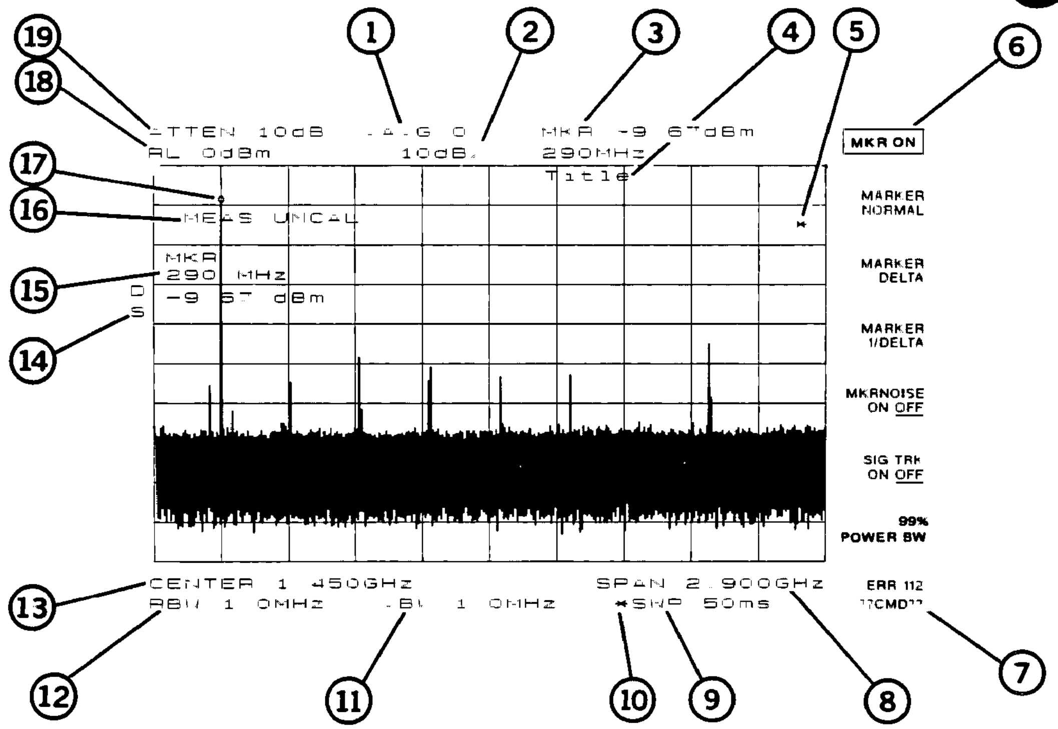


Figure 1-2. Display Annotation

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

14. Active special functions:

    T = Trigger mode set to line, video, or external
    D = Detector mode set to sample, negative peak, or positive peak
    S = Single-sweep mode
    F = Frequency Offset $\neq$ 0 Hz
    X = External Frequency Reference Active
    R = Reference level offset $\neq$ 0 dB
    A = IF adjust turned OFF
    K = Signal track is ON
    M = Trace math is ON
    + = Positive External Mixer Bias On (>0 mA)
    − = Negative External Mixer Bias On (<0 mA)

15. Active function area.
16. Measurement uncalibrated message.
17. Marker indicator.
18. Reference level.
19. Input attenuation or conversion loss.

The Rear Panel

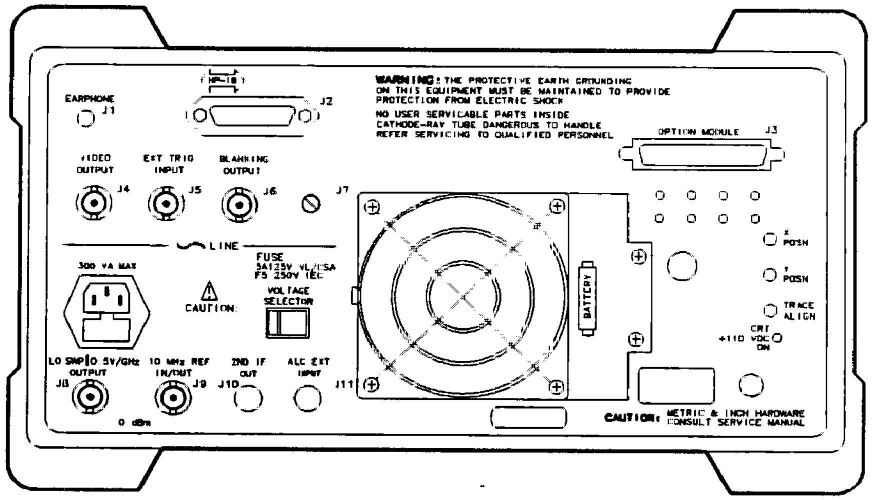


Figure 1-3. HP 8562A/B Rear Panel

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 Installation Manual.

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

J1 provides a 4Ω impedance earphone jack.

J2 is the Hewlett-Packard Interface Bus (HP-IB) connector.

J3 allows you to connect optional modules, such as the HP 85629B Test and Adjustment Module or the HP 85620A Mass Memory Module.

J4 provides a detected video output that is proportional to the vertical deflection of the CRT trace. The output range is 0—1 V when terminated in 50Ω, and can be used when the display is in 10 dB/div or LINEAR mode. ~~full scale in log~~

J5 provides an external trigger input. The input signal range is 0—5 V (TTL). When the trigger is in external mode, the instrument sweep triggers on the rising, positive edge of the signal (about 1.5 V).

J6 provides a blanking output from 0—5 V (TTL) that is low (0 V) during spectrum analyzer sweeps. The output is high (5 V) when the instrument is relocking between bands in multiband sweeps. Use this output for pen lift when plotting with nondigital plotters. This output is also useful for synchronizing instruments. ~~Low between sweeps Hi during retrace.~~

and during retrace

J8 provides a 0—10 V ramp corresponding to the sweep ramp that tunes the local oscillator or a sweeping dc output having the following value:

HP 8562A/B: .... 0.5V/GHz from 0—22 GHz
HP 8562A/B (Option 026): .... 0.5V/GHz from 0—26.5 GHz
HP 8561A: .... 0.5V/GHz from 0—6.5 GHz

The output can be selected from the keys **0 → 10V LO SWP** and **.5 V/GHz (FAV)**, respectively, which are under the (SWEEP) menu.

J9 provides a 10 MHz, 0 dBm minimum, time-base reference signal. This connector can be switched to an input, in order to connect an external reference. An external reference must be 10 MHz ±100 Hz at a nominal amplitude of 0 dBm (−2 to +10 dBm). To select the external reference mode, use the key **10 MHZ EXT INT** under the (FREQUENCY) menu.

X POSN, Y POSN, and TRACE ALIGN allow you to align the spectrum analyzer CRT using a special CRT pattern. Refer to the key **CRT ADJ PATTERN** under the (RECALL) menu, or consult the Installation and Verification Manual.

Introducing Menus and Keys

introducing| introducing| When you press certain front-panel keys, menus of keys appear along the right-hand side of the display screen. These keys provide additional functions and are dependent on the front-panel key selected.

Most front-panel keys activate key menus. For example, press (FREQUENCY). This calls up the menu of related frequency functions shown in Figure 1-4. Note on the menu the function labeled CENTER FREQ. CENTER also appears in the active function block, indicating that it is the active frequency function and can now be changed using any of the data entry controls.

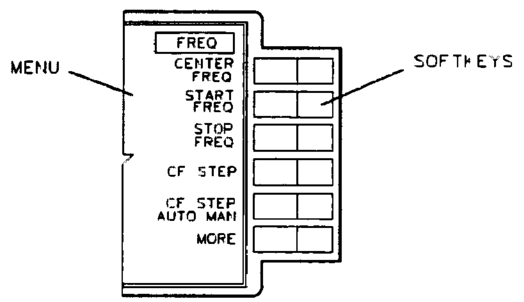


Figure 1-4. Frequency Key Menu

To activate a different frequency function—in this case, the start frequency—press the key to the right of the START FREQ annotation. START also appears in the active function block, indicating that it is the active function and can now be changed using any of the data entry controls. At the bottom of some menus, a MORE key allows access to additional, related keys. At the top of the menu, a menu title names the front- panel key pressed to obtain the current menu. To activate other frequency functions, press the appropriate keys. To select a different key menu, press another front-panel key.

Now, to become more familiar with keys, review the following basic measurement example.

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. Set the **amplitude.**
4. Activate the **marker.**

As an example, we will measure the 300 MHz calibration signal. First, power on the spectrum analyzer (for maximum accuracy, allow for a 5-minute warm-up). Next, connect the CAL OUT output to the INPUT 50Ω and complete the four steps as described below.

1. Set the center frequency. 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). To set the center frequency to 300 MHz, use the keys in the data section of the front panel and press 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 function values.

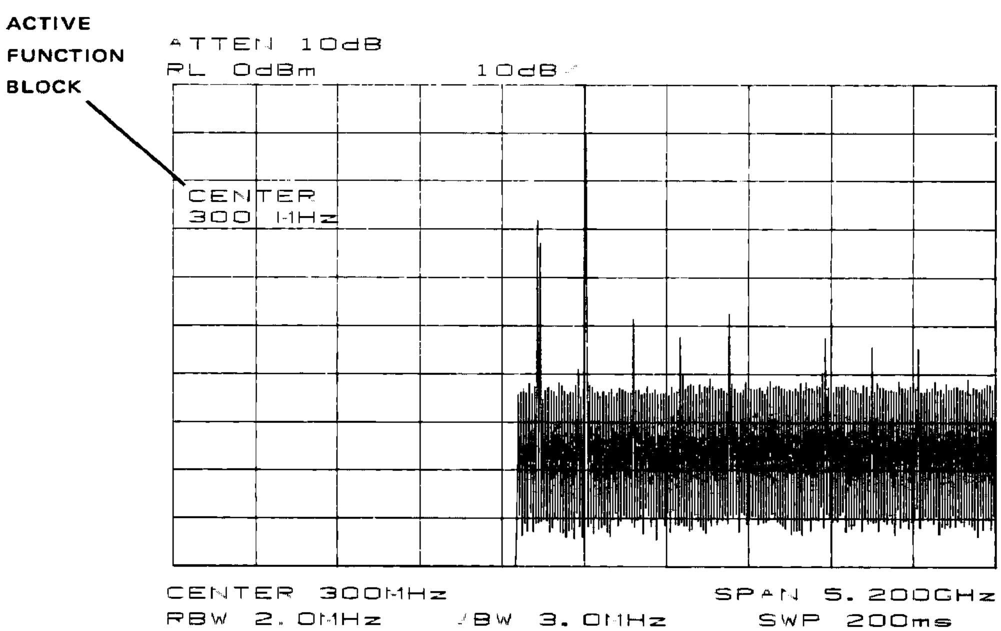


Figure 1-5. Center Frequency Set to 300 MHz

2. Set the frequency span. Press (SPAN). Note that SPAN is now displayed in the active function block, identifying it as the current active function. To reduce the frequency span—for example, to 20 MHz—either key in (2) (0) (MHz) or use the step down-arrow 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. Sweep time is also a coupled function.

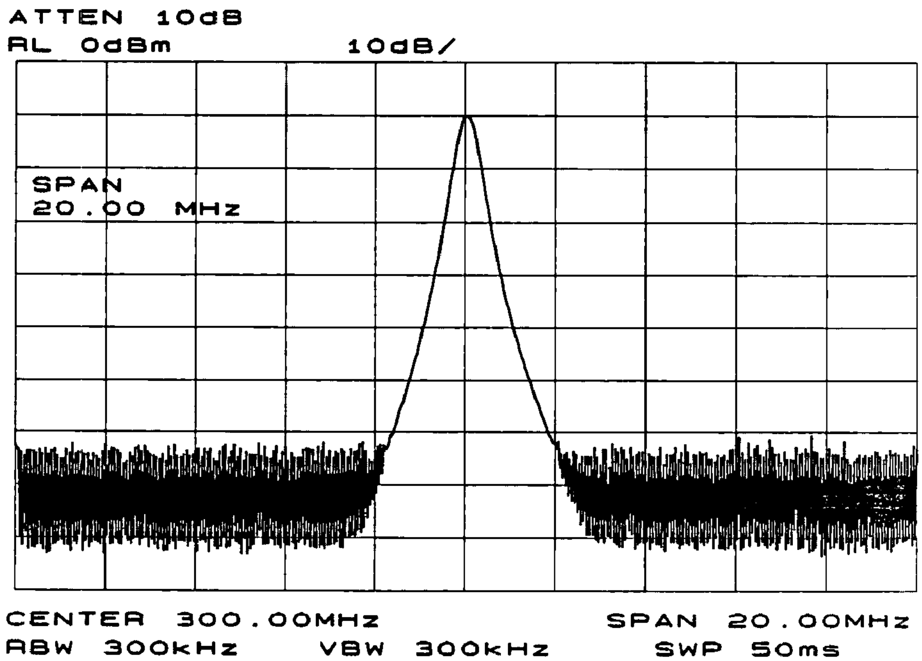


Figure 1-6. Frequency Span Reduced to 20 MHz

Note

The low band of the HP 8562A/B ranges from 9 kHz to 2.9 GHz. The upper band ranges from 2.75 GHz to 22 GHz. The frequency span cannot be set to overlap both bands at the same time in continuous sweep. For example, to sweep a range from 2.0 GHz to 3.5 GHz, use the low band to sweep from 2.0 GHz to 2.9 GHz and use the upper band to sweep from 2.75 GHz to 3.5 GHz. The frequency span can be set to overlap both bands in single sweep mode.

3. Set the amplitude. Generally, placing the signal peak at the reference level provides the best measurement accuracy. To adjust the signal peak to the reference level (Figure 1-7), press (AMPLITUDE), then key in (1) (0) (- dBm), or use either the step keys or the knob. Using the knob is the easiest way of fine-tuning the signal peak to the reference level, which is at the top of the screen.

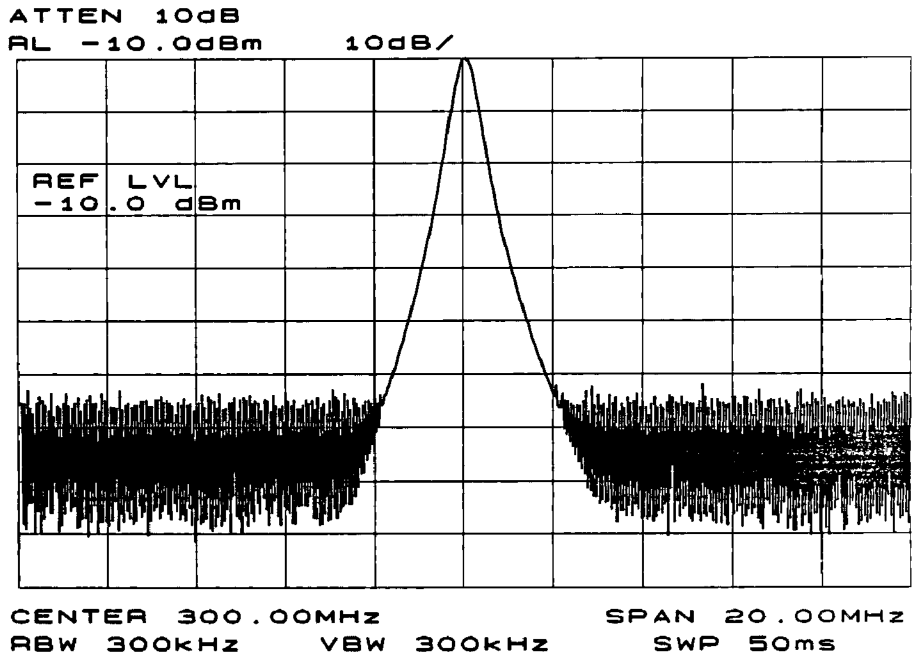


Figure 1-7. Signal Peak Set to Reference Level

4. Activate the marker. Press (ON) which is located in the MARKER section of the front panel. This places a marker at the center of the trace (in this case, at the peak of the signal) and completes the measurement. 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 1-8.

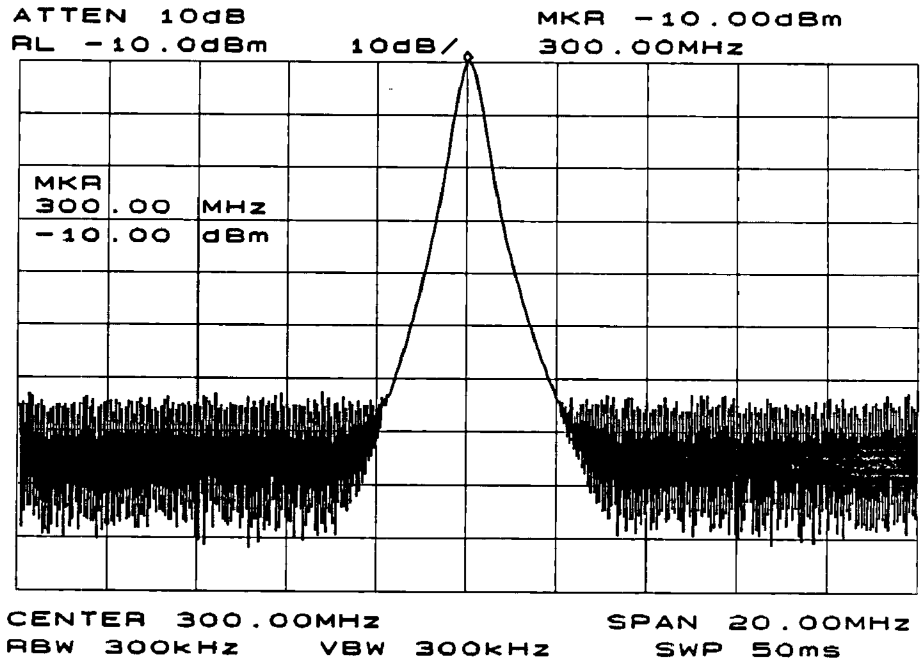


Figure 1-8. Activated Normal Marker

Many measurements require only these four steps. To return the instrument to its initial power-on state, press (PRESET).

Calibrating the Spectrum Analyzer

Note If the spectrum analyzer has just been plugged into an electrical outlet, allow for a 5-minute warm-up before calibration.

The spectrum analyzer reference level calibration function is stored under the key **REF LVL CAL** in the (AMPLITUDE) menu. To calibrate the instrument, perform the following steps.

1. Use a short BNC cable to connect the front panel's CAL OUT and INPUT 50Ω connectors.
2. Set the center frequency to 300 MHz, the span to 20 MHz and the reference level to −10 dBm. See Figure 1-9.

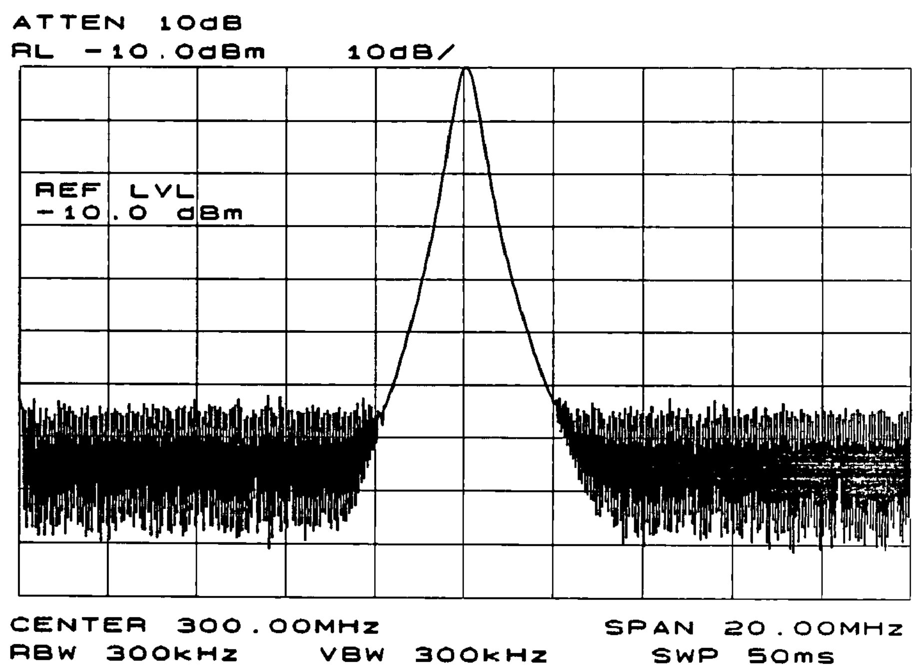


Figure 1-9. Frequency, Span, and Amplitude Set for Calibration

3. Press (AMPLITUDE), **MORE**, and then **REF LVL CAL**.
4. Using the front-panel knob, adjust the peak of the signal to the reference level as shown in Figure 1- 10. Note the number that appears in the active function block. This number, which ranges from −33 to 33, is a relative number indicating how much amplitude correction was required to calibrate the spectrum analyzer. The number is usually around 0.
5. To store the value, press **STORE REF LVL**.

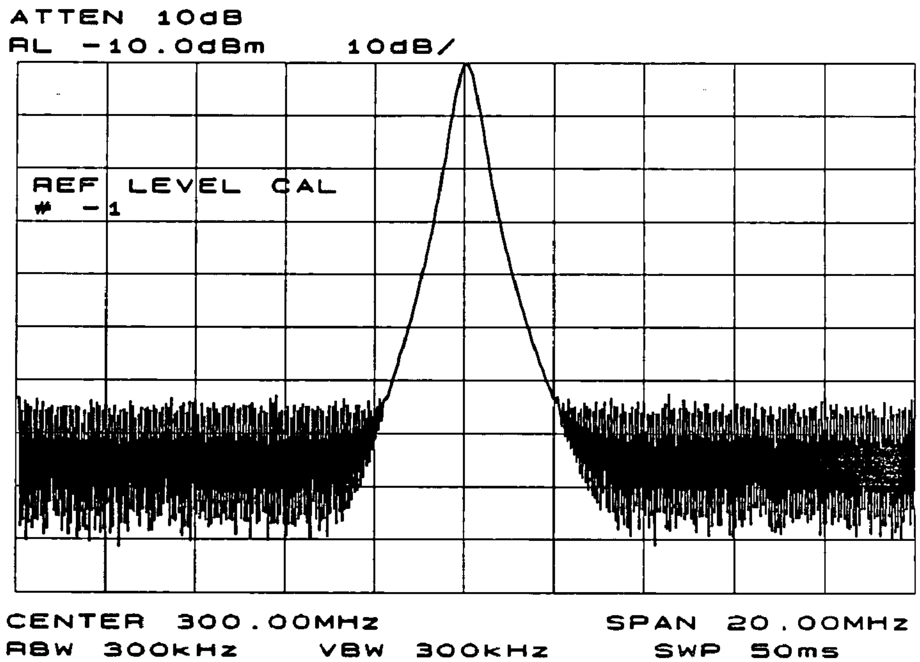


Figure 1-10. Signal Peak Calibrated to the Reference Level

Note Recalibrating the reference level is usually necessary only when the ambient temperature changes more than 10 degrees Celsius. Because the HP 8561A and HP 8562A/B continually monitor and reduce any IF errors, executing the IF calibration is seldom necessary.

Key Menus

The following menus appear on the display when the indicated front-panel keys are pressed.

AMPLITUDE

- REF LVL
- ATTEN
- ATTEN, AUTO MAN
- LOG, dB/DIV
- LINEAR
- MORE →
  - REF LVL CAL
  - REF LVL OFFSET
  - MAX MXR. LEVEL
  - IF, ADJUST →
    - IF ADJ ON OFF
    - ADJ CURR. IF STATE
    - FULL IF ADJ
    - PREV MENU
  - UNITS →
    - UNITS, AUTO MAN
    - dBm
    - dBuV
    - dBmV
    - VOLTS
    - WATTS
  - PREV. MENU [1]

[1] Reads COUPLING AC DC on HP 8561A instruments

AUTO COUPLE

- ALL
- VBW/RBW
- RBW/SPAN
- MAX MXR. LEVEL

BW

- RES BW
- RES BW AUTO MAN
- VIDEO BW
- VIDEO BW, AUTO MAN
- MAX. NO. VID AVGS
- VID AVG, ON OFF

DEMOD

- AM DEMOD, ON OFF
- FM DEMOD, ON OFF
- MARKER, NORMAL [1]
- PEAK, SEARCH
- NEXT, PEAK
- MORE →
  - DEMOD, TIME
  - VOLUME
  - SQUELCH
  - SQUELCH, ON OFF
  - AGC, ON OFF
  - PREV MENU

[1] Reads "MARKER DELTA" when two markers are active or "CENTER FREQ" when SPAN = 0.

DISPLAY

- PRINT, PLOT →
  - PRINT
  - COLOR, PRINT
  - PLOT
  - PLOT, OPTIONS →
    - PLOT TRACE A
    - PLOT, TRACE B
    - PLOT GRATICUL
    - PLOT, ANNOT
    - PLOT ORG, DISP GRAT
    - PREV MENU
  - PREV MENU
- DISPLAY, LINE
- DISPL LIN, ON OFF
- THRESHLD
- THRESHLD, ON OFF
- MORE →
  - SCREEN, TITLE →
    - SELECT, CHAR
    - SPACE
    - BACK, SPACE
    - TITLE, DONE
    - CHAR SET, 1 2
    - ERASE, TITLE
  - GRAT, ON OFF
  - ANNOT, ON OFF
  - FREQ DSP OFF
  - FOCUS
  - INTEN [1]

[1] For outdoor use, maximum intensity is 255. For indoor use, keep intensity around 80

EXT

- FULL BAND
- LOCK HARMONIC
- LOCK, ON OFF
- AMPTD. CORRECT
  - AVERAGE, CNV LOSS
  - CNV LOSS, VS FREQ
  - PREV MENU
- SIGNAL, IDENT
  - SIG ID, AT MKR
  - SIG ID. → CF
  - SIG ID. ON OFF
  - MARKER NORMAL
  - PEAK SEARCH
  - NEXT PEAK [1]
- BIAS
  - BIAS, OFF
  - POSITIVE, BIAS
  - NEGATIVE, BIAS
  - PREV, MENU

[1] Active when marker is on

FREQUENCY

- CENTER, FREQ
- START, FREQ
- STOP, FREQ
- CF STEP
- CF STEP, AUTO MAN
- MORE
  - FREQ, OFFSET
  - 10 MHz EXT INT
  - PREV, MENU

FREQ COUNT

- COUNTER, ON OFF
- COUNTER, RES
- MARKER NORMAL
- MARKER DELTA
- PEAK, SEARCH
- NEXT, PEAK

INT

- PRESEL MAN ADJ
- PRESEL, AUTO PK
- SIG ID AT MKR
- SIG ID, → CF
- SIG ID, ON OFF

MKR →

(Single Marker Active)

MARKER, NORMAL
MARKER, DELTA
PEAK, SEARCH
MARKER →, REF LVL
MARKER → CF [1]
MARKER →, CF STEP [1]

MKR →

(Marker Delta Active)

MARKER, NORMAL
MARKER, DELTA
PEAK, SEARCH
MKR Δ →, SPAN [1]
MKR Δ →, CF [2]
MKR Δ →, CF STEP [2]

[1] Active when SPAN > 0 Hz.

[2] " Δ " changes to "1/ Δ " when SPAN = 0 Hz

ON

MARKER, NORMAL
MARKER, DELTA
MARKER,1/DELTA
MKRNOISE, ON OFF
SIG TRK, ON OFF
99% POWER BW

PEAK SEARCH

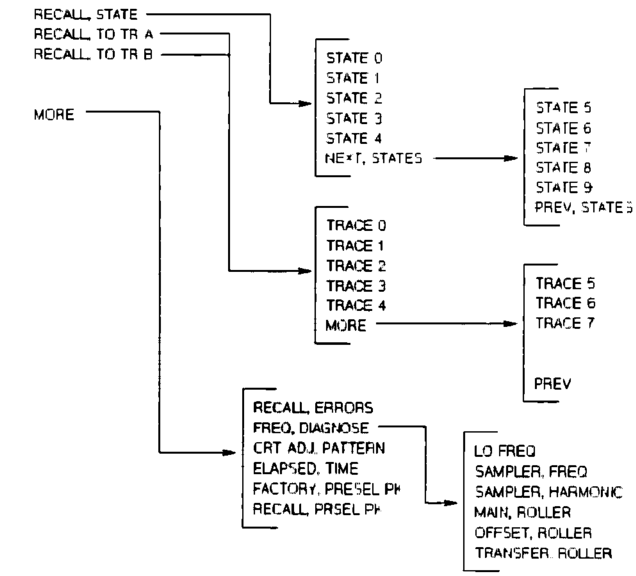
MARKER → CF [1]
MARKER, DELTA
NEXT, PEAK
MKRNOISE, ON OFF
SIG TRK ON OFF
MORE →
- NEXT PK, RIGHT
- NEXT PK, LEFT
- PEAK, EXCURSN
- PEAK, THRESHLD
- PREV, MENU

[1] Active when SPAN > 0 Hz. Reads MARKER NORMAL when SPAN = 0 Hz

PRESET

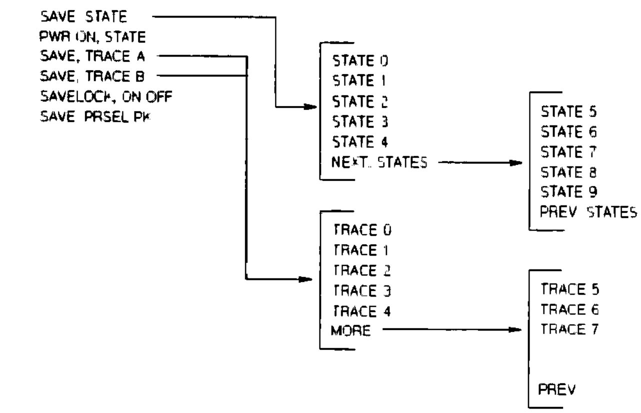
RECALL PWR ON
LAST STATE
REALIGN LO & IF
HP-IB ADDRESS

RECALL



For states and traces stored from titled displays 'STATE', 'TRACE' and numbers are replaced with the first 16 characters of the title.

SAVE



For states and traces stored from titled displays, 'STATE' 'TRACE' and numbers are replaced with the first 16 characters of the title.

SPAN

SPAN, WIDTH
FULL, SPAN
ZERO, SPAN
LAST, SPAN
SWEEP TIME
SWP TIME AUTO MAN

SWEEP

- CONT
- SINGLE
- SWEEP, TIME
- SWP TIME, AUTO MAN
- REAR PNL, OUTPUT →
  - 0 → 10V LO SWP
  - 5V/GHz, (FAV)
  - PREV, MENU

TRACE

- CLR-WRT, A
- MAX HOLD, A
- VIEW, A
- BLANK, A
- TRACE, B →
  - CLR-WRT, B
  - MAX HOLD, B
  - VIEW, B
  - BLANK, B
  - TRACE, A [1]
  - MORE → (see MORE menu below)
- MORE →
  - A-B → A, ON OFF
  - A-B+DL → A, ON OFF
  - MORE TRC MATH →
    - A+B → A
    - A EXCH B
    - B-DL → B
    - PREV, MENU
  - DETECTOR MODES →
    - DETECTOR NORMAL
    - DETECTOR, SAMPLE
    - DETECTOR, POS PEAK
    - DETECTOR, NEG PEAK
    - PREV MENU
  - FFT
  - PREV MENU

[1] TRACE A returns to TRACE A menu.

TRIG

- CONT
- SINGLE
- FREE RUN
- VIDEO
- LINE
- EXTERNAL

2. Operation Reference

2

Operation Reference

This chapter describes the functions available from the front panel. Descriptions are organized by front-panel key and are located on the following pages:

Fundamental Functions

The keys described in this section provide the fundamental functions required for making most measurements. Figure 2-1 illustrates this key group.

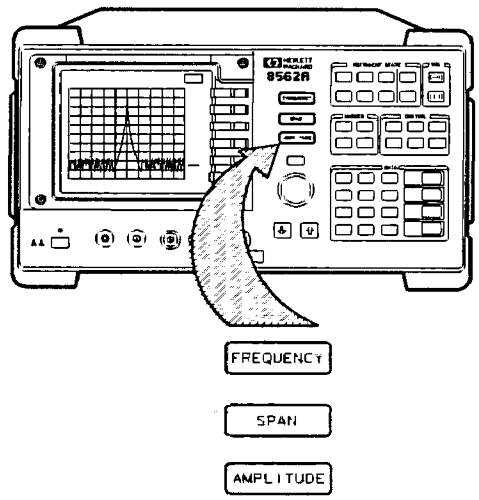


Figure 2-1. Fundamental Functions

(FREQUENCY)

This key accesses a menu of frequency-related functions, which are described below. (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. Figure 2-2 shows the menu displayed by this key.

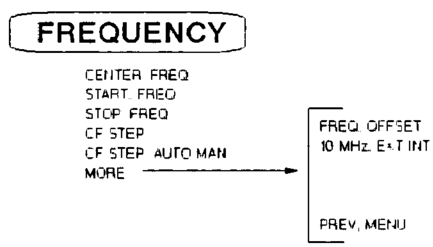


Figure 2-2. (FREQUENCY) Menu

CENTER FREQ

Pressing this key activates the center frequency and sets the spectrum analyzer to the center-frequency/span mode. The center frequency 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. For example, this would occur when a sweep crossed over the following ranges:

HP 8562A/B:
9 kHz to 2.9 GHz range to the 2.75—22 GHz range

HP 8562A/B (Option 026):
9 kHz to 2.9 GHz range to the 2.75—26.5 GHz range

START FREQ

The start frequency is activated and the spectrum analyzer set to the start-frequency/stop-frequency mode. The start frequency 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 span for that harmonic. (minimum span equals harmonic number times 2.5 kHz)

STOP FREQ

This key activates the stop frequency and sets the spectrum analyzer to the start-frequency/stop-frequency mode. The stop frequency can be adjusted using the data keys, the step keys, or the knob. When adjusting the stop frequency, if the selected stop frequency is less than the start frequency, the start frequency decreases to equal the stop frequency minus the minimum span.

CF STEP and CF STEP AUTO MAN

These keys adjust the center frequency step size. When this function is in coupled (AUTO) mode, pressing a step key yields a one-division shift (10% of span) in the center frequency. For zero span, pressing a step key when center frequency is the active function yields a center-frequency shift equal to ~~25%~~ 50% of the resolution bandwidth.

For manual (MAN) mode, press either key to activate the step size. 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, press **CF STEP** 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 mode MAN. When the step size is in manual mode, pressing **CF STEP AUTO MAN** returns the function to coupled mode.

MORE Use this key to access additional, frequency-related functions, which are described below.

FREQ OFFSET This function 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, an F appears on the left edge of the display.

10 MHz EXT INT Pressing this key allows you to select the internal frequency reference (INT) or to supply your own external reference (EXT). An external reference must be 10 MHz ±100 Hz at a nominal amplitude of 0 dBm (limits are from −2 dBm to +10 dBm). Connect the external reference to J9 on the rear panel. 'X' displayed on screen in ext. (active area)

PREV MENU Use this key to access the previous key menu.

(SPAN) This key accesses the menu of span-related functions, which are described below. Figure 2-3 shows the menu displayed by this key.

SPAN

SPAN WIDTH
FULL SPAN
ZERO SPAN
LAST SPAN
SWEEP TIME
SWP TIME AUTO MAN

Figure 2-3. (SPAN) Menu

Note

The low band of the spectrum analyzer ranges from 1 kHz to 2.9 GHz on the HP 8561A and 9 kHz to 2.9 GHz on the HP 8562A/B. The upper band ranges from as follows:

HP 8562A/B:	2.75—22 GHz
HP 8562A/B (Option 026):	2.75—26.5 GHz
HP 8561A:	2.75—6.5 GHz

The frequency span cannot be set to overlap both bands at the same time while in continuous sweep. For example, on the HP 8562A/B, two sweeps are required to cover the range of 2.0 GHz to 3.5 GHz: a low band to sweep from 2.0 GHz to 2.9 GHz, and an upper band to sweep from 2.9 GHz to 3.5 GHz.

`SPAN WIDTH` Pressing this key activates the span width function and sets the spectrum analyzer to center-frequency/span mode. The span 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`.

`FULL SPAN` This function sets the spectrum analyzer to the center-frequency/span mode and sets the span to the maximum range. The maximum span selected depends on whether the center frequency is in low band or upper band. The full span for low band is 2.9 GHz; for the upper band, the full span is as follows:

HP 8562A/B:	19.25 GHz
HP 8562A/B (Option 026):	23.75 GHz
HP 8561A:	3.75 GHz

`ZERO SPAN` Use this function to set 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.

LAST SPAN This function 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.

SWEEP TIME and SWP TIME AUTO MAN These keys adjust the sweep time of the spectrum analyzer. The sweep time is normally a coupled function; that is, the analyzer selects an appropriate sweep time for the chosen span and bandwidth settings. If desired, the sweep time can be adjusted using the data keys, the step keys, or the knob. If the chosen sweep time is too fast for the measurement conditions, the message MEAS UNCAL appears on the display. To activate the sweep time function, press either key. A line under AUTO or MAN indicates whether the sweep time is coupled (AUTO) or is in manual mode (MAN). If the sweep time is in manual mode, press SWP TIME AUTO MAN to return to the coupled mode.

AMPLITUDE This key activates the reference level function and accesses a menu of amplitude-related functions, which are described below. Figure 2-4 shows the menu displayed by this key.

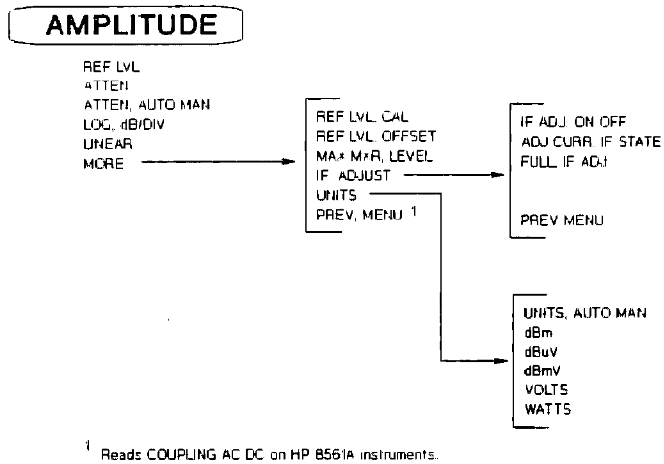


Figure 2-4. AMPLITUDE Menu

REF LVL This key activates the reference level function. The reference level can be adjusted using the data keys, the step keys, or the knob. When the spectrum analyzer scale is in dB/div, the reference level is the topmost horizontal line of 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. The function MAX MXR LEVEL , which is described in this section, is closely related to the reference level.

The minimum reference level available varies with the frequency band and the amplitude scale, as shown in Table 2-1.

Note Values listed in Table 2-1 require setting the analyzer's input attenuator to 0 dB. 0 dB attenuation can only be selected using the data keys. The knob and step keys to not provide this capability.

When switching bands, the reference level may automatically increase if the current reference level is not available in the new band.

Table 2-1.
Frequency Bands and Their Minimum Reference Levels

	Minimum Reference Level*	
Band	**Log Scale**	**Linear Scale**
1 kHz—2.9 GHz	−120.0 dBm	2.2 μV
2.75 GHz—6.46 GHz	−120.0 dBm	2.2 μV
5.8 GHz—13 GHz	−115.0 dBm	4.0 μV
12.4 GHz—19.7 GHz	−105.0 dBm	12.6 μV
19.1 GHz—22 GHz	−100.0 dBm	22.4 μV
Option 026:		
19.1 GHz—26.5 GHz	−100.0 dBm	22.4 μV
* with 0 dB input attenuation		

ATTEN and ATTEN AUTO MAN

Use these keys to adjust the spectrum analyzer input attenuator. The attenuator ranges from 0 dB to 70 dB in 10 dB increments. Input attenuation can be adjusted using the data keys, the step keys, or the knob; 0 dB attenuation can be selected using only the data keys. Attenuation is normally a coupled function and automatically adjusts to changes in the reference level. The reference level, however, generally does not change when the attenuation changes. The attenuator adjusts 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 minus 40 equals −17). This prevents signal compression. Press either **ATTEN** or **ATTEN AUTO MAN** to adjust the input attenuator. 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** recouples the attenuator to the reference level.

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.

LOG dB DIV

This key selects a 1, 2, 5, or 10 dB logarithmic amplitude scale. The default value is 10 dB/division. One and five dB/division scales are not available in fast zero span (sweep times less than 30 ms). Any activated markers normally read out in dBm, and delta markers read the difference between the markers, in dB. If desired, it is possible to read other units while in a log-scale mode (see **UNITS**, below).

LINEAR This function selects a linear amplitude scale. Measurements using a linear scale are normally read in volts, but other units can be selected (see UNITS , below).

MORE Use this key to access additional keys, which are described below.

REF LVL CAL This key allows you to calibrate the reference level. Refer to "Calibrating the Spectrum Analyzer" in Chapter 1.

REF LVL OFFSET Pressing this key introduces an offset to all amplitude readouts, (for example, 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. 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.

MAX MXR LEVEL This function selects the maximum signal amplitude seen at the input mixer. This value is always in dBm, regardless of the selected scale or units. This function 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.

IF ADJUST Pressing this key accesses a menu of adjustment functions, which are described below.

IF ADJ ON OFF

Use this key to turn the automatic IF adjustment ON or OFF. This function is normally ON. When the IF adjustment 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. This function is automatically deactivated when the analyzer is set to zero span; it may be reactivated, if desired. It is automatically reactivated when the analyzer is set to a span greater than zero.

[illegible]

IF adj. should turn off when go to zero span but softkeys + "A" say it's still on?? (later FW's) [illegible]

When the IF adjustment is OFF, an A appears in the active functions column along the left side of the screen graticule.

~~Zero span doesn't~~ turn it off

ADJ CURR IF STATE

This key executes a routine that adjusts only the current state of the IF system.

FULL IF ADJ

Pressing this key executes a complete adjustment of the IF system. Once activated, the key changes to STOP ADJUST which, if pressed, stops the IF adjustment and returns the analyzer to its original state.

PREV MENU

This key accesses the previous menu of keys.

UNITS This key accesses additional amplitude functions, which are described below.

UNITS AUTO MAN

This key select amplitude units automatically (AUTO) or manually (MAN). When in AUTO mode, the default units are dBm (in log scale) or volts (in linear scale).

dBm

Use this key to select amplitude units in absolute decibel referenced to 1 milliwatt.

dBμV

Use this key to select amplitude units in absolute decibel referenced to 1 microvolt.

dBmV

Use this key to select amplitude units in absolute decibel referenced to 1 millivolt.

VOLTS

Use this key to select amplitude units in volts.

WATTS

Use this key to select amplitude units in watts.

PREV MENU
(HP 8562A/B only)

Pressing this key accesses the previous menu of keys.

COUPLING AC DC
(HP 8561A only)

This key selects either ac or dc coupling of the instrument's input attenuator. AC coupling is the default state. Selecting ac coupling switches in a dc-blocking capacitor. This capacitor protects the instrument from damage caused by dc signals at the input.

Caution

DC coupling should only be used with caution. Use only if a lower frequency limit is required, and a dc signal is not present at the INPUT 50Ω connector.

Marker Functions

Marker functions read out frequencies and amplitudes located along the displayed trace. They can make relative measurements, automatically locate the highest amplitude signal on a trace, and mark and track a signal. Figure 2-5 illustrates this group of keys.

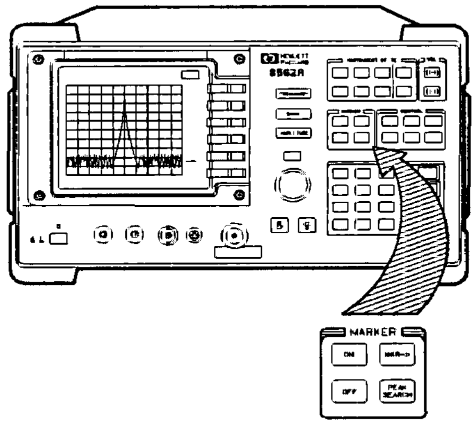


Figure 2-5. Marker Functions

Marker (ON)

This key accesses a menu of keys, which are described below. (ON) also activates the current marker mode (such as MARKER DELTA); if no mode is active, (ON) activates MARKER NORMAL. Figure 2-6 shows the menu displayed by this key.

(ON)

MARKER NORMAL
MARKER DELTA
MARKER 1/DELTA
MKRNOISE ON OFF
SIG TRK ON OFF
99% POWER BW

Figure 2-6. Marker (ON) Menu

`MARKER NORMAL`

This key activates a single marker and places it at the center of the trace. If one marker is already on, no operation takes place. If two markers are on (as in **MARKER DELTA** mode), this function 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.

MARKER DELTA

This function reads the difference in amplitude and frequency (or time, when the frequency span equals 0 Hz) 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, this function 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 this key once makes it the active function. However, if the marker delta function is already the active function, pressing this key 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. You can toggle between **MARKER DELTA** and **MARKER 1/DELTA** without changing the status of the markers.

MARKER 1/DELTA

This function reads the reciprocal of the frequency or time difference between two markers, and displays this value 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, the active function block shows the difference between the two markers in time. If two markers are on and the frequency span is equal to 0 Hz, the active function block shows the difference in frequency. You can toggle between **MARKER 1/DELTA** and **MARKER DELTA** without changing the status of the markers.

MKRNOISE ON OFF

Turn the marker noise function ON or OFF by using this key. 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 32 data points (16 data points on one side of the marker, the marker itself, and 15 data points on the other side). This average is corrected for effects of the log amplifier, bandwidth shape factor, RF detector, and resolution bandwidth. If two markers are on, this function works on the active marker and not on the anchor marker. Turning off the marker also turns off this function.

SIG TRK ON OFF

Turn the signal tracking function ON or OFF by using this key. 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 marker signal at the center frequency. This allows you to quickly "zoom in" from a wide span to a narrow one without losing the signal from the screen. Or, use signal tracking 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.

99% PWR BW

This function integrates the power displayed and places the delta markers at the points containing 99% of the power. The power-bandwidth routine first computes the combined power of all signal responses contained in the trace. It then computes the bandwidth equal to 99% of the total power and displays this value on-screen.

Marker (OFF) This key turns off all markers, including frequency counter and demodulation markers.

(PEAK SEARCH) Pressing this key places a marker on the highest point of a trace and accesses a menu of marker functions. 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 and ignores the LO feedthrough as a peak. The functions available from the (PEAK SEARCH) menu are described below. Figure 2-7 shows the menu displayed by this key.

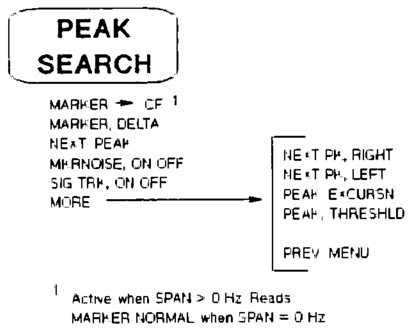


Figure 2-7. (PEAK SEARCH) **Menu**

MARKER → CF Set the center frequency equal to the marker frequency by using this key. This function provides a quick way to move a signal to the center of the screen. When the frequency span is equal to 0 Hz, this key accesses the **MARKER NORMAL** function.

MARKER DELTA Using this function causes the analyzer to read the difference in amplitude and frequency (or time, when the frequency span equals 0 Hz) 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, this function 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 the marker delta function is already on, pressing this key 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.

NEXT PEAK — Press this key to move the active marker to the next highest trace point relative to the current marker position. The next peak must meet the current peak excursion and peak threshold criteria in order to be considered a peak. This function finds successively lower peaks when the key is pressed repeatedly. Setting the peak excursion and threshold values is discussed under the MORE key.

MKRNOISE ON OFF — Turn the marker noise function ON or OFF with this key. 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 32 data points (16 data points on one side of the marker, the marker itself, and 15 data points on the other side). This average is corrected for effects of the log amplifier, bandwidth shape factor, RF detector, and resolution bandwidth. If two markers are on, this function works on the active marker and not on the anchor marker. Turning off the marker also turns off this function.

SIG TRK ON OFF — Turn the signal tracking function ON or OFF with this key. The signal track function keeps the active marker on 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 marker signal at the center frequency. This allows you to quickly "zoom in" from a wide span to a narrow one without losing the signal from the screen. Or, use signal tracking 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.

MORE — This key accesses additional marker functions, which are described below.

NEXT PK RIGHT — Pressing this key finds the next peak to the right of the current marker position. The trace peak must meet the current peak excursion and peak threshold criteria in order to be considered a peak. Setting the peak excursion and threshold values is discribed in the following key definitions.

NEXT PK LEFT — Pressing this key finds the next peak to the left of the current marker position. The trace peak must meet the current peak excursion and peak threshold criteria in order to be considered a peak.

PEAK EXCURSN

This function 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 and then decrease in amplitude 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 Figure 2-8). The excursion values range from 0 dB to 30 dB in log mode, and 0.1 ΔDIVs to 10.0 ΔDIVs 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.

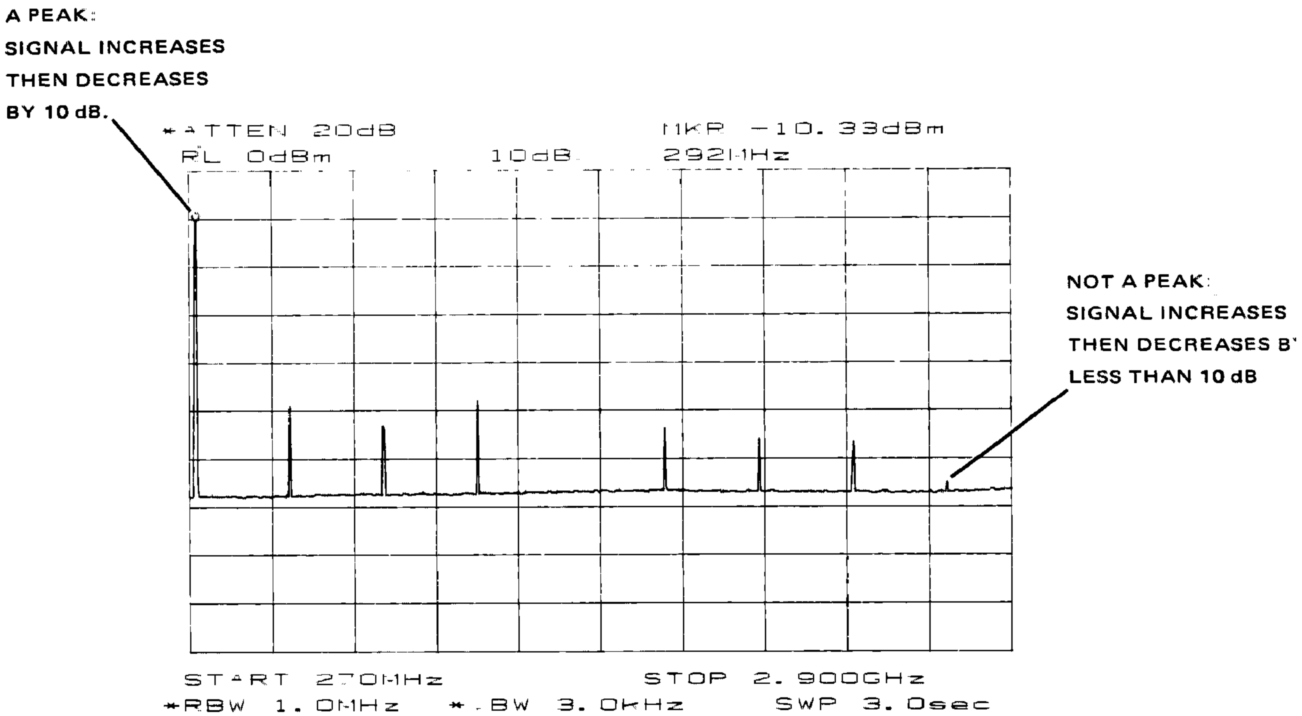


Figure 2-8. PEAK EXCURSN Defines the Peaks on a Trace

PEAK THRESHLD

Set the minimum amplitude level from which a peak on the trace can be detected with this key. This function places a dashed line across the graticule to denote the selected level. (The line disappears when the menu is exited.) 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 −120 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.

PREV MENU — This key displays the previous key menu.

(MKR →) This key accesses a menu of marker functions, which are described below. If no markers are active, (MKR) activates `MARKER NORMAL`. Figure 2-9 shows the menu displayed by this key.

The menu of marker functions that appear when (MKR →) is pressed, depends on (1) the marker mode selected, either normal marker or delta marker, and (2) the frequency span. The menus for these different modes are shown below.

(MKR →) (Single Marker Active)	(MKR →) (Marker Delta Active)
MARKER NORMAL	MARKER NORMAL
MARKER DELTA	MARKER DELTA
PEAK SEARCH	PEAK SEARCH
MARKER → REF LVL	MKR Δ → SPAN [1]
MARKER → CF [1]	MKR Δ → CF [2]
MARKER → CF STEP [1]	MKR Δ → CF STEP [2]

1 Active when SPAN > 0 Hz

2 "Δ" changes to "1/Δ" when SPAN = 0 Hz

Figure 2-9. (MKR →) Menu

`MARKER NORMAL` Pressing this key activates a single marker. 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.

`MARKER DELTA` Pressing this key causes the analyzer to read the difference in amplitude and frequency (or time, when the frequency span equals 0 Hz) 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, this function 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 this function is already on, 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.

PEAK SEARCH This function 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; this function does not alter the active function. In most cases, a peak search does not find the LO feedthrough as a peak.

Note

The appearance of the following keys in the (MKR→) menu depend on the settings of the analyzer. See Figure 2-9 for the conditions required for each key.

MARKER → REF LVL Use this function to set the amplitude reference level equal to the amplitude of the marker. This key does not alter the active function.

MARKER→CF This key sets the center frequency equal to the frequency of the marker. This key does not alter the active function.

MARKER→CF STEP This function sets the center frequency step-size equal to the marker frequency. This function provides a quick way to move a signal to the center of the screen. The active function is not affected. This key is not available in zero span.

MKRΔ→SPAN This key sets the start frequency equal to the frequency of the left marker and sets the stop frequency equal to the frequency of the right marker. This does not change the active function.

MKRΔ→CF Pressing this key sets the center frequency equal to the difference in frequency between the two markers. This key does not change the active function.

MKR Δ →CF STEP This function sets the center frequency step-size equal to the difference in frequency between the two markers. This key does not change the active function.

MKR 1/Δ→CF This key sets the center frequency equal to the frequency corresponding to the time period designated by the two markers. This key does not change the active function.

MKR 1/Δ → CF STEP Pressing this key sets the center frequency step-size equal to the frequency corresponding to the time period designated by the two markers. This key does not change the active function.

Instrument State Functions

Instrument State functions generally affect the state of the entire spectrum analyzer and not just of a single function. Figure 2-10 illustrates this group of keys.

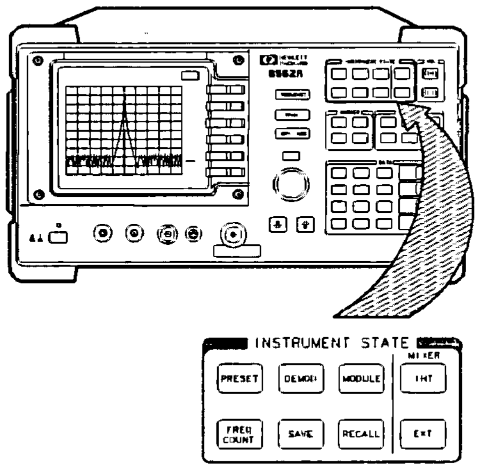


Figure 2-10. Instrument State Functions

(PRESET)

Pressing this key sets the spectrum analyzer to a known, predefined state as shown in Table 2-2. (PRESET) does not affect the spectrum analyzer HP-IB address, the contents of any data or trace registers, stored preselector data, or whether the state and trace registers are locked (SAVELOCK). Figure 2-11 shows the menu displayed by this key.

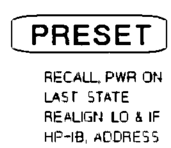


Figure 2-11. (PRESET) Menu

Table 2-2. State of Instrument After (PRESET) is Executed

Function	State
FREQ MODE	CENTER-SPAN
CENTER FREQ	HP 8561A: 3.250 GHz
	HP 8562A: 12.38 GHz
	HP 8562A (Option 026): 14.63 GHz
	HP 8562B: 1.45 GHz
SPAN	HP 8561A: 6.500 GHz
	HP 8562A: 19.25 GHz
	HP 8562A (Option 026): 23.75 GHz
	HP 8562B: 2.9 GHz
CF STEP	1.93 GHz AUTO
	Option 026: 2.375 GHz
FREQ OFFSET	0 MHz, OFF
10 MHz REF	INTERNAL
REFERENCE LEVEL	0 dB~~m~~
INPUT ATTENUATION	10 dB, AUTO
MAX MIXER LEVEL	−10 dBm
REF LEVEL OFFSET	0 dB~~m,~~ OFF
VERTICAL SCALE	10 dB/DIV
UNITS	dBm, AUTO
AUTO IF ADJUST	ON
DETECTOR	NORMAL
RESOLUTION BW	1 MHz, AUTO
VIDEO BW	1 MHz, AUTO
VBW/RBW RATIO	1
RBW/SPAN RATIO	0.011
VIDEO AVERAGE	100, OFF
SWEEP TIME	HP 8561A: 200 ms AUTO
	HP 8562A/B: 400 ms AUTO
	HP 8562A (Option 026): 500 ms AUTO
TRIGGER MODE	CONTINUOUS
TRIGGER SOURCE	FREE-RUN
VIDEO TRIG LEVEL	0 dBm
SWEEP OUTPUT	0—10V LO-SWEEP RAMP
MARKER MODE	OFF
NOISE MARKER	OFF
SIGNAL TRACK	OFF
PEAK THRESHOLD	−120 dBm
PEAK EXCURSION	6 dB

FWD for [illegible] & SATG stays on .5/GHz if set there

Table 2-2.
State of Instrument After (PRESET) is Executed
(continued)

Function	State
FREQUENCY COUNTER	OFF
FREQUENCY COUNTER RESOLUTION	10 kHz
TRACE A	CLEAR-WRITE
TRACE B	BLANK
TRACE-DATA	FORMAT P
A−B→A	OFF
A−B+DISPLAY LINE→A	OFF
DISPLAY LINE	0 dBm, OFF
THRESHOLD	−90 dBm, OFF
GRATICULE	ON
ANNOTATION	ON
FREQUENCY DISPLAY OFF	CLEAR
DEMODULATION	FM OFF AM OFF
DEMODULATION TIME	1 second
SQUELCH	OFF
SQUELCH LEVEL	−120 dBm
AGC	OFF
VOLUME	0
SIGNAL IDENTIFICATION	OFF
MIXER	INT
EXT MIXER LO HARMONIC	6
MIXER CONV LOSS	30.0 dBm
BAND LOCK	OFF
EXT MIXER BIAS	0 mA

FM D
stays where it's set

stays where it's set

`RECALL PWR ON` This key sets the instrument state to the same state that occurred when (LINE) was switched on. This state must be saved initially under the (SAVE) key.

`LAST STATE` Pressing this key recalls the instrument state that existed before (PRESET) was pressed or the power was turned off.

`REALIGN LO & IF` Activate the automatic local oscillator (LO) and intermediate frequency (IF) alignment routines with this key. These are the same routines that occur when (LINE) is switched on. When this function is on, the annotation key changes to `STOP REALIGN` , to allow you to stop the routine before it is finished. If alignment routines are stopped, the accuracy of measurements made by the instrument may not meet published specifications.

the menu changes not the annotation key

`HP-IB ADDRESS` This key displays the current HP-IB address in the active function block. To change the address, use the data keys (and terminate the entry with (ENTER)), or use the step keys or the knob (and terminate with (HOLD)). The spectrum analyzer will continue to use this address until (LINE) is switched off. To store the address so that it will return when (LINE) is switched on, press `STORE HP-IB` after selecting an address.

(FREQ COUNT) This key 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 the marker normal or marker delta functions are 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 this key 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. All signal counting is done during the retrace time of the sweep. (FREQ COUNT) uses the same marker priority as described at the end of this chapter.

Figure 2-12 shows the menu displayed by this key.

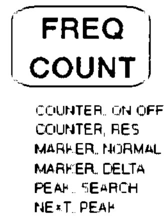


Figure 2-12. (FREQ COUNT) Menu

`COUNTER ON OFF` This key allows you to activate or deactivate the counter mode. The counted value appears in the upper-right corner of the display.

`COUNTER RES` Use this function to adjust the resolution of the frequency- count measurement. The resolution ranges from 10 Hz to 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.

`MARKER NORMAL` This key activates a single marker and places it at the center of the trace. If one marker is already on, no operation takes place. If two markers are on (as in `MARKER DELTA` mode), this function 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.

MARKER DELTA Pressing this key causes the analyzer to read the difference in amplitude and frequency (or time, when the frequency span equals 0 Hz) 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, this function 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 this key 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.

PEAK SEARCH Pressing this key places a marker on the highest point on a trace. The peak must meet the current peak excursion and peak threshold criteria in order to be considered a peak. The frequency and amplitude of the marker are displayed in the upper- right corner of the screen; a peak search does not alter the active function.

NEXT PEAK Press this key to move the active marker to the next highest trace point relative to the current marker position. This function finds successively lower peaks when the key is pressed repeatedly.

DEMOD — This key accesses a menu of demodulation functions, which are described below. An example of how to perform demodulation appears in Chapter 3. Figure 2-13 shows the menu displayed by this key.

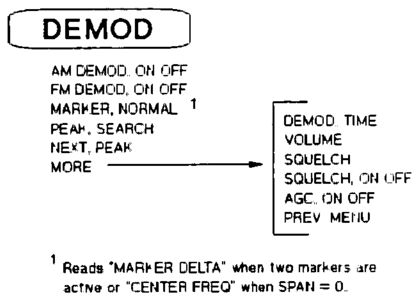


Figure 2-13. DEMOD Menu

`AM DEMOD ON OFF` — Turn AM demodulation ON or OFF by using this key. If no marker is active and the frequency span is greater than 0 Hz, pressing this key 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.

`FM DEMOD ON OFF` — Turn FM demodulation ON or OFF by using this key. If no marker is active and the frequency span is greater than 0 Hz, pressing this key 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.

`MARKER NORMAL`
`MARKER DELTA`
`CENTER FREQ` — One of three keys will be presented at this position depending on the following instrument conditions:

`MARKER NORMAL`	This key appears when one marker is on and the frequency span is greater than 0 Hz.
`MARKER DELTA`	This key appears when two markers are on and the frequency span is greater then 0 Hz.
`CENTER FREQ`	This key appears when the frequency span equals 0 Hz.

MARKER NORMAL This key activates a single marker and places it at the center of the trace. If one marker is already on, no operation takes place. If two markers are on (as in marker delta mode), ~~pressing~~ this key 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.

MARKER DELTA This key causes the analyzer to read the difference in amplitude and frequency (~~or time, when the frequency span equals 0 Hz)~~ between two markers. These values are displayed in the active function block and in the upper-right corner of the display. If a single marker is already on, the marker delta function 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 this key once makes it the active function. When marker delta is already the active function, pressing this key 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.

OK

CENTER FREQ Pressing this key activates the center frequency. To adjust the center frequency, use the data keys, the step keys, or the knob.

PEAK SEARCH This key 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; This function does not alter the active function.

NEXT PEAK This key moves the active marker to the next highest trace point relative to the current marker position. This function finds successively lower peaks when the key is pressed repeatedly.

MORE Press this key to access a menu of additional demodulation functions.

DEMOD TIME This function 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, except for transients during retrace. To avoid these transients, place the analyzer in single-trigger mode with span equal to 0 Hz. When the frequency span equals 0 Hz, demodulation is continuous.

VOLUME Pressing this key adjusts the volume of the demodulated signal. Use the VOL keys (located in the upper-right corner of the front panel) to lower or raise the volume. The volume can also be changed using the data keys, the step keys, or the knob. The volume level is displayed in the active function block. This level is a unitless value in which 0 equals no volume and 15 equals maximum volume.

SQUELCH and SQUELCH ON OFF These keys adjust 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.

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

PREV MENU This key displays the previous menu of keys.

(SAVE) This key accesses a menu of keys that allow you to save instrument-state data and trace data. These functions are described below. Figure 2-14 shows the menu displayed by this key.

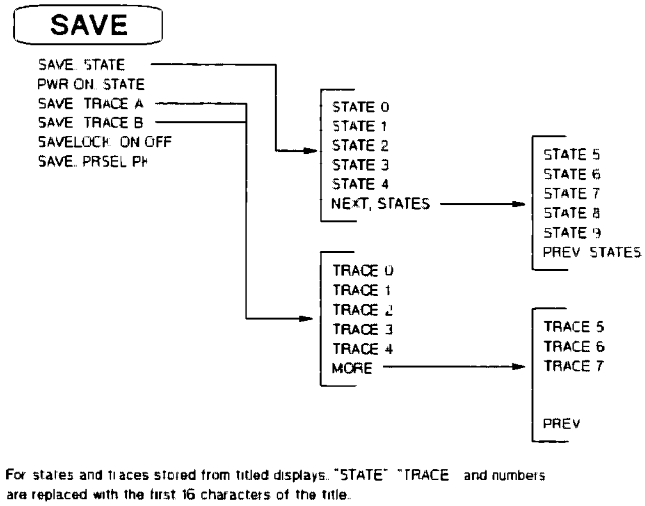


Figure 2-14. (SAVE) Menu

SAVE STATE — Pressing this key displays a menu of registers in which the current instrument state can be stored. Registers 0 through 4 appear on the display, as well as the key NEXT STATES. Press NEXT STATES to access registers 5 through 9. To store current instrument data in a desired register, press the key next to the register number, or enter the number using the data keys. Terminate the entry with any units key ((Hz), (kHz), etc.).

If a stored state has a title, the first sixteen characters of the title are used as the key 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 annotation "STATE 0" is replaced with "Harmonic Test".

PWR ON STATE — This key saves the current instrument state in the power-on register. The spectrum analyzer will then be set to this state whenever (LINE) is switched on. The same state can be retrieved with RECALL PWR ON (available from the (PRESET) menu).

SAVE TRACE A

Pressing this key displays a menu of eight registers in which the current contents of trace A can be stored. Registers 0 through 4 appear on the display, as well as the key MORE. Press MORE to view registers 5 through 7. To store current trace A data in a desired register, press the key next to the register number, or enter the number using the data keys. Terminate the entry with any units key (Hz, kHz, etc). Like SAVE STATE, SAVE TRACE A registers are annotated with a label derived from the display title.

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.

SAVE TRACE B

Pressing this key displays a menu of eight registers in which the current contents of trace B can be stored. Registers 0 through 4 appear on the display, as well as the key MORE. Press MORE to view registers 5 through 7. To store the data, press the key next to the desired register number, or enter the number using the data keys. Terminate the entry with any units (Hz, kHz, etc). Like SAVE STATE, SAVE TRACE B registers are annotated with a label derived from the display title.

SAVELOCK ON OFF

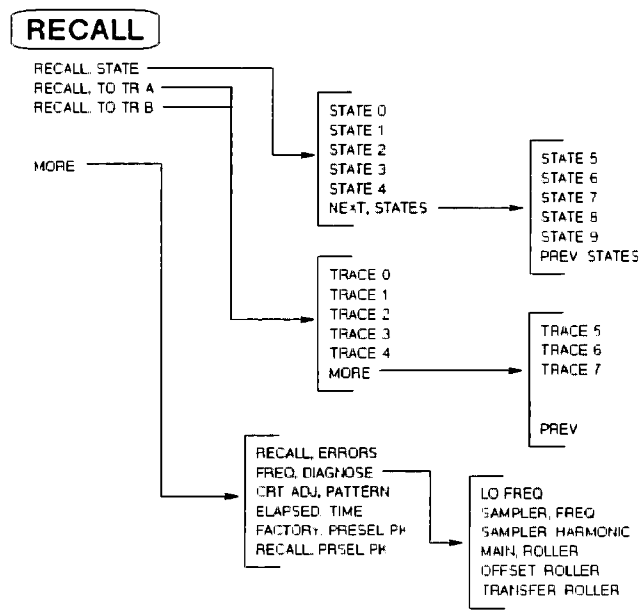
This key prevents storing any new data in the state or trace registers. When the function is ON, the registers are "locked"; the data in them cannot be erased or overwritten, although the data can be recalled. To "unlock" the registers and store new data, switch the function to OFF.

SAVE PRES PK **(HP 8562A only)**

Use this function to save the current preselector-peak data in a user data table. This does not affect the preselector data that is set at the factory, which is in a factory data table. To recall the saved data, use the RECALL PRSEL PK key listed under RECALL. For more information on the preselector data tables, refer to MIXER INT in this chapter.

(MODULE) Press this key to gain access to additional functions of an option module, such as the HP 85629B Test and Adjustment Module or the HP 85620A Mass Memory Module. The option module must be connected to J3 on the spectrum analyzer's rear panel J3. 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.

(RECALL) This key accesses a menu of keys that allow you to recall stored instrument-state data and trace data. The keys are described below. Figure 2-15 shows the menu displayed by this key.



For states and traces stored from titled displays 'STATE 'TRACE and numbers are replaced with the first 16 characters of the title

Figure 2-15. (RECALL) Menu

RECALL STATE Pressing this key displays a menu of ten registers from which the stored instrument states can be recalled and displayed on the spectrum analyzer screen. Registers 0 through 4 appear on the display, as well as NEXT STATES. Press NEXT STATES to view registers 5 through 9. To recall the data, press the key next to the desired register number, or enter the number using the data keys. Terminate the entry with any units ((Hz), (kHz), etc.). If a save-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 key 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 annotation "STATE 0" is replaced with "Harmonic Test".

`RECALL to TRA`

This function displays a menu of eight registers from which trace data can be recalled and placed in trace A. Registers 0 through 4 appear on the display, as well as `MORE`. Press `MORE` to view registers 5 through 7. To recall trace data from a desired register into trace A, press the key next to the register number, or enter the number using the data keys. Terminate the entry with any units ([Hz], [kHz], etc) Like `RECALL STATE`, `RECALL TO TRA` registers are annotated with a label derived from the display title. If a save-trace register does not contain previously-saved trace data, the `NOT SAVED!` message appears.

`RECALL TO TRB`

This function displays a menu of registers from which trace data can be recalled and placed in trace B. Registers 0 through 4 appear in the display, as well as `MORE`. Press `MORE` to view registers 5 through 7 and `PREV MENU` (for returning to the previous menu). To recall trace data from a desired register into trace B, press the key next to the register number, or enter the number using the data keys. Terminate the entry with any units ([Hz], [kHz], etc). Like `RECALL STATE`, `RECALL TO TRB` registers are annotated with a label derived from the display title. If a save-trace register does not contain previously-saved trace data, the `NOT SAVED!` message appears.

`MORE`

This key accesses additional keys, which are described below.

`RECALL ERRORS`

Displays the last error that has occurred with this key. Use the step keys to cycle through accumulated errors. A list of HP-IB remote-operation error codes appears in Appendix C. For additional error information, refer to the Installation and Service Manual.

Hint

If you are using an external frequency reference and generating errors, be sure your reference meets the requirements specified in Chapter 1 of the *Installation Manual.*

`FREQ DIAGNOSE`

Pressing this key displays a menu of diagnostic functions, described below, which allow various internal parameters of the analyzer to be retrieved.

`LO FREQ`

This key displays the first local oscillator frequency corresponding to the current start frequency. In multiband sweeps, the frequency displayed corresponds to the band being swept when the key was pressed.

SAMPLER FREQ

This key displays the sampling oscillator frequency corresponding to the current start frequency. In multiband sweeps, the frequency displayed corresponds to the band being swept when the key was pressed.

SAMPLER HARMONIC

This key displays the sampler harmonic number corresponding to the current start frequency. In multiband sweeps, the harmonic displayed corresponds to the sampler harmonic for the local- oscillator start frequency of the band being swept when the key was pressed.

MAIN ROLLER

This key displays the main-roller oscillator frequency corresponding to the current start frequency. In multiband sweeps, the frequency displayed corresponds to the band being swept when the key was pressed.

OFFSET ROLLER

This key displays the offset-roller oscillator frequency corresponding to the current start frequency. The frequency displayed corresponds to the frequency of the offset-roller oscillator when this key is pressed.

TRANSFER ROLLER

This key displays the transfer-roller oscillator frequency corresponding to the current start frequency.

CRT ADJ PATTERN

This key 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, blanking, etc.). Three of these adjustments—X POSN, Y POSN, and TRACE ALIGN—are available from the rear panel. Use these three adjustments to align the display. Refer to Figure 2-16. When this function is active, the key annotation changes to EXIT. Press EXIT to remove the pattern. For other display adjustments, refer to the *Installation Manual.*

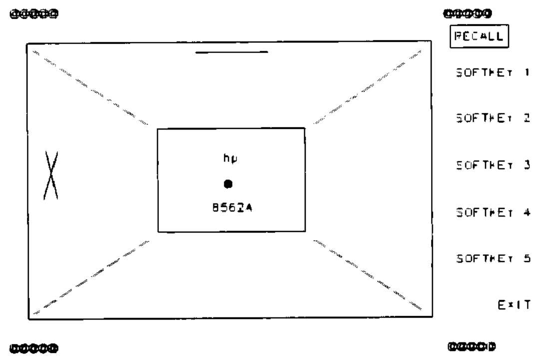


Figure 2-16. CRT Alignment Pattern

`ELAPSED TIME`

This key displays the cumulative operating time of the spectrum analyzer. The value, which is expressed in hours, appears in the active function block.

`FACTORY PRESEL PK` **(HP 8562A only)**

This function restores the preselector-peaking data that is set at the factory 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 MIXER INT in this chapter.

`RECALL PRSEL PK` **(HP 8562A only)**

This function 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. More information on preselector data tables appears under the internal mixing key INT.

MIXER (INT)

This key accesses a menu of functions that employ the internal input mixer in the spectrum analyzer. Always press (INT) after using an external mixer. These functions are described below. Figure 2-17 shows the menu displayed by this key.

(INT)

PRESEL MAN ADJ
PRESEL AUTO PK
SIG ID, AT MKR
SIG ID, →CF
SIG ID ON OFF

Figure 2-17. MIXER (INT) Menu

Preselector Peaking

The analyzer has three tables of preselector data. These tables are described below.

Current Data Table

This table contains the data used to tune the preselector. The data is obtained from either the user data table or the factory data table. You can modify the data in the current table using the PRESEL MAN ADJ or the PRESEL AUTO PK functions. To save the data, use the SAVE PRSEL PK function listed under (SAVE). If the current data is not saved, it is lost when the instrument is preset or turned off.

Factory Data Table

This is the default data table. This data is set at the factory and can only be changed by service personnel. This data is sent to the current data table when (PRESET) is pressed. The data in this table is sufficient for virtually all applications, since this is the table that allows the analyzer to meet its published specifications.

User Data Table

The data in this table is a previously-saved current data table that is recalled using RECALL PRSEL PK . The data is stored in nonvolatile memory and is placed in the current data table when it is recalled using RECALL PRSEL PK listed under (RECALL).

PRESEL MAN ADJ
(HP 8562A only)

Adjust the preselector tracking with this key. Before pressing this key, place a marker on a desired signal on a trace. 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 displays a message ACTIVATE MARKER, which must be performed before this key can be used. 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 the SAVE PRES PK found under (SAVE).

PRESEL AUTO PK

Automatically peaks the preselector on a desired signal on a trace when tuned above band 0. Before pressing this key, set the trace to clear-write mode, and place a marker on the desired point The peaking routine zooms to zero span, peaks the preselector tracking, then returns to the original position. Press PRESEL MAN ADJ to read the new preselector peaking number.

SIG ID AT MKR

Pressing this key activates a signal identification function that locates the frequency and harmonic number of the mixer response Before pressing this key, place a marker on the desired signal. 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.

SIG ID → CF

Doesn't ~~do~~ give this "DO SIG ID AT MKR"

This function sets the center frequency to a correct mixer response obtained from 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 ? No MKR momentarily appears in the active function block, and no other action takes place. Use this function only after executing SIG ID AT MKR.

SIG ID ON OFF

Switch the manual signal identification function ON and OFF with this key. When ON, this function employs the 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~~ 30 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.)

MIXER [EXT]

Use this key to access a menu of functions that allow you to extend the frequency range using external mixers. These functions are described below. Figure 2-18 shows the menu displayed by this key.

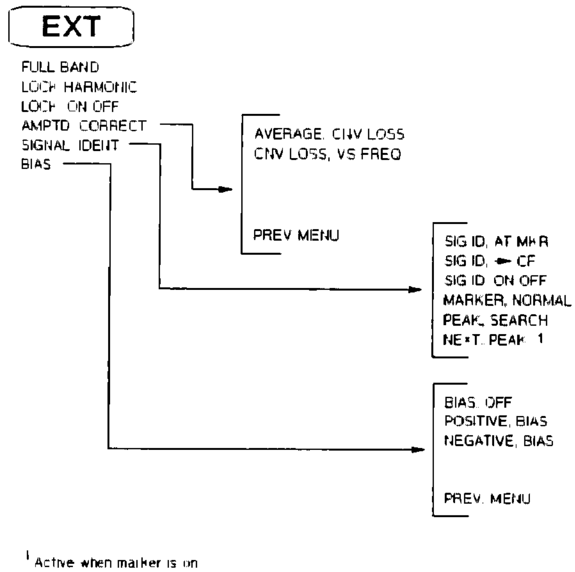


Figure 2-18. MIXER [EXT] Menu

FULL BAND

This key allows you to select a commonly used frequency band above 18 GHz. These bands are shown in Table 2-3. Use the step keys or the knob to select a desired frequency band; the selected band appears in the active function block. Activating this function also activates the harmonic lock function, which is described below.

LOCK HARMONIC **and** LOCK ON OFF

Display the current harmonic number with this key. A harmonic number refers to the local oscillator harmonic that is used to sweep a specific frequency band. These numbers are shown in Table 2-3 When LOCK HARMONIC 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 HARMONIC is OFF, more than one harmonic can be used to sweep across a desired span. For example, with HARMONIC LOCK OFF , you can sweep a span from 26.5 GHz to 60 GHz. In this case, the spectrum analyzer will automatically sweep first using 8− and then using 10−. When FULL SPAN is active and LOCK HARMONIC is OFF, the entire range of external mixing appears on the display.

Table 2-3.
Mixing Harmonics for Frequencies above 18 GHz

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

FW/ D
; f a val. is c
the default va
Gi

AMPTD CORRECT

Press this key to display a menu of functions that set conversion losses and flatness data.

AVERAGE CNV LOSS

This key 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 the key labeled CNV LOSS VS FREQ . Any change to the average conversion loss also affects the flatness data, which is described below.

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

CNV LOSS VS FREQ

This function displays the stored conversion loss for a specific frequency in the current 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 . Table 2-4 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 front panel IF INPUT and set the analyzer to sweep the associated band.

Table 2-4.
Conversion Losses for Frequencies above 18 GHz

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

PREV MENU

This key displays the previous menu of keys.

SIGNAL IDENT

This key displays a menu of signal identification functions, which are described below.

SIG ID AT MKR

This key 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 mode, then no action takes place and the message ACTIVATE TRACE appears. During the signal- identification routine, SIG ID AT MKR is replaced with STOP SIG ID .

SIG ID → CF

This function sets the center frequency to a correct mixer response obtained from 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

Doesn't give it

MKR momentarily appears in the active function block, and no other action takes place. Use this function only after executing SIG ID AT MKR . This function is available when the center frequency is less than the following values:

HP 8562A/B:	22 GHz
HP 8562A (Option 026):	26.5 GHz
HP 8561A:	6.5 GHz

SIG ID ON OFF

This function 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. The correct signal is shifted horizontally by less than 80 kHz. To ensure accuracy, limit the frequency span to less than 20 MHz.

80 kHz p 2-37

80 kHz p 2-37

MARKER NORMAL

Press this key to activate a single marker and places it at the center of the trace. If one marker is already on, no operation takes place. If two markers are on (as in marker delta mode), this function 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.

Add MKR Delta

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.

PEAK SEARCH

This function 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; this function does not alter the active function.

NEXT PEAK

Note This functions is only displayed after MARKER NORMAL is pressed.

Press this key to move the active marker to the next highest trace point relative to the current marker position. This function finds successively lower peaks when the key is pressed repeatedly.

BIAS

This key displays a menu of functions that allow you to select external-mixer bias. The bias is provided on the center conductor of the IF INPUT connector on the front panel. These functions are described below.

Caution

The open-circuit bias 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 (that is, the amount of current that would flow if the center conductor of the IF line were shorted to ground). The actual amount of current flowing into the mixer will be less.

BIAS OFF

Turns off the external-mixer bias with this key.

POSITIVE BIAS

Select positive mixer bias for an external mixer with this key. 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.

NEGATIVE BIAS

Select negative mixer bias for an external mixer with this key. 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.

PREV MENU

This key displays the previous menu of keys.

Control Functions

Control functions adjust the resolution and video bandwidths, the sweep time, the display, and other functions that control spectrum analyzer measurement capabilities. Figure 2-19 illustrates this group of keys.

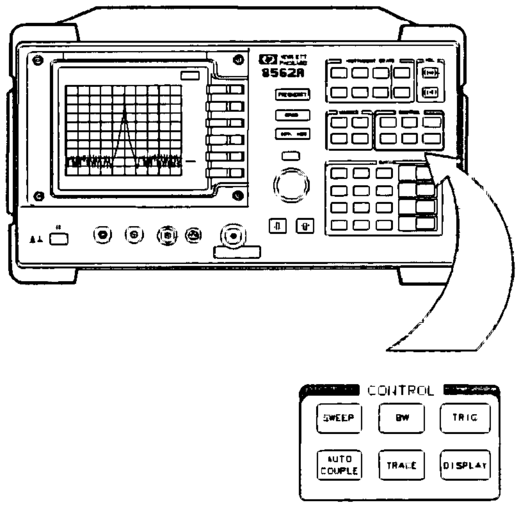


Figure 2-19. Control Functions

(SWEEP) This key accesses a menu of sweep-related functions, which are described below. (SWEEP) also activates the sweep-time function. Figure 2-20 shows the menu displayed by this key.

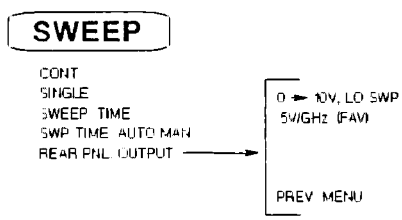


Figure 2-20. (SWEEP) Menu

CONT This key activates the continuous-sweep mode. The key label is underlined to indicate that it is the current sweep mode. Press this key to restart the sweep at the next trigger.

SINGLE This key activates the single-sweep mode. The key label is underlined, to indicate that it is the current sweep mode. Press this key to restart the sweep at the next trigger. When this function is active, an S appears on the left edge of the display.

SWEEP TIME and SWP TIME AUTO MAN These keys adjust the sweep time of the spectrum analyzer. Press either key to activate this function. To change the sweep time, use the data keys, the step keys, or the knob. A line under AUTO or MAN indicates whether the sweep time can be manually set (MAN) or is coupled (AUTO), based on the resolution bandwidth, span, and video bandwidth settings. When the sweep time is in manual mode, pressing SWP TIME AUTO MAN returns the sweep time to coupled mode.

REAR PNL OUTPUT This key displays a menu of functions that provide access to certain signals via J8 on the rear-panel. These functions are described below.

0 → 10V LO SWP

This function sends a 0—10 V ramp to J8 on the rear panel. This ramp corresponds to the sweep ramp that tunes the first local oscillator (LO). In multiband sweeps, one ramp is provided for each frequency band.

.5V/GHz (FAV)

This function sends a dc ramp to J8 on the rear panel. The ramp is a frequency-analog voltage (FAV) corresponding to the tuned frequency of the analyzer. The voltage is 0.5 V per GHz, from 0 Hz to the following frequencies:

HP 8562A/B: ....22 GHz
HP 8562A/B (Option 026): .... 26.5 GHz
HP 8561A: .... 6.5 GHz

PREV MENU

This key displays the previous menu of keys.

(AUTO COUPLE) This key accesses a menu of coupled-mode functions, which are described below. Figure 2-21 shows the menu displayed by this key.

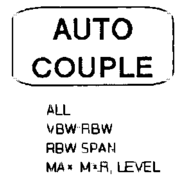


Figure 2-21. (AUTO COUPLE) Menu

ALL This key sets the video bandwidth, the resolution bandwidth, the input attenuator, the sweep time, and the center frequency step- size to coupled mode. 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 the keys VBW:RBW or RBW:SPAN . If no ratios are stored, default ratios are used instead.

VBW:RBW Pressing this key displays the current coupling ratio between the video bandwidth and the resolution bandwidth. The ratio is displayed in the active function block, and it 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.

RBW:SPAN Pressing this key 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 the two functions are in coupled mode. The ratio ranges from 0.002 to 0.10, in a 1, 2, 5 sequence. The default ratio is 0.011.

MAX MXR LEVEL This key selects the maximum signal amplitude seen at the input mixer. This value is always in dBm, regardless of the selected scale or amplitude units. This function is useful when distortion-free dynamic range is an important consideration.

The following procedure explains how to check for signal compression quickly. 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.

(BW) This key accesses a menu of bandwidth functions, which are described below. (BW) also activates the resolution bandwidth function. Figure 2-22 shows the menu displayed by this key.

(BW)

RES BW
RES BW, AUTO MAN
VIDEO BW
VIDEO BW, AUTO MAN
MAX NO. VID AVGS
VID AVG, ON OFF

Figure 2-22. (BW) Menu

RES BW and RES BW AUTO MAN

Adjust the resolution bandwidth with these keys. The bandwidth, which appears in the active function block, ranges from 100 Hz to 1 MHz in a 1, 3, 10 sequence and 2 MHz (3 MHz at −6 dB). The value can be changed using the data keys, the step keys, or the knob. Press either key to activate the resolution bandwidth. 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, pressing RES BW AUTO MAN returns the bandwidth to coupled mode.

VIDEO BW and VIDEO BW AUTO MAN

These keys adjust 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. Press either key to activate the video bandwidth. 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, pressing VIDEO BW AUTO MAN returns the bandwidth to coupled mode. When the video bandwidth is less than 300 Hz, the IF detector automatically changes to sample mode.

Narrow video filters help smooth a trace, allowing you to view signals that are otherwise masked by the noise. However, narrower bandwidths require longer sweep times, approximately proportional to the ratio of resolution bandwidth to video bandwidth.

MAX NO. VID AVGS and VID AVG ON OFF

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 faster than a narrow video filter.

Video averaging is available only for trace A, and trace A must be in clear-write mode for video average to execute. After video averaging is activated, the number of sweeps that have been averaged appears at the top of the screen.

Select the number of sweeps used in video averaging with `MAX NO. VID AVGS`. This value ranges from 1 to 999 and appears in the active function block. After the desired value is entered, video averaging automatically begins. A number indicating the sweeps that have been averaged appears at the top of the display.

Turn the video averaging ON or OFF with `VID AVG ON OFF`. Video averaging smoothes the displayed trace without using a narrow video bandwidth. The function sets the IF detector to sample mode and smoothes the trace by averaging successive traces with each other.

(TRACE) This key accesses a menu of trace-related functions, which are described below. Trace A is brighter than trace B, to distinguish the two traces. Figure 2-23 shows the menu displayed by this key.

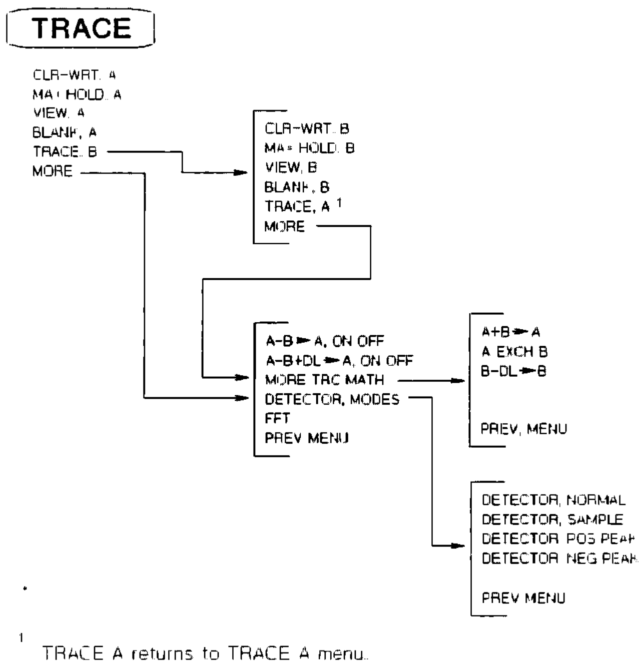


Figure 2-23. (TRACE) Menu

CLR-WRT A — This function clears trace A and sets it to accept and display new input-signal data continuously.

MAX HOLD A — This function 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.

VIEW A — Pressing this key displays the current of trace A, but does not update the contents.

BLANK A — This key blanks trace A from the screen. The contents of trace A are retained, but not updated.

TRACE B — This key displays the trace B menu of keys, which are described below.

CLR-WRT B

Pressing this key clears trace B and sets it to accept and display new input signal data continuously.

MAX HOLD B

This function displays and holds the maximum responses of the input signal in trace ~~A~~ B. In this mode, the trace accepts data from subsequent sweeps and selects the positive-peak detector mode.

VIEW B

This function displays the current contents of trace B, but does not update the contents.

BLANK B

Blanks trace B from the screen with this key. The contents of trace B are retained, but not updated.

TRACE A

This key displays the trace A menu of keys, as previously described.

MORE

Pressing this key displays the menu of keys described under the following paragraph.

MORE This key accesses additional keys, which are described below.

A—B→A ON OFF This key turns A—B→A trace math ON or OFF. When this function is ON, the contents of trace B are subtracted from the contents of trace A; the result, in dBm, is placed in trace A. In linear mode, the result is in volts. When this function is on, it is executed on all subsequent sweeps. An M appears on the left edge of the display to indicate its active status. A discussion on trace math appears at the end of this chapter.

A—B+DL→A ON OFF Press this key to turn A−B+DL→A trace math 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. The result is then displayed in trace A. This function is executed on all subsequent sweeps until it is turned off. An M appears on the left edge of the display to indicate its active status. The display line is activated as a result of this function; however, it can only be turned off by DSPL LIN ON OFF located under (DISPLAY). A discussion on trace math appears at the end of this chapter.

MORE TRC MATH This key accesses additional trace math functions defined in the following paragraphs.

A+B→A

This function sums the contents of trace A with the contents of trace B, and places the result, in dBm, in trace A. When in linear mode, the result is in volts. This function is done only once and not on a continuous basis. A discussion on trace math appears at the end of this chapter.

A EXCH B

Use this function to exchange the contents of trace A with that of trace B.

B−DL→ B

This function subtracts the value of the display line from the contents of trace B and places the result (in dBm) in trace B. This function is executed only once; to execute it a second time, press the key again. The display is activated as a result of this function.

PREV MENU

This key displays the previous menu of keys.

DETECTOR MODES Press this key to access a menu of detector modes, which are described below. When any detector mode other than NORMAL is active, a D appears on the left edge of the display.

DETECTOR NORMAL

This key 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

DETECTOR SAMPLE

This key sets the detector to video sample mode. This mode is used with the following:

- Video Averaging Functions
- Marker Noise Functions
- Combinations of resolution bandwidths ≥ 300 Hz and video bandwidths ≤ 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.

DETECTOR POS PEAK

This key selects the positive-peak detector mode. Use this mode to detect the positive-peak noise level of a trace. This is the detector selected by MAX HOLD .

DETECTOR NEG PEAK

This key selects the negative-peak detector mode. Use this mode to detect the negative-peak noise level of a trace.

PREV MENU

This key displays the previous menu of keys.

FFT

This function 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 an FFT on a frequency sweep will *not* provide time-domain results.

When 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 and displays the frequency-domain results.

Note

Pressing FFT sets the analyzer into single-sweep mode. To leave the FFT measure mode, set the sweep to continuous by pressing CONT under the (SWEEP) key.

The FFT results are displayed on the spectrum analyzer in a 10 dB/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/sweeptime. 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 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 narrow resolution and/or video bandwidth.

PREV MENU This key displays the previous menu of keys.

(TRIG) This key accesses a menu of trigger functions, which are described below. When any mode other than FREE RUN is selected, a T appears on the left edge of the display. Figure 2-24 shows the menu displayed by this key.

Figure 2-24. (TRIG) Menu

FWD
It does in Free Run also

CONT Set the sweep and trigger to continuous mode with this key. This function, which is the default mode, is underlined to indicate that it is the current mode. In trigger modes other than free run, press CONT to restart the sweep at the next trigger.

SINGLE Pressing this key sets the sweep mode. SINGLE is underlined to indicate that it is the current mode. Press this key to restart the sweep at the next trigger. An S appears on the left edge of the display to indicate the function's active status.

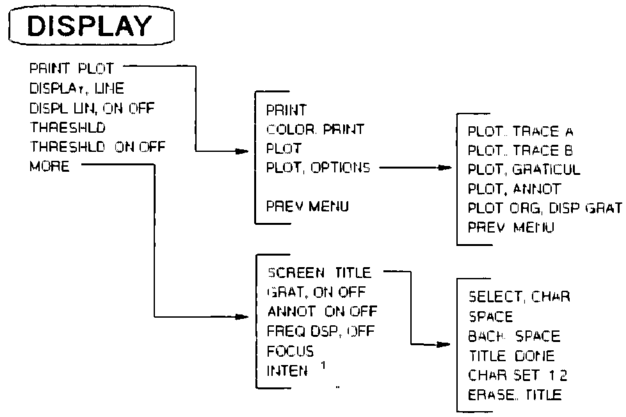
FREE RUN Sets the trigger to free-run mode. Sweep triggers occur as rapidly as the spectrum analyzer will allow.

VIDEO Sets the trigger to video mode. Sweep triggers occur whenever the input signal passes through, with a positive slope, the video trigger level. 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/div, the error in this line can be up to three divisions.

LINE Sets the trigger to line mode. Sweep triggers occur at intervals synchronized to the line frequency.

EXTERNAL Sets the trigger to external mode. Connect an external trigger source to J5 EXT TRIG INPUT on the rear panel of the spectrum analyzer. The source must range from 0 to 5 VDC (TTL). The trigger occurs on the rising, positive edge of the signal (about 1.5 V).

DISPLAY This key accesses a menu of display-related functions, which are described below. Figure 2-25 shows the menu displayed by this key.



1 For outdoor use, maximum intensity is 255.
For indoor use, keep intensity around 60.

Figure 2-25. DISPLAY Menu

PRINT PLOT This key accesses a menu of print and plot functions which are described below.

PRINT

Press this key to print the entire contents of the spectrum analyzer display (except for the menus and error codes). When printing, STOP PRINT appears in its place, allowing you to stop printing before it is finished.

COLOR PRINT

Use this key to print the entire contents of the spectrum analyzer display (except for the menus and error codes) in color to the HP 3630A PaintJet printer. When printing, STOP PRINT appears ~~in its place~~ on top the, allowing you to stop printing before it is finished. Colors of the printed display are fixed by the spectrum analyzer.

Note

If another printer other than the HP 3630A PaintJet printer is connected at the execution of COLOR PRINT, erroneous information will be printed.

PLOT

This key plot the entire contents of the spectrum analyzer screen (except for the menu and error codes). When active, STOP PLOT appears ~~appears in its place,~~ allowing you to stop the plot before it is finished.

PLOT OPTIONS

This key accesses a menu of plotter functions, which are described below. Plot keys (except for PLOT OPTIONS and PLOT ORG) can be pressed in any order; the functions will be executed in that order.

PLOT TRACE A. Pressing this key plots only the contents of trace A and any markers associated with trace A. STOP TRACE A appears when this function is active, allowing you to stop the plot before it is finished. If trace A is blanked, a message TRACE IS BLANKED will momentarily appear in the active function area, and no plotting will occur.

PLOT TRACE B. Pressing this key plots only the contents of trace B and any markers associated with trace B. STOP TRACE B appears when this function is active, allowing you to stop the plot before it is finished.

PLOT GRATICUL. Use this key to plot only the graticule. STOP GRAT appears when this function is active, allowing you to stop the plot before it is finished. If trace B is blanked, a message TRACE IS BLANKED will momentarily appear in the active function area, and no plotting will occur.

belongs up here

PLOT ANNOT. This key plots only the annotation (excluding the menu, trace markers, and error codes). STOP ANNOT appears when this function is active, allowing you to stop the plot before it is finished. If the annotation is turned off, no output will occur.

PLOT ORG DSP GRAT. This key selects either the display (DSP) or the graticule (GRAT) origin mode. When DSP is selected, the plotter references P1 and P2 to the corners of the spectrum analyzer display. When GRAT is selected, the plotter references P1 and P2 to the lower-left and upper-right corners of the graticule, respectively. GRAT allows you to position the desired plot information on a preprinted graticule (obtained from PLOT GRAT), and to save plotting time. This function is locked out when any plot is in process or when any plot is pending.

PREV MENU. This key displays the previous menu of keys.

PREV MENU

This key displays the previous menu of keys.

DISPLAY LINE and DSP LINE ON OFF — These keys activate a display line. Press either key to activate the display line, then use the data keys, the step keys, or the knob to adjust it. When the display line is ON, pressing DSP LINE ON OFF turns the line OFF.

THRESHLD and THRESHLD ON OFF — These keys set a threshold that determines the lower limit of the active trace(s). 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 view or in max-hold mode, once the threshold is raised, any data below the new threshold is permanently lost.

MORE — This key accesses a menu of additional keys, which are described below.

SCREEN TITLE — Pressing this key displays a menu of functions that allow you to create a title on the screen. These functions are described below. Pressing this key 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. Press SELECT CHAR after selecting the desired character, 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.

SELECT CHAR

This function 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" period. This key may be held for repeated characters.

SPACE

This key places a blank space in the next available character position in the title.

BACK SPACE

Pressing this key deletes the last character placed in the title.

TITLE DONE

This key fixes the current title and returns to the previous menu.

CHAR SET 1 2

Pressing this key 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.

ERASE TITLE

Erase the current title from the display by pressing this key.

GRAT ON OFF — This function blanks the graticule from the display (OFF) or reactivates it (ON).

ANNOT ON OFF — This key blanks the annotation from the display (OFF) or reactivates it (ON).

FREQ DSP OFF — This key 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).

FOCUS — This function changes the focus of the display. 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.

INTEN — This key changes the intensity of the display. Use the data keys, the step keys, or the knob to adjust the intensity. The intensity ranges from 0 to 255; the current value appears in the active function block. When the key is pressed, STORE INTEN appears on the menu. Press STORE INTEN to store the new intensity value.

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.

Trace Math in the Analyzer

Trace math allows easy application of correction data to a trace. Trace math is performed either in dBm units, when in log mode, or in volts, when in linear mode. Sometimes trace-math results are not intuitive; an explanation of what occurs follows.

Adding and Subtracting in dBm

The trace-math scheme allows 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 A+B→A or A−B→A; thus the effects of the loss can be eliminated.

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 A−B→A, the result is (−50 dBm) + (−50 dBm) = −100 dBm. However, if two −50 dBm power sources at two different frequencies are physically summed, the result is a power of −47 dBm.

To further illustrate this point, if trace A is at 3.0 dBm and trace B is at 7.0 dBm, performing A+B→A moves trace A to 10.0 dBm (for example, 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 A+B→A drops trace A data to −16 dBm, even though trace B is 4.0 dBm higher in power in both cases. As you can see, the analyzer is not adding and subtracting physical values, but rather providing an efficient method for calculations in dBm units.

Use `A−B+DL→A` to Correct Data

The function `A−B+DL→A` provides the most versatile method for applying correction data to a trace. `A−B+DL→A` 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 `A−B+DL→A` 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 difference of 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 at the end of this chapter). The display line is added to return the result to the screen, with no clipping occurring. Since you can specify the position of the display line, you can move the corrected data to any on-screen position.

The following example illustrates how to use A−B+DL→A. Preset the instrument, connect the calibration signal to the RF input, then set the spectrum analyzer to the state described below:

Center Frequency:	299.995 MHz
Frequency Span:	20 kHz
Resolution Bandwidth:	10 kHz
dB per Division:	5
Sweep Mode:	Single
Trace A and Trace B:	clear-write mode

Take two sweeps (for example, press SINGLE twice) and set trace B to view mode. This places an identical trace in both trace A and trace B, then freezes the data in trace B. Activate the display line and place the line where you want the corrected data to appear on the screen (at −16 dBm, for example). Now activate A−B+DL→A. Trace B is subtracted from trace A; since 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 function A+B→A moves trace A data up the screen, while the function A−B→A moves trace A data down the screen (assuming trace B contains nonzero data).

Trace Data Limits

The displayed amplitude of each trace element falls in one of 600 data points (see Figure 2-26). There are an additional 10 points of overrange. The 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, 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).

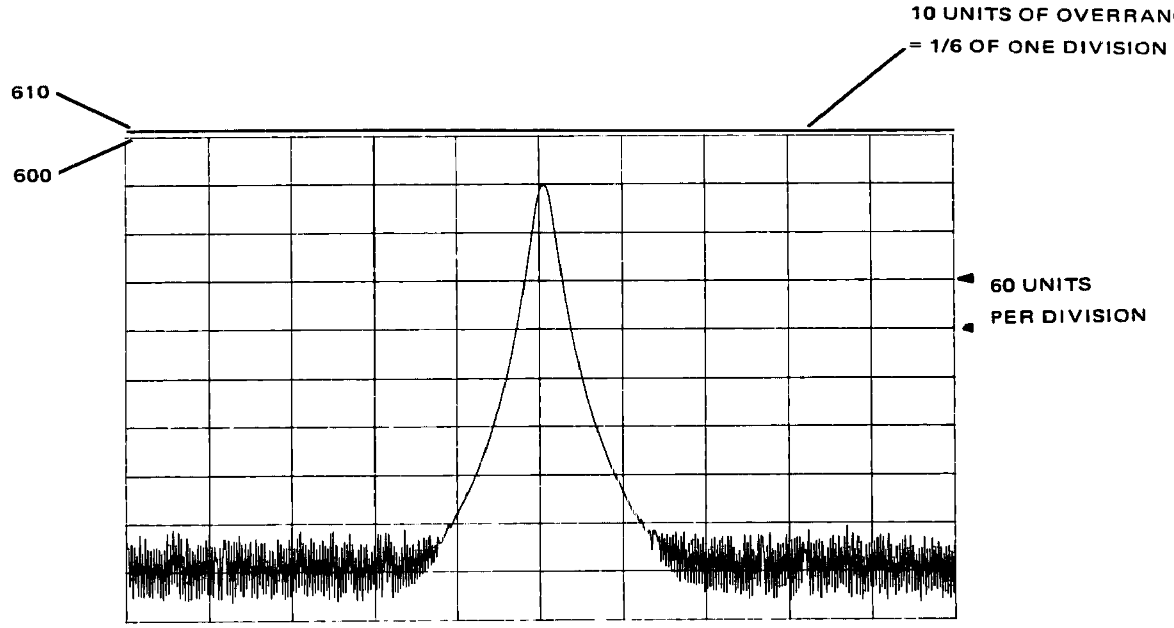


Figure 2-26. Display Units

Marker Priority

Markers can be activated on trace A or trace B. However, the markers will appear. The trace states are listed below, in order of highest marker priority to lowest priority:

Trace A in Clear-Write Mode
Trace B in Clear-Write Mode
Trace A in Max-Hold Mode
Trace B in Max-Hold Mode
Trace A in View Mode
Trace B in View Mode

3. Common Measurements

3

Common Measurements

This chapter presents general topics on performing various measurements. These topics are presented on the following pages:

Demodulate and Listen with Keys

Note: The FM detector is designed to demodulate narrowband FM (5kHz deviation) signals. The volume keys will ~~Monitor~~ not fully quiet a wideband FM signal such as those used in FM broadcasting.

The functions listed in the menu under the (DEMOD) key allow you to quickly demodulate and hear signal information displayed on the spectrum analyzer. Simply place a marker on a signal of interest, activate AM or FM demodulation, and then listen. Refer to the three-step procedure below.

1. Connect an antenna to the spectrum analyzer input. Select a frequency range on the spectrum analyzer, such as the range for FM radio broadcasts: 88 MHz to 108 MHz in the USA and Canada. Press (FREQUENCY) and the key **START**, then key in 88 (MHz). Press the key **STOP** and key in 108 (MHz). See Figure 3-1.

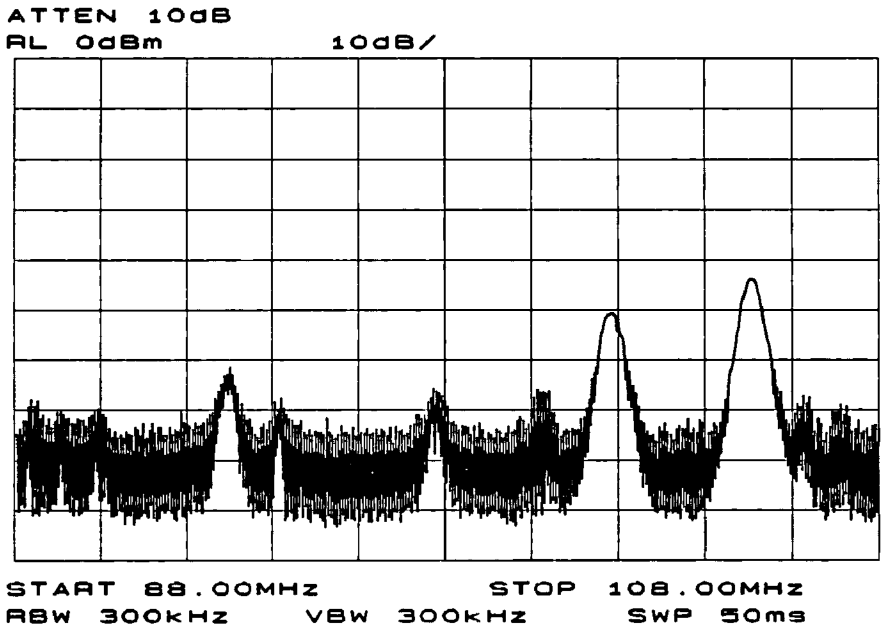


Figure 3-1. Spectrum Analyzer Tuned to Sweep the FM Band

2. Press (DEMOD) to view the menu of demodulation functions. Activate either **MARKER NORMAL** to move the marker to a signal of interest, or **PEAK SEARCH** to place a marker on the highest-amplitude signal. See Figure 3-2. Press **FM DEMOD** to hear the audio information. Adjust the volume using the keys in the upper right-hand corner of the analyzer.

[illegible] of
FM detection
08562-90086

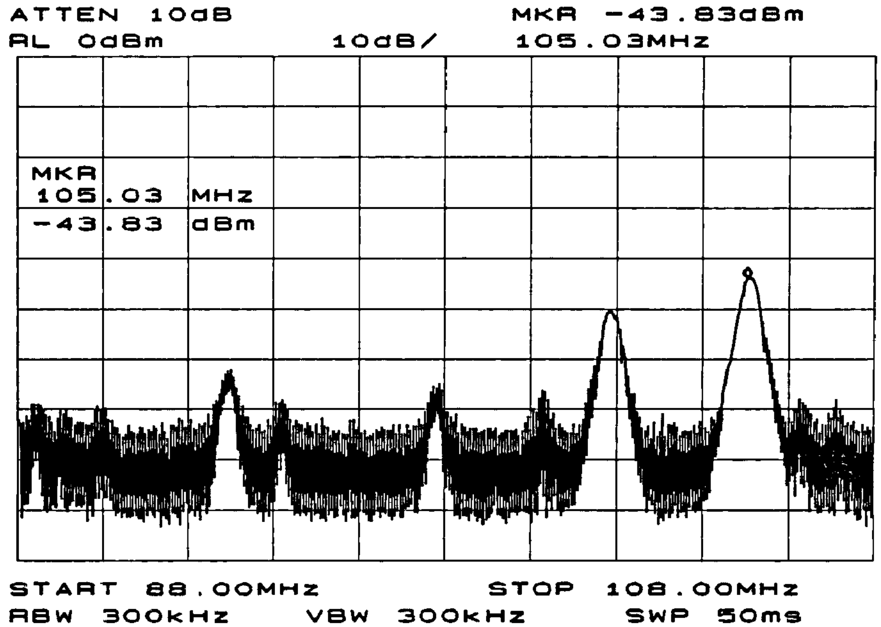


Figure 3-2. Marker Placed on a Signal to be Demodulated

3. Press `MORE` to view additional demodulation keys. The function `DEMOD TIME` sets the length of time that the spectrum analyzer will pause at the marker. The default value is one second. If desired, the time may be adjusted using the data keys.

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 is often 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 harmonics generated ($2F_1$ and $2F_2$) and create third-order intermodulation distortion products. These distortion products are located close to the original signals at $2F_2$—F_1 and $2F_1$—F_2 (see Figure 3-3). Higher order intermodulation distortion can also occur. These distortion products are generated by such system components as amplifiers and mixers.

F_1 = 20 MHz
F_2 = 21 MHz

$F_1 + F_2$ = 41 MHz
$2F_2 - F_1$ = 22 MHz (3rd order)
$3F_1 - 2F_1$ = 23 MHz (5th order)

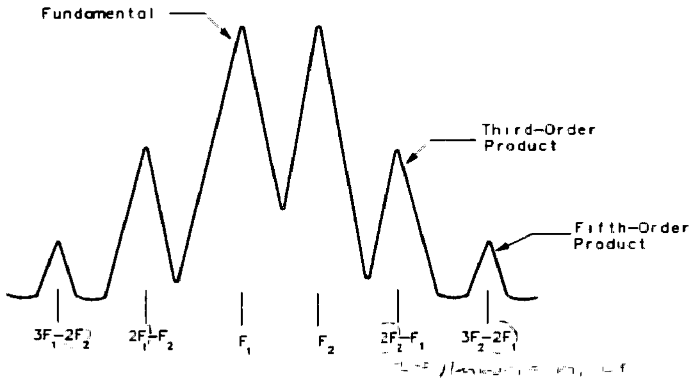


Figure 3-3. Two Input Signals and Resulting Intermodulation Distortion

The Functions Used

The procedure below 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.

Measurement Overview

Briefly, to measure third-order intermodulation distortion, tune the spectrum analyzer frequency so that the two source signals appear on the spectrum analyzer display, making sure to use a frequency span wide enough to include the third-order distortion products. Next, select the spectrum analyzer resolution bandwidth, mixer level, and reference level. Finally, using the delta marker mode, measure the distortion products relative to the test tones. This measurement procedure is described more fully in the following paragraph.

Stepping through the Measurement

To test a device for third-order intermodulation, connect the equipment as shown in Figure 3-4. This example uses two sources set to 20 MHz and to 21 MHz. Of course, other source frequencies may be substituted, but a frequency separation of approximately 1 MHz should be maintained to best follow this example. The low-pass filters are not required if this procedure is used only to practice using the instrument.

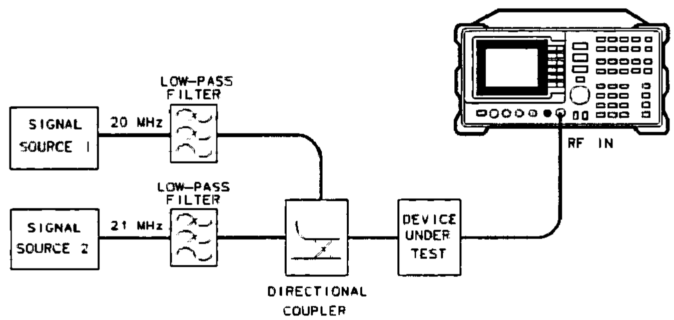


Figure 3-4. Third-Order Intermodulation Test Setup

1. Set one source to 20 MHz and the other source to 21 MHz for a frequency separation of 1 MHz. Set the sources equal in amplitude (for this example we have set the sources to −20 dBm).
2. Tune both signals onto the display by setting the center frequency to 20 MHz. Next, 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 the ones in this example, choose a span greater than three times the separation of the source signals. Press (FREQUENCY) and, using the knob, center the two signals on the display, as in Figure 3-5. If necessary, to be sure that the distortion products are resolved, reduce the resolution bandwidth until the distortion products are visible; press (BW), then use the ⇩ STEP key to reduce the resolution bandwidth. You may wish to reduce the video bandwidth as well. To ensure that the input signals are equal in amplitude, press (PEAK SEARCH) and the keys **MARKER DELTA** and **NEXT PEAK** . Adjust one of the source signals until the difference in amplitude reads zero.

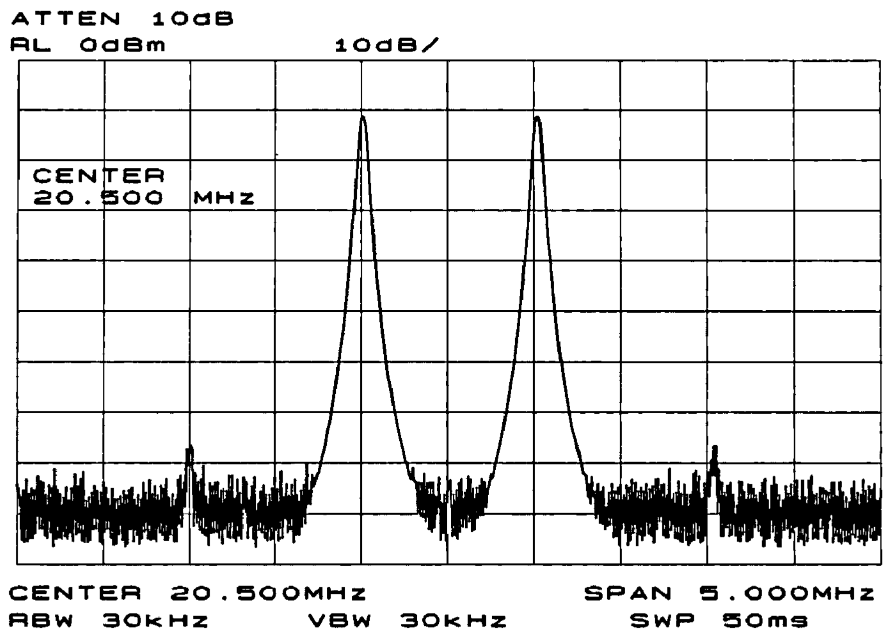


Figure 3-5. Signals Centered on Display

Note

It is sometimes necessary to choose a specific resolution bandwidth to verify the distortion products are at a certain level below the source signal. For these cases, refer to "Resolution Bandwidth" in this chapter.

---

3. For greatest measurement accuracy, position the peaks of the source signals at the reference level. To do this, place a marker on the source signal of highest amplitude by pressing (PEAK SEARCH) and **MARKER NORMAL**. Then set the reference level to this value by pressing (MKR→) and then **MKR→REF LVL**. Figure 3-6 illustrates the resulting display.

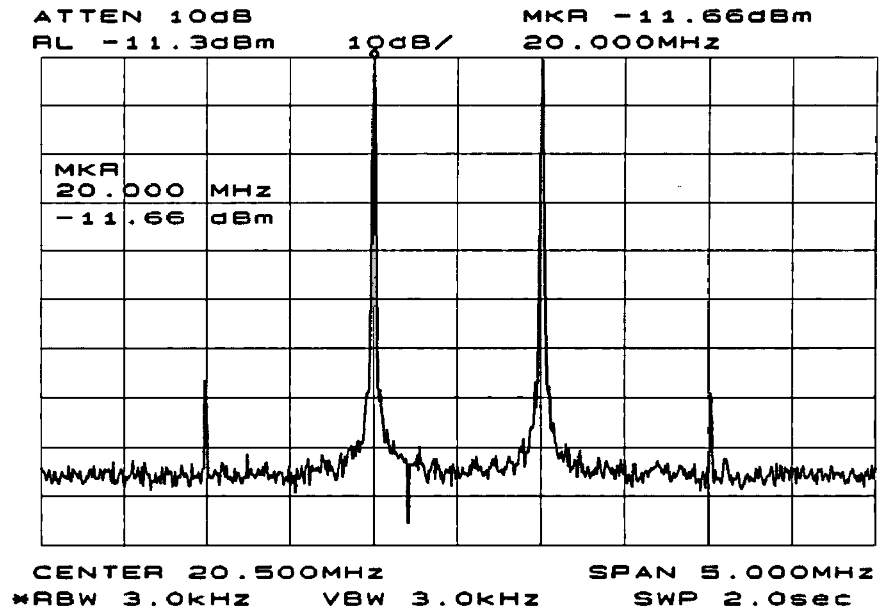


Figure 3-6. Signal Peak Set to the Reference Level

4. For this type of measurement, distortion-free dynamic range is an important consideration. To maximize such dynamic range, set the mixer input level to −30 dBm: press (AUTO COUPLE), then the `MAX MXR LEVEL` ; key in 30 (−dBm). The spectrum analyzer automatically sets the attenuation so the maximum signal level seen at the input mixer when the signal is at or below the reference level is −30 dBm.

5. The spectrum analyzer `MARKER DELTA` function activates a second marker and displays the difference between the two markers. Relative measurements can then be performed easily. To measure a distortion product, press (PEAK SEARCH) to place a marker on a source signal. To activate a second marker, press `MARKER DELTA` , `MORE` , and `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. (You may have to press the key a few times to place the marker at the desired peak.) See Figure 3-7. The difference in frequency and amplitude between the two markers is displayed in the active function block. Because the source signals are equal in amplitude, the intermodulation products should be equal as well, so it is not necessary to measure the amplitude of the second harmonic.

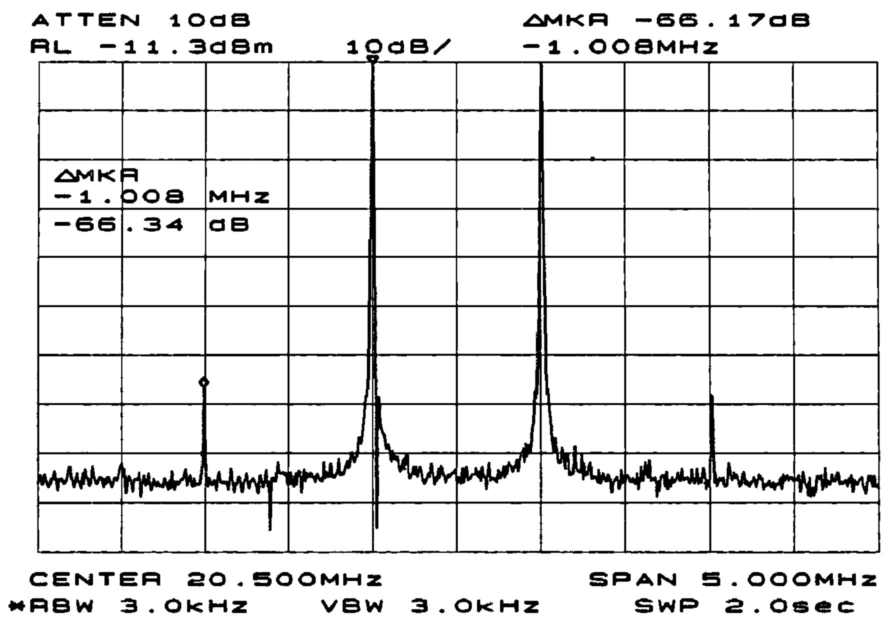


Figure 3-7. Intermodulation Distortion Measured in dBc

6. The functions (SAVE) and (RECALL) allow you to store data for later viewing. The `SCREEN TITLE` function allows you to create a title on the screen and a label for the (RECALL) menu. To create a title, press (DISPLAY), `MORE` and `SCREEN TITLE`. Next, use the keys from the `SCREEN TITLE` menu and the knob (to choose the letters and spaces) to create a title. The title appears in the upper right corner of the graticule and can be one or two rows of 16 characters each. See Figure 3-8. Press the key `TITLE DONE` when the title is complete.

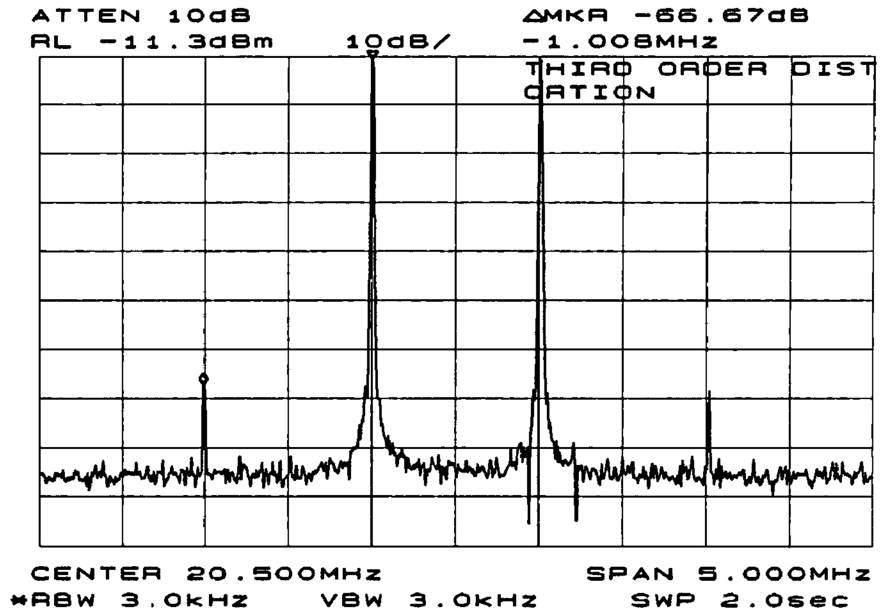


Figure 3-8. Display with Title

7. To save the instrument state, press (SAVE) and SAVE STATE ; then press a key to enter the instrument state data into whichever register (0 through 9) you select. The first sixteen characters of the title are used to label the register on the (RECALL) menu. To view this menu, press (RECALL) and the key RECALL STATE (see Figure 3-9). If a stored state has no title, the menu reads STATE followed by the register number chosen.

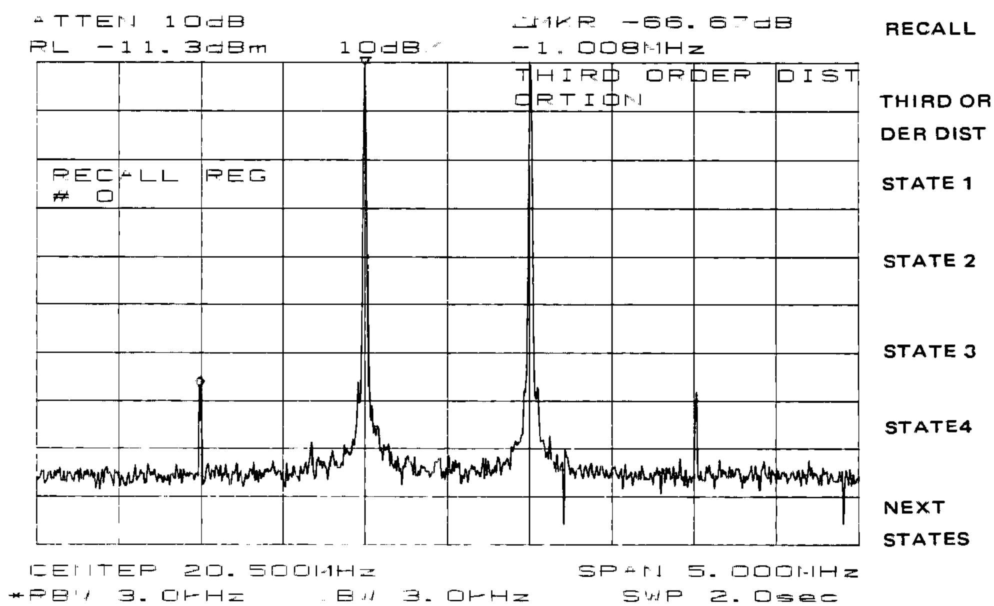


Figure 3-9. (RECALL) Menu

Harmonic Distortion

Why Measure 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 using the measurement routine described below. This procedure measures harmonic amplitudes relative to the source frequency.

The Functions Used

The harmonic distortion measurement below employs an important set 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. Also demonstrated are how to set a signal to the center frequency using a marker and how to set the frequency step size to the value of the center frequency.

"Fast Measurement" Overview

There are two common ways to measure harmonic distortion using a spectrum analyzer. The following procedure illustrates the faster method, which permits simultaneous display of the fundamentals and its harmonics. A second procedure is also given, and although it is somewhat lengthier to perform, it provides a better measurement of harmonics closer to the noise floor.

To measure harmonic distortion quickly, first set the spectrum analyzer start frequency to a value slightly less than that of the source (fundamental) frequency and set the stop frequency to a value just greater than that of the last harmonic you wish to measure. Next, place a marker on the peak of the fundamental. Activate a second marker using the function `NEXT PEAK` and move the marker along the trace. This allows you to measure the frequencies and amplitudes of the harmonics relative to the fundamental.

The example below measures the harmonic content of the 300 MHz calibration signal. If desired, you may use another source, but be sure to adjust the spectrum analyzer start and stop frequencies to accommodate the source frequency and its harmonics.

Making Fast Harmonic Measurements

Connect the signal source to the spectrum analyzer's INPUT 50Ω and complete the following steps. Start from a preset state (that is, press (PRESET)).

1. For measuring the 300 MHz fundamental and its first two harmonics, set the start frequency to 270 MHz and the stop frequency to 1000 MHz. This displays the fundamental frequency and the second and third harmonics. To improve visibility, smooth the video bandwidth: press (BW) and `VIDEO BW`; then use the STEP (⇩) key as desired. See Figure 3-10.

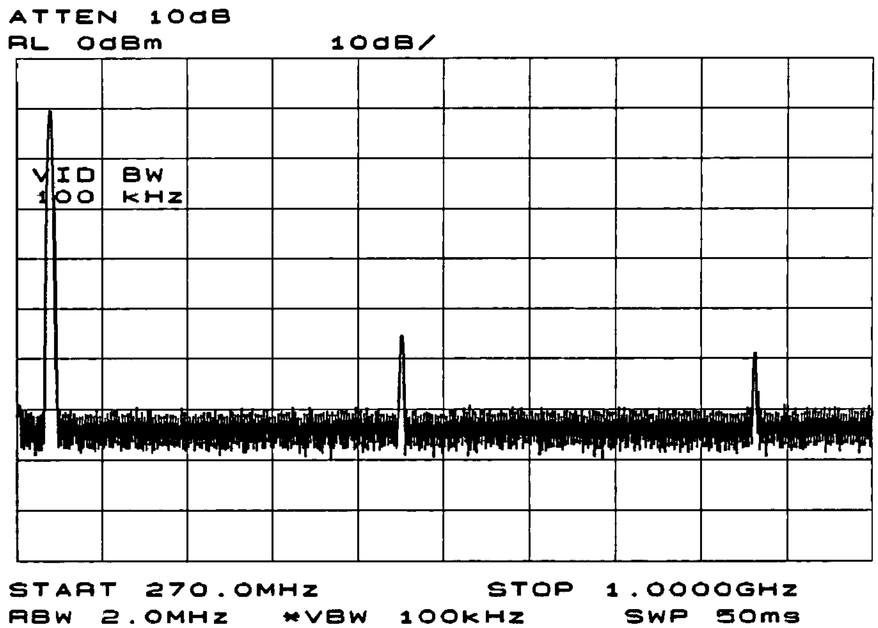


Figure 3-10. Input Signal and Harmonics

2. For greatest measurement accuracy, raise the peak of the fundamental to the reference level by pressing (PEAK SEARCH), (MKR→), and then the key **MKR→REF LVL** . To measure the difference between the fundamental and a harmonic, activate a second marker by pressing (PEAK SEARCH), **MARKER DELTA** , and **NEXT PEAK** . This places the second marker on the peak of the second harmonic, as shown in Figure 3-11. The difference in amplitude between the fundamental and second harmonic shown in the figure is approximately −45 dB, or 0.56% harmonic distortion (see Figure 3-12). To measure the third harmonic, press **NEXT PEAK** again. The marker in this example reads approximately −50 dB, or 0.32% distortion. Continue reading amplitudes and comparing them to Figure 3-12 for each additional harmonic you wish to measure.

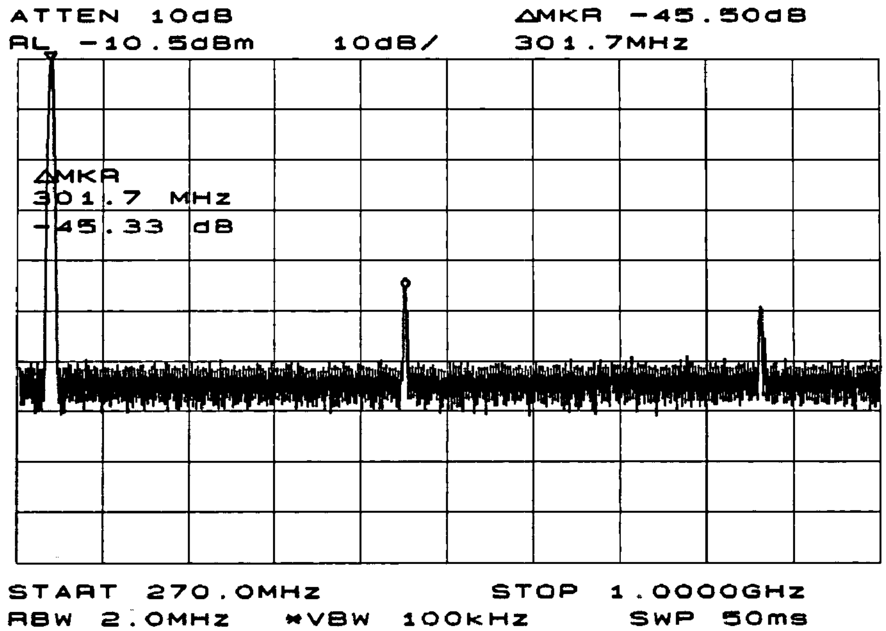


Figure 3-11. Harmonic Distortion Measured in dBc

Another easy way of determining percent of distortion is to change the units to `VOLTS`: press (AMPLITUDE) and `MORE`, `UNITS`, and `VOLTS`. The marker readout automatically switches to voltage units. To determine percent of distortion, use the ratio given by the marker and move the decimal point of this value two places to the right.

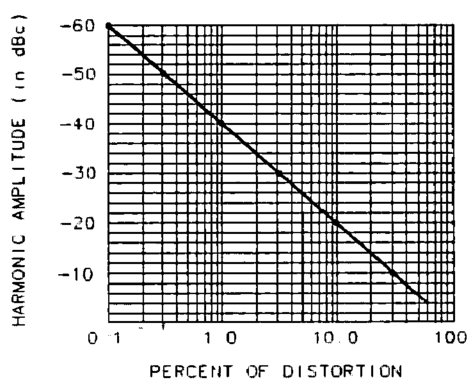


Figure 3-12. Percent of Distortion Versus Harmonic Amplitude

3. To plot the display for hard-copy documentation, simply connect a graphics plotter (such as an HP 7440A ColorPro) to the analyzer via HP-IB. Set the plotter address to 5. On the spectrum analyzer, press (DISPLAY) and `PLOT MENU` to view available plot functions. Press `PLOT ALL` to transfer the entire display contents

to the plotter. Other plotter functions allow you to select certain traces or parts of the display for plotting. The PLOT ORG function selects the plotter reference point to correlate to the display (DSP) or to the display graticule (GRAT).

Getting the Most Accurate Harmonic Distortion Measurements

An alternative method for measuring harmonics is described below. This method is somewhat lengthier, 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 setup from the previous example, press (OFF) to clear the markers from the screen. To measure the fundamental, press (PEAK SEARCH). Press MARKER→CF to move the fundamental to the center frequency and then press (PEAK SEARCH) and SIG TRK ON. Reduce the frequency span to 15 MHz by pressing (SPAN) 15 (MHz). The signal track function allows you to "zoom" quickly to a narrower span without losing the signal from the screen. After the span is reduced, turn off the signal track function. Next, set the center frequency step size to 300 MHz by pressing (MKR→) and MKR→CF STEP. The resulting display should resemble Figure 3-13.

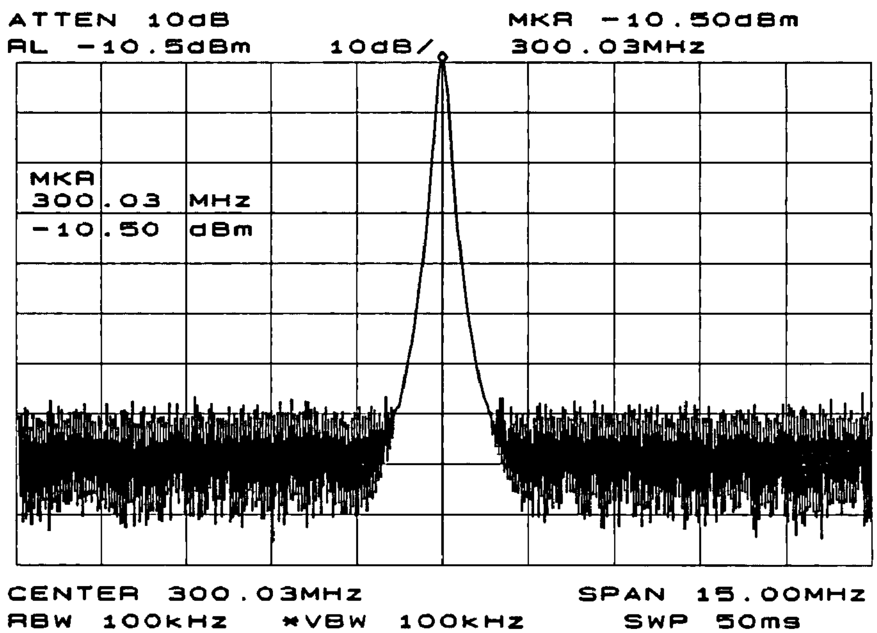


Figure 3-13. Input Signal Displayed in a 15 MHz Span

2. To measure the second harmonic, press MARKER DELTA, (FREQUENCY) and the (⇧) step key. This step retunes the spectrum analyzer center frequency to the second harmonic. Adjust the harmonic to the reference level. This displays the amplitude of the second harmonic as shown in Figure 3-14. The difference between the second harmonic and the fundamental can be converted to

a percentage of distortion by changing the amplitude units to VOLTS in order to read the voltage ratio of the two signals.

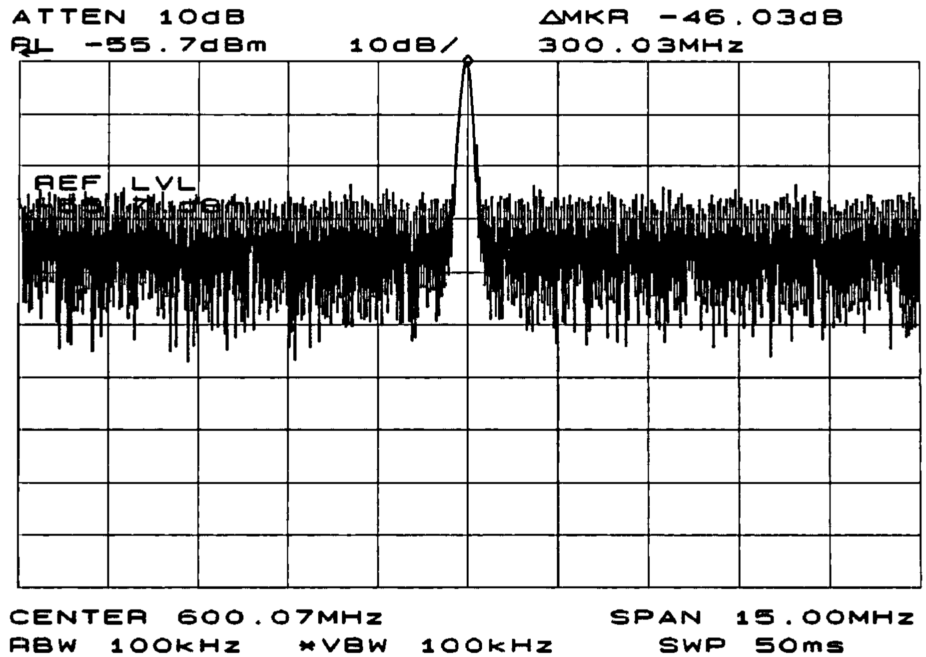


Figure 3-14. Second Harmonic Displayed in dBc

For each additional harmonic you wish to measure, simply press the (↑) step key and adjust the reference level.

Percent of Harmonic Distortion

Measuring the total percentage of harmonic distortion of a signal is also performed 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) and the keys MORE, UNITS, and VOLTS.) The amplitude values of these signals are used in the equation below to compute total harmonic distortion.

$$\text{Percent of distortion} = \frac{\sqrt{(A_2)^2 + (A_3)^2 + (A_4)^2 \ldots + (A_n)^2} \times 100}{A_1}$$

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 percentage of harmonic distortion very accurately. However, such calculations make manual operation tedious. Therefore, a complete program that automatically measures percentage of total harmonic distortion is included at the end of Chapter 4.

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 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.

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

Input Signals of Equal Amplitude

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. See Figure 3-15. Further, to resolve two signals with a frequency separation of 2 kHz, a 1 kHz resolution bandwidth again must be used. See Figure 3-16. 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 phase noise can also affect resolution.

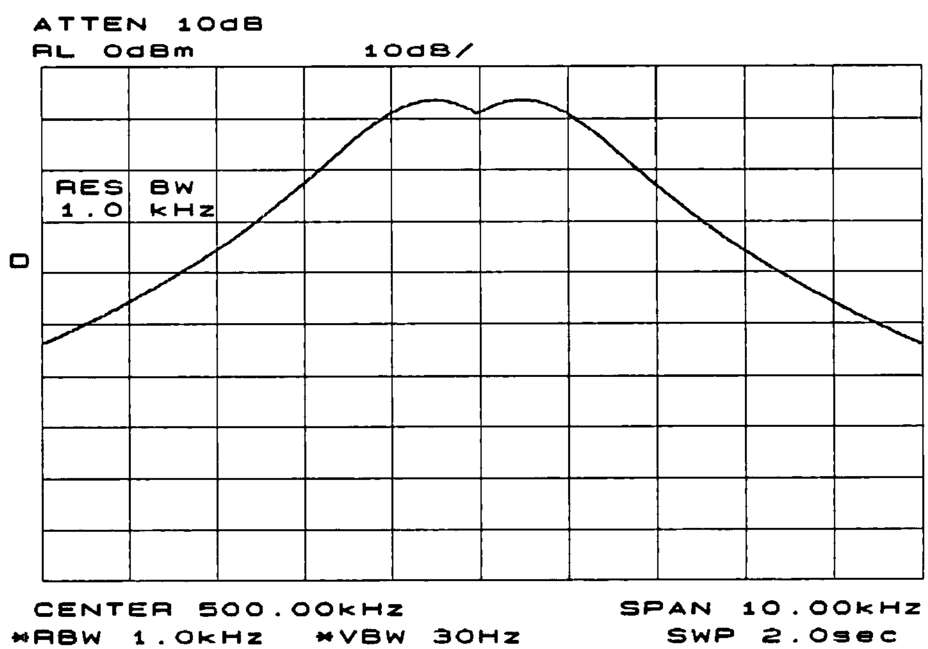


Figure 3-15. 1 kHz Signal Separation

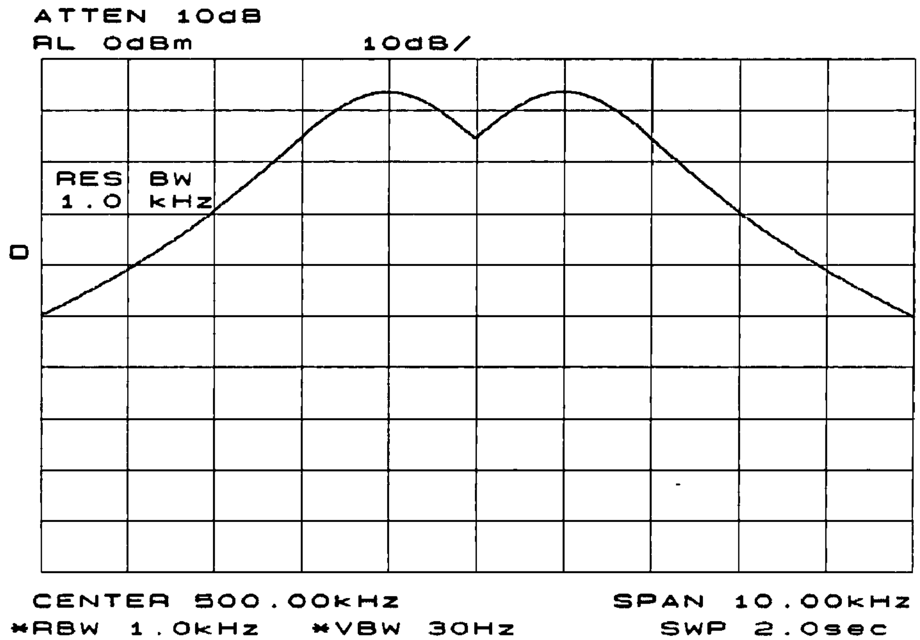


Figure 3-16. 2 kHz Signal Separation

Input Signals of Unequal Amplitude

To resolve two signals of unequal amplitude, the resolution bandwidth must also be less than or equal to the frequency separation of the two 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 3 dB bandwidth to the 60 dB bandwidth of the IF filter, as in Figure 3-17. The IF filters in this spectrum analyzer have shape factors of 15:1 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.

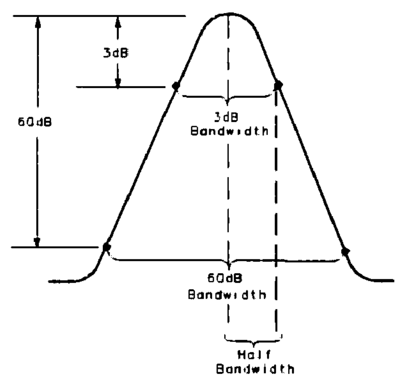


Figure 3-17. Bandwidth Shape Factor

For example, consider resolving a third-order intermodulation distortion product with a frequency separation of 700 kHz and an amplitude separation of 60 dB. Using a 100 kHz filter with a typical shape factor of 12:1, the filter will have 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 3-18). 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 (see Figure 3-19).

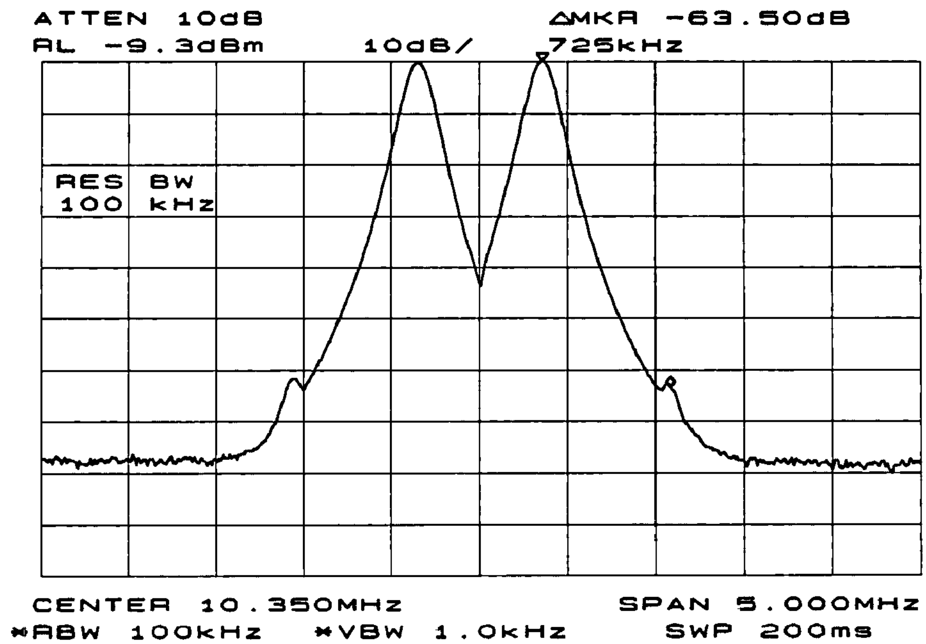


Figure 3-18. 100 kHz Bandwidth Resolution

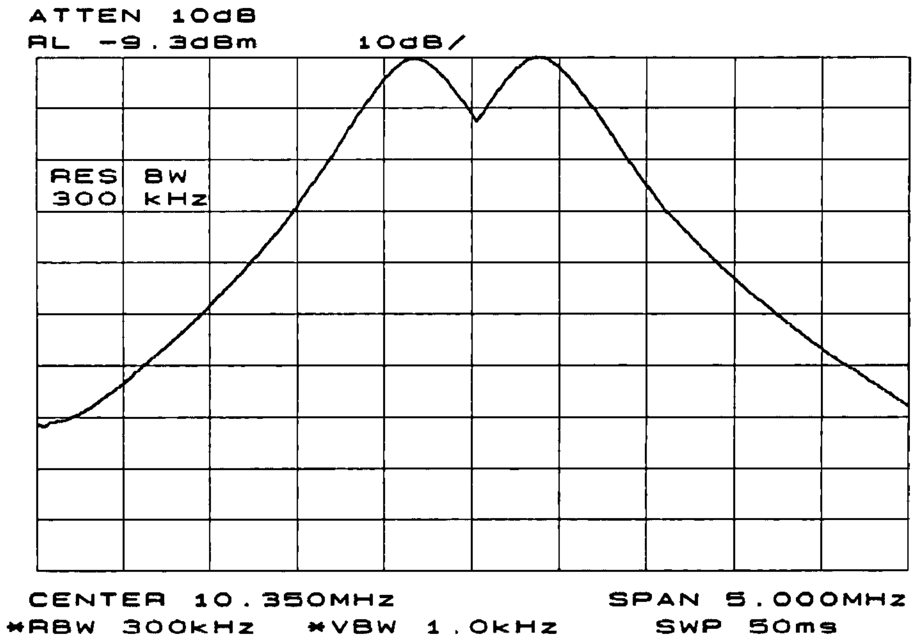


Figure 3-19. 300 kHz Bandwidth Resolution

Note

Spectrum analyzer sweep time is inversely proportional to the square of the resolution bandwidth. 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.

Amplitude Modulation

Figure 3-20 illustrates an amplitude-modulated signal as seen on a spectrum analyzer display. Note the carrier signal. To determine its frequency, simply press (PEAK SEARCH). 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 3-21).

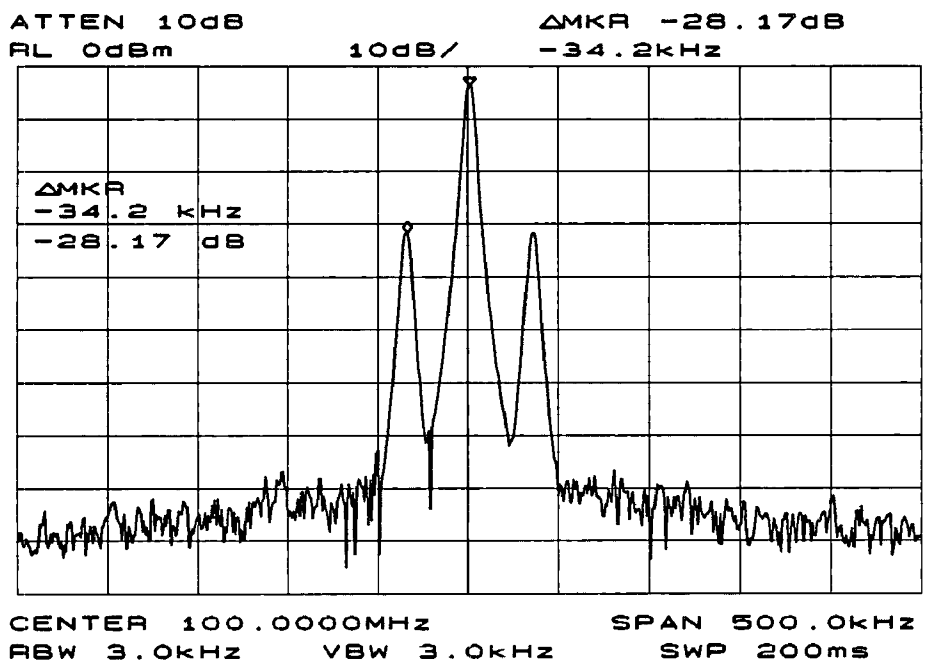


Figure 3-20. An Amplitude-Modulated Signal

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.

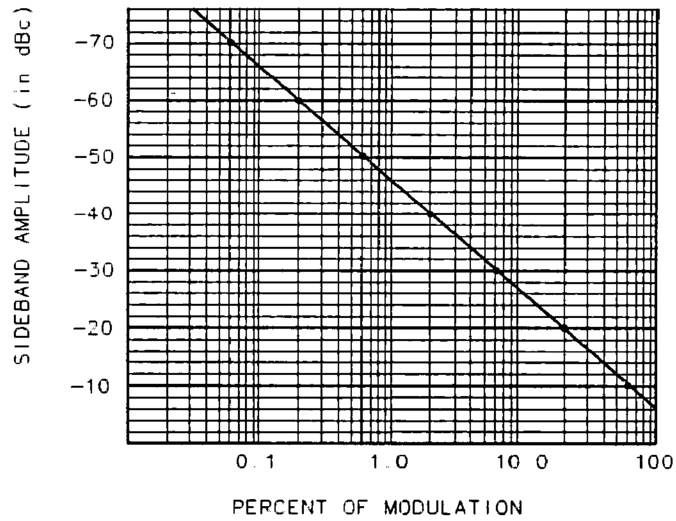


Figure 3-21. Percentage of Modulation

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.

Figures 3-22, 3-23, and 3-24 illustrate a frequency-modulated signal as it appears on a spectrum analyzer. Figure 3-25 contains Bessel functions for determining modulation. (Tables 3-1 and 3-2 also contain modulation index numbers for carrier nulls and first sideband nulls.)

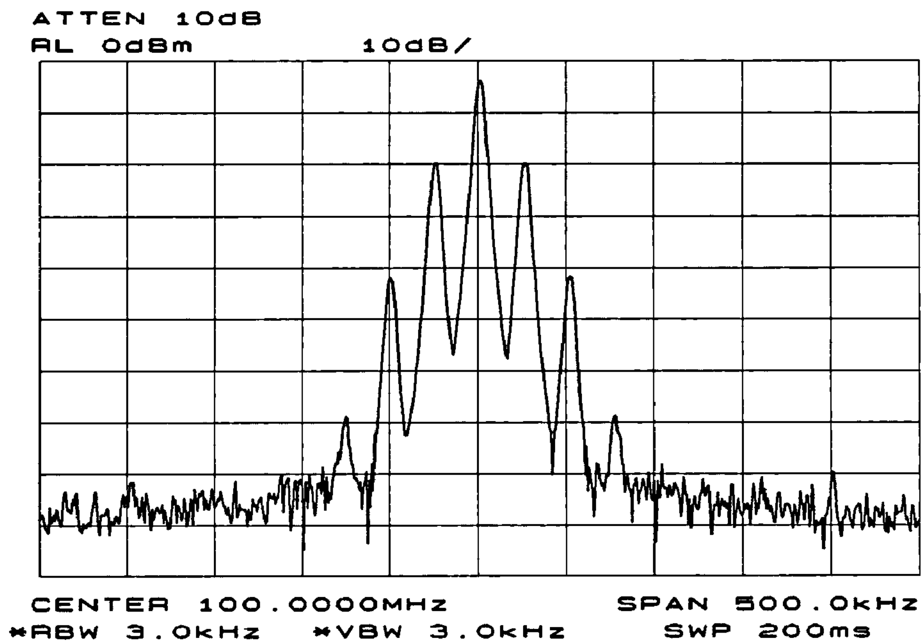


Figure 3-22. A Frequency-Modulated Signal

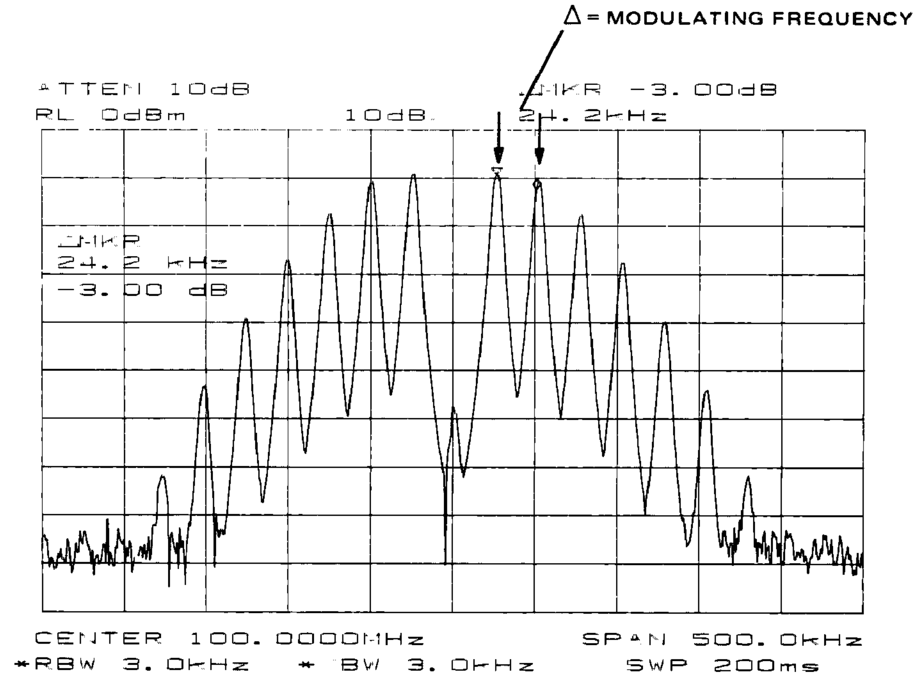


Figure 3-23. FM Signal with Carrier at a Null

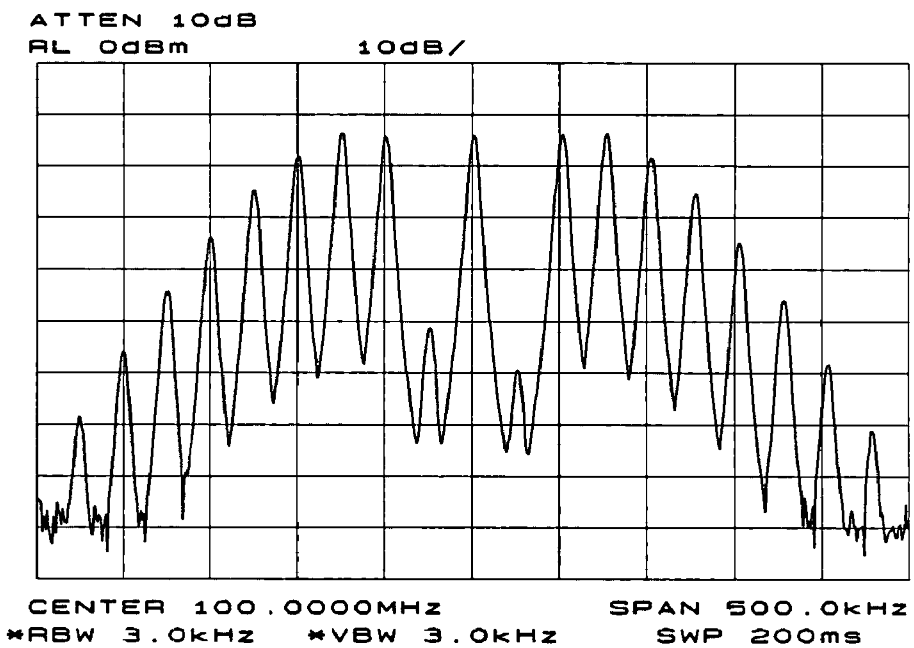


Figure 3-24. FM Signal with First Sidebands at a Null

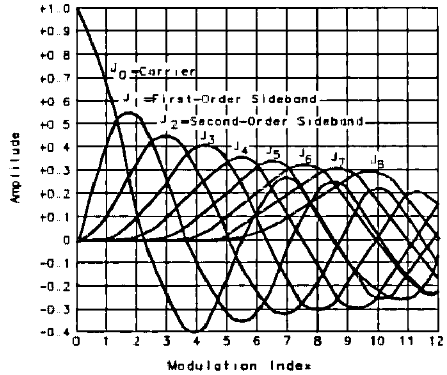


Figure 3-25. Bessel Functions for Determining Modulation Index

Table 3-1. 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)	$18.071 + \pi(n - 6)$

Table 3-2. 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

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 3-26 illustrates how to set up the equipment for this measurement.

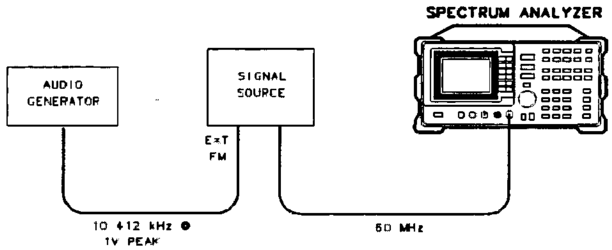


Figure 3-26. FM Deviation Test Setup

Beginning with the spectrum analyzer in a preset state, connect the source to the spectrum analyzer input. Set the source to 100 MHz. Set the center frequency of the spectrum analyzer to 100 MHz and the span to 100 kHz. Knowing that the desired deviation is 25 kHz, and choosing the modulation index of the first carrier null, calculate the modulating frequency as follows:

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

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

Set the modulation rate on the signal generator to 10.412 kHz. If the signal generator doesn't have an accurate internal audio source, use an external audio source. You can use the delta count mode of the analyzer to accurately set the audio source frequency as follows: press (FREQ COUNT) to activate the counter function, then press **COUNTER RES** and set the counter resolution. Press **COUNTER ON** and use the delta count mode to read the difference between two sideband peaks. See Figure 3-27. Now adjust the frequency deviation for a maximum null of the carrier. Calculate the FM deviation by multiplying the modulation index (from Table 3-1) by the modulation rate:

$$\text{FM Deviation} = 10.412\ \text{kHz} \times 2.401$$

$$\text{FM Deviation} = 25\ \text{kHz}$$

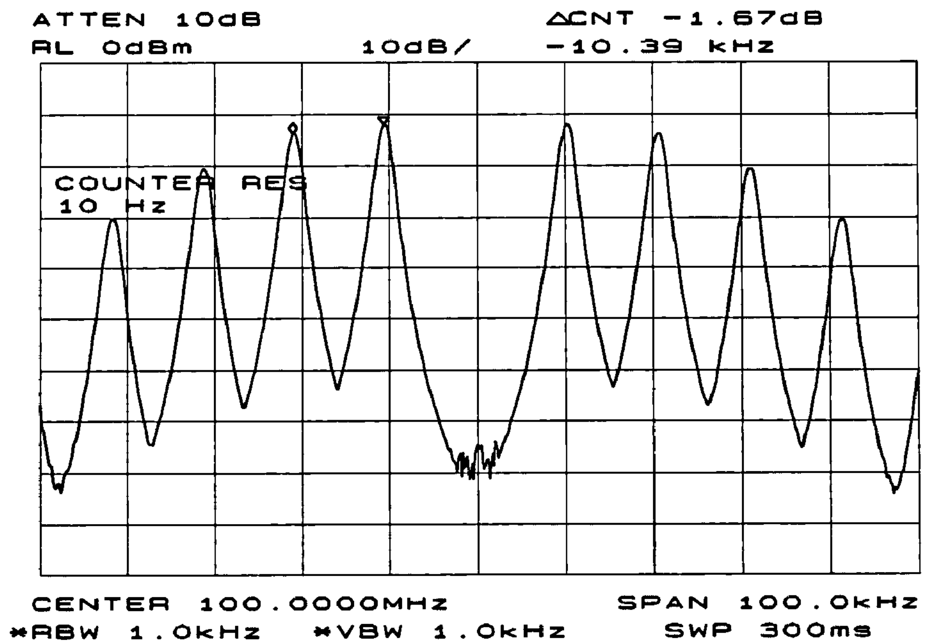


Figure 3-27. Markers Show Modulating Frequency

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 HP 8901A/B.

Pulse Mode:
VBW 3MHZ, Pos PK

Pulsed RF

This section contains information on pulsed RF and illustrates several procedures for measuring characteristics of a pulsed-RF signal. The procedures explain how to measure center frequency, pulse width, and pulse repetition frequency.

Pulse Mode

Pulsed RF measurements are generally made in the "pulse" mode. To set the spectrum analyzer for pulse-mode measurements, begin by setting the video bandwidth to 3 MHz and activate the positive peak detector (press (TRACE), **MORE**, **DETECTOR MODES**, and **DETECTOR POS PEAK**). Select the center frequency, then adjust the span until the center lobe and at least one pair of side lobes appear on the display (see Figure 3-28). Increase the sweep time (that is, the sweep becomes slower) until the display fills in and becomes a solid line. See Figure 3-29. If this line does not fill in, the instrument is not in pulse mode, in which case the following procedures for side lobe ratio, pulse width, and peak pulse power do not apply. For further reference, consult Hewlett-Packard Application Note 150-2, entitled "Pulsed RF."

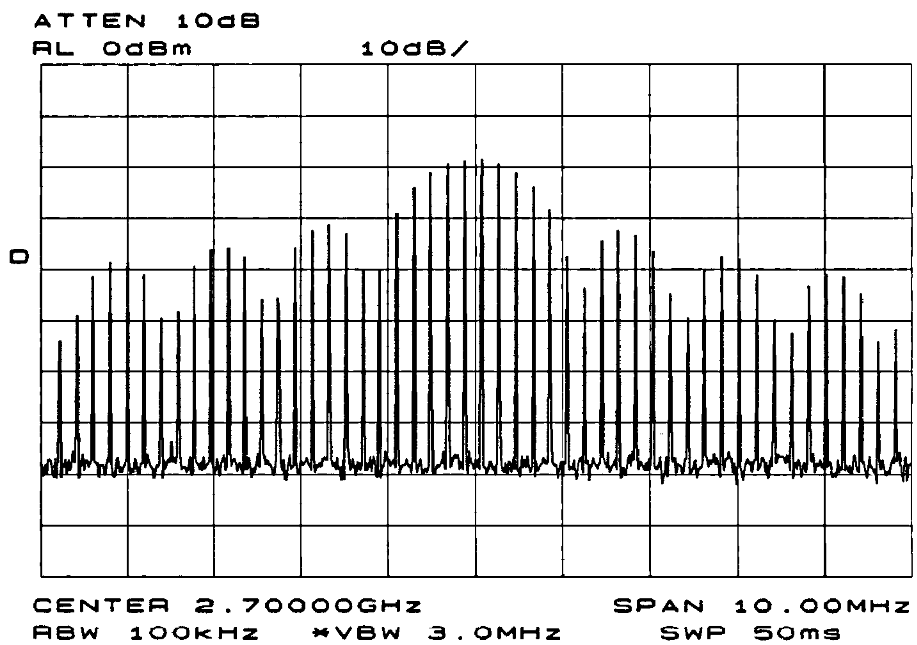


Figure 3-28. Main Lobe and Side Lobes

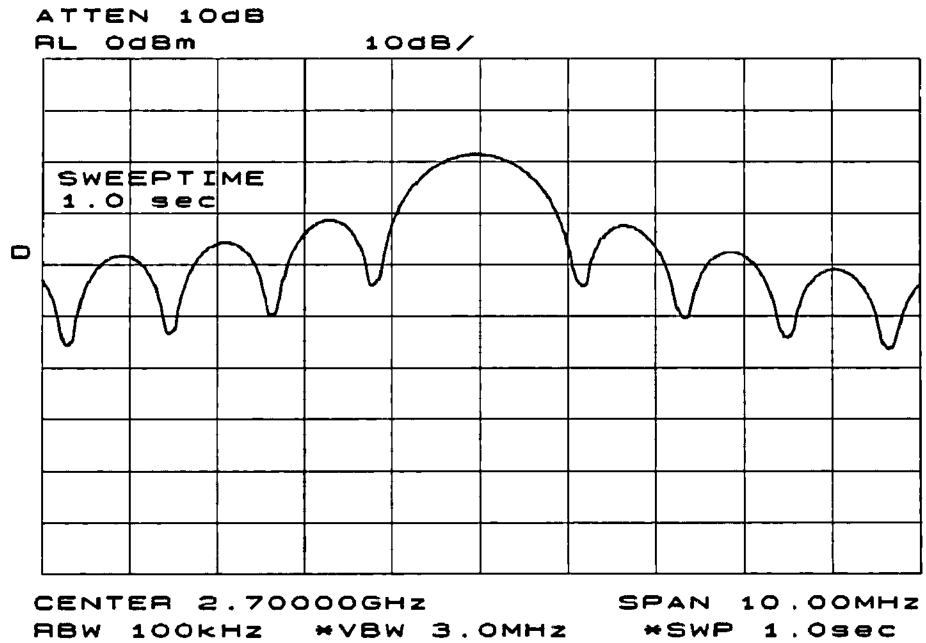


Figure 3-29. Trace Displayed as a Solid Line

Center Frequency, Sidelobe Ratio, and Pulse Width

For a pulsed RF signal, the center frequency is at the center of the main lobe (see Figure 3-30). To identify this frequency, simply use the spectrum analyzer peak search function. The marker also reads the main lobe amplitude.

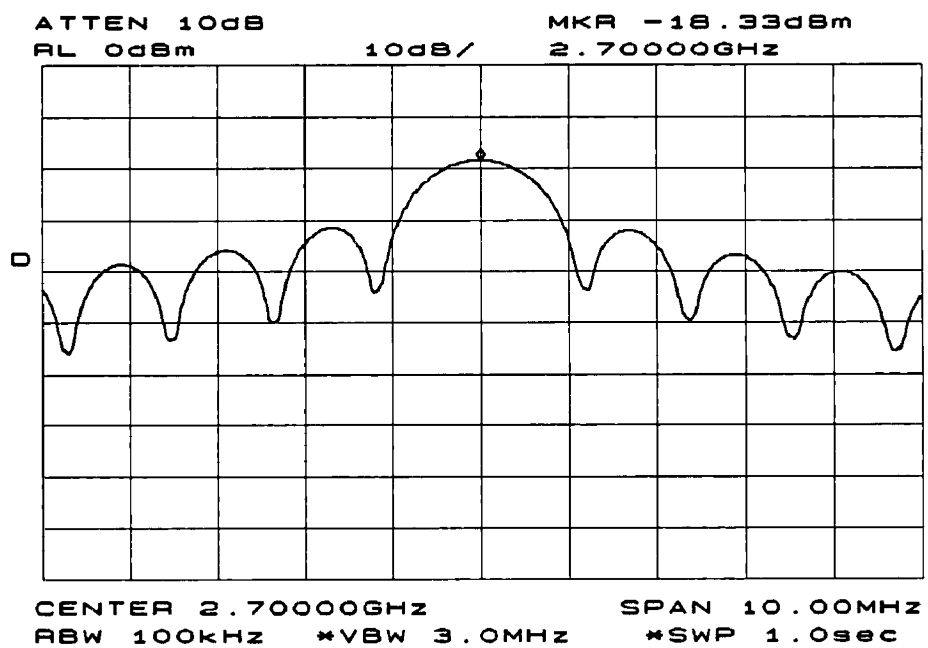


Figure 3-30. Center Frequency at Center of Main Lobe

To measure the side lobe ratio, with the marker still at the center frequency of the main lobe, press the `MARKER DELTA` and `NEXT PEAK` (see Figure 3-31). The difference between the amplitude of the main lobe and the side lobe is the side lobe ratio.

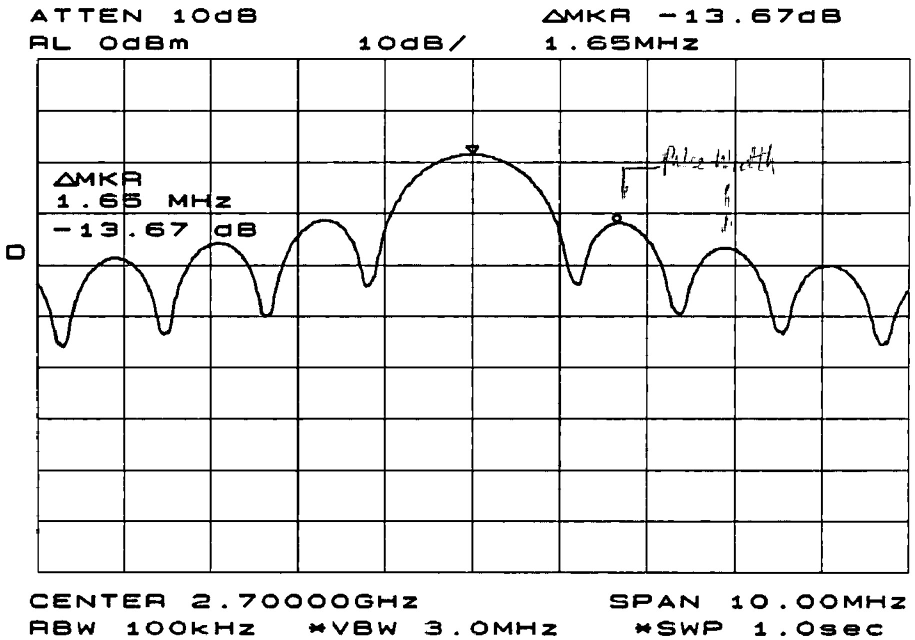


Figure 3-31. Markers Show Sidelobe Ratio

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`, `MORE`, and `NEXT PK RIGHT`; then press (ON), and `MARKER 1/DELTA`. The pulse width is equal to the time value displayed on the spectrum analyzer screen, as in Figure 3-32. 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.

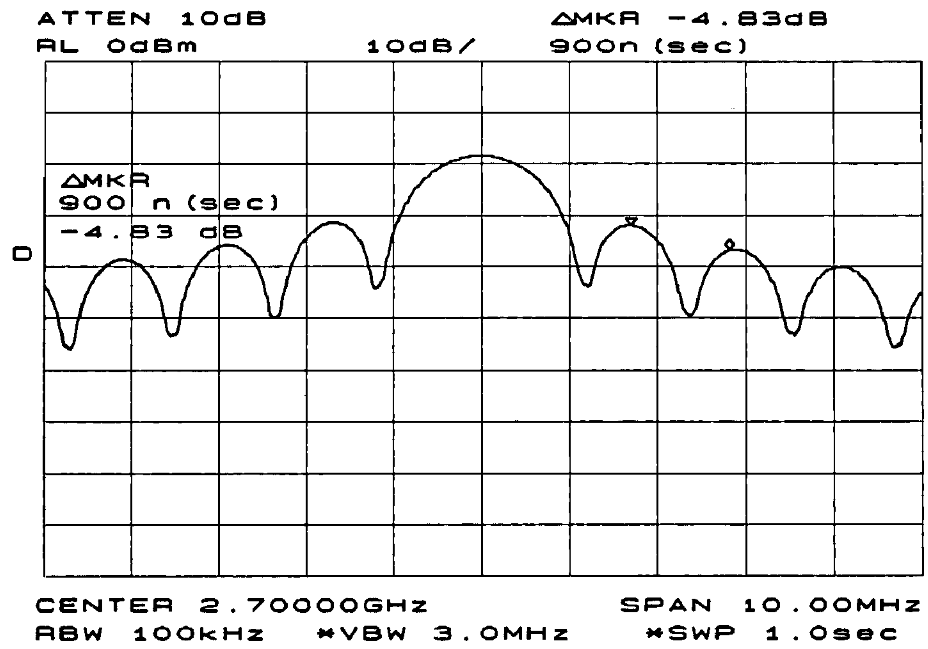


Figure 3-32. Markers Show Pulse Width

Pulse Repetition Frequency (PRF)

Pulse repetition interval (PRI) is the spacing in time between any two adjacent pulse responses, shown in Figure 3-28. Using the **MARKER 1/DELTA** function, PRI can easily be inverted to read PRF instead. To measure PRI, set the span to 0 Hz and adjust amplitude of the main lobe to the reference level. Set the amplitude scale to linear and readjust the signal so that it is on screen. Next, decrease the sweep time (that is, the sweep becomes faster) until the display resembles Figure 3-33. Select the **SINGLE** trigger mode. Finally, press (PEAK SEARCH), **MARKER DELTA**, **MORE**, and **NEXT PK RIGHT** or **NEXT PK LEFT**. The difference displayed between the two markers is equal to the PRI. Simply press (ON) and **MARKER 1/DELTA** for the PRF, as shown in Figure 3-33.

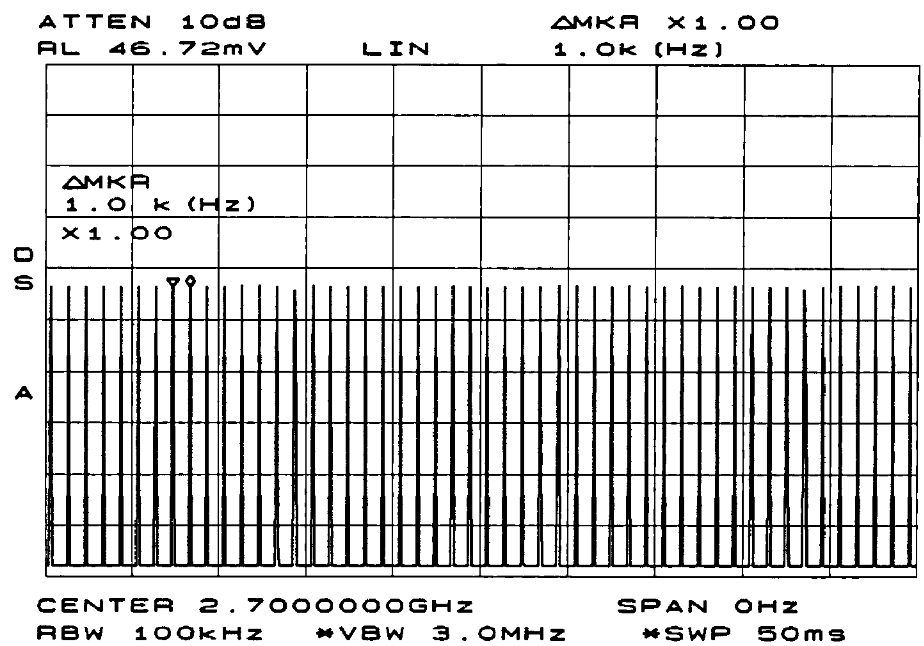


Figure 3-33. Measuring Pulse Repetition Frequency

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:

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

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 2.7 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).

External Harmonic Mixers and Signal Identification

The frequency range of the analyzer can be easily extended using external harmonic mixers. This section explains how to connect external mixers to the spectrum analyzer and how to use its automatic signal identification functions.

Equipment Setup

Figure 3-34 illustrates how to connect an external harmonic mixer to the spectrum analyzer.

Caution

The spectrum analyzer LO output is +16 dBm. Be sure your mixer can accommodate this power level before connecting it to the analyzer.

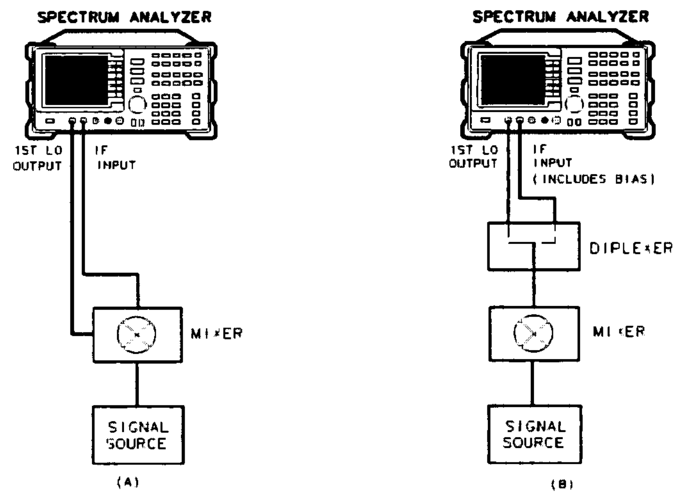


Figure 3-34. External Mixer Setup (a) without Bias; (b) with Bias

Be sure to connect the mixer to the spectrum analyzer using Hewlett-Packard SMA-type cables, part number 5064-5458. Do not overtighten the cables.

To select a frequency above 22 GHz, press (EXT) to set the analyzer to external mixer mode, then enter the desired frequency directly using the center frequency function. Note in Table 3-3, however, that some frequencies overlap and fall into two bands. Using the above method to select a frequency in an overlapping area will set the analyzer to one of the two bands, but it may not be the band you desire. To be sure the desired band is selected, refer to Table 3-3 and select a desired frequency band, then use the FULL BAND function to enter this band. Press (EXT) and the key FULL BAND , then press the (⇧) step key until the letter following FULL BAND corresponds to the chosen frequency band. The HARM LOCK function "locks" the spectrum analyzer in that band, ensuring that the spectrum analyzer sweeps only the chosen band.

Table 3-3. External Mixer Frequency Ranges

Frequency Band	Frequency Range (GHz)	Mixing Harmonic	Conversion Loss
K	18.0—26 5	6−	30 dB
A	26.5—40.0	8−	30 dB
Q	33.0—50.0	10−	30 dB
U	40.0—60 0	10−	30 dB
V	50.0—75 0	14−	30 dB
E	60.0—90.0	16−	30 dB
W	75.0—110.0	18−	30 dB
F	90.0—140.0	24−	30 dB
D	110.0—170.0	30−	30 dB
G	140.0—220.0	36−	30 dB
Y	170.0—260.0	44−	30 dB
J	220.0—325.0	54−	30 dB

Conversion Loss

Table 3-3 lists default conversion loss values that are stored in the analyzer for each frequency band. These values approximate the values for HP 11970 Series mixers. Other conversion loss values may be entered into the spectrum analyzer with the **AVERAGE CNV LOSS** function. To activate this function, press (EXT) and the keys **AMPTD CORRECT** and **AVERAGE CNV LOSS** ; then enter the appropriate conversion-loss value. On HP 11970 Series mixers, these values are charted on the mixer.

Signal Identification

The IF output of a harmonic mixer contains many mixer products (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 3-35) and the rightmost member of the pair is the correct response (for this analyzer, the left member of a pair is not valid).

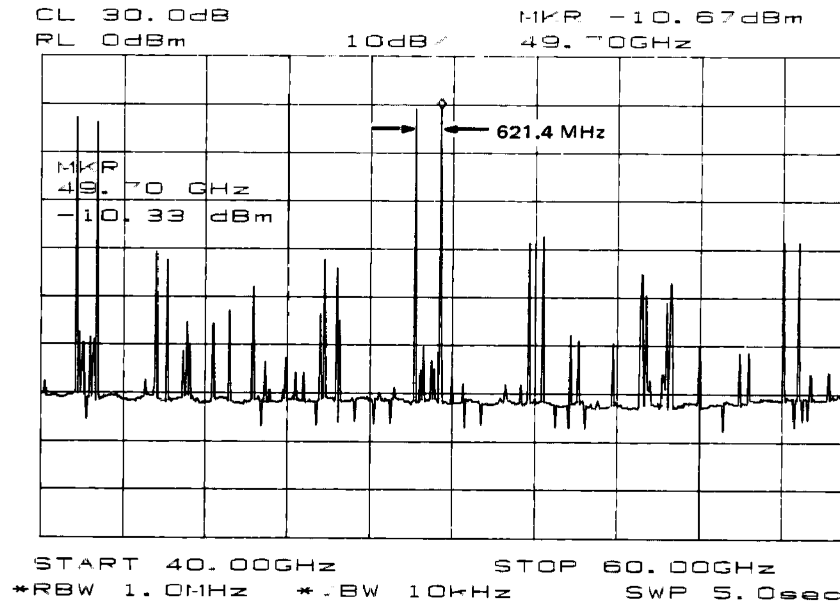


Figure 3-35. Signal Responses Produced of a 50 GHz Signal in U Band

The **frequency shift method** of identifying valid signals employs the spectrum analyzer function `SIG ID ON OFF`. To activate this function, press (EXT) and the keys `SIGNAL IDENT` and `SIG ID ON OFF`. A valid signal response (one that has been produced by the selected harmonic) will be shifted vertically on alternate sweeps. The response will not shift horizontally. See Traces A and B in Figure 3-36. Any signal not produced by the currently selected harmonic will be shifted horizontally on alternate sweeps. In trace B of Figure 3-37 the horizontal shift of an invalid response has placed the signal outside the range of the frequency span. To ensure accuracy, limit the frequency span to a maximum of 20 MHz.

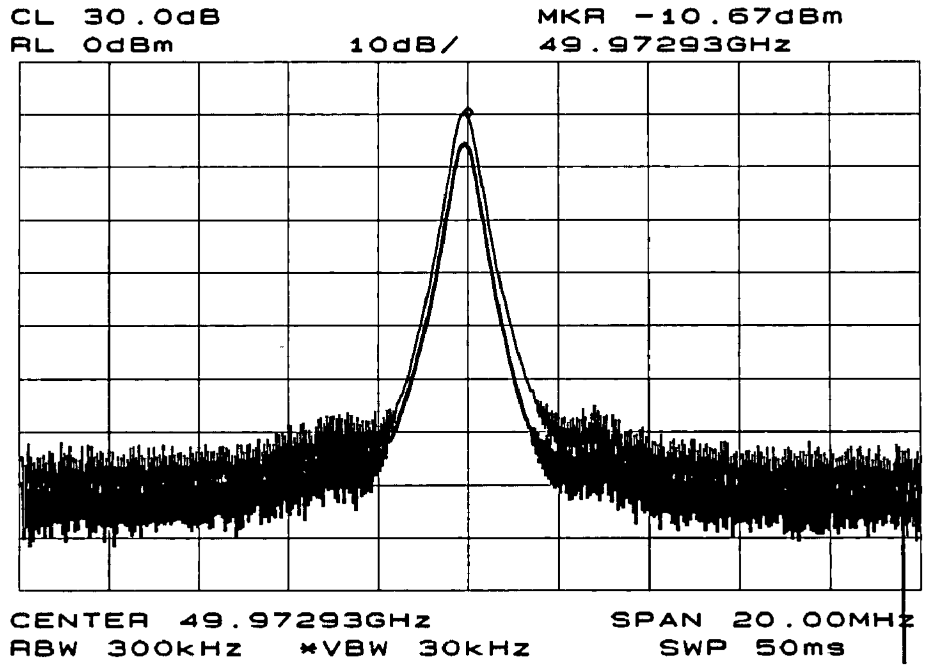


Figure 3-36. Response for Valid Signals

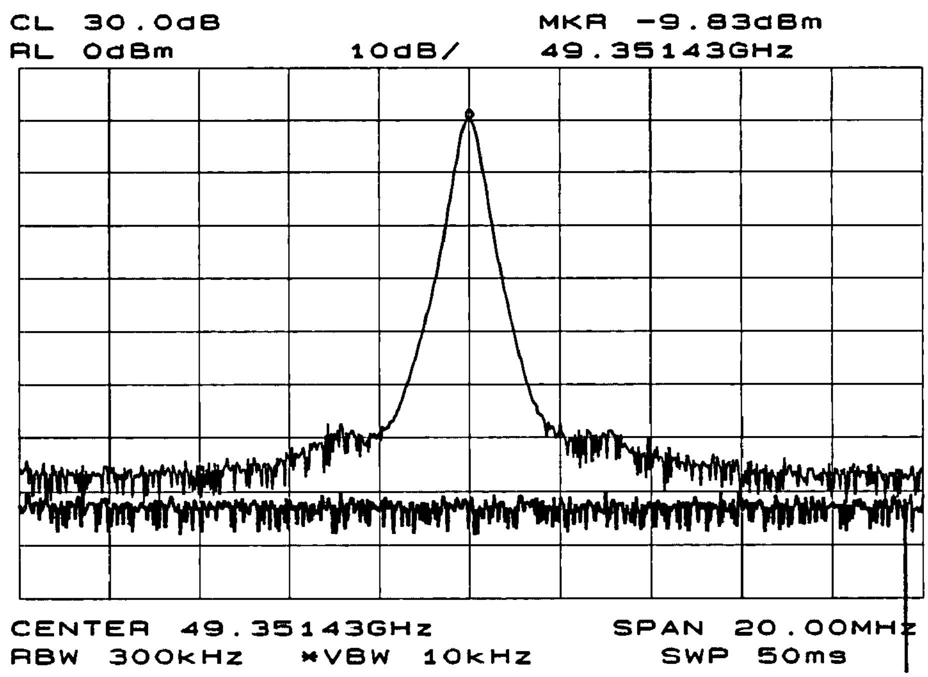


Figure 3-37. Response for Invalid Signals

There is also a function for identifying signals in wide frequency spans. This function, SIG ID AT MKR , employs a **harmonic search**

method of signal identification. SIG ID AT MKR automatically determines the proper frequency of a signal and displays its value on the spectrum analyzer. To activate SIG ID AT MKR , place a marker on a signal and press (EXT), the key SIGNAL IDENT , and the key SIG ID AT MKR .

Bias

The HP 11970 Series mixers mentioned in the section above do not require bias. Mixers requiring bias can also be used with the analyzer, for example, HP 11517A Series harmonic mixers.

Bias gives these mixers minimum conversion loss; however, bias must be adjusted for every measurement made. Mixers requiring bias are connected as shown in Figure 3-34 (with mixer bias supplied via the IF line). To measure a signal, access a band as described above. To activate the bias, press (EXT) and the key BIAS ; then press the key corresponding to the bias polarity (positive or negative) that your mixer requires. Use the knob on the spectrum analyzer to adjust the bias and to peak the signal for maximum amplitude. Finally, activate the signal identification method you desire. 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.

---

4. Programming Fundamentals

4

Programming Fundamentals

This chapter describes programming methods and techniques for the spectrum analyzer. Major chapter topics are located on the following pages:

Remote Operation

This section begins with instructions on how to set the analyzer address and execute commands remotely, then introduces you to using variables and numeric formats in a program. From these simple concepts it develops a program that illustrates important spectrum analyzer programming techniques: how to control the spectrum analyzer sweep; how to use markers to set a signal to the reference level; and how to query the analyzer for amplitude and frequency values of an active marker, read the values, and enter them into variables. While the programs and programming examples in this chapter are written in HP BASIC 5.1 using HP 9000 Series 300 Computers, other versions of BASIC, and any computer that complies with the Institute of Electrical and Electronic Engineers (IEEE-488) standards, may be used. To best understand this section, general knowledge of the BASIC language is required.

Connecting the Analyzer to the Computer

Figure 4-1 illustrates how to connect a computer that complies with IEEE-488 standards to the spectrum analyzer. When the analyzer is operated remotely, a single softkey **RMT LCL** appears on the display and allows you to return to local mode. Either RMT or LCL will be underlined indicating access.

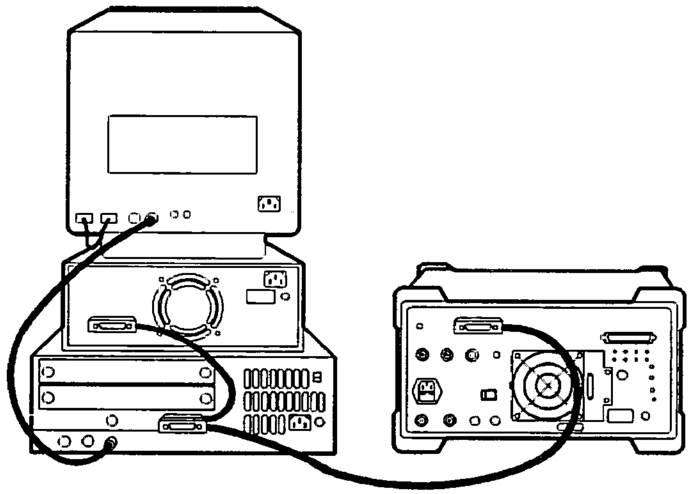


Figure 4-1. Connecting Analyzer to an HP 9000 Series 300 Computer

Setting the Address

The spectrum analyzer address is displayed in the active function block (see Figure 4-2). To read the address, press (PRESET) and then `HP-IB ADDR`. To change the address, use the data keys to enter the desired number, then terminate the entry with (Hz). For example, to set the address to 18, press (PRESET) `HP-IB ADDR` 1 8 (Hz). To store the address, press `STORE HP-IB`.

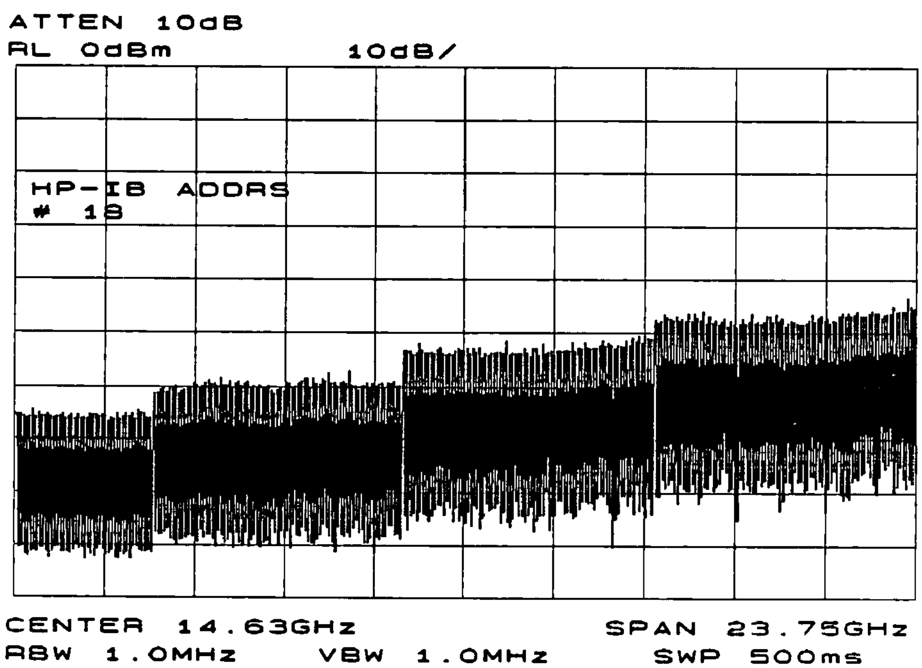


Figure 4-2. Address Displayed on the Screen

How to Program Common Spectrum Analyzer Functions

Nearly all manual functions on the spectrum analyzer have corresponding programming commands. For example, the commands CF and SP activate center frequency and frequency span, respectively. The following example illustrates how to set the center frequency to 300 MHz and the frequency span to 20 MHz.

Example 1

```
10  OUTPUT 718;"CF 300MHZ;"
20  OUTPUT 718;"SP 20MHZ;"
30  END
```

In the program lines above, OUTPUT is a BASIC command that designates the computer as the "talker" on the bus. OUTPUT is also used to direct command strings to the spectrum analyzer (at address 18); these spectrum analyzer commands are contained in quotation marks. For example, executing line 10 sets the spectrum analyzer center frequency to 300 MHz.

Note that the quotation marks contain spectrum analyzer commands followed by a semicolon as the terminator. All spectrum analyzer commands must be contained within quotation marks. The semicolons appearing in the examples above conform to IEEE-728, which recommends placing semicolons in between spectrum analyzer commands and at the end of a line. This makes programs easier to read and prevents the spectrum analyzer from misinterpreting commands.

Programming with numerical constants is the easiest way to control the spectrum analyzer remotely. However, for all but the simplest programs, variables provide greater measurement flexibility. Variables allow you to set the center frequency and span using values that you have selected, as in the following example.

Example 2

```
10  A=300
20  B=20
30  OUTPUT 718 USING "K";"CF";A;"MHZ;"
40  OUTPUT 718 USING "K";"SP";B;"MHZ;"
30  END
```

This programming technique allows you to change the center frequency and span by changing the values of variables A and B. Also, by using variables, you can enter numeric values via the computer keyboard. Note that the variables are not actual spectrum analyzer commands; thus they are not placed within the quotation marks.

In the example above, the USING statement creates a format (K) for the data. In this case, the format uses 15 characters to send numeric values. Formats, though not required, ensure accurate transfer of data by allowing you to control the resolution of the data sent. However, using 15 characters to transfer numbers such as

300 and 20 does not provide the best control over a data transfer. Example 3 illustrates a more concise format.

Example 3

```
10  A=300
20  B=20
30  IMAGE K,5D.DD,K
40  OUTPUT 718 USING 30;"CF",A,"MHZ;"
50  OUTPUT 718 USING 30;"SP",B,"MHZ;"
60  END
```

In the example above, the IMAGE statement (K,5D.DD,K) creates a format for the data. In this case the format allows two character strings (each represented by the letter K) and a numeric variable consisting of up to five significant digits plus two decimal places (represented by 5D.DD). Not only does this format save time, but an IMAGE statement can be reused in other parts of the program. Simply use the line number on which the IMAGE statement appears, as in lines 40 and 50.

The format 5D.DD provides numeric accuracy to within 10 kHz. To increase the resolution—for example, to 100 Hz—increase the number of decimal places to four (5D.4D).

The order in which you set spectrum analyzer functions is also important; the following checklist shows the best order in which to activate these functions.

- Set the center frequency and span or set the start and stop frequencies.
- Set the input attenuation.
- Set the resolution and video bandwidths and the sweep time. (As a general rule, these functions can be left in auto mode and set by the spectrum analyzer.)
- Set the reference level.
- Activate markers.

Developing a Simple Program

The best way to begin automating a measurement procedure is first to perform it manually. This allows you to select the exact functions you will want to use in your program. Choosing the right functions beforehand usually reduces program de-bugging. By now you should be familiar with making a basic measurement (that is, setting the frequency, span, reference level, and marker), so we will use these functions to create a programming example.

The first spectrum analyzer commands to use in a program are those that execute an instrument preset (programming command IP) and activate the single sweep mode (programming command SNGLS). The instrument preset sets the spectrum analyzer to a known condition from which to begin your setup. Single sweep mode gives you explicit control of spectrum analyzer sweeps and of the input and output of data.

Example 4

```
10  OUTPUT 718;"IP;SNGLS;"
20  END
```

Next, select spectrum analyzer measurement settings. For this example, we can use the program segment from the previous section.

Example 5

```
10  OUTPUT 718;"IP;SNGLS;"
20  A=300
30  B=20
40  IMAGE K,5D.DD,K
50  OUTPUT 718 USING 40;"CF",A,"MHZ;"
60  OUTPUT 718 USING 40;"SP",B,"MHZ;"
70  END
```

After the settings have been programmed, execute a take sweep command (TS). This ensures that, for the entire sweep, the analyzer functions are set to the values selected and that any measurements on the trace will be made with these settings. If the single sweep and take sweep commands were not included, the spectrum analyzer might transfer data before completing a full sweep. As a result, part of the trace data may not be valid, since it might have been taken from previous settings. Under these conditions, it would be hard to know if the measurement data were valid. The preferred method is shown in Example 6.

Example 6

```
10  OUTPUT 718;"IP;SNGLS;"
20  A=300
30  B=20
40  IMAGE K,5D.DD,K
50  OUTPUT 718 USING 40;"CF",A,"MHZ;"
60  OUTPUT 718 USING 40;"SP",B,"MHZ;TS;"
70  END
```

At this point in the program, we can be sure that all measurements will be made in reference to the selected settings.

As with manual measurements, reading the signal amplitude at the reference level provides the best measurement accuracy. Once a signal is present, a convenient method for setting the reference level uses the "marker to reference level" function. After a marker has been activated, the marker to reference level function can set the reference level to the value of the marker. This function is particularly useful for setting the reference level to the value of the highest point on a trace. The peak search function (MKPK HI) finds the highest point on a trace and places a marker on it. The marker to reference level function (MKRL) sets the reference level to the value of this point. To read the marker values, take another sweep, then "re-peak" the marker. This marker command routine is illustrated in line 70 of Example 7.

Example 7

```
10  OUTPUT 718;"IP;SNGLS;"
20  A=300
30  B=20
40  IMAGE K,5D.DD,K
50  OUTPUT 718 USING 40;"CF",A,"MHZ;"
60  OUTPUT 718 USING 40;"SP",B,"MHZ;TS;"
70  OUTPUT 718;"MKPK HI;MKRL;TS;MKPK HI;"
80  END
```

Note the placement of the TS command in line 70. Using TS ensures that the spectrum analyzer makes a complete sweep with the new settings before executing any additional commands that follow TS.

Reading Marker Frequency and Amplitude

Now that you have set up the spectrum analyzer to find the marker values, the next logical step is to read marker information from the spectrum analyzer and enter it into variables. The following example, which continues from the last, shows how to find the amplitude and frequency values of a marker and enter them into variables.

Example 8.

```
10   OUTPUT 718;"IP;SNGLS;"
20   A=300
30   B=20
40   IMAGE K,5D.DD,K
50   OUTPUT 718 USING 40;"CF",A,"MHZ;"
60   OUTPUT 718 USING 40;"SP",B,"MHZ;TS;"
70   OUTPUT 718;"MKPK HI;MKRL;TS;MKPK HI;"
80   OUTPUT 718;"MKA?"
90   ENTER 718;Amplitude
100  OUTPUT 718;"MKF?"
110  ENTER 718;Frequency
120  PRINT "MARKER AMPLITUDE = ",Amplitude
130  PRINT "MARKER FREQUENCY = ",Frequency
140  END
```

The question marks in lines 80 and 100 query the spectrum analyzer for the amplitude and frequency of the marker. The ENTER statement designates the spectrum analyzer as the talker so it can send information over to the computer, which becomes the listener. The spectrum analyzer can then output these values into the variables Amplitude and Frequency. Lines 120 and 130 print the values on the computer screen. Of course, the variables can be used later in the program. Most spectrum analyzer commands can be queried in order to return values.

The marker values are returned to the computer in the "K" format. To select another format for the results (such as the format in Line 40), simply insert formatting statements on lines 90 and 110, similar to those on Lines 50 and 60.

Creating Screen Titles

Screen titles (shown in Figure 4-3) allow you to label instrument data. They can help identify on-screen data or data that you want to store or plot. The spectrum analyzer has 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.

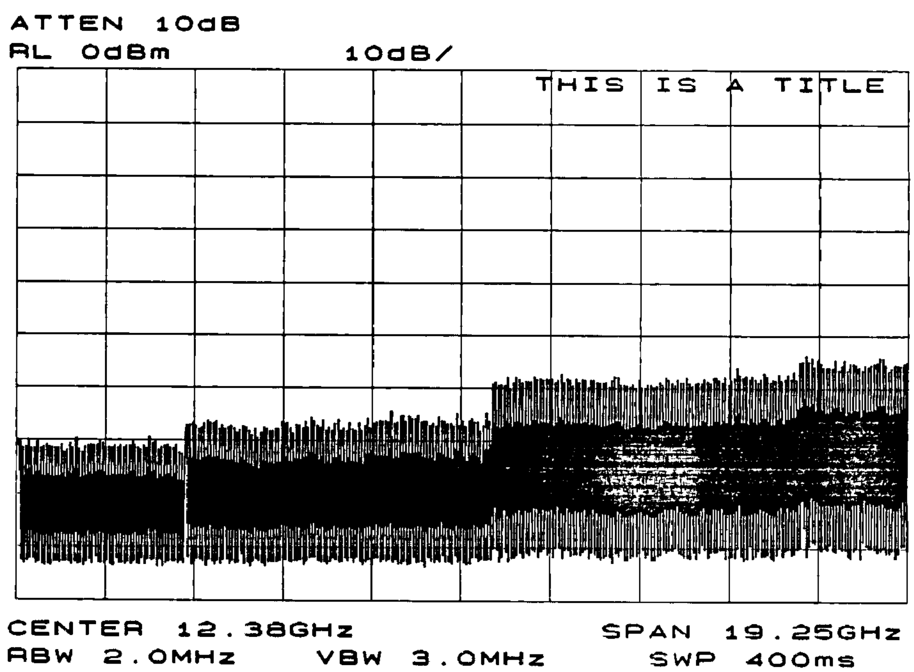


Figure 4-3. Screen Titles

No-Format Method

This is the simplest method for creating a title. No format is used; simply enclose the title within string delimiters as shown in Example 9.

The list of string delimiters follows:

```
! " $ % & ' / : = @ \ | < > { }
```

Example 9

```
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).

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 10.

Example 10.

```
10  DIM A$[15]
20  A$="THIS IS A TITLE"
30  END
```

A-block format also requires that you send the length of the title, in bytes. When using Hewlett-Packard BASIC, this task is easily accomplished. See Example 11.

Example 11.

```
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 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. The # sign in the USING statement suppresses any end-of-line characters.

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 12.

Example 12.

```
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. 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. Again, the # sign in the USING statement suppresses any end-of-line characters.

Generating Plots Remotely

In addition to the plot functions available from the spectrum analyzer front panel, the analyzer also allows you to generate plots remotely.

Plotter Requirements

Be sure your plotter satisfies the following requirements to execute the programming examples in this chapter successfully.

1. The analyzer supports the following plotters: the HP 7470A, HP 7475A, HP 7550A, HP 9872A/B/C, and the HP 7440A ColorPro. Be sure that the HP 7550A Plotter is in "standard" mode.
2. Set the plotter to address 5 (see Figure 4-4). If you cannot locate the address switch on the plotter, refer to the plotter's 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.

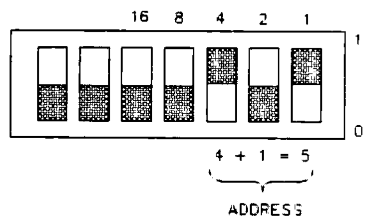


Figure 4-4. Plotter Address Set to 5

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 4-5). These coordinates define the size of the plot. Table 4-1 shows the scaling points for several Hewlett- Packard plotters.

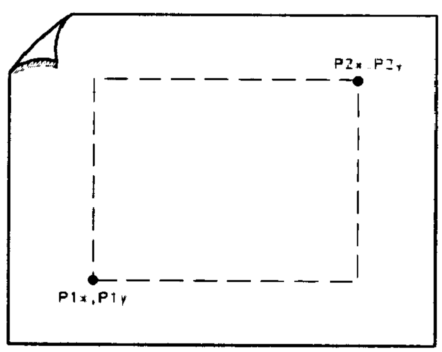


Figure 4-5. P1 and P2 Coordinates

Table 4-1. Scaling Points for Various Plotters

	Typical Scaling Points		Plotting Range	
Plotter	P1x,P1y	P2x,P2y	X-Axis	Y-Axis
HP 7440A	200,200	7400,11000	0 to 7544	−39800 to +51000
HP 7475A	250,279	10250,7479	0 to 10300	0 to 7650
HP 9872C	520,380	15720,10380	0 to 16000	0 to 11400

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 4-1 create a plot with approximately 1″ margins on an 8-1/2″ × 11″ 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 HP-IB to the computer and execute Example 13.

Example 13

```
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 of the example above queries the plotter for its P1 and P2 coordinates, and Line 20 enters these values into variables. Line 30 sends the spectrum analyzer PLOT command and the plotter coordinates. Line 40 sends the following statements over the HP-IB interface: `UNL` sets all instruments on the HP-IB to unlisten mode; `LISTEN 5` sets only the plotter to listen mode; `TALK 18` specifies as the talker the spectrum analyzer, which can then send its display contents to the plotter. Since the controller's HP-IB interface must not interfere with the plot, the `DATA` statement puts the controller HP-IB interface on standby and sets the attention line low.

Example 13 illustrates the statements required to generate a plot. However, there is no provision to indicate to the controller when the plot is finished. Example 14 uses a spectrum analyzer "command complete" service request to indicate when the plot is done. (Refer to "Service Requests" 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 14

```
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. On 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 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 15 illustrates how to plot trace A and the annotation.

Example 15

```
10  OUTPUT 705;"OP;"
20  ENTER 705;P1x,P1y,P2x,P2y
30  OUTPUT 718;"PLOTSRC TRA;RQS 16;"
40  OUTPUT 718;"PLOT ";P1x;", ";P1y;", ";P2x;",";P2y; ";RQS 0;"
50  Done=0
60  IF Done=0 THEN GOSUB Wait_plot
70  Done=0
80  OUTPUT 718;"PLOTSRC ANNT;RQS 16;"
90  OUTPUT 718;"PLOT" ;P1x;" ,";P1y;" ,";P2x;",";P2y;";RQS 0;"
100  IF Done=0 THEN GOSUB Wait_plot
110   PRINT "COMMAND IS COMPLETE"
120  STOP
```

```
130  Wait_plot:     Done=1
140  ON INTR 7 GOTO Go_back
150  ENABLE INTR 7;2
160  SEND 7;UNL LISTEN 5 TALK 18 DATA
170  Idle: GOTO Idle
180  Go_back: S_poll=SPOLL(718)
190  RETURN
200 END
```

Another available plot function, the PLOTORG 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.

Trace Data Transfers

An important part of spectrum analyzer remote operation is receiving and sending trace data via HP-IB.

The analyzer provides five formats: real number (P) format, binary (B) format, A-block format, I-block format, and measurement units (M) format. Transferring data to and from a computer with each format is described below.

Transfer Requirements

The three requirements listed here apply to all trace data transfers, regardless of the format selected.

1. Trace Length
2. Trace Conditions
3. Specify the data format before transferring data.

Trace Length

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, set the dimension of trace-data arrays to 601 elements.

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 start and stop frequencies, reference level, amplitude scaling, and absolute amplitude units. You may want to store additional conditions such as resolution bandwidth, attenuation, or sweep time. Example 16 queries the spectrum analyzer for the trace conditions shown on the display and stores them. Example 17 shows how to return this data to the analyzer.

Example 16.

```
10  SUB Get_data(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 17.

```
10  SUB Enter_data(Fa,Fb,Rl,Rb,Vb,St,Lg,Aunits$)
20  OUTPUT 718;"FA ";Fa;"HZ;"
30  OUTPUT 718;"FB ";Fb;"HZ;"
40  OUTPUT 718;"AUNITS ";Aunits$;";"
50  OUTPUT 718;"RB ";Rb;"HZ;"
60  OUTPUT 718;"VB ";Vb;"HZ;"
70  OUTPUT 718;"ST ";St;"SEC;"
80  IF Lg=0 THEN
90  OUTPUT 718;"LN;"
100  ELSE
```

```
110  OUTPUT 718;"LG ";Lg;"DB;"
120  END IF
130  SUBEND
```

Specify the Data Format Before Transferring Data

Use the TDF command to specify the format before sending data from the spectrum analyzer to the computer. The examples in this chapter illustrate how to use this command. For more information, refer to Chapter 5.

The examples in this chapter use the TRA command. This command transfers data to and from trace A. A TRB 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 vice versa. For simplicity, this capability is not reflected in the programming examples in this chapter.

Formats

P-Format

The real number, or "P," format allows you to receive or send trace data in a real-number format. This is the default format when the instrument is powered up. Numbers are in dBm, dBmV, dBμV, volts, or watts. Be sure to include the amplitude units with the trace data (use the AUNITS command or the trace conditions procedure discussed above). Real-number data may 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 take up a lot of memory (compared to binary format, in some cases, P- format can take up to four times the amount of memory).

The following programming example illustrates how to send trace data to a computer.

Example 18.

```
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$)
40  OUTPUT 718;"TDF P;TRA?;"
50  ENTER 718;A(*)
60  END
70  SUB Get_data(Fa,Fb,Rl,Rb,Vb,St,Lg,Aunits$)
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). Dimension the array 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 the P-format (`TDF P`), then queries the analyzer for the data in trace A (TRA?). The data is entered into the array on Line 50. You can use the data in a program or store it on a disk for later use.

Example 19 illustrates how to return data from a computer to the spectrum analyzer.

Example 19.

```
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
```

Note that lines 10—50 effectively repeat Example 18. This is to ensure that Example 19 will run properly; trace data does not need to be output twice. Sending the trace data begins on Line 80. Line 80 presets the analyzer, readies the spectrum analyzer to accept data into trace A, and selects the P-format. Line 90 sets the analyzer to the stored trace conditions. Lines 100—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 each point is followed by the amplitude units (in this case, dBm). If the specified amplitude units for the trace data are the same as the amplitude units currently selected for the analyzer, you may omit the amplitude units in the above program. When sending trace data into the analyzer using P-format, each point is terminated with the amplitude units (in this case, dBm).

B-Format (output only)

The binary, or "B," 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 data points are in the internal representation of measurement data. 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.

Example 20 shows how to transfer data in B-format from the spectrum analyzer to a computer.

Example 20.

```
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_data(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). On Line 20, the spectrum analyzer address is assigned to **@Sa_bin**. 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, no number builder is needed to transfer the binary data. The number builder is turned off whenever the spectrum analyzer is addressed as **@Sa_bin**. 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:

$$\begin{aligned} n &= \mathrm{RL} - 10 \times \text{Log Scale} + \text{Log Scale} \times (x/600) \\ &= \mathrm{RL} + \text{Log Scale}(x/60 - 10) \end{aligned}$$

where:

x = binary data in an array element

RL = reference level in dBm, dBmV, or dBμV

Log Scale = the dB per division log scale selected on the spectrum analyzer.

Example 21 converts binary values to measurement data and prints them on the computer display.

Example 21.

```
10  INTEGER Trace_a(1:601)
20  DIM Real_num(1:601)
30  Ref_lvl=0 ! 0 DBM REFERENCE LEVEL
40  Log_scale=10 ! 10/DIV 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:

$$n = \mathrm{RL}(x/600)$$

where:

x = binary data in an array element
RL = reference level, in volts or watts

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.

One important 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.

A-Block Format

A-block format is similar to binary format in that each data point is sent as two 8-bit bytes (this, too, is in the internal representation of measurement data). A-block format also transfers a four-byte header before the 601 points of trace data. These bytes are the ASCII characters "#," "A," and a two-byte length field equal to 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 contains 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. Refer to "Generating Plots Remotely" in this chapter.

Example 22.

```
10  INTEGER Tra_binary(1:601)
20  DIM Header$[4]
30  OUTPUT 718;"IP;CF 300MHZ;SP 20 MHZ;SNGLS;TS;"
40  CALL Get_data(Fa,Fb,Rl,Rb,Vb,St,Lg,Aunits$)
50  OUTPUT 718;"TDF A;TRA?;"
60  ENTER 718 USING "#,4A,601(W)";Header$,Tra_binary(*)
70  END
```

Like B-format, the array in Line 10 is created 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). Since 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 may occur before the last trace-data byte is sent.

Example 23 sends trace data from the computer to the analyzer.

Example 23.

```
10  INTEGER Tra_binary(1:601)
20  DIM Header$[4]
30  OUTPUT 718;"IP;CF 300MHZ;SP 20MHZ;SNGLS;TS;"
40  CALL Get_data(Fa,Fb,Rl,Rb,Vb,St,Lg,Aunits$)
50  OUTPUT 718;"TDF A;TRA?;"
60  ENTER 718 USING "#,4A,601(W)";Header$,Tra_binary(*)
70  PRINT "PRESS CONTINUE TO RETURN DATA TO THE ANALYZER"
80  PAUSE
90  OUTPUT 718;"IP;TS;VIEW TRA;"
100  CALL Enter_data(Fa,Fb,Rl,Rb,Vb,St,Lg,Aunits$)
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 and end-of-line signals characters.

I-Block Format

Data points transferred in the I-block format are sent as two 8-bit bytes in the internal representation of measurement data. In addition to transferring trace data, I-block format also transfers the 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. Refer to Example 24.

Example 24.

```
10  INTEGER Tra_binary(1:601)
20  DIM Header$[2]
30  OUTPUT 718;"IP;CF 300MHZ;SP 20 MHZ;SNGLS;TS;"
40  CALL Get_data(Fa,Fb,Rl,Rb,Vb,St,Lg,Aunits$)
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 25.

Example 25.

```
10  INTEGER Tra_binary(1:601)
20  DIM Header$[2]
30  OUTPUT 718;"IP;CF 300MHZ;SP 20MHZ;SNGLS;TS;"
40  CALL Get_data(Fa,Fb,Rl,Rb,Vb,St,Lg,Aunits$)
50  OUTPUT 718;"TDF I;TRA?;"
60  ENTER 718 USING "#,2A,601(W)";Header$,Tra_binary(*)
70  PRINT "PRESS CONTINUE TO RETURN DATA TO THE ANALYZER"
80  PAUSE
90  OUTPUT 718;"IP;TS;VIEW TRA;"
100 CALL Enter_data(Fa,Fb,Rl,Rb,Vb,St,Lg,Aunits$)
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 HP-IB EOI line set "true," as required by I-block format.

M-Format (output only)

The measurement units, or "M," format transfers trace data in the internal format used by the spectrum analyzer. Refer to Figure 4-6. The displayed amplitude of each element falls on one of 600 vertical points (with 600 equal to the reference level). For example, the peak of the signal in Figure 4-6 is equal to −10 dBm, or one division below the reference level. In measurement units, it is equal to 540 (600 − 60 = 540). There are also 10 additional points of overrange. Measurements units, then, range from 0 to 610. The advantage of M-format is that it transfers data as ASCII characters, allowing you to view the data directly. The data points are separated by commas.

To send trace data to the computer, see Example 26.

Example 26.

```
10  INTEGER 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 M;TRA?;"
50  ENTER 718;A(*)
60  PRINT A(*)
70  END
```

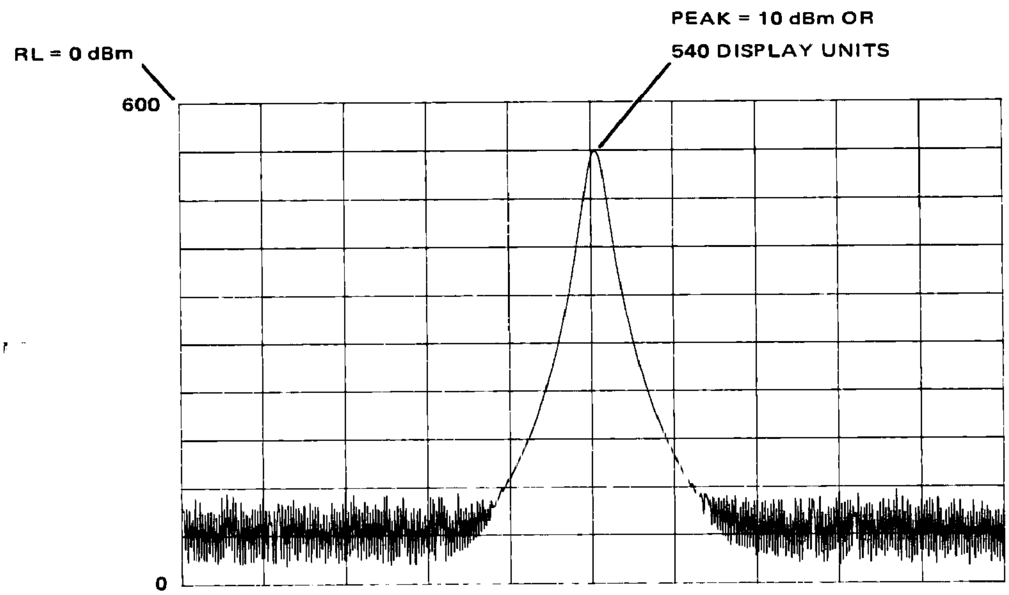


Figure 4-6. Measurement Units

Service Requests

A service request can interrupt a normal program sequence in order to attend to an event outside of the regular program sequence. Earlier in this chapter, a service request indicated when the plotter had finished plotting the contents of the spectrum analyzer display. Service requests have other applications as well. For example, while the spectrum analyzer is making a remote measurement, the computer can be processing numeric data or attending to some other task. When the analyzer is finished with its task, it can then interrupt the computer, signaling that the task is done. Or, a service request can be used to indicate that a specific event has occurred; the computer can then branch to another routine. This chapter describes the controller statements and analyzer commands used to generate service request routines.

The Status Register

The status register is a register in the spectrum analyzer. The bits in this register summarize the conditions that can create a service request. See Table 4-2. Each condition is assigned to a bit in the status register. The decimal equivalent of that bit is also included. The conditions have been selected by Hewlett- Packard as appropriate spectrum analyzer service requests. For example, when the spectrum analyzer becomes uncalibrated, a message is generated to indicate this condition. You can use this "message generated" event to trigger a service request, causing the computer to branch to a subprogram. The subprogram can then alert you of the spectrum analyzer's uncalibrated state. If you want to be notified of any errors that occur during remote operation, the `error present` service request can cause branching to a subroutine that notifies you that an error has occurred and perhaps prints the errors.

Table 4-2. HP 8562A/B 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

Masking Service Requests

Use Table 4-2 to select the condition or conditions that will generate service requests and interrupt the program sequence. Once you have selected the desired conditions, use the spectrum analyzer RQS command to specify these conditions. You will want to "mask" or blank the conditions that you do not use. Use the decimal equivalents of the desired bits to set the bit mask. The following program line sets a bit mask for the "command complete" condition.

```
10  OUTPUT 718;"RQS 16;"
20  END
```

Once RQS is executed, all conditions other than "command complete" are no longer recognized as service request conditions. Note, however, that bit 6 of the status byte is the universal service request bit. This bit signals to the computer which instrument on the HP-IB (in this case, the spectrum analyzer) has generated an interrupt condition, specifically a service-request interrupt. The spectrum analyzer service-request commands (RQS, SRQ and STB) have no effect on this bit. If desired, you can add the decimal value of bit 6 to the value in the RQS command (for example, 64 + 16 = 80; then send `RQS 80;`), but this is not necessary.

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 cause 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 GOTO Srq
30  ENABLE INTR 7;2
40  END
```

In this example, Line 20 indicates that if an interrupt appears (`ON INTR 7`), the computer is to go to the subroutine Srq (`GOTO Srq`). The 7 specifies the interface select code; in this case, it refers to the Hewlett-Packard Interface Bus (HP- IB). Line 30 enables the computer to accept an interrupt. Here, the 7 again specifies the HP-IB 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 HP-IB. 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. (Since 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 27, below.

Example 27

```
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 LOCAL 718
120 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 command is sent that the RQS command is sent. This ensures that no previous commands can accidentally generate an SRQ. Line 30 indicates to go to the routine Srq when an interrupt occurs. Line 40 enables the computer to accept the interrupt. Line 50 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. Here, on line 70, the SPOLL statement 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. On line 100, the status register is returned 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 analyzer's STB command also reads service request data. Example 28 shows how.

Example 28

```
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 781;Sbyte
90  PRINT Sbyte
100 PRINT "VIDEO AVERAGING IS COMPLETE"
110 OUTPUT 718;"RQS 0;"
120 LOCAL 718
130 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 HP 8561A and HP 8562A/B. 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 than can generate a service request, you need to modify the above program to look for interrupts from more than one instrument. See Example 29.

Example 29.

```
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   OUTPUT 718;"TS;"
60   Idle: GOTO Idle
70   Srq: Sbyte_1=SPOLL(718)
80   Sbyte_2=SPOLL(705)
90   IF BIT (Sbyte_1,6)=1 THEN
100    PRINT "SERVICE REQUEST",Sbyte_1,"ON ADDRESS 18"
110    OUTPUT 718;"RQS 0;"
120    LOCAL 718
130    STOP
140  END IF
150  IF BIT(Sbyte_2,6)=1 THEN
160    PRINT "SERVICE REQUEST",Sbyte_2,"ON ADDRESS 5"
170  END IF
180  ENABLE INTR 7;2
190  RETURN
200  END
```

In this example, you execute the SPOLL command for each instrument that may 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 30.

Example 30

```
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
```

Here, on Line 50, a "command complete" service request is immediately generated, and you can be sure that the routine will work.

Trace Math

Trace math allows easy application of correction data to a trace. Trace math is performed either in dBm units, when in log mode, or in volts, when in linear mode. Sometimes trace-math results are not intuitive; an explanation of what occurs follows.

Adding and Subtracting in dBm

The trace-math scheme allows 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 (APB) or subtracted (AMB ON) 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 are physically summed, the result is a power of −47 dBm. To further illustrate this point, 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 (i.e., 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 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 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 at the end of this chapter). The display line is added to return the result to the screen, with no clipping occurring. Since you can specify the position of the display line, you can move the corrected data to any on-screen position.

Example 31 illustrates how to correct data remotely. Before running this example, connect the calibration signal to the RF input.

Example 31.

```
10  OUTPUT 718;"IP;SNGLS;CF 299.995MHZ;"
20  OUTPUT 718;"SP 20KHZ;RB 10KHZ;LG 5DB;TS;"
30  OUTPUT 718;"CLRW TRA; CLRW TRB;TS;TS;"
40  OUTPUT 718;"VIEW TRB;DL -16DBM;"
50  OUTPUT 718;"AMBPL ON;"
60  END
```

Lines 20 execute 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 299.995 MHz, the resolution bandwidth to 10 kHz, the log scale to 5 dB, and the sweep to single mode. Line 30 sets traces A and B to clear-write mode. The program then executes the take-sweep command twice; this places the trace data in both traces. Line 40 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 50 executes the function AMBPL. Trace B is subtracted from trace A; since 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, run Example 32. 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 32

```
10  ! PUT TRACES ON SCREEN
20  INTEGER Atrace(1:601)
30  FOR I=1 TO 601
40  Atrace(I)=300
50  NEXT I
51  OUTPUT 718;"IP;LG 10DB;SNGLS;TS;"
60  OUTPUT 718 USING "#,K,W,601(W)
   ,K";"TDFA;TRA#A",1202,Atrace(*),";"
61  OUTPUT 718 USING "#,K,W,601(W),K";"TDF A;TRB#A",
   1202,Atrace(*),";"
71  OUTPUT 718;"AMB ON;"
```

```
72  PRINT "PRESS CONTINUE"
74  PAUSE
75  OUTPUT 718;"LN;SNGLS;TS;"
82  OUTPUT 718 USING "#,K,W,601(W) ,K";"TDF
   A;TRA#A",1202,Atrace(*),";"
83  OUTPUT 718 USING "#,K,W,601(W) ,K";"TDF
   A;TRB#A",1202,Atrace(*),";"
93  OUTPUT 718;"AMB ON;"
103 PAUSE
113 END
```

Trace Data Limits

The displayed amplitude of each trace element falls in one of 600 data points (see Figure 4-7). There are an additional 10 points of overrange. The 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 and the scale is equal to 10 dB per division, 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).

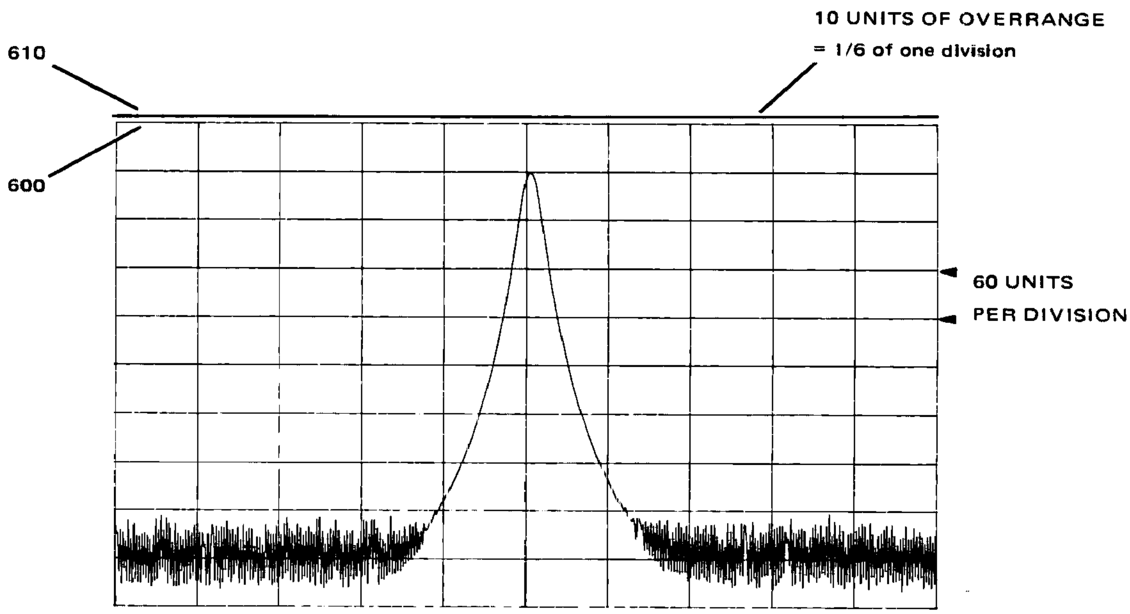


Figure 4-7. Display Units

Input and Output Buffers

This section describes how to take advantage of the input and output data 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 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 Figure 4-8.

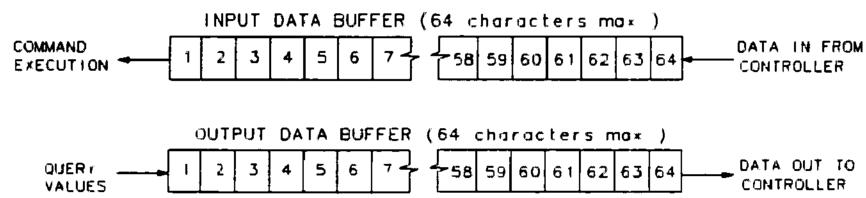


Figure 4-8. Buffer Summary

If you are entering multiple values into multiple variables with one ENTER statement, use a "K" format with the ENTER statement. The 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.

Example 33 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 queried the spectrum analyzer.

Example 33

```
10  OUTPUT 718;"IP;SNGLS;MKPX 6DB;MKPT -65DB;"
20  OUTPUT 718;"FA 270MHZ;FB 1200MHZ;TS;"
30  OUTPUT 718;"MKPK HI;MKD;MKPK NR;MKF?;MKA?;"
40  ENTER 718 USING "K";Mka,Mkf
50  PRINT Mka,Mkf
60  END
```

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 34.

Example 34

```
10  OUTPUT 718;"CF?;";
20  OUTPUT 718;"AT UP;RL?;"
30  ENTER 718;R1
40  PRINT R1
50  END
```

In Example 34, 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.

Buffer Space

The maximum number of characters that the output-data buffer can hold is 64. In Example 33, the query MKA? 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. Note that the length of returned frequency values are dependent on the current resolution bandwidth and frequency counter resolution.

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 may 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 may 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 or the interface clear statement CLEAR 7. 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.

The spectrum analyzer will stop accepting data under the following two 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.

Illustrating Programming Techniques

The harmonic distortion program presented here illustrates how to program the spectrum analyzer.

Percent of Harmonic Distortion

Measuring percent-of-total harmonic distortion is tedious when performed manually: it involves tuning to the fundamental and to each harmonic of interest, noting the amplitude of each signal, converting these amplitudes to linear units (volts), and calculating the result from a formula. The following program measures percent-of-total harmonic distortion automatically, quickly, and accurately.

The program operates in the following manner. The program prompts you to connect a source to the spectrum analyzer and enter the source frequency. It sets the spectrum analyzer center frequency to the value of the source, or fundamental, frequency and sets other analyzer functions for optimum measurement accuracy. It measures and records the amplitude of the fundamental, then measures and records the amplitude of the second, third, and fourth harmonics. These values are then used to compute percent- of-harmonic distortion. The percent-of-harmonic distortion results, plus harmonic amplitudes in dBc, are displayed on the computer.

Harmonic Distortion Program

```
1  !* file:DISTORTION ... rev date: 860528 ... author: xx *!
2  OPTION BASE 1
3  ASSIGN @Sa TO 718
4  DIM Harm(2:4)
5  Clear_screen$=CHR$(255)&CHR$(75)
6  !*
7  OUTPUT KBD;Clear_screen$;
8  PRINT TABXY(22,4);"**** HARMONIC DISTORTION ****"
9  PRINT TABXY(15,7);"CONNECT SOURCE TO SPECTRUM ANALYZER INPUT,
   THEN"
10 PRINT TABXY(15,8);"ENTER FREQUENCY OF FUNDAMENTAL IN MHz ...
   ?"
11 PRINT TABXY(18,10);"READY !!!!    =>    press  ENTER
   (RETURN) ... "
12 INPUT Fund
13 OUTPUT KBD;Clear_screen$;
14 !*
15 OUTPUT @Sa;"IP;TS;ML -40 DB;AUNITS V;"
16 OUTPUT @Sa;"CF ";Fund;"MZ;"
17 OUTPUT @Sa;"SP ";Fund/10;"MZ;TS;"
18 OUTPUT @Sa;"MKTRACK ON;SP100KZ;TS;"
19 OUTPUT @Sa;"MKTRACK OFF;SNGLS;"
20 OUTPUT @Sa;"TS;MKPK HI;"
```

```
21 OUTPUT @Sa;"MKSS;MKCF"
22 OUTPUT @Sa;"TS;MKPK HI;"
23 OUTPUT @Sa;"MKRL;TS;RL?"
24 ENTER @Sa;Ref_level
25 OUTPUT @Sa;"AT MAN;MKPK HI;MKA?"
26 ENTER @Sa;First
27 FOR Number=2 TO 4
28   OUTPUT @Sa;"CF UP;TS;MKPK HI;"
29   OUTPUT @Sa;"MKRL;TS;MKPK HI;MKA?"
30   ENTER @Sa;Harm(Number)
31   OUTPUT @Sa;"RL";Ref_level;"V;"
32 NEXT Number
33 !*
34 OUTPUT @Sa;"MKOFF;CF DN DN DN;CONTS;AT AUTO;"
35 LOCAL @Sa
36 !*
37 OUTPUT KBD;Clear_screen$;
38 Sum_sqr=0
39 FOR Number=2 TO 4
40   Sum_sqr=Sum_sqr+Harm(Number)^2
41 NEXT Number
42 Prcnt=SQR(Sum_sqr)/First*100
43 OUTPUT CRT USING
   "5/,22X,K";"****** HARMONIC DISTORTION ******
44 OUTPUT CRT USING "/,20X,K";"FUNDAMENTAL ... "
45 OUTPUT CRT USING "32X,K,5D.5,K";"FREQUENCY = ";Fund;" MHz"
46 OUTPUT CRT USING "32X,K,5D.5,K";"AMPLITUDE =
   ";10*LGT(First^2/.05);" dBm"
47 OUTPUT CRT USING "21X,K";"HARMONICS ... "
48 OUTPUT CRT USING "34X,K,5D.D,K";" SECOND =
   ",20*LGT(Harm(2)/First);" dBc"
49 OUTPUT CRT USING "34X,K,5D.D,K";" THIRD =
   ",20*LGT(Harm(3)/First);" dBc"
50 OUTPUT CRT USING "34X,K,5D.5,K";" FOURTH =
   ",20*LGT(Harm(4)/First);" dBc"
51 OUTPUT CRT USING "/,23X,K,3D.D,K";"PERCENT DISTORTION =
   ";Prcnt;" %"
52 !*
53 END
```

Program Annotation

Line 2	Specify the lower bound of the program arrays as 1.
Line 3	Assign the spectrum analyzer address path (718) to @Sa.
Line 4	Create the array "Harm" to store amplitude values of the second, third, and fourth harmonics.
Line 5	Assign string variable `Clear_screen` to perform the computer keyboard function Clear Screen.

Lines 7—13	Clear the computer screen, then print the measurement instructions on the computer screen and wait for the user entry.
Line 15	Preset the instrument and take a sweep in order to start from a known state. Set the mixer level to −40 dB for maximum distortion-free dynamic range for this type of measurement. Select the amplitude units as volts, since voltage values are used for percent of harmonic distortion calculations.
Lines 16—17	Set the center frequency to the fundamental frequency and reduce the span to 10% of center frequency.
Lines 18—19	Activate the marker-track function to ensure that the signal remains on the screen while the span is set. Deactivate marker track and set the spectrum analyzer to single sweep mode for synchronous control of the sweep.
Lines 20—26	Measure the frequency of the fundamental and set the center frequency step size to this value. This allows you to step up the center frequency to the next harmonic. find the value of the reference level and store it in Ref_level for later use. Set the attenuation to manual in order to "hold" it at a constant level for distortion-free dynamic range. Peak the marker to measure the fundamental amplitude and store this value in First.
Lines 27—32	Measure the second, third, and fourth harmonics using the FOR/NEXT loop.
Lines 28—32	Step up the center frequency to measure a harmonic. Find the amplitude of the harmonic and set the reference level to this value for best measurement accuracy. Measure the amplitude and store it in the appropriate array cell. Set the reference level back to its original value (stored in Ref_level) and repeat for the next harmonic.
Lines 34—35	Return the analyzer to its initial state and return to local mode.
Lines 37—42	Clear the computer screen. Calculate the percent of harmonic distortion using the sum of the squares.
Lines 43—51	Print on the computer screen the fundamental frequency and amplitude; the second, third, and

fourth harmonics in dBc; and the percent of distortion.

Line 53 End the program.

5. Language Reference

5

Language Reference

This chapter describes the remote programming commands for the spectrum analyzer. It contains the following major sections:

Syntax Conventions

Command syntax is represented pictorially.

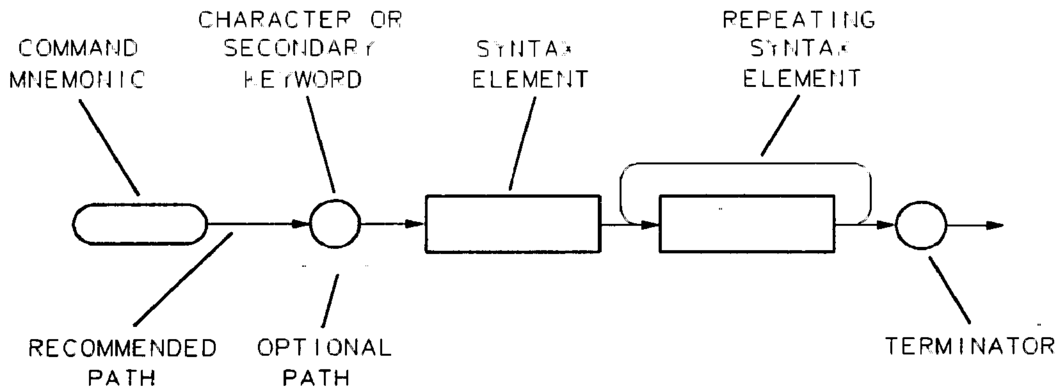


Figure 5-1. Command Syntax

- Narrow ovals enclose command mnemonics. The command mnemonic must be entered exactly as shown.
- Circles and wide 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. See Table 5-1.
- Rectangles contain the description of a syntax element defined in Table 5-2.
- A loop above a syntax element indicates that the syntax element can be repeated.
- Solid lines represent the recommended path.
- Dotted lines indicate an optional path for bypassing secondary keywords.
- Curved intersections indicate command path direction.
- Semicolons are the recommended command terminators. Using semicolons makes programs easier to read, prevents command misinterpretation, and is recommended by IEEE Standard 728.

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), etc.). When using the STEP keys or the knob, terminate the value with (HOLD).

Table 5-1. Characters and Secondary Keywords (Reserved Words)

Element	Description
A	ampere (unit); A-block data format.
ALL	All.
AM	amplitude modulation (DEMOD).
ANNT	annotation
AUTO	Auto couple.
B	8-bit byte.
CURR	current (IF adjustment)
DB	Decibel (unit).
DBM	Absolute decibel milliwatt (unit).
DBMV	Decibel millivolt (unit).
DBUV	Decibel microvolt (unit).
DM	absolute decibel milliwatt (unit).
DN	Decreases parameter one step size
DSP	display.
EP	enable parameter for front panel operator entry.
EXT	External trigger.
FAV	frequency analog voltage (sweep output)
FM	frequency modulation (DEMOD).
FREE	Free run.
FULL	full band span width.
GHZ	Gigahertz (unit).
GRT	graticule.
GZ	Gigahertz (unit).
HARM	harmonic number (frequency diagnostic).
HI	Highest.
HZ	Hertz (unit).
I	I-block data format.
INT	internal (reference, mixer mode).
KHZ	Kilohertz (unit).
KZ	Kilohertz (unit).
LAST	previous state before a change.
LAST SPAN	previous span before a change
LINE	Line trigger.
LO	local oscillator (frequency diagnostic).
M	ASCII display data output format.
MA	milliamp (unit).
MAN	manual operation.
MHZ	Megahertz (unit).
MROLL	main roller oscillator (frequency diagnostic).
MS	Millisecond (unit).
MSEC	millisecond (unit).

Table 5-1.
Characters and Secondary Keywords (Reserved Words) (continued)

Element	Description
MV	Millivolts (unit).
MW	milliwatt (unit).
MZ	Megahertz (unit).
NEG	Negative
NH	Next highest peak.
NL	Next peak left.
NRM	Normal.
NR	Next peak right.
OA	function query (same as ?).
OFF	Turn function off.
ON	Turn function on.
OROLL	offset roller oscillator (frequency diagnostic).
P	real number output format.
POS	Positive.
PWRON	sets same state as turning power on.
RAMP	sweep ramp voltage (sweep output)
S	second (unnit)
SC	Seconds (unit).
SEC	second (unit).
SMP	Sample detection mode.
TRA	Trace A.
TRB	Trace B.
UA	microamp (unit).
UP	Increases the parameter one step size.
US	Microseconds (unit).
UV	Microvolts (unit).
V	Volts (unit).
VID	Video trigger.
W	Word (for MDS command).
XROLL	transfer roller oscillator (frequency diagnostic).
ZERO	zero span.
;	Semicolon (ASCII code 59).
,	Comma (ASCII code 44).
0	Off. Command argument
1	On. Command argument.
?	Returns a query response containing the value or state of the associated parameter. The query response is followed by a carriage-return/line-feed.

Table 5-2. Syntax Elements

Syntax Element	Definition/Range
analyzer command	Any spectrum-analyzer command in this chapter, with required parameters and terminators.
character	Sp ! " # $ % & ' ( ) + , / 0 1 2 3 4 5 6 7 8 9 : ; 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 [\ ] ? _ ' 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 (Characters are a subset of data byte.
character & EOI	8-bit byte containing character data only, followed by end-or-identify (EOI) condition, where the EOI control line on HP-IB is asserted to indicate the end of the transmission.
data byte	character or numerical data. Defined for each command where used.
data byte & EOI	data byte followed by end-or-identify (EOI) condition, where the EOI control line on HP-IB is asserted to indicate the end of the transmission.
delimiter	! " $ % & ' / : < = > @ \ Matching characters that mark the beginning and end of a character string or analyzer commands Choose delimiting characters that are not used within the string they delimit.
digit	0 1 2 3 4 5 6 7 8 9
lsb length	Represents the least significant byte. Defined for each command where used.
msb length	Represents the most significant byte. Defined for each command where used.
number	Expressed as integer, decimal, or in exponential (E) form. Defined for each command where used.
LF with EOI	Line feed (L_F) with end-or-identify (EOI) condition. ASCII code 10 (line feed) is sent via HP-IB, then the end-or-identify control line on HP-IB sets to indicate the end of the transmission.

Command Summary

Alternate commands common to the HP 8561A and HP 8562A/B, and the HP 8566/8568A are shown in parentheses (). For further information see Appendix D "Backward-Compatible Commands."

Amplitude Control

AT	Specifies input attenuation.
AT AUTO	Couples input attenuation (CA).
AUNITS	Specifies amplitude units for input, output, and display.
COUPLE	HP 8561A only. Selects ac or dc coupling of input attenuator.
LG	Selects log scale.
LN	Selects linear scale.
MKRL	Moves active marker amplitude to reference level (E4).
ML	Specifies mixer level.
RL	Specifies reference level.
RLCAL	Calibrates reference level.
ROFFSET	Specifies reference level offset.

Bandwidth Control

RB	Specifies resolution bandwidth.
RB AUTO	Couples resolution bandwidth (CR).
RBR	Specifies the coupling ratio of resolution bandwidth and frequency span.
VB	Specifies video bandwidth.
VB AUTO	Couples video bandwidth (CV).
VBR	Specifies coupling ratio of video bandwidth and resolution bandwidth.

Coupling Control

AUTOCPL	Auto couple all controls.
AT AUTO	Auto couple the RF attenuator (CA).
RB AUTO	Auto couple resolution bandwidth (CR).
SS AUTO	Auto couple center frequency step size (CS).
ST AUTO	Auto couple sweep time (CT).
VB AUTO	Auto couple video bandwidth (CV).
RBR	Specifies coupling ratio of resolution bandwidth and frequency span.
VBR	Specifies coupling ratio of video bandwidth and resolution bandwidth.

Demodulation

DEMOD	Demodulation.
DEMODAGC	Demodulation auto gain control.
DEMODT	Demodulation time.
SQUELCH	Squelch control for demodulation.
VOL	Sets speaker volume.

Display Control

ANNOT	Turns annotation on or off. Preset condition is on.
AUNITS	Specifies amplitude units for input, output, and display.
DL	Specifies display line level in dBm.
DLE	Turns display line on and off (L0).
FDSP	Turns all frequency display annotation off. Power-on preset is only way to turn back on.
GRAT	Turns graticule on or off. Preset condition is on.
LG	Selects log scale.
LN	Selects linear scale.
TH	Specifies display threshold value.

External Mixing

CNVLOSS	Sets reference level offset to compensate for external mixer conversion loss.
FULBAND	Sets start and stop frequencies for full waveguide bands.
HNLOCK	Locks to specified harmonic number.
HNUNLK	Unlocks the specified harmonic number.
IDCF	Sets center frequency to frequency of SIGID.
IDFREQ	Returns frequency of identified signal.
MBIAS	Specifies the bias level for external mixers.
MKPX	Specifies minimum excursion for peak identification. Default value is 6 dB.
MXRMODE	Specifies either internal or external mixing.
SIGID	Identifies signals for external mixing frequency bands.

Frequency Control

CF	Specifies center frequency.
SS AUTO	Couples center frequency step size (CS).
FA	Specifies start frequency.
FB	Specifies stop frequency.
FOFFSET	Specifies frequency offset.
FREF	Specifies the frequency reference source.
FS	Specifies full frequency span as defined by instrument state.
FULBAND	Sets the start and stop frequency for full waveguide band. (external mixing only.)
MKFCR	Specifies resolution of frequency counter.
SP	Specifies frequency span.
SS	Specifies center frequency step size.

Information and Service Diagnostics

ADJALL	Initiates power-on adjustment sequence.
ADJCRT	Initiates CRT adjustment patters.
ADJIF	Initiates IF adjustment sequence.
ERR?	Returns list of instrument error codes.
ET?	Elapsed time.
FDIAG	Returns frequency of specified oscillator.
ID?	Returns the HP model number of analyzer used (HP 8561A, HP 8562A/B).
PSDAC	Returns preselector DAC setting at frequency of marker.

REV?	Returns analyzer revision number.
RLCAL	Calibrates reference level.
RQS	Returns decimal weighting of status byte bits which are enabled during service request.
SER?	Returns analyzer serial number.

Instrument State Control

IP	Sets instrument parameters to preset values.
RCLS	Recalls previously saved state (RC).
PSTATE	Protect saved states (save lock).
SAVES	Saves current state of the analyzer in the specified register (SV).

Marker Control

MKA	Amplitude of active marker (MA).
MKCF	Enter marker frequency into center frequency (E2).
MKD	Moves delta marker to specified frequency (M3).
MKDR	Marker delta reciprocal, readout in time.
MKF	Frequency of active marker (MF).
MKFC	Counts marker frequency for greater resolution (See MKFCR).
MKFCR	Specifies resolution of marker frequency counter.
MKMIN	Moves marker to minimum signal detected.
MKN	Moves amrker to specified frequency or center screen (M2).
MKNOISE	Returns average noise value at marker, normalized to 1 Hz bandwidth.
MKOFF	Turns the active marker off (M1).
MKPK	Moves marker to signal peak (E1).
MKPT	Specifies marker peak threshold.
MKPX	Moves marker to signal peak (E1).
MKRL	Moves active marker to reference level (E4).
MKSP	Moves marker delta frequency into span.
MKSS	Moves marker frequency to center frequency step size (E3).
MKSWP	Marker sweep.
MKT	Positions marker at point corresponding to the time from beginning of sweep.
MKTRACE	Moves marker to same position on another trace.
MKTRACK	Turns marker signal track on (MT1) or off (MT0).

Plotter Output

OP	Returns P1 and P2 in display units.
PLOT	Sends analyzer display to a plotter.
PLOTORG	Scaling points for plot.
PLOTSRC	Specifies plot source.

Preselector Control

PP	Peaks preselector.
PSDAC	Preselector peak data.

Printer Output

PRINT	Sends the analyzer display to a printer.

Service Request

RQS	Specifies the decimal weighting of status byte bits which are allowed during service request. Set to 0 with powerup 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.

Table 5-3. Status Byte Definition

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

Sweep and Trigger Control

CONTS	Selects continuous sweep mode (S1).
ST	Specifies sweep time.
ST AUTO	Couples sweep time.
SNGLS	Selects single sweep mode (S2).
TM	Selects trigger mode: free run (T1), video (T4), line (T2), external (T3).
TS	Takes a sweep.
VTL	Video trigger level.

Synchronization

TS	Takes a sweep.
DONE?	Returns a 1 when task has been completed.

Trace Functions

Processing

BLANK	Stores and blanks specified trace register (A4/B4).
CLRW	Clear-writes specified trace register (A1/B1).
MINH	Holds the minimum trace register values.
MXMH	Max holds the specified trace register (A2/B2).
RCLT	Recall specified trace data.
SAVET	Save specified trace data.
TRA	Input/output trace A.
TRB	Input/output trace B.
VIEW	Views specified trace register (A3/B3).

Math

AMB	A−B into A (C1/C2).
AMBPL	A−B+DL into A.
APB	A+B into A.
AXB	Exchanges A and B (EX).
BML	B−DL into B (BL).
FFT	Performs a fast fourier transform.
TWNDOW	Selects window for FFT function.
VAVG	Turns video averaging on or off.

Other

AUNITS	Specifies amplitude units for input, output, and display.
DET	Specifies input detector type.
TITLE	Writes specified ASCII characters in title block area of display.
PWRBW	Computes trace power bandwidth.

Operator Entry

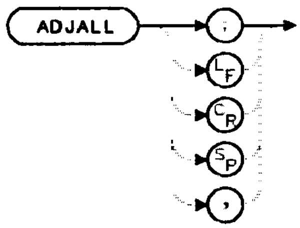
HD	Holds or disables data entry and blanks active function CRT readout.

Output Format Control

AUNITS	Specifies amplitude units for input, output, and display.
MKA?	Returns marker amplitude (MA).
MKF?	Returns marker frequency (MF).
SWPOUT	Specifies the sweep output.
TRA?	Outputs trace A (TA).
TRB?	Outputs trace B (TB).
TDF	Selects trace data output as binary (B) or real numbers (P) in Hz, volts, dB, or watts. Preset is P.

ADJALL
LO and IF Adjustments

Syntax



Example

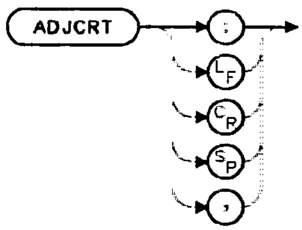
```
10 OUTPUT 718;"ADJALL;";
20 END
```

Description

The ADJALL command activates the local oscillator (LO) and intermediate frequency (IF) alignment routines. These are the same routines that occur when (LINE) is switched on. Commands following ADJALL are not executed until after the analyzer has finished the alignment routines.

ADJCRT
Adjust CRT Alignment

Syntax



Example

```
10 OUTPUT 718;"ADJCRT;";
20 OUTPUT 2;CHR$(255)&"K";
30 PRINT TABXY(0,1);"USE X POSN AND Y POSN"
40 PRINT TABXY(0,2);"TO ADJUST THE DISPLAY"
50 INPUT "THEN PRESS ENTER",Ans$
60 OUTPUT 718;"IP;";
70 END
```

Description

The ADJCRT command activates a CRT adjustment pattern, shown in Figure 5-2. Use the X POSN, Y POSN, and TRACE ALIGN adjustments (available from the rear panel) to align the display. X POSN and Y POSN moves the display horizontally and vertically, respectively. TRACE ALIGN aligns the pattern within the bezel. To remove the pattern from the screen, execute the IP command.

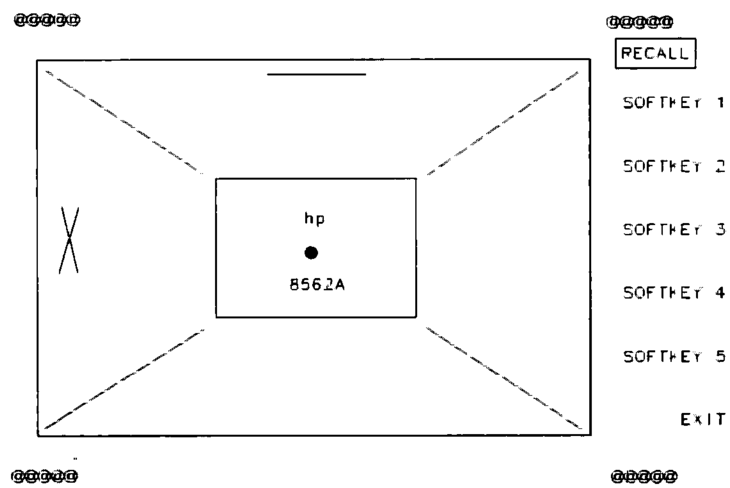
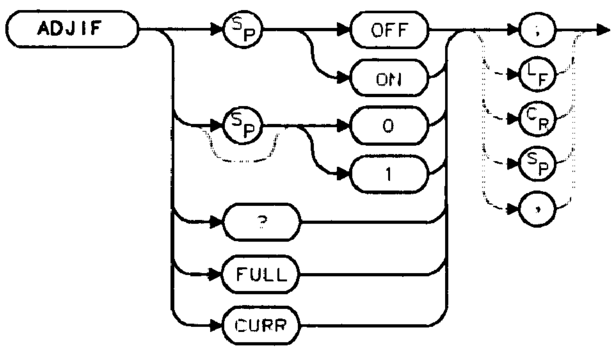


Figure 5-2. CRT Alignment Pattern

ADJIF
Adjust IF

Syntax



Preset State: On

FULL: IF adjustment is done for all IF settings

CURR: IF adjustment is done only for the IF settings currently displayed

OFF: Turns the IF adjustment off

ON: Reactivates the IF adjustment

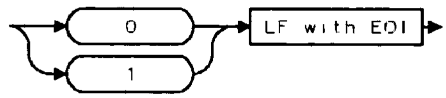
Example

```
10 OUTPUT 718;"ADJIF OFF;";
20 OUTPUT 718;" ADJIF?;";
30 ENTER 718;Adjif
40 PRINT Adjif
50 END
```

Description

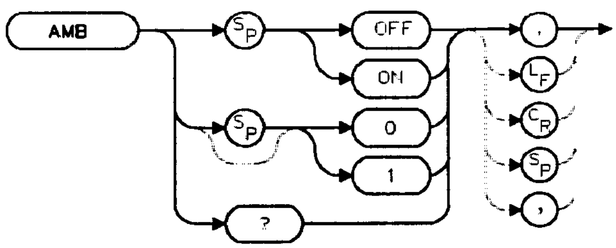
The ADJIF command turns the automatic IF adjustment on or off. This function is normally on. Because the IF is continuously adjusting, manual IF adjustments are seldom necessary. When the IF adjustment is not active, an A appears on the left side of the display.

Query Response



AMB
Trace A Minus Trace B

Syntax



Preset State: Off

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
```

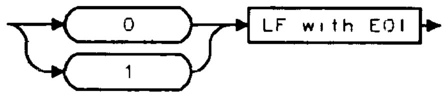
Description

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 this function 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 4.

Note

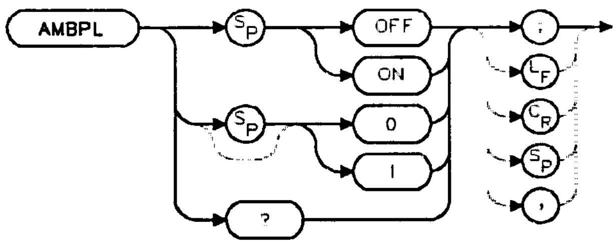
The displayed amplitude of each trace element falls in one of 600 data points. There are 10 points of overrange, which corresponds to one-sixth of a division of overrange. When adding or subtracting trace data, any results exceeding this limit are clipped at the limit.

Query Response



AMBPL
Trace A Minus Trace B Plus Display Line

Syntax



Preset State: Off

Example

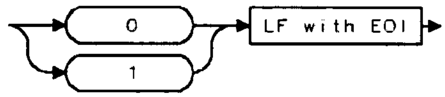
```
10 OUTPUT 718;"IP;"
20 OUTPUT 718;"CLRW TRB;TS;VIEW TRB;DL -50DBM;"
30 OUTPUT 718;"AMBPL ON;"
40 OUTPUT 718;"AMBPL?;"
50 ENTER 718;Ambpl
60 PRINT Ambpl
70 END
```

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.

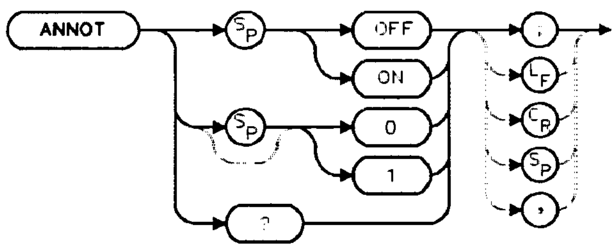
Note The displayed amplitude of each trace element falls in one of 600 data points. There are 10 points of overrange, which corresponds to one-sixth of a division of overrange. When adding or subtracting trace data, any results exceeding this limit are clipped at the limit.

Query Response



ANNOT
Annotation On/Off

Syntax



Preset State: On

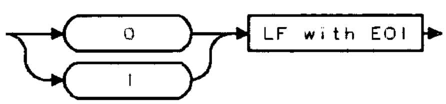
Example

```
10 OUTPUT 718;"IP;"
20 OUTPUT 718;"ANNOT OFF;"
30 OUTPUT 718;"ANNOT?;"
40 ENTER 718;Annot
50 PRINT Annot
60 END
```

Description

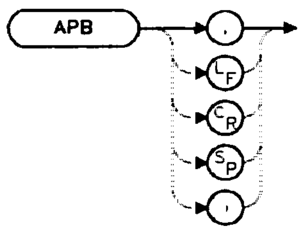
The ANNOT command turns the display annotation off or on.

Query Response



APB
Trace A Plus
Trace B

Syntax



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
```

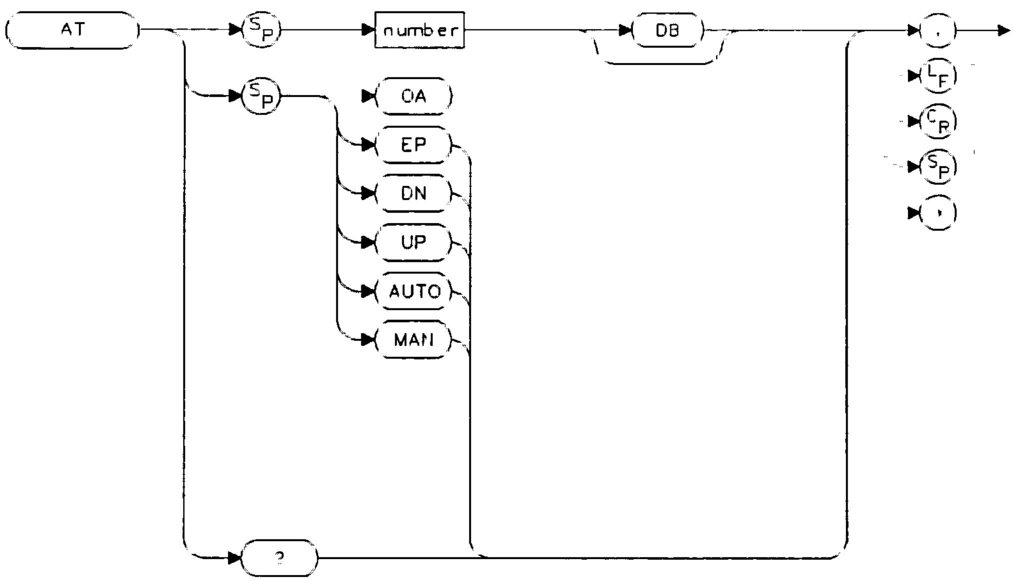
Description

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.

AT
Input Attenuation

Syntax



Item	Description/Default	Range
number	integer in decade increments. Numbers are rounded up to the nearest decade.	0 to 70

Preset State: Coupled mode, 10 dB

AUTO: sets the attenuation to coupled mode.

MAN: sets the attenuation to manual mode.

UP/DN: changes the attenuation by 10 dB.

Example

```
10 OUTPUT 718;"AT UP;"
20 OUTPUT 718;"AT?"
30 ENTER 718;At
40 PRINT At
50 END
```

Description

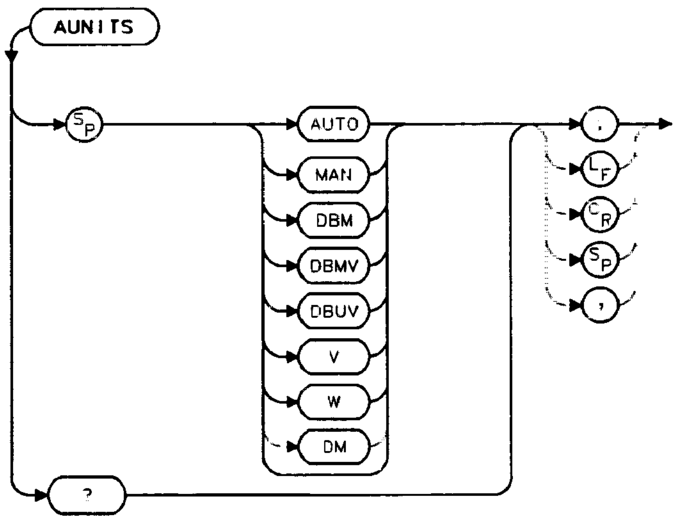
The AT command sets the amount of attenuation between the input and the first mixer.

The attenuation may be set to 0 dB only by numeric entry.

Query Response

AUNITS
Absolute Amplitude Units

Syntax



Preset State: coupled mode, dBm

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.

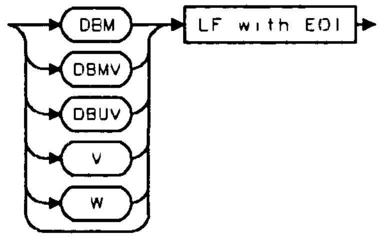
Example

```
10 OUTPUT 718;"AUNITS DBUV;"
20 OUTPUT 718;"AUNITS?;"
30 ENTER 718;Aunits$
40 END
```

Description

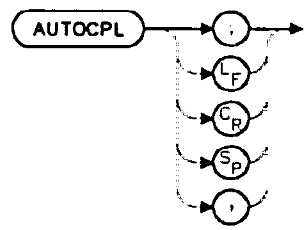
The AUNITS command sets the absolute amplitude units for the input signal and the display. AUNITS will affect the query responses of the following commands: MKA, TRA/TRB (when in P- format), DL, RL, SQUELCH, TH, and VTL.

Query Response



AUTOCPL
Auto Coupled

Syntax



Example

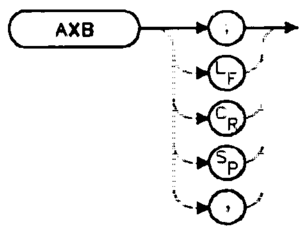
```
10 OUTPUT 718;"AUTOCPL;"
20 END
```

Description

The AUTOCPL command sets video bandwidth, resolution bandwidth, input attenuator, 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 under the softkeys **VBW:RBW** or **RBW:SPAN**, or the ratios selected using the RBR or VBR commands. If no ratios are chosen, default ratios (0.011 and 1.0, respectively) are used instead.

AXB
Trace A Exchange Trace B

Syntax



Example

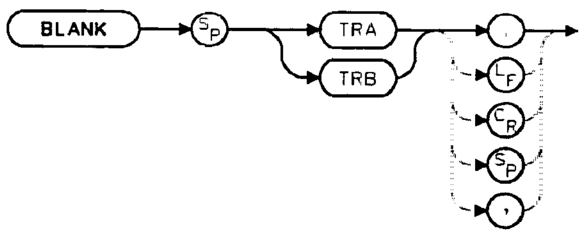
```
10 OUTPUT 718;"AXB;"
20 END
```

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.

BLANK
Blank Trace

Syntax



Example

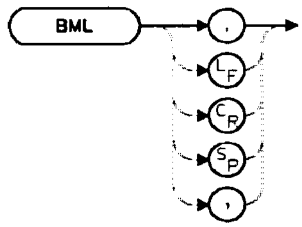
```
10 OUTPUT 718;"BLANK TRA;"
20 OUTPUT 718;"CLRW TRB;"
20 END
```

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.

BML
Trace B Minus Display Line

Syntax



Example

```
10 OUTPUT 718;"IP;"
20 OUTPUT 718;"BLANK TRA;"
30 OUTPUT 718;"CLRW TRB;TS;DL -50DBM;"
40 OUTPUT 718;"BML;"
50 END
```

Description

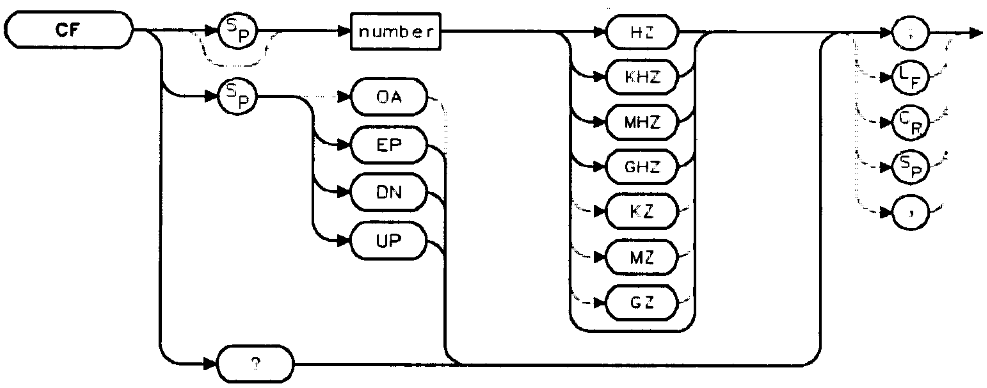
The BML command subtracts the display line from trace B and places the result in dBm (when in log mode) in trace B, which is then set to view mode. In linear mode, the results are in volts.

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.

CF
Center Frequency

Syntax



Item	Description/Default	Range
number	real	0 to 22E+9 External mixer mode: 18E+9 to 325E+9

Preset State (HP 8561A): 3.25 GHz

Preset State (HP 8562A): 12.38 GHz

Preset State (HP 8562B): 1.45 GHz

UP/DN: 10% of the frequency span or the amount set by the SS command.

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
```

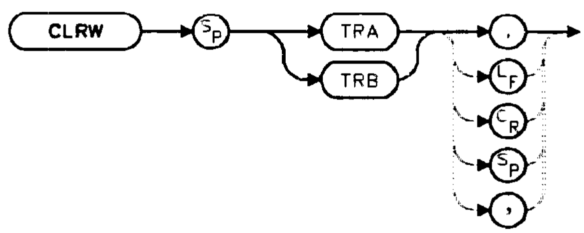
Description

The CF command sets the center frequency and sets the spectrum analyzer to center frequency/span mode. The span remains constant; the start and stop frequencies change as the center frequency changes.

Query Response

CLRW
Clear Write

Syntax



Example

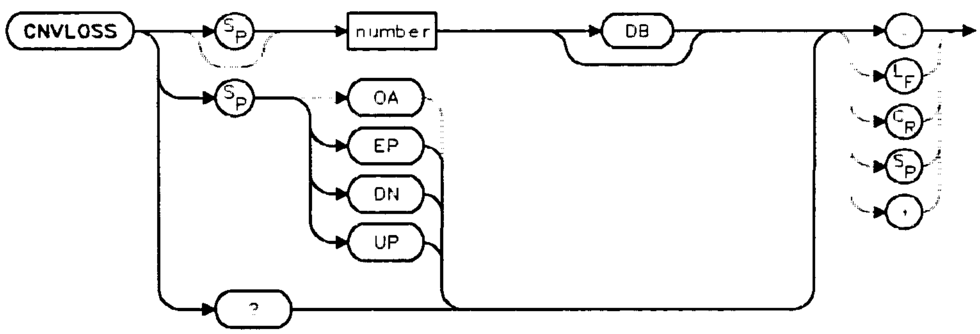
```
10 OUTPUT 718;"IP;"
20 OUTPUT 718;"BLANK TRA;CLRW TRB;"
30 END
```

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.

CNVLOSS
Conversion Loss

Syntax



Item	Description/Default
number	any real

Preset State: 30 dB

UP/DN: 0.1 dB

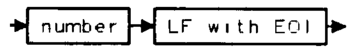
Example

```
10 OUTPUT 718;"IP;MXRMODE EXT;"
20 INPUT "ENTER THE DESIRED FREQUENCY BAND (KAQUVEWFDGY OR
   J)",Fulband$
30 OUTPUT 718;"FULBAND ";Fulband$;";"
40 INPUT "ENTER IN THE DESIRED CENTER FREQUENCY IN GHZ",Cf
50 INPUT "ENTER IN THE CONVERSION LOSS FOR THAT FREQUENCY",Loss
60 OUTPUT 718;"CF ";Cf;"GHZ;SP 10 MHZ;"
70 OUTPUT 718;"CNVLOSS ";Loss;"DB;"
80 END
```

Description

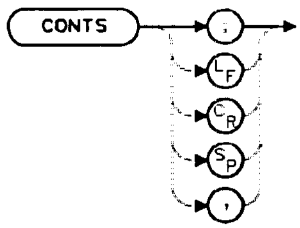
The CNVLOSS command compensates for losses outside the instrument when in external mixer mode (such as losses within connector cables, external mixers, etc.). CNVLOSS specifies the mean conversion loss for the current harmonic band. In a full frequency band (such as band K), the mean conversion loss 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.

Query Response



CONTS
Continuous Sweep

Syntax



Preset State: On

Example

```
10 OUTPUT 718;"CONTS;"
20 END
```

Description

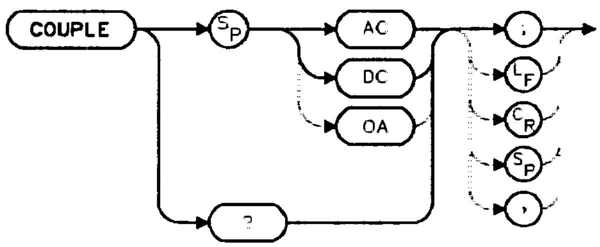
The CONTS command activates the continuous-sweep mode. This mode enables another sweep at the completion of the current sweep once the trigger conditions are met.

COUPLE
Couple

Note

COUPLE is an HP 8561A command. It is not valid on HP 8562A/B instruments.

Syntax



Preset State: AC

AC: selects ac coupling of input attenuator.

DC: selects dc coupling of input attenuator.

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
```

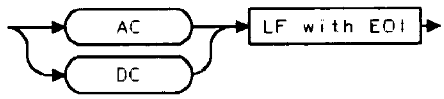
Description

The COUPLE command selects either ac or dc coupling of the instrument's input attenuator. AC coupling is the default state. Selecting ac coupling switches in a dc-blocking capacitor. This capacitor protects the instrument from damage caused by dc signals at the input.

Caution

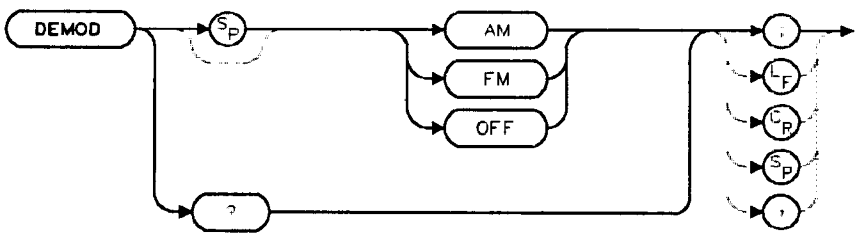
DC coupling should only be used with caution. Use only if a lower frequency limit is required, and a dc signal is not present at the INPUT 50Ω connector.

Query Response



DEMOD
Demodulation

Syntax



Preset State: Off

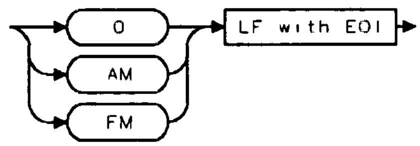
Example

```
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)",Dtime
80 OUTPUT 718;"DEMODT ";Dtime;"SEC;"
90 OUTPUT 718;"DEMOD FM;"
100 LOCAL 718
110 PRINT "ADJUST VOLUME AND SQUELCH AS NECESSARY"
120 END
```

Description

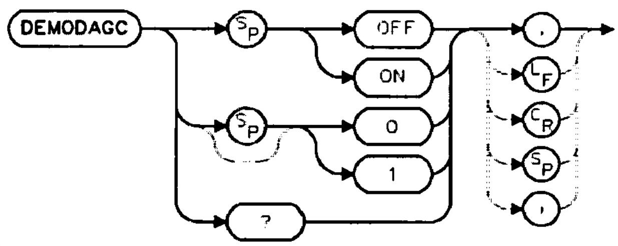
The DEMOD command activates either AM or FM demodulation or turns the demodulation off. Place a marker on a desired signal and then activate DEMOD; demodulation takes place on this signal. If no marker is on, DEMOD automatically places a marker at the center of the trace and demodulates the frequency at that marker position. Use the VOL command to activate the speaker and listen.

Query Response



DEMODAGC
Demodulation Automatic Gain Control

Syntax



Preset State: Off

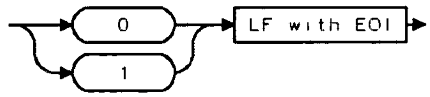
Example

```
10 OUTPUT 718;"IP;"
20 OUTPUT 718;"FA 550KHZ;FB 1600KHZ;"
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 - 60 SEC)",Dtime
80 OUTPUT 718;"DEMODT ";Dtime;"SEC;"
90 OUTPUT 718;"DEMOD AM;DEMODAGC ON;"
100 LOCAL 718
110 PRINT "ADJUST VOLUME AND SQUELCH AS NECESSARY"
120 END
```

Description

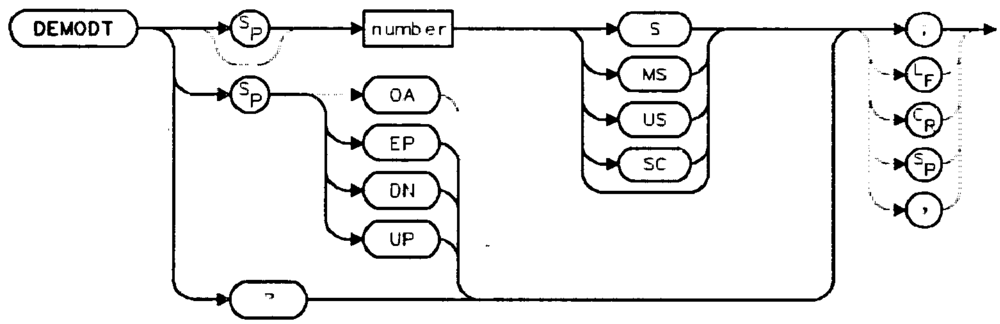
The DEMODAGC command turns the demodulation automatic gain control (AGC) on or off. The AGC keeps the volume of the speaker relatively constant during AM demodulation. AGC is available only during AM demodulation and when the frequency span is greater than 0 Hz.

Query Response



DEMODT
Demodulation Time

Syntax



Item	Description/Default	Range
number	real	100E−3 to 60

Preset State: Off

UP/DN: increments in a 1, 2, 5, 10 sequence.

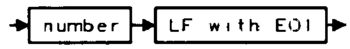
Example

```
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)",Dtime
80 OUTPUT 718;"DEMODT ";Dtime;"SEC;"
90 OUTPUT 718;"DEMOD FM;"
100 LOCAL 718
110 PRINT "ADJUST VOLUME AND SQUELCH AS NECESSARY"
120 END
```

Description

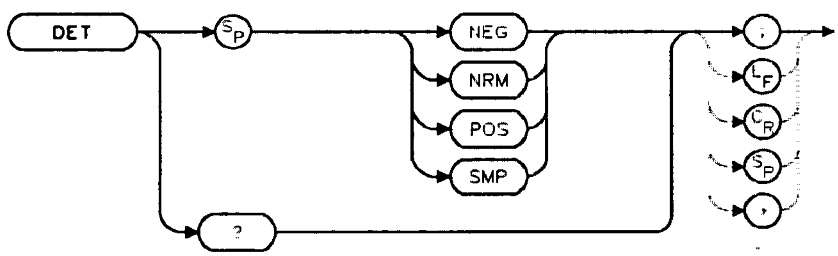
The DEMODT command selects the amount of time that the sweep pauses at the marker to demodulate a signal. The default value is 1 second. When the frequency span equals 0 Hz, demodulation is continuous.

Query Response



DET
Detection Modes

Syntax



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 is made up of alternately selecting the positive peak and negative peak detectors. 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. Preset State: Coupled mode, normal detector.
2. If video averaging or marker noise functions are on, or if the video bandwidth is less than 300 Hz, the detector is set to sample mode.
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 apply, the first rule listed determines the detector used.

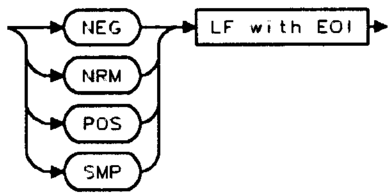
Example

```
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
```

Description

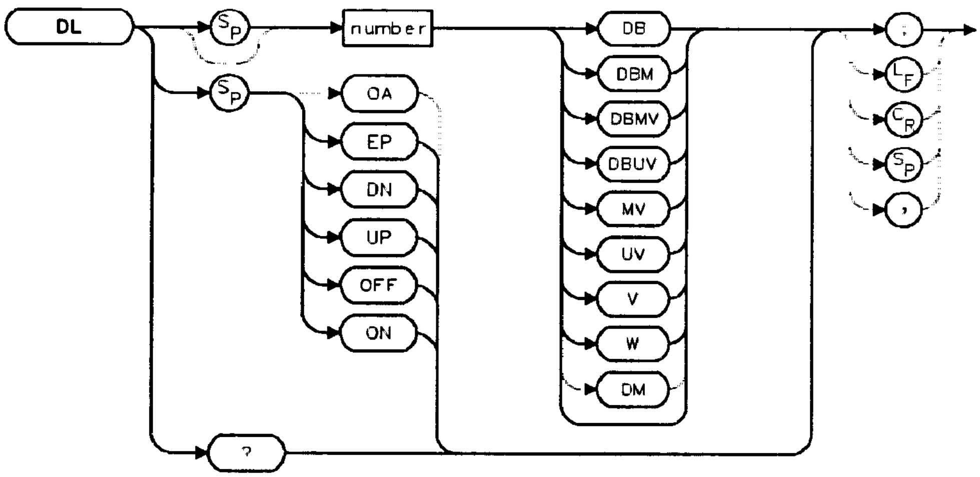
The DET command specifies the IF detector used for acquiring measurement data. This is normally a coupled function, in which the spectrum analyzer selects the appropriate detector mode. Four modes are available: normal, positive, negative, and sample. The modes are described below. When a mode other than normal is chosen, a D appears on the left side of the display.

Query Response



DL
Display Line

Syntax



Item	Description/Default	Range
number	real	Dependent on the selected amplitude units.

Preset State: Off

UP/DN: changes the display line by one vertical division

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
```

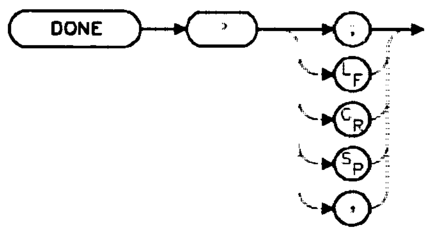
Description

The DL command activates a horizontal display line for use as a visual aid or for computational purposes. The default value is 0 dBm.

Query Response

DONE
Done

Syntax



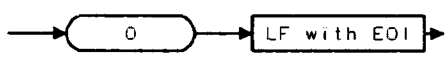
Example

```
10 OUTPUT 718;"IP;CF 12GHZ;SP 2GHZ;TS;DONE?;"
20 ENTER 718;Done
30 PRINT "COMMAND STRING IS DONE"
40 END
```

Description

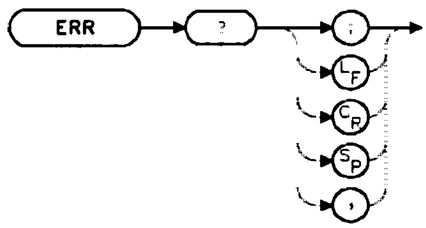
The DONE command sends a “1” to the controller when all commands in a command string entered before DONE have been completed. Sending a TS command before DONE ensures that the spectrum analyzer will complete a full sweep before continuing on in a program.

Query Response



ERR
Error

Syntax



Preset State: Remote error list cleared. (Persistent errors are reentered into the error list.)

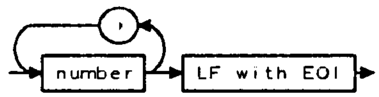
Example

```
10 DIM Err$[200]
20 OUTPUT 718;"ERR?;"
30 ENTER 718;Err$
40 PRINT Err$
50 Position_comma=POS(Err$,",")
60 IF Position_comma>0 THEN
70    !MULTIPLE ERRORS
80     First_error=VAL(Err$)
90     PRINT First_error
100     Err$=Err$[POS(Err$,",")+1]
110     REPEAT
120        Position_comma=POS(Err$,",")
130        Next_error=VAL(Err$)
140        PRINT Next_error
150        IF Position_comma THEN Err$=Err$[POS(Err$,",")+1]
160     UNTIL Position_comma=0
170 ELSE
180     Err=VAL(Err$)
190     IF Err<>0 THEN
200      PRINT Err
210      ELSE
220      PRINT "NO ERRORS"
230      END IF
240 END
```

Description

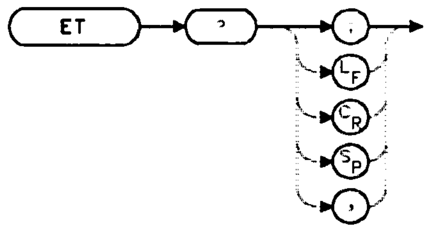
The ERR command outputs a list of errors present. An error code of 0 means there are no errors present. For a list of HP-IB remote-operation error codes and descriptions, refer to Appendix C. For other error codes, refer to the *Installation and Support Manual.* Executing ERR clears all HP-IB errors. For best results, enter error data immediately after querying for errors.

Query Response



ET
Elapsed Time

Syntax



Example

```
10 DIM Et$[5]
20 OUTPUT 718;"ET?;"
30 ENTER 718;Et$
40 PRINT Et
50 END
```

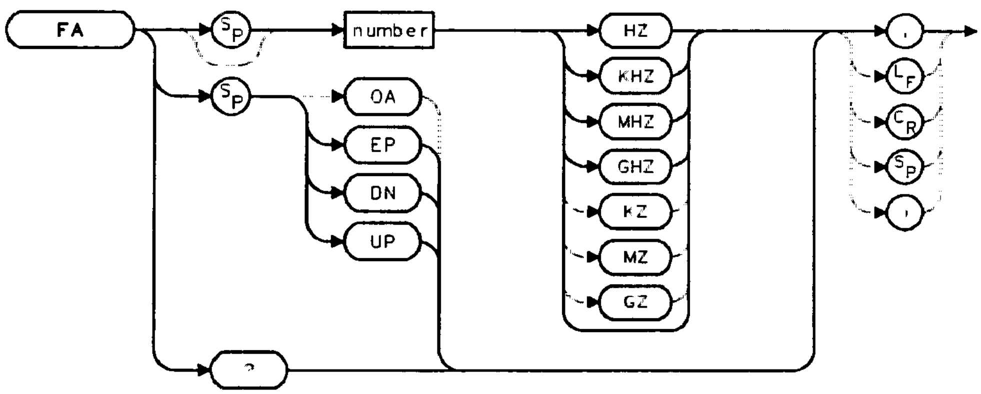
Description

The ET command returns to the controller the elapsed time (in hours) since the last servicing. This value is reset to 0 by Hewlett-Packard at the time of servicing.

Query Response

FA
Start Frequency

Syntax



Item	Description/Default	Range
number	real	0 to 22E+9 External mixer mode: 18E+9 to 325E+9

Preset State (HP 8561A): 0 Hz

Preset State (HP 8562A): 2.75 GHz

Preset State (HP 8562B): 0 Hz

UP/DN: increments in 10% of span.

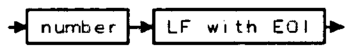
Example

```
10 OUTPUT 718;"FA 88MHZ;FB 108MHZ;"
20 OUTPUT 718;"FA?;"
30 ENTER 718;Fa
40 PRINT Fa
50 END
```

Description

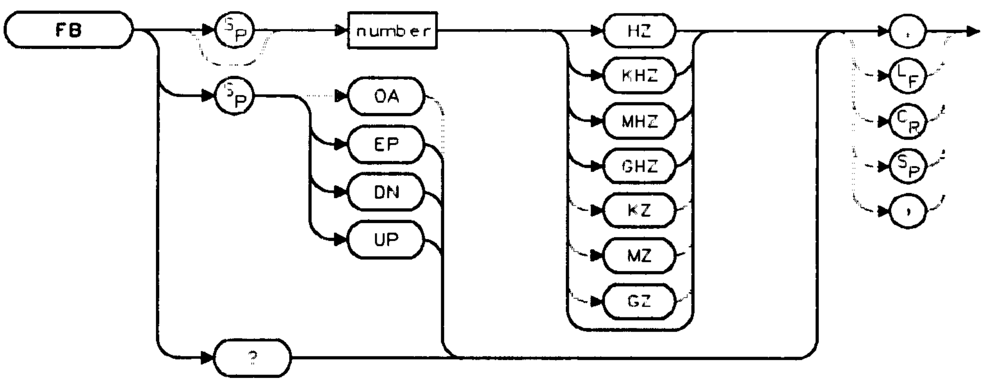
The FA command sets the start frequency and sets the spectrum analyzer to start-frequency/ stop-frequency mode. If the start frequency exceeds the stop frequency, the stop frequency is set equal to the start frequency. The center frequency and span change with changes in the start frequency.

Query Response



FB
Stop Frequency

Syntax



Item	Description/Default	Range
number	real	0 to 22E+9 External mixer mode: 18E+9 to 325E+9

Preset State (HP 8561A): 6.5 GHz

Preset State (HP 8562A): 22.0 GHz

Preset State (HP 8562B): 2.9 GHz

UP/DN: increments in 10% of span.

Example

```
10 OUTPUT 718;"FA 88MHZ;FB 108MHZ;"
20 OUTPUT 718;"FB?;"
30 ENTER 718;Fb
40 PRINT Fb
50 END
```

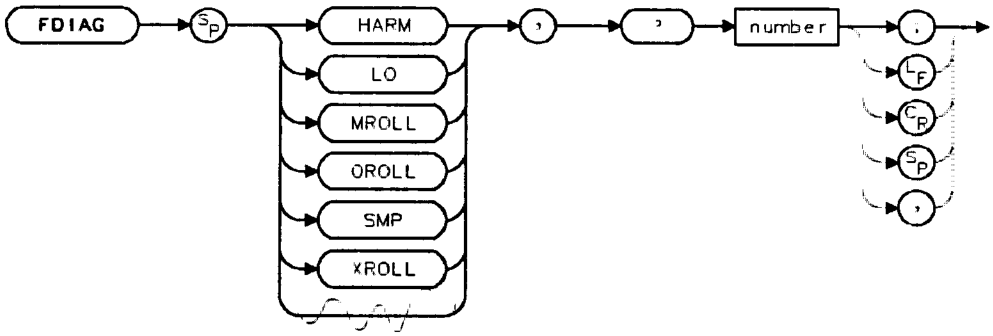
Description

The FB command sets the stop frequency and sets the spectrum analyzer to start-frequency/stop-frequency mode. If the stop frequency is less than the start frequency, the start frequency is set equal to the stop frequency. The center frequency and span change with changes in the stop frequency.

Query Response

FDIAG
Frequency Diagnostics

Syntax



LO: returns the first local oscillator frequency corresponding to the current start frequency.

SMP: returns the sampling oscillator corresponding to the current start frequency.

HARM: returns the sampler harmonic number corresponding to the current start frequency.

MROLL: returns the main roller oscillator frequency corresponding to the current start frequency.

OROLL: returns the offset roller oscillator frequency corresponding to the current start frequency.

XROLL: returns the transfer roller oscillator frequency corresponding to the current start frequency.

Note In multiband sweeps, the above frequencies correspond to the band being swept when the command is executed.

Example

```
10 OUTPUT 718;"FDIAG SMP,?;"
20 ENTER 718;Fdiag
30 PRINT "DIAGNOSTIC FREQUENCY IS ",Fdiag
40 END
```

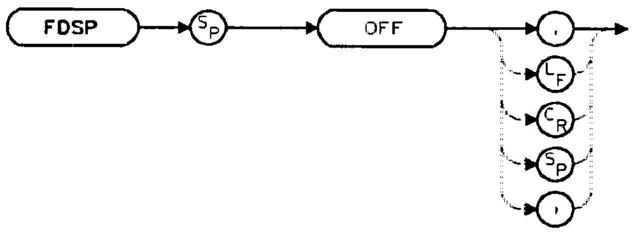
Description

The FDIAG command activates the frequency diagnostic routine, which returns the frequency of the specified oscillator.

Query Response

FDSP
Frequency Display Off

Syntax



Preset State: Off

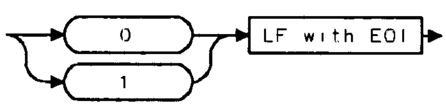
Example

```
10 OUTPUT 718;"FDSP OFF;"
20 OUTPUT 718;"FDSP?;"
30 ENTER 718;Fdsp
40 PRINT Fdsp
50 END
```

Description

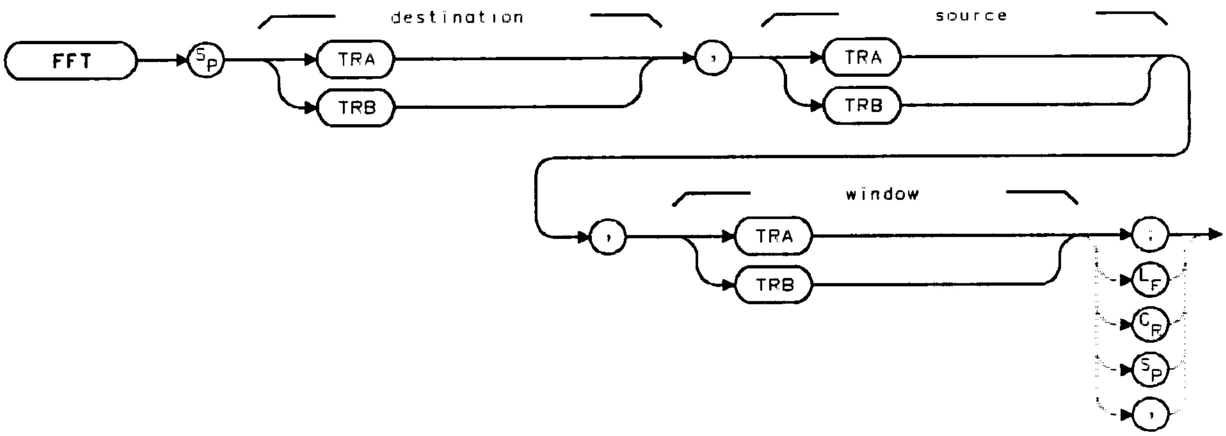
The FDSP command turns off all annotation that describes the spectrum analyzer frequency setting. This includes the start and stop frequencies, the center frequency, the frequency span, marker readouts, the center frequency step-size, and signal identification to center frequency. To retrieve the frequency data, query the spectrum analyzer. To reactivate the annotation, execute the IP command.

Query Response



FFT
Fast Fourier Transform

Syntax



Example

```
10  OUTPUT 718;"IP;"
20  OUTPUT 718;"CF 300MHZ;"
30  OUTPUT 718;"SP 0HZ;ST 50MSEC;"
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
```

Description

The FFT command performs a Discrete Fourier Transform on the source trace array and stores the logs of the magnitudes of the results in the destination array. The maximum length of any of the traces is 601 points.

Upon power up, the default window is set to HANNING. Refer to the TWNDOW command.

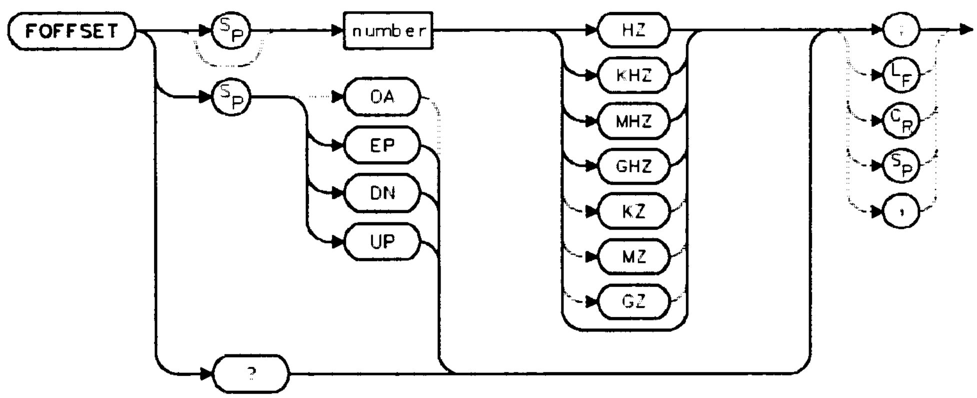
The FFT results are displayed on the spectrum analyzer in logarithmic scale. For the horizontal dimension, the frequency at the left side of the graph is 0 Hz, and at the right side is Fmax. Fmax can be calculated using a few simple equations and the sweeptime of the analyzer. The sweeptime divided by the number of trace array elements containing amplitude information is equal to the sampling period. The reciprocal of the sampling period is the sampling rate. The sampling rate divided by two yields Fmax.

For example, let the sweep time of the analyzer be 20 ms and the number of trace elements be 600. 20 ms divided by 600 equals 50 μs, the sampling period. The sample rate is 1/50 μs. Fmax equals 1/50 μs divided by 2, or 10 kHz.

FFT is designed to be used in transforming zero span information into the frequency domain. Performing FFT on a frequency sweep will not provide time domain results.

FOFFSET
Frequency Offset

Syntax



Item	Description/Default	Range
number	real	0 to 22E+9

Preset State: off

UP/DN: changes by 20% of span.

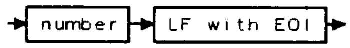
Example

```
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
```

Description

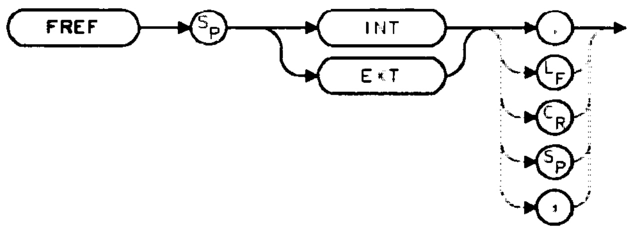
The FOFFSET command adds a specified offset to the displayed absolute-frequency values, including marker-frequency values. It does not affect the frequency range of the sweep, nor does it affect relative frequency readouts. When this function is active, an F appears on the left side of the display.

Query Response



FREF
Frequency Reference

Syntax



Preset State: Internal

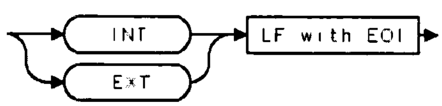
Example

```
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
```

Description

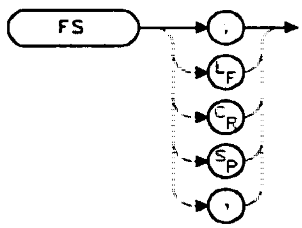
The FREF command specifies the frequency reference source. Select either the internal frequency reference (INT) or supply your own external reference (EXT). An external reference must be 10 MHz (±100 Hz) at a minimum amplitude of 0 dBm. Connect the external reference to J9 on the rear panel. When the external mode is selected, an X appears on the left edge of the display.

Query Response



FS
Full Span

Syntax



Description

The FS command selects the full frequency span as defined by the instrument. The full span for low band (0—2.9 GHz) is 2.9 GHz; for high band (greater than 2.75 GHz), the full span is 6.5 GHz for the HP 8561A and 19.25 for the HP 8562A/B.

Example

```
10 OUTPUT 718;"FS;"
20 END
```

FULBAND
Full Band

Syntax

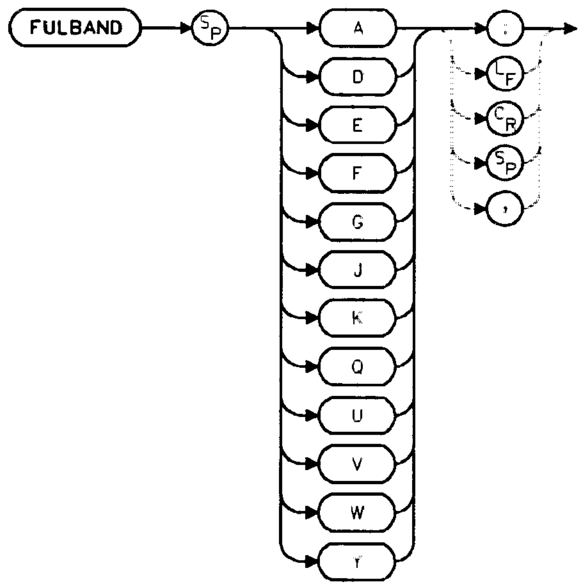


Table 5-4. External-Mixer Frequency Bands

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

Example

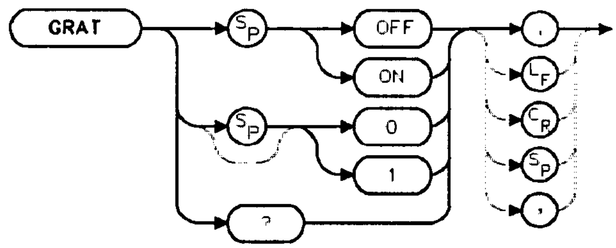
```
10 OUTPUT 718;"IP;MXRMODE EXT;"
20 INPUT "ENTER THE DESIRED FREQUENCY BAND (KAQUVEWFDGY OR
   J)",Fulband$
30 OUTPUT 718;"FULBAND ";Fulband$;";"
40 OUTPUT 718;"MKN EP;"
50 PRINT "POSITION THE MARKER ON THE DESIRED SIGNAL"
60 PRINT "PRESS HOLD, THEN PRESS CONTINUE"
70 PAUSE
80 OUTPUT 718;"SNGLS;TS;SIGID 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 END
```

Description

The FULBAND command selects a commonly-used, external-mixer frequency band, as shown in Table 5-4. The harmonic lock function (HNLOCK) is also set; this locks the harmonic of the chosen band.

GRAT
Graticule On/Off

Syntax



Preset State: On

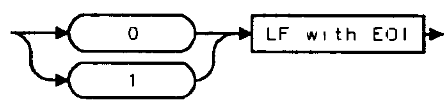
Example

```
10 OUTPUT 718;"GRAT OFF;"
20 OUTPUT 718;"GRAT?;"
30 ENTER 718;Grat
40 PRINT Grat
50 END
```

Description

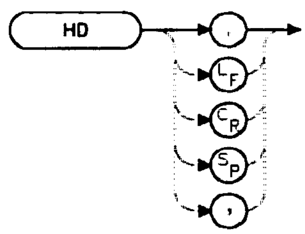
The GRAT command turns the display graticule on or off.

Query Response



HD
Hold

Syntax



Example

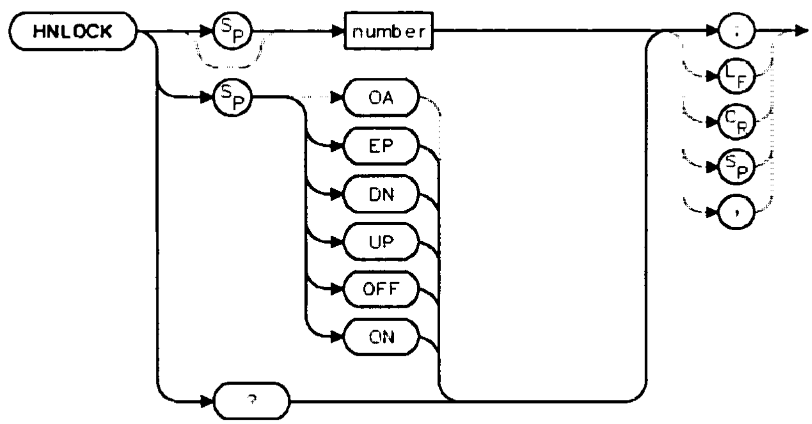
```
10 OUTPUT 718;"IP;CF 300MHZ;SP 20MHZ;HD;
20 END
```

Description

The HD command freezes the active function at its current value. If no function is active, no operation takes place.

HNLOCK
Harmonic Number Lock

Syntax



Item	Description/Default	Range
number	integer	1 to 54 (for best results, choose from harmonic numbers shown in Table 5-5).

Preset State: Off

UP/DN: increments of 1.

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
```

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 a harmonic number or refer to the FULBAND command. Table 5-5 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 may be entered. When the FS command is activated, the span is limited to the frequency band of the selected harmonic.

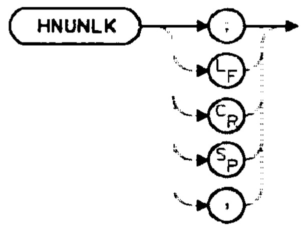
Table 5-5. Frequency Bands and the Corresponding LO Harmonic

Mixer Mode	Frequency Range (GHz)	Mixing Harmonic
Internal	2.75–6.46	1–
	5.69–13.03	2–
	12.36–19.70	3–
	19.03–22.10	4–
External	18.00–26.50	6–
	26.50–40.00	8–
	33.00–50.00	10–
	40.00–60.00	10–
	50.00–75.00	14–
	60.00–90.00	16–
	75.00–110.00	18–
	90.00–140.00	24–
	110.00–170.00	30–
	140.00–220.00	36–
	170.00–260.00	44–
	220.00–325.00	54–

Query Response

HNUNLK
Unlock Harmonic Number

Syntax



Example

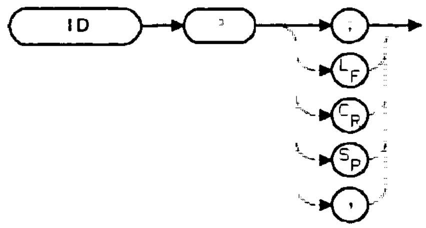
```
10 OUTPUT 718;"IP;MXRMODE EXT;FULBAND Q;"
20 OUTPUT 718;"FA 18GHZ;FB 40GHZ;"
30 OUTPUT 718;"HNUNLK;"
40 END
```

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−, then using 8−.

ID
Output Identification

Syntax



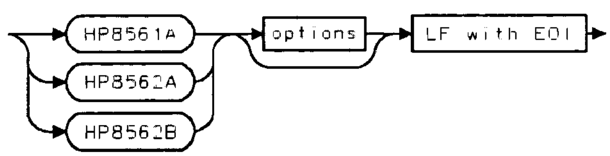
Example

```
10 DIM Id$[8]
20 OUTPUT 718;"ID?;"
30 ENTER 718;Id$
40 PRINT Id$
50 END
```

Description

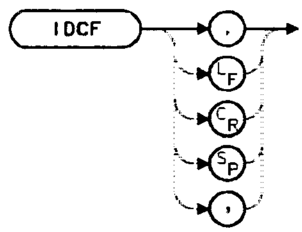
The ID command returns the model number of the spectrum analyzer (HP 8561A, HP 8562A, or HP 8562B) and any options installed.

Query Response



IDCF
Signal Identification to Center Frequency

Syntax



Example

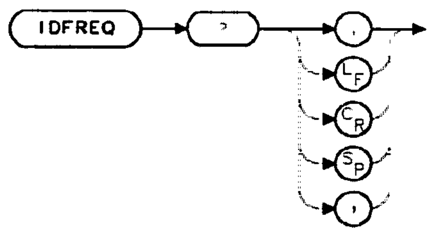
```
10 OUTPUT 718;"SIGID AUTO;"
20 OUTPUT 718;"IDCF;"
30 OUTPUT 718;"CF?;"
40 ENTER 718;Cf
50 PRINT Cf
60 END
```

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. For use on signals less than the spectrum analyzer's maximum frequency.

IDFREQ
Signal Identified Frequency

Syntax



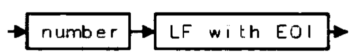
Example

```
10 OUTPUT 718;"IDFREQ?;"
20 ENTER 718;Idfreq
30 PRINT Idfreq
40 END
```

Description

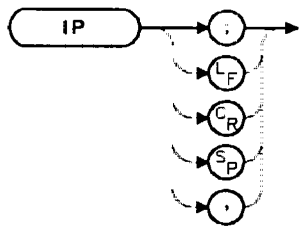
The IDFREQ command returns the frequency of the last identified signal. After an instrument preset or an invalid signal identification, IDFREQ returns a 0.

Query Response



IP
Instrument Preset

Syntax



Example

```
10 OUTPUT 718;"IP;SNGLS;"
20 END
```

Description

The IP command sets the spectrum analyzer to a known, predefined state, shown in Table 5-6. 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 5-6. Preset State

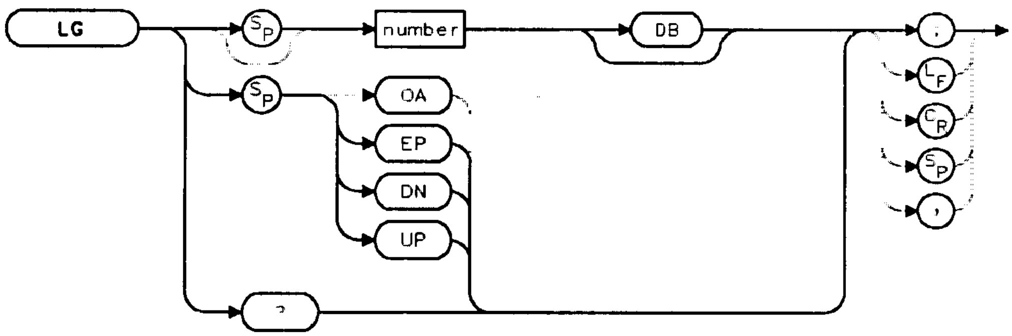
Function	State
FREQ MODE	CENTER-SPAN
CENTER FREQ	HP 8561A: 3.250 GHz
	HP 8562A: 12.38 GHz
	HP 8562A (Option 026): 14.63 GHz
	HP 8562B: 1.45 GHz
SPAN	HP 8561A: 6.500 GHz
	HP 8562A: 19.25 GHz
	HP 8562A (Option 026): 23.75 GHz
	HP 8562B: 2.9 GHz
CF STEP	1.93 GHz AUTO
	Option 026: 2.375 GHz
FREQ OFFSET	0 MHz, OFF
10 MHz REF	INTERNAL
REFERENCE LEVEL	0 dBm
INPUT ATTENUATION	10 dB, AUTO
MAX MIXER LEVEL	−10 dBm
REF LEVEL OFFSET	0 dBm, OFF
VERTICAL SCALE	10 dB/DIV
UNITS	dBm, AUTO
AUTO IF ADJUST	ON
DETECTOR	NORMAL
RESOLUTION BW	1 MHz, AUTO
VIDEO BW	1 MHz, AUTO
VBW/RBW RATIO	1
RBW/SPAN RATIO	0.011
VIDEO AVERAGE	100, OFF
SWEEP TIME	HP 8561A: 200 ms AUTO
	HP 8562A/B: 400 ms AUTO
	HP 8562A (Option 026): 500 ms AUTO
TRIGGER MODE	CONTINUOUS
TRIGGER SOURCE	FREE-RUN
VIDEO TRIG LEVEL	0 dBm
SWEEP OUTPUT	0—10V LO-SWEEP RAMP
MARKER MODE	OFF
NOISE MARKER	OFF
SIGNAL TRACK	OFF
PEAK THRESHOLD	−120 dBm
PEAK EXCURSION	6 dB

Table 5-6. Preset State (continued)

Function	State
FREQUENCY COUNTER	OFF
FREQUENCY COUNTER RESOLUTION	10 kHz
TRACE A	CLEAR-WRITE
TRACE B	BLANK
TRACE-DATA	FORMAT P
A−B→A	OFF
A−B+DISPLAY LINE→A	OFF
DISPLAY LINE	0 dBm, OFF
THRESHOLD	−90 dBm, OFF
GRATICULE	ON
ANNOTATION	ON
FREQUENCY DISPLAY OFF	CLEAR
DEMODULATION	FM OFF AM OFF
DEMODULATION TIME	1 second
SQUELCH	OFF
SQUELCH LEVEL	−120 dBm
AGC	OFF
VOLUME	0
SIGNAL IDENTIFICATION	OFF
MIXER	INT
EXT MIXER LO HARMONIC	6
MIXER CONV LOSS	30 0 dBm
BAND LOCK	OFF
EXT MIXER BIAS	0 mA

LG
Logarithm Scale

Syntax



Item	Description/Default	Range
number	integer	1, 2, 5, or 10

Preset State: 10 dB/div

UP/DN: increments in a 1, 2, 5, 10 sequence.

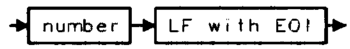
Example

```
10 OUTPUT 718;"LG 10DB;"
20 OUTPUT 718;"AUNITS DBMV;"
30 OUTPUT 718;"TS;MKPK HI;MKRL;"
40 OUTPUT 718;"LG 2DB;"
50 END
```

Description

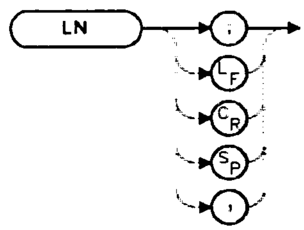
The LG command selects a 1, 2, 5, or 10 dB logarithmic amplitude scale. When in linear mode, querying LG returns a zero.

Query Response



LN
Linear Scale

Syntax



Example

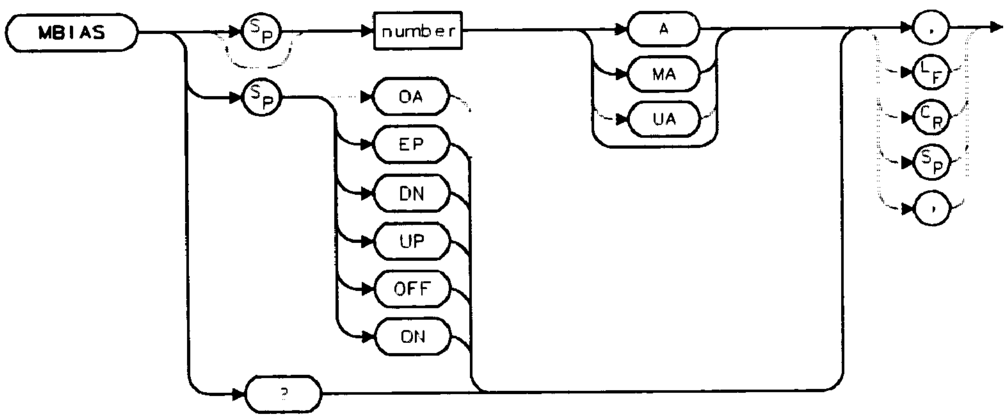
```
10 OUTPUT 718;"LN;"
20 END
```

Description

The LN command selects a linear amplitude scale. Measurements made on a linear scale can be read out in volts or watts.

MBIAS
Mixer Bias

Syntax



Item	Description/Default	Range
number	any real	

Preset State: Off

UP/DN: increments of 0.01 mA.

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
```

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.

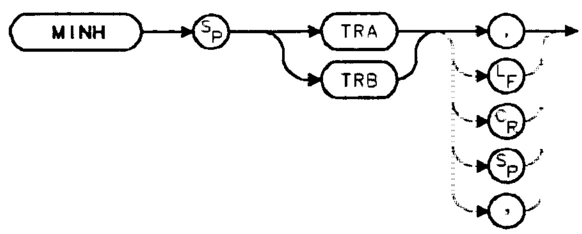
Caution The open-circuit voltage can be a great as ±3.5 V through a source resistance of 300 ohms. Such voltage may appear when recalling an instrument state in which an active bias has been stored.

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.

Query Response

MINH
Minimum Hold

Syntax



Example

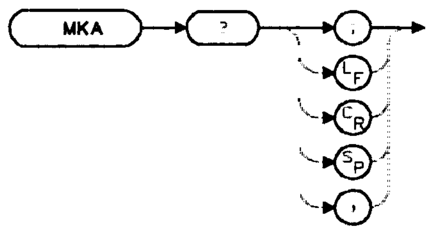
```
10 OUTPUT 718;"IP;SNGLS;"
20 INPUT "ENTER START FREQUENCY, IN MHZ",Fa
30 INPUT "ENTER STOP FREQUENCY, IN MHZ",Fb
40 OUTPUT 718;"FA ";Fa;"MHZ;"
50 OUTPUT 718;"FB ";Fb;"MHZ;"
60 OUTPUT 718;"TS;MINH TRA;"
70 OUTPUT 718;"TS;MKPK HI;MKD;"
80 OUTPUT 718;"TS;MKPK HI;MKD;"
90 ENTER 718 USING "K";Difference,Aunits$
100 PRINT "DIFFERENCE IN AMPLITUDE IS ",Difference,Aunits$
110 END
```

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).

MKA
Marker Amplitude

Syntax



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
```

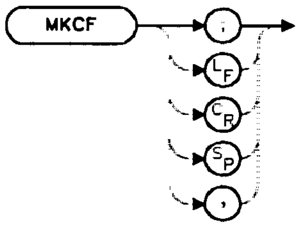
Description

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

MKCF
Marker to Center Frequency

Syntax



Example

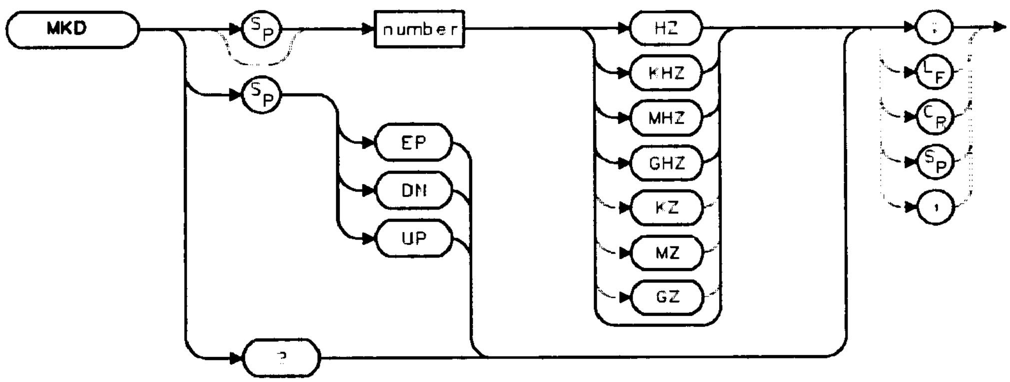
```
10 OUTPUT 718;"IP;SNGLS;";
20 INPUT "ENTER IN DESIRED START FREQUENCY, IN MHZ",Fa
30 INPUT "ENTER IN DESIRED STOP FREQUENCY, IN MHZ",Fb
40 OUTPUT 718;"FA ";Fa;"MHZ;"
50 OUTPUT 718;"FB ";Fb;"MHZ;"
60 OUTPUT 718;"TS;MKPK HI;MKCF;TS;"
70 END
```

Description

The MKCF command sets the center frequency to the frequency value of an active marker.

MKD
Marker Delta

Syntax



Item	Description/Default	Range
number	real	Low band: −2.9 E+9 to +2.9 E+9 High band: ±maximum frequency in Hz External mixer mode: −3.7 E+9 to +307 E+9

UP/DN: increments in 10% of span.

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
```

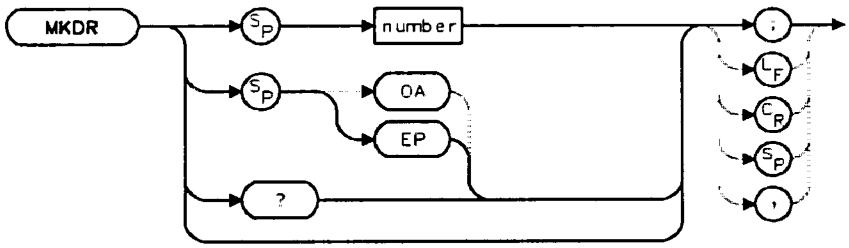
Description

The MKD command places a second marker on the trace. The number specifies the distance in frequency or time (when in zero span) between the two markers.

Query Response

MKDR
Reciprocal of Marker Delta

Syntax



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
```

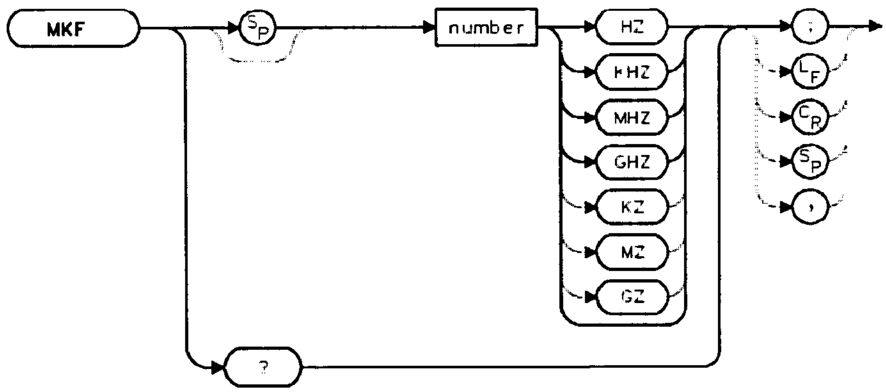
Description

The MKDR command returns the reciprocal of the frequency or time (when in zero span) difference between two markers.

Query Response

MKF
Marker Frequency

Syntax



Item	Description/Default	Range
number	real	0 to maximum frequency in Hz

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
```

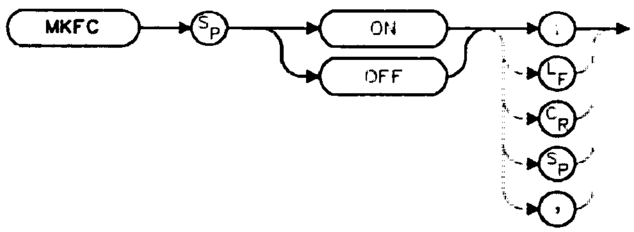
Description

The MKF command places an active marker on the chosen frequency or can be queried to return the frequency of the active marker.

Query Response

MKFC
Frequency Counter

Syntax



Preset State: Off

Example

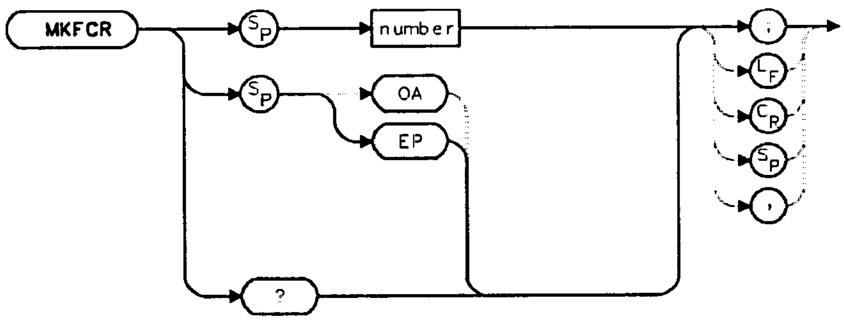
```
10 INPUT "ENTER IN THE DESIRED CENTER FREQUENCY, IN MHZ",Freq
20 INPUT "ENTER IN THE DESIRED FREQUENCY SPAN, IN MHZ",Span
30 OUTPUT 718;"IP;CF ";Freq;"MHZ;"
40 OUTPUT 718;"SP ";Span;"MHZ;"
50 INPUT "ENTER IN DESIRED FREQUENCY-COUNTER RESOLUTION, IN
   HZ",Resolution
60 OUTPUT 718;"MKFCR ";Resolution;"HZ;",
70 OUTPUT 718;"MKN EP;"
80 PRINT "PLACE THE MARKER ON THE DESIRED SIGNAL"
90 PRINT "PRESS HOLD THEN PRESS CONTINUE"
100 PAUSE
110 OUTPUT 718;"MKFC ON;"
120 END
```

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 pauses at the marker, counts the value, then continues the sweep. To adjust the frequency counter resolution, use the MKFCR command.

MKFCR
Frequency Counter Resolution

Syntax



Item	Description/Default	Range
number	integer	10 Hz to 1 MHz, in powers of ten

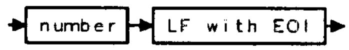
Example

```
10 INPUT "ENTER IN THE DESIRED CENTER FREQUENCY, IN MHZ",Freq
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 IN 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 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
```

Description

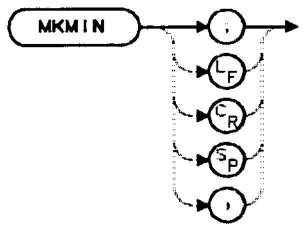
The MKFCR command specifies the resolution of the frequency counter. Refer to the MKFC command. The default value is 10 kHz.

Query Response



MKMIN
Marker to Minimum

Syntax



Example

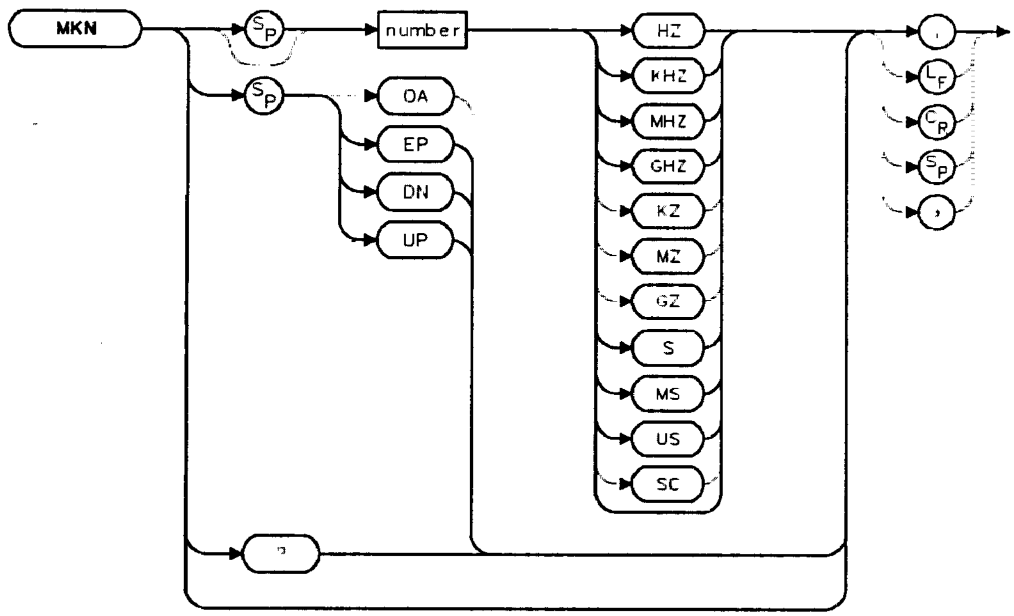
```
10 OUTPUT 718;"IP;SNGLS;"
20 INPUT "ENTER IN THE START FREQUENCY, IN MHZ",Start_freq
30 INPUT "ENTER IN THE STOP FREQUENCY, IN MHZ",Stop_freq
40 OUTPUT 718;"FA ";Start_freq;"MHZ"
50 OUTPUT 718;"FB ";Stop_freq;"MHZ"
60 OUTPUT 718;"TS;MKPK HI;MKD;MKMIN;TS;MKF?;"
70 ENTER 718;Delta_freq
80 OUTPUT 718;"MKA?;"
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
```

Description

The MKMIN command places an active marker on the minimum signal detected on a trace.

MKN
Marker Normal

Syntax



Item	Description/Default	Range
number	real	0 to maximum frequency in Hz External mixer mode: 18 E+9 to 325 E+9

UP/DN: increments in 10% of span.

Example

```
10 INPUT "ENTER IN THE START FREQUENCY, IN MHZ",Start_freq
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
```

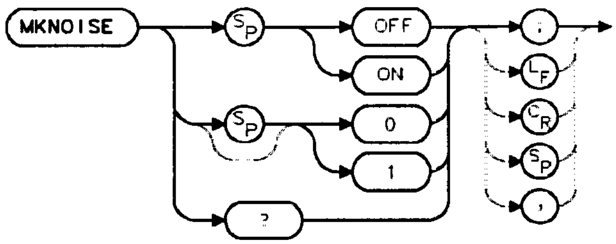
Description

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.

Query Response

MKNOISE
Marker Noise

Syntax



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
70 C_to_n=Amp_1-Amp_2
80 PRINT "CARRIER TO NOISE RATIO IN 1 HZ BANDWIDTH IS ";C_to_n;"
   DB"
90 END
```

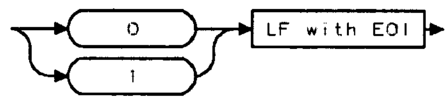
Description

MKNOISE sets the detector mode to sample and computes the average of 32 data points (16 points on one side of the marker, the marker itself, and 15 points on the other side of the marker). This average is corrected for effects of the log amplifier, bandwidth shape factor, IF detector, and resolution bandwidth. If two markers are on (whether in marker delta mode or 1/marker delta mode), MKRNOISE works on the active marker and not on the anchor marker. This allows you to measure signal-to-noise ratio directly. In linear mode, the value returned is equal to

$$\frac{V_1}{V_2} \times \frac{1}{\sqrt{RBW}}$$

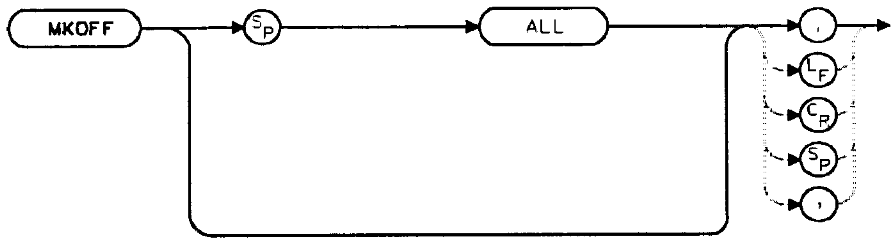
(RBW=resolution bandwidth). To query the value, use the MKA command.

Query Response



MKOFF
Marker Off

Syntax



Example

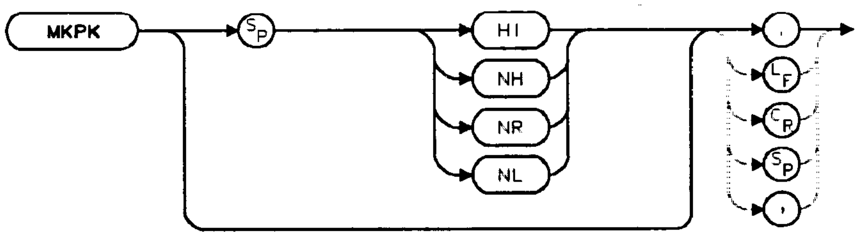
```
10 OUTPUT 718;"MKOFF ALL;"
20 END
```

Description

The MKOFF command turns off the active marker or, if specified, turns off all markers.

MKPK
Peak Search

Syntax



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

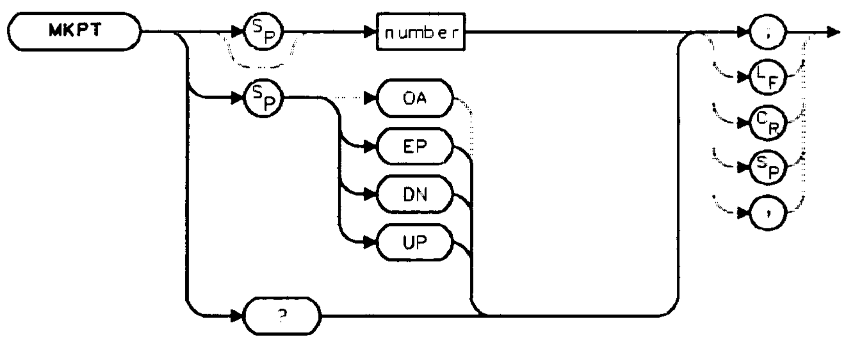
```
10 OUTPUT 718;"IP;SNGLS;"
20 INPUT "ENTER START FREQUENCY, IN MHZ",Start_freq
30 INPUT "ENTER STOP FREQUENCY, IN MHZ",Stop_freq
40 OUTPUT 718;"FA ";Start_freq;"MHZ;"
50 OUTPUT 718;"FB ";Stop_freq;"MHZ;"
60 OUTPUT 718;"TS;MKPK HI;MKD;TS;MKPK NH;"
70 OUTPUT 718;"MKA?;"
80 ENTER 718;Delta_amplitude
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
```

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). The trace peaks must meet the criteria of the marker threshold and peak excursion functions in order for a peak to be found. See also the MKPT and MKPX commands.

MKPT
Marker Threshold

Syntax



Item	Description/Default	Range
number	real	−120 to 30

UP/DN: increments of 10 dB.

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;"DB;"
80 OUTPUT 718;"TS;MKPK HI;"
90 END
```

Description

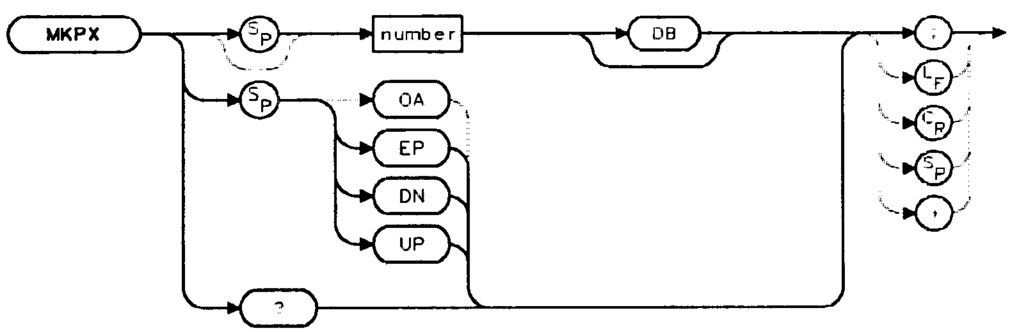
The MKPT command sets the minimum amplitude level from which a peak on the trace can be detected. The default value is −120 dBm. See also the MKPX command.

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.

Query Response

MKPX
Peak Excursion

Syntax



Item	Description/Default	Range
number	real	0.1 to 99

UP/DN: 1 vertical division of the display.

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 IF Mka<>0 THEN
90 PRINT "PEAK FOUND AT ",Mkf
100 PRINT "PEAK AMPLITUDE IS",Mka
110 ELSE
120 PRINT "NO PEAKS FOUND"
130 END IF
140 END
```

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 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 Figure 5-3). 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, 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.

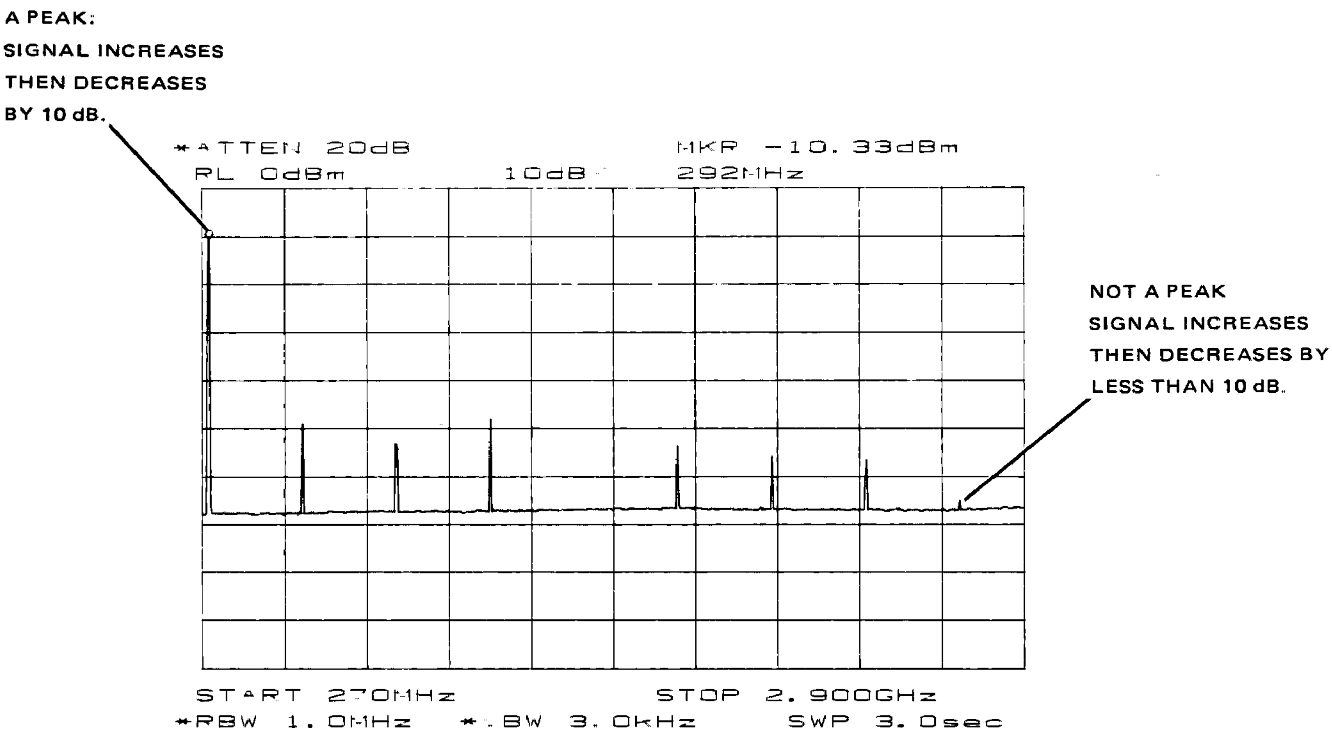
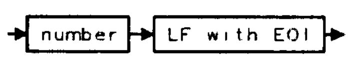


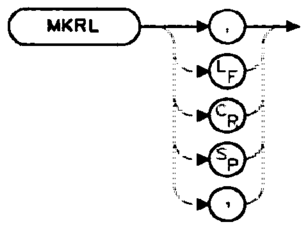
Figure 5-3. MKPX Determines Which Signals are Considered Peaks

Query Response



MKRL
Marker to Reference Level

Syntax



Example

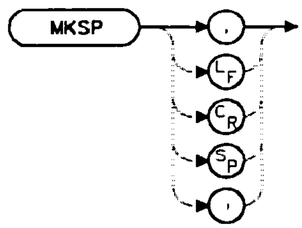
```
10 OUTPUT 718;"IP;SNGLS;CF 300MHZ;SP 20MHZ;"
20 OUTPUT 718;"TS;MKPK HI;MKRL;TS;"
30 OUTPUT 718;"RL?;AUNITS?;"
40 ENTER 718 USING "K";Ref_level,Aunits$
50 PRINT "REFERENCE LEVEL IS",Ref_level,Aunits$
60 END
```

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.

MKSP
Marker Delta to Span

Syntax



Example

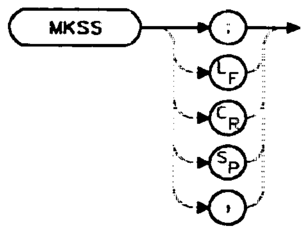
```
10 INPUT "CONNECT THE 300 MHZ CALIBRATOR TO THE INPUT",Ans$
20 OUTPUT 718;"IP;SNGLS;FA 270MHZ;FB 1275MHZ;TS;"
30 OUTPUT 718;"MKPK HI;MKD;MKPK NH;TS;MKSP;TS;"
40 END
```

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.

MKSS
Marker to Center Frequency Step-Size

Syntax



Example

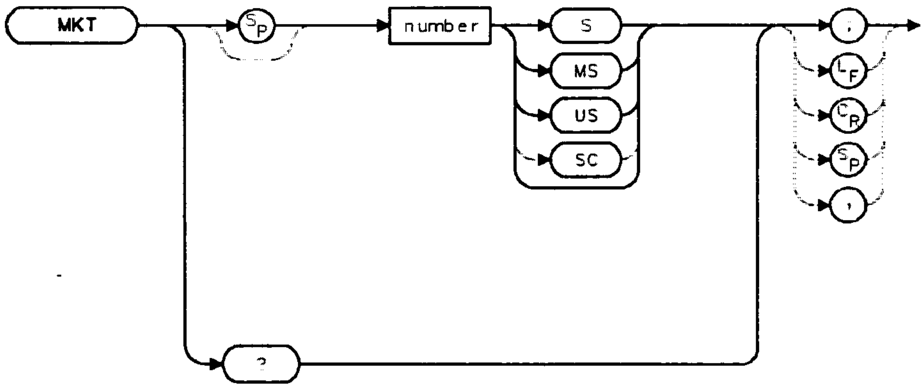
```
10 INPUT "CONNECT THE 300 MHZ CALIBRATOR TO THE INPUT",Ans$
20 OUTPUT 718;"IP;SNGLS;CF 300MHZ;SP 20MHZ;TS;"
30 OUTPUT 718;"MKPK HI;MKSS;MKD;CF UP;TS;MKPK HI;"
40 OUTPUT 718;"MKA?;"
50 ENTER 718;Delta_amplitude
60 OUTPUT 718;"MKF?"
70 ENTER 718;Delta_freq
80 PRINT "DIFFERENCE IN AMPLITUDE IS",Delta_amplitude,"DB"
90 PRINT "DIFFERENCE IN FREQUENCY IS ",Delta_freq,"HZ"
100 END
```

Description

The MKSS command sets the center frequency step-size equal to the frequency value of the active marker.

MKT
Marker Time

Syntax



Item	Description/Default	Range
number	real	0 to the current sweep time

Preset State: Off

Example

```
10 OUTPUT 718;"ST 2SEC;MKT 1.6SEC;"
20 END
```

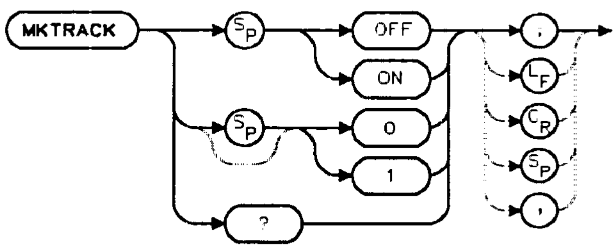
Description

The MKT command places a marker at a position that corresponds to a specified point in time during the sweep.

Query Response

MKTRACK
Signal Track

Syntax



Preset State: Off

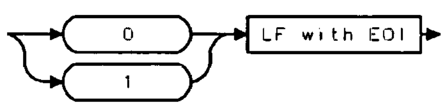
Example

```
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
```

Description

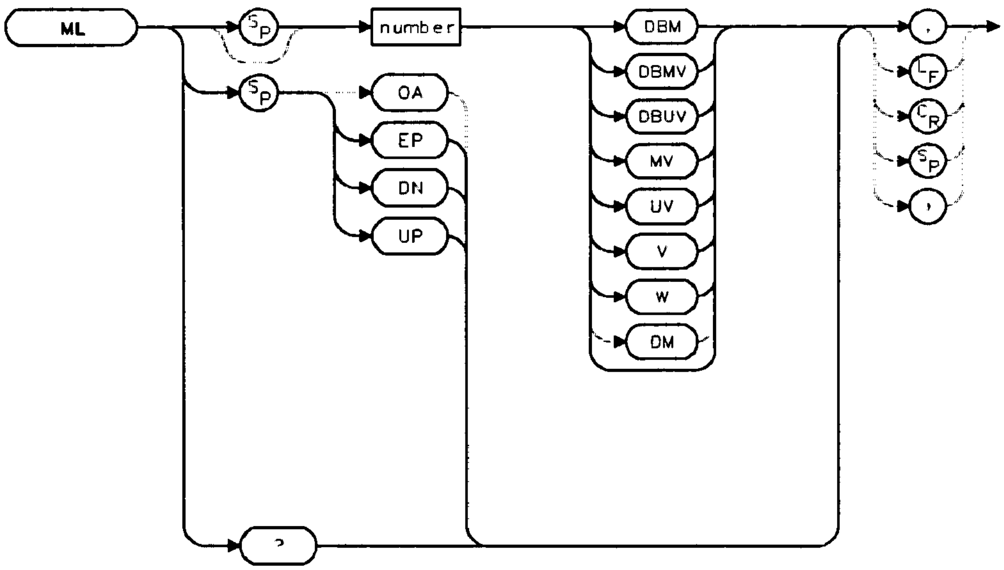
The MKTRACK command locates the active marker and sets the center frequency to the marker value. This is done after every sweep, thus maintaining the marker value at the center frequency. This allows you to "zoom in" quickly from a wide span to a narrow one, without losing the signal from the screen. 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.

Query Response



ML
Mixer Level

Syntax



Item	Description/Default	Range
number	integer	−80 to −10, in decade increments. Numbers round down to the nearest decade.

Preset State: −10 dBm

UP/DN: increments by 10 dB.

Example

```
10 OUTPUT 718;"ML -40 DBM;"
20 OUTPUT 718;"ML?;";
30 ENTER 718;M1
40 PRINT M1
50 END
```

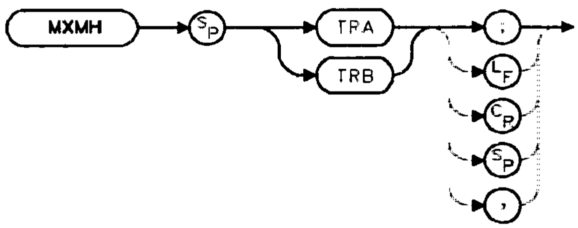
Description

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.

Query Response

MXMH
Maximum Hold

Syntax



Example

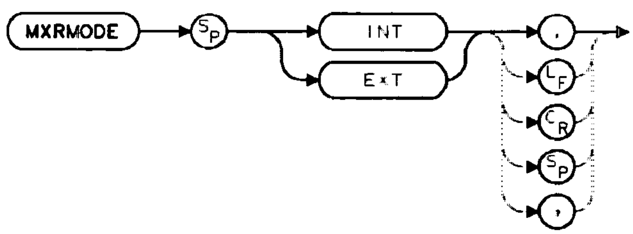
```
10 OUTPUT 718;"BLANK TRA;CLRW TRB;MXMH TRB;"
20 END
```

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 max hold is initialized.

MXRMODE
Mixer Mode

Syntax



Preset State: Internal

Example

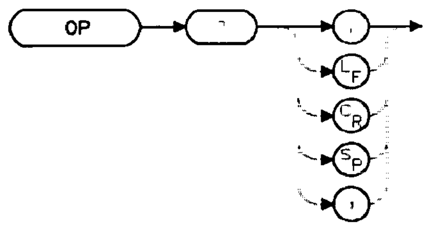
```
10 INPUT "ENTER THE MIXER MODE (INT OR EXT)",Mode$
20 OUTPUT 718;"MXRMODE ";Mode$;";"
30 END
```

Description

The MXRMODE command specifies the mixer mode. Select either the internal mixer (INT) or supply an external mixer (EXT).

OP
Output

Syntax



Example

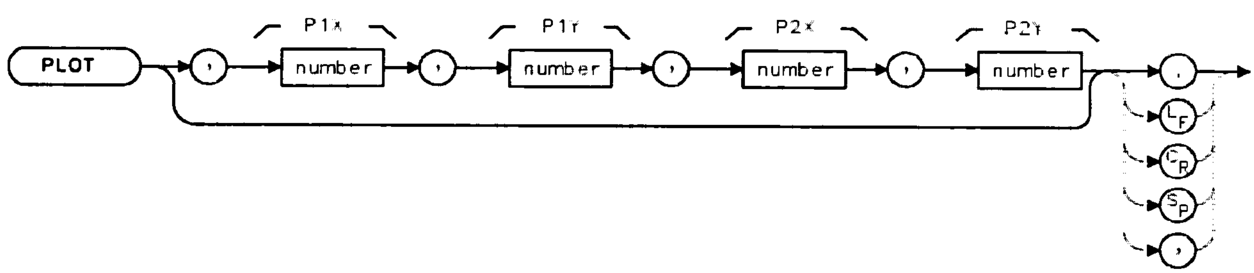
```
10  OUTPUT 718;"OP?;"
20  ENTER 718;P1x,P1y,P2x,P2y
30  DISP P1x,P1y,P2x,P2Y
40  END
```

Description

The OP command is used by a controller to determine the coordinates of the lower left and upper right vertices of the display window. The command returns the location of the lower left (P1) and upper right (P2) vertices of the window in display units.

PLOT
Plot Display

Syntax



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

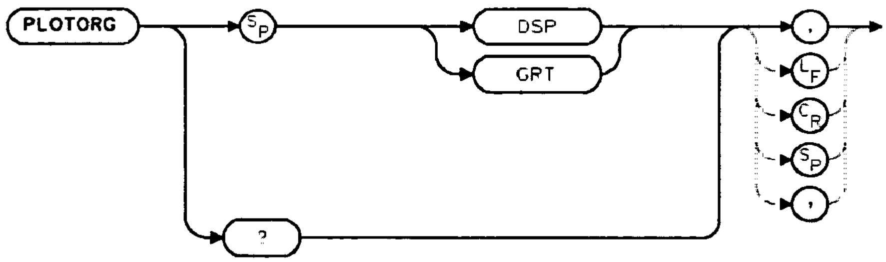
```
10 OUTPUT 705;"OP;"
20 ENTER 705;P1x,P1y,P2x,P2y
30 ON INTR 7 GOTO Done
40 ENABLE INTR 7;2
50 OUTPUT 718;"RQS 16;"
60 OUTPUT 718;"PLOT ";P1x;",";P1y;",";P2x;",";P2y;";"
70 SEND 7;UNL LISTEN 5 TALK 18 DATA
80       Idle:   GOTO Idle
90       Done:        S_poll=SPOLL(718)
100   OUTPUT 718;"RQS 0;"
110   PRINT "COMMAND IS COMPLETE"
120 END
```

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 4.

PLOTORG
Display Origins

Syntax



DSP: references P1 and P2 to the corners of the entire display.

GRT: references P2 and P2 to the corners of the graticule.

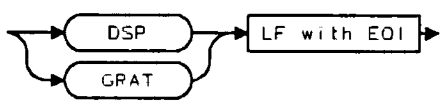
Example

```
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
```

Description

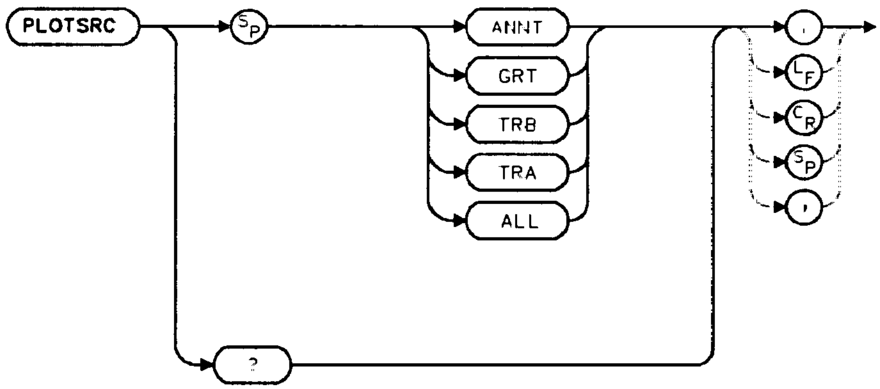
The PLOTORG command specifies whether the P1 and P2 plotter settings are the origin for the display graticule or for the entire display. GRT allows you to position the output plot, such as trace A, on a preprinted graticule (obtained from the PLTSRC command) and to save plotting time. For more information on P1 and P2 settings, see the PLOT command, or refer to Chapter 4.

Query Response



PLOTSRC
Plot Source

Syntax



Preset State: All

ALL: plots the entire display.

TRA: plots only trace A.

TRB: plots only trace B.

GRT: plots only the graticule.

ANNT: plots only the annotation.

Example

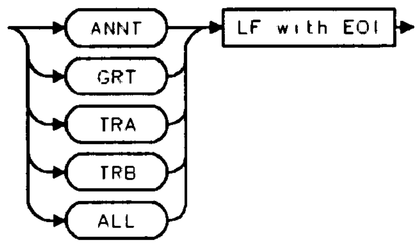
```
10 OUTPUT 705;"OP;"
20 ENTER 705;P1x,P1y,P2x,P2y
30 OUTPUT 718;"PLOTSRC TRA;RQS 16;PLOT ";P1x;",";
   P1y;",";P2x;",";P2y;";RQS 0;"
40 Done=0
50 IF Done=0 THEN GOSUB Wait_plot
60 Done=0
70 OUTPUT 718;"PLOTSRC ANNT;RQS 16;PLOT ";P1x;",";
   P1y;",";P2x;",";P2y;";RQS 0;"
80 IF Done=0 THEN GOSUB Wait_plot
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
```

Description

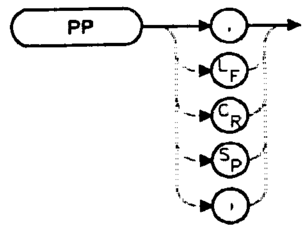
The PLOTSRC command specifies the source for the PLOT command.

Query Response



PP
Preselector Peak

Syntax



Example

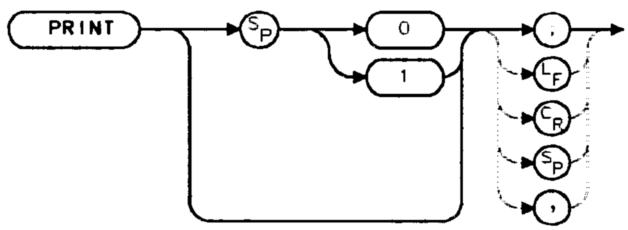
```
10 OUTPUT 718;"CF 3GHZ;SP 500KHZ;"
20 OUTPUT 718;"TS;MKPK HI;MKCF;TS;PP;"
30 END
```

Description

The PP command peaks the preselector. 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.

PRINT
Print

Syntax



0: monochrome output

1: color format output

Example

The printer usually resides at address 1. (The program is only valid for HP 9000 Series 200 and 300 computers and HP Vectra personal computer with an HP raster graphics printer, such as the HP Thinkjet.)

This example illustrates how an external controller can initiate the sending of print data to an external printer.

```
10  OUTPUT 718;"IP;CF 300MHZ;SP 1MHZ;TS;DONE?;"
20  ENTER 718;Done
30  ON INTR 7 GOTO Finish
40  ENABLE INTR 7;2
50  OUTPUT 718;"RQS 16;"
60  OUTPUT 718;"PRINT;"
70  SEND 7;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
```

Description

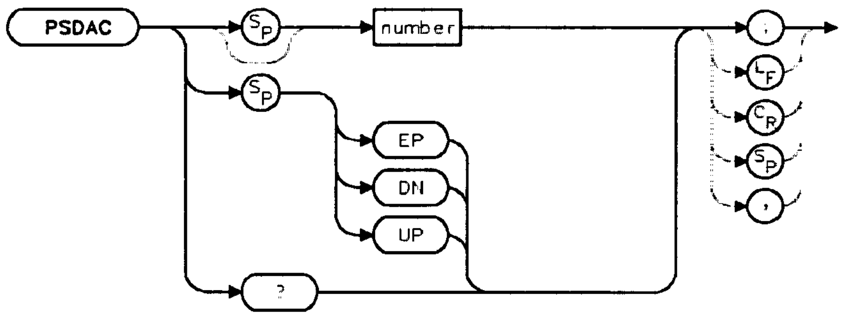
The PRINT command initiates an output of the screen data to the remote interface. With appropriate HP-IB commands, the HP-IB can be configured to route the data to an external printer. The data is output in HP raster graphics format. PRINT or PRINT 0 produces a monochrome printout. PRINT 1 produces a "color format" output if a PaintJet printer is used.

The PRINT command must be followed by the program line listed below:

```
SEND Sel_code; UNT UNL LISTEN Prt_addr TALK Sa_addr DATA
```

PSDAC
Preselector DAC Number

Syntax



Item	Description/Default	Range
number	integer	0 to 255

UP/DN: increments of 1.

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
```

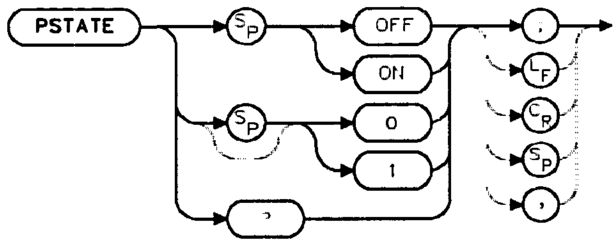
Description

The PSDAC command returns the preselector peak DAC number.

Query Response

PSTATE
Protect State

Syntax



Preset State: Off

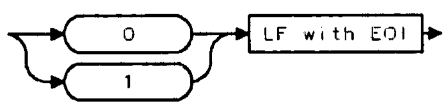
Example

```
10 OUTPUT 718;"PSTATE ON;"
20 OUTPUT 718;"PSTATE?;"
30 ENTER 718;State
40 PRINT State
50 OUTPUT 718;"PSTATE OFF;"
60 END
```

Description

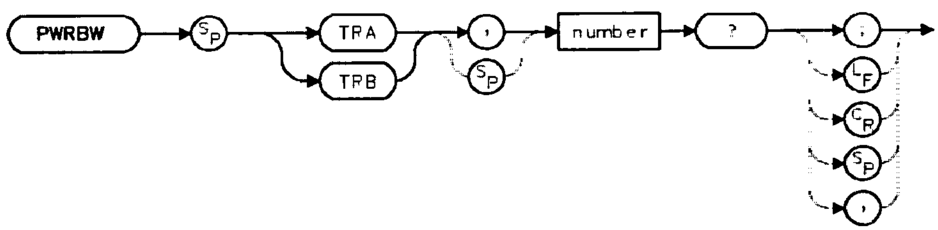
The PSTATE command prevents storing any new data in the state or trace registers. When PSTATE is ON, the registers are "locked"; the data in them cannot be erased or overwritten, although the data can be recalled. To "unlock" the registers, and store new data, set PSTATE to OFF.

Query Response



PWRBW
Trace Power Bandwidth

Syntax



Example

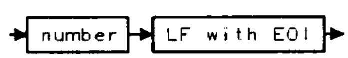
```
10 DISP "CONNECT CAL OUT TO INPUT"
20 OUTPUT 718;"IP;"
30 OUTPUT 718;"SNGLS;"
40 OUTPUT 718;"CF 100MHZ;SP 1MHZ;RB 300KHZ;"
50 OUTPUT 718;"MXMH TRA;TS;TS;TS;TS;"
60 OUTPUT 718;"PWRBW TRA, 99.0;"
70 ENTER 718;P
80 DISP "THE POWER BANDWIDTH AT 99 PERCENT IS";P/1.0E+3;"kHz"
```

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.

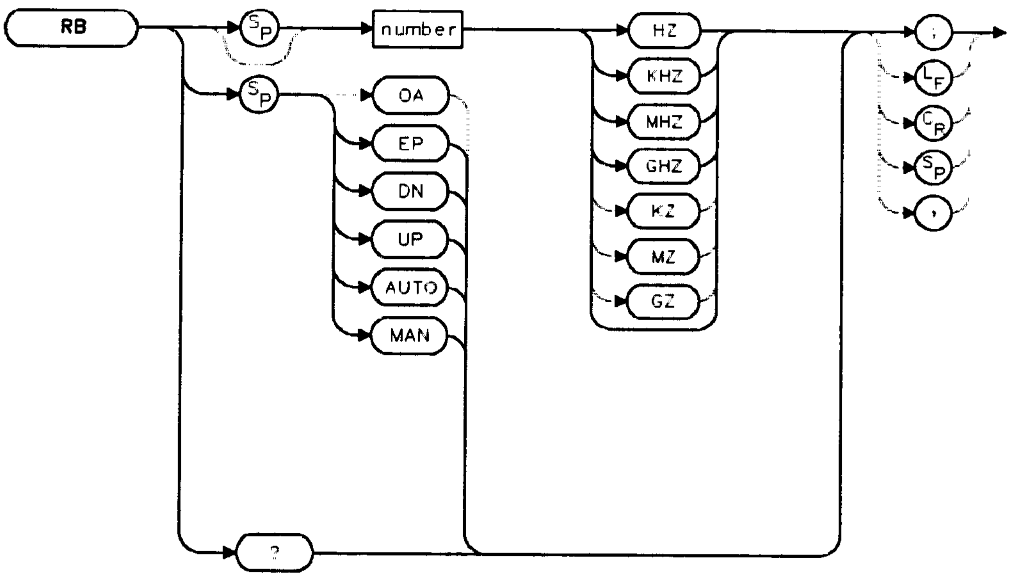
For example, if 100% is specified, the power bandwidth equals the frequency range of the CRT display, which is 100 MHz if the frequency span per division is 10 MHz. If 50% is specified, trace elements are eliminated from either end of the array, until the combined power of the remaining signal response equals half of the original power computed. The frequency span of these remaining trace elements is the power bandwidth output to the controller.

Query Response



RB
Resolution Bandwidth

Syntax



Item	Description/Default	Range
number	integer	100 to 1E+6. Numbers are rounded to the nearest bandwidth.

Preset State: Coupled mode, 1 MHz

UP/DN: increments in a 1, 3, 10 sequence.

Example

```
10 OUTPUT 718;"IP;"
20 OUTPUT 718;"CF 12GHZ;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
```

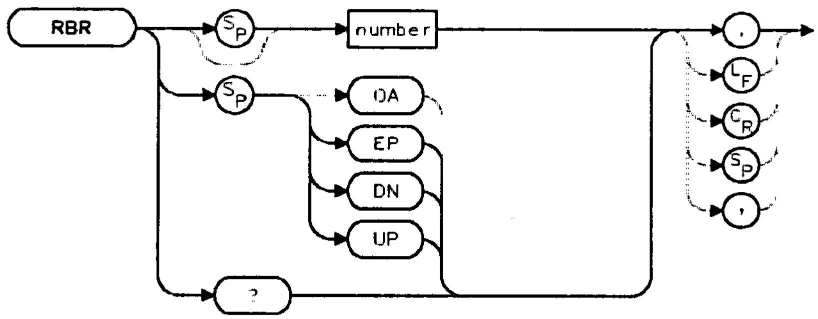
Description

The RB command sets the resolution bandwidth. This is normally a coupled function that is selected 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 100 Hz to 1 MHz, may also be selected manually.

Query Response

RBR
Resolution Bandwidth to Span Ratio

Syntax



Example

```
10 OUTPUT 718;"IP;"
20 OUTPUT 718;"CF 12GHZ;SP 2GHZ;"
30 INPUT "SELECT THE RESOLUTION BANDWIDTH TO SPAN RATIO",B_ratio
40 OUTPUT 718;"RBR ";B_ratio;";"
50 INPUT "SELECT THE RESOLUTION BANDWIDTH, IN KHZ:,B_width
60 OUTPUT 718;"RB ";B_width;"KHZ;"
70 OUTPUT 718;"RB?;";
80 ENTER 718;B_width
90 PRINT "SELECTED BANDWIDTH IS ",B_width,"KHZ"
100 END
```

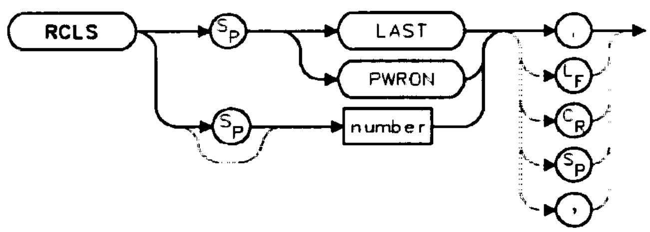
Description

The RBR command specifies the coupling ratio between the resolution bandwidth and the frequency span. The ratio ranges from 0.002 to 0.10 in a 1, 2, 5 sequence. The default ratio is 0.011

Query Response

RCLS
RECALL STATE

Syntax



Item	Description/Default	Range
number	integer	0 to 9. 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 (LINE) off.

PWR ON: sets the instrument state to the same state that occurred when (LINE) was switched on. This state was originally saved using the SAVES command.

Example

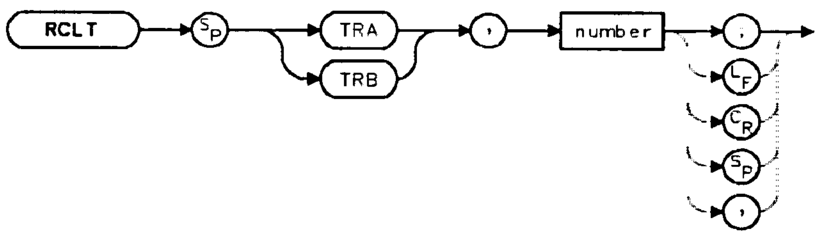
```
10 OUTPUT 718;"SAVES 7;"
20 OUTPUT 718;"IP;"
30 OUTPUT 718;"RCLS 7;"
40 END
```

Description

The RCLS command recalls to the display a previously saved instrument state.

RCLT
Recall Trace

Syntax



Item	Description/Default	Range
number	integer	0 to 7. Numbers less than zero default to zero; numbers greater than seven default to seven.

TRA: recalls the trace data to trace A.

TRB: recalls the trace data to trace B.

Example

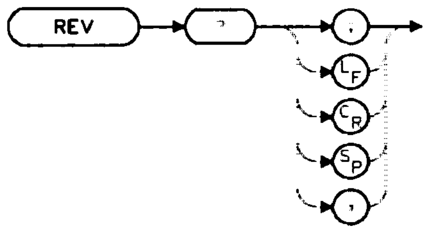
```
10 OUTPUT 718;"IP;CF 300MHZ;SP 20MHZ;"
20 OUTPUT 718;"SAVET TRA,7;"
30 OUTPUT 718;"IP;"
40 OUTPUT 718;"RCLT TRB,7;"
50 END
```

Description

The RCLT command recalls previously saved trace data to the display.

REV
Revision Number

Syntax



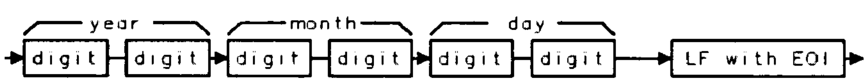
Example

```
10 DIM A$[6]
20 OUTPUT 718;"REV?;"
30 ENTER 718;A$
40 PRINT A$
50 END
```

Description

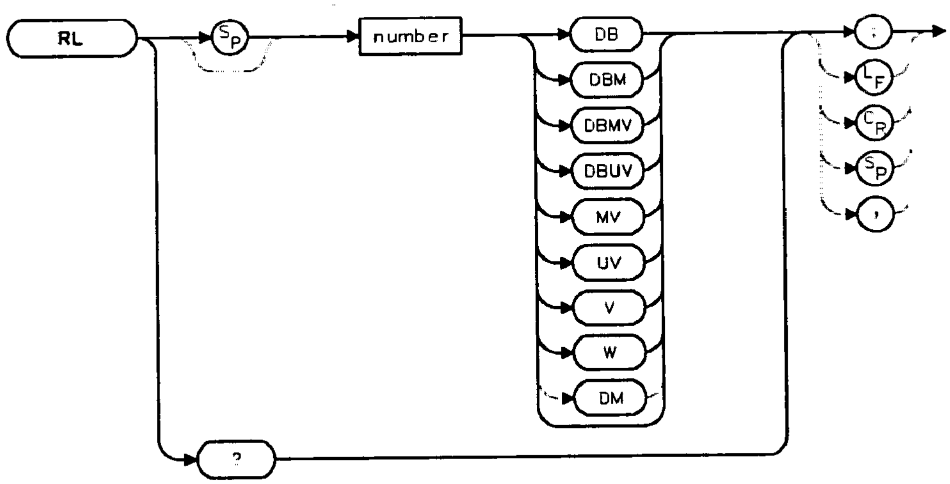
The REV command sends to the computer the revision date code of the spectrum analyzer firmware.

Query Response



RL
Reference Level

Syntax



Item	Range
number	dependent on the chosen amplitude units.

Preset State: 0 dBm

UP/DN: increments by one vertical division in log mode and in a 1, 2, 5, 10 sequence in linear mode.

Example

```
10 OUTPUT 718;"IP;SNGLS;CF 300 MHZ;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
```

Description

The RL command sets the 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 5-7 shows the minimum reference level for each band and amplitude scale. When switching bands, the reference level may be automatically increased if the current level is not available for the new band. Refer also to AUNITS.

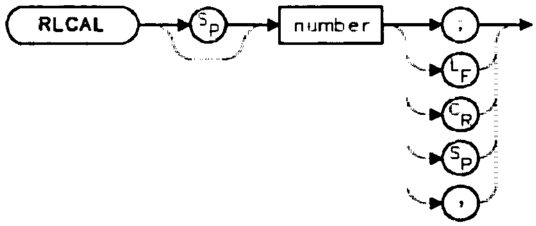
Table 5-7. Frequency Ranges and Minimum Reference Level

	Minimum Reference Level	
Band	**Log Scale**	**Linear Scale**
1 kHz—2.9 GHz	−120.0 dBm	2.2 μV
2.75 GHz—6.46 GHz	−120.0 dBm	2.2 μV
5.8 GHz—13 GHz	−115.0 dBm	4.0 μV
12.4 GHz—19.7 GHz	−105.0 dBm	12.6 μV
19.1 GHz—22 GHz	−100.0 dBm	22.4 μV

Query Response

RLCAL
Reference Level Calibration

Syntax



Item	Description/Default	Range
number	integer	−30 to 30

Example

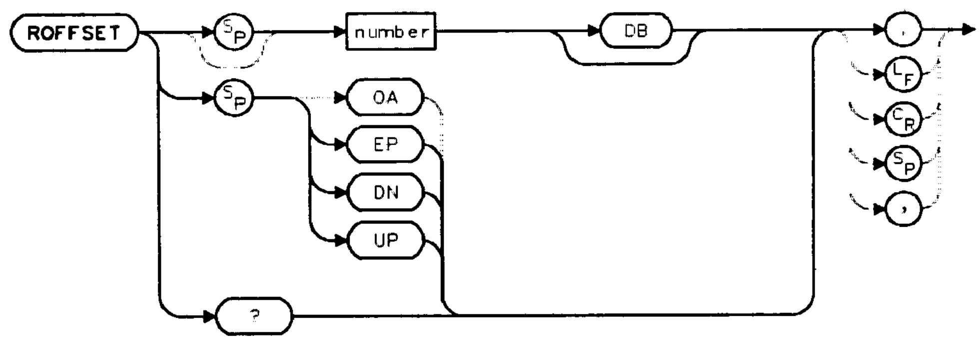
```
10 INTEGER Rlcal
20 INPUT "CONNECT CAL SIGNAL TO RF INPUT AND PRESS CONTINUE",A$
30 OUTPUT 718;"IP;TS;CF 300MHZ;SP 100KHZ;RL 0DBM;TS;"
40 OUTPUT 718;"MKPK HI;MKA?;"
50 ENTER 718;Mkamptd
60 OUTPUT 718;"RLCAL?;"
70 ENTER 718;Rlcal
80 Rlcal=Rlcal-INT((Mkamptd+10)/.17)
90 OUTPUT 718;"RLCAL ";Rlcal;";"
100 END
```

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 reference level to the input signal. 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.

ROFFSET
Amplitude Reference Offset

Syntax



Item	Description/Default	Range
number	real	−100 to 100

Preset State: Off

UP/DN: increments of one vertical division.

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
```

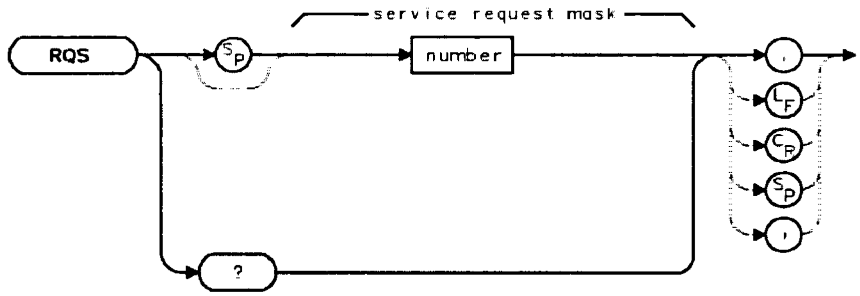
Description

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 of 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.

Query Response

RQS
Request Service Conditions

Syntax



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:  Sbyte=SPOLL(718)
80    PRINT Sbyte
90    PRINT "VIDEO AVERAGING IS COMPLETE"
100    OUTPUT 718;"RQS 0;"
110    LOCAL 718
120 END
```

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 5-8. 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 4.

RQS Request Service Conditions

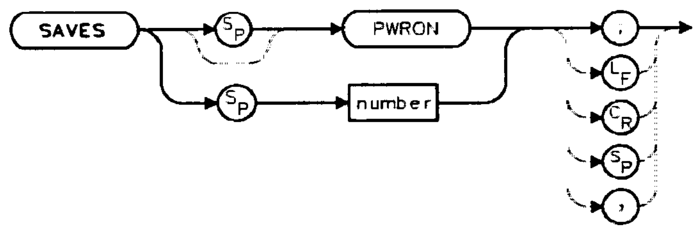
Table 5-8. HP 8562A/B Service Requests

Bit Number	Decimal Equivalent	Service Request	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

Query Response

SAVES
Saves State

Syntax



Item	Description/Default	Range
number	integer	0 to 9. Numbers less than zero default to zero; numbers greater than nine default to nine.

PWRON: sets the spectrum analyzer to the current state when LINE is switched on.

Example

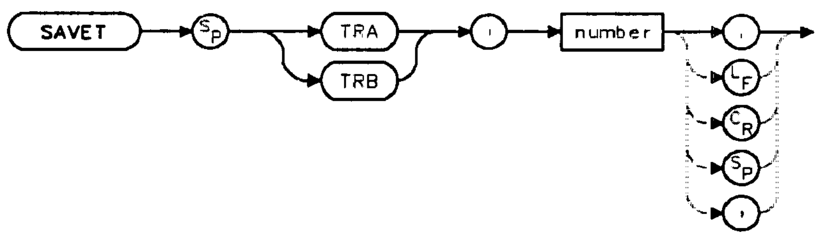
```
10 OUTPUT 718;"IP;CF 300MHZ;SP 20MHZ;"
20 OUTPUT 718;"SAVES PWRON;"
30 END
```

Description

The SAVES command saves the currently displayed instrument state in the specified state register.

SAVET
Save Trace

Syntax



Item	Description/Default	Range
number	integer	0 to 7. Numbers less than zero default to zero; numbers greater than seven are not allowed.

TRA: stores the contents of trace A.

TRB: stores the contents of trace B.

Example

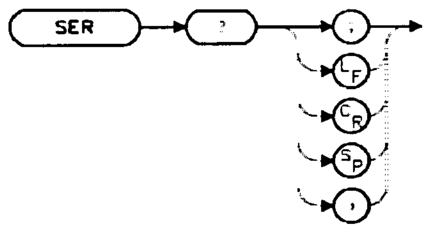
```
10 INPUT "SELECT THE TRACE YOU WISH TO SAVE (TRA OR
   TRB)",Save_trace$
20 INPUT "SELECT THE REGISTER NUMBER",Reg_number
30 OUTPUT 718;"SAVET ";Save_trace$;", ";Reg_number;";"
40 END
```

Description

The SAVET command saves the selected trace in the specified trace register.

SER
Serial Number

Syntax



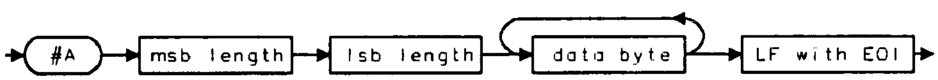
Example

```
10 DIM Ser$[20]
20 OUTPUT 718;"SER?;"
30 ENTER 718;Ser$
40 PRINT Ser$
50 END
```

Description

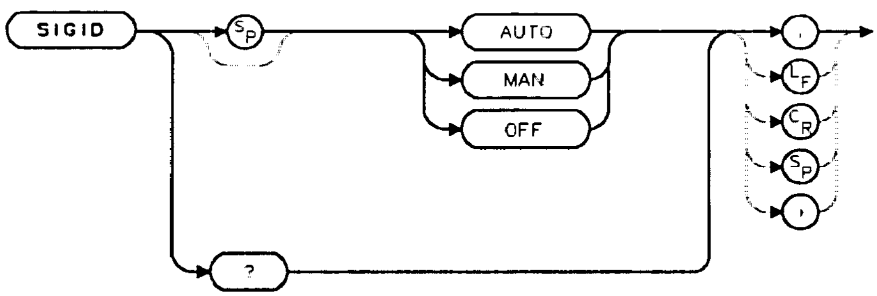
The SER command returns the spectrum analyzer serial number to the computer.

Query Response



SIGID
Signal Identification

Syntax



Example

```
10 OUTPUT 718;"SIGID AUTO;"
20 OUTPUT 718;"IDCF;"
30 OUTPUT 718;"CF?;"
40 ENTER 718;Cf
50 PRINT Cf
60 END
```

Description

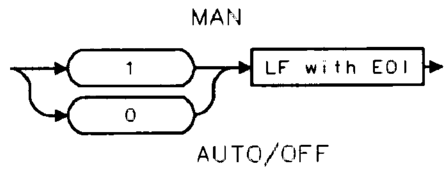
The SIGID command identifies signals for the external mixing frequency bands.

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.

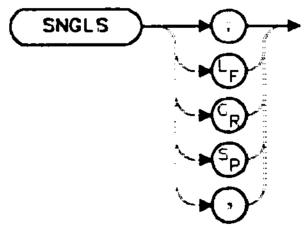
To ensure accuracy in MAN mode, limit the frequency span to less than 20 MHz.

Query Response


MAN
1
0
LF with EOI
AUTO/OFF

SNGLS
Single Sweep

Syntax



Example

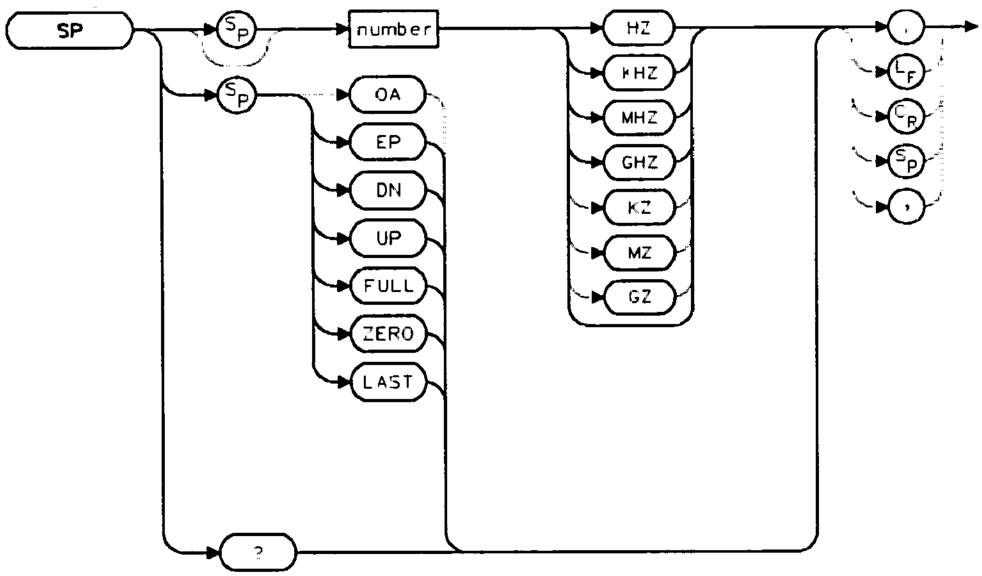
```
10 OUTPUT 718;"IP;SNGLS;"
20 END
```

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.

SP
Frequency Span

Syntax



Item	Description/Default	Range
number	real	Low band: 0 to 2.9E+9 High band: 2.75 E+9 to 19 25 E+9 External mixer mode: 18 E+9 to 307 E+9

Preset State (HP 8561A): Full span; 6.5 GHz

Preset State (HP 8562A): Full span; 19.25 GHz

Preset State (HP 8562B): Full span; 1.45 GHz

UP/DN: increments in a 1, 2, 5 sequence.

Example

```
10 OUTPUT 718;"IP;CF 300MHZ;SP 20MHZ;"
20 OUTPUT 718;"SP UP;SP?;"
30 ENTER 718;Span
40 PRINT Span
50 END
```

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/span mode.

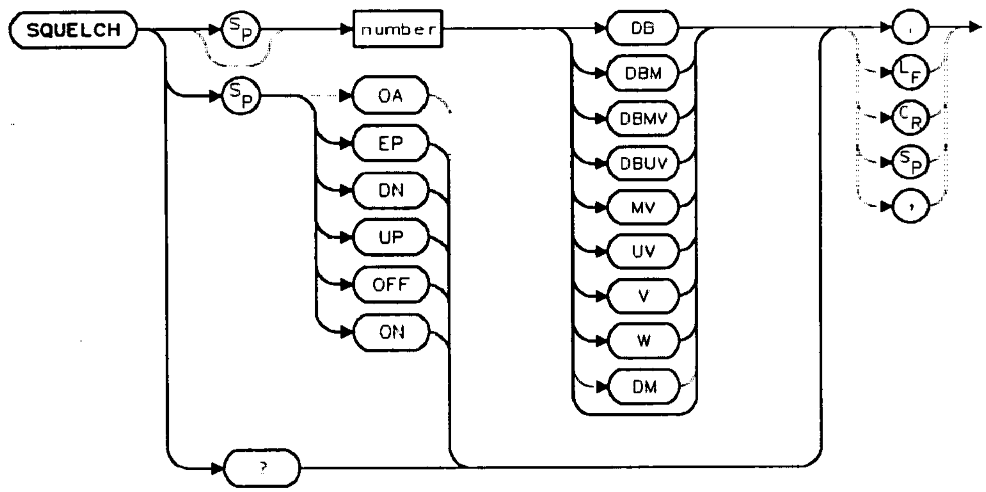
Note

The low band of the spectrum analyzer ranges from 1 kHz to 2.9 GHz. (9 kHz to 2.9 Hz for the HP 8562A/B.) The upper band ranges from 2.75 to maximum frequency. The frequency span cannot be set to overlap both bands at the same time. For example, to sweep a range from 2.0 to 3.5 GHz, use the low band to sweep from 2.0 to 2.9 GHz and use the upper band to sweep from 2.9 to 3.5 GHz.

Query Response

SQUELCH
Squelch

Syntax



Item	Description/Default	Range
number	real	−220 to 30

Preset State: Off

UP/DN: increments by 1 vertical division.

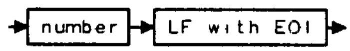
Example

```
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)",Dtime
80 OUTPUT 718;"DEMODT ";Dtime;"SEC;"
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
```

Description

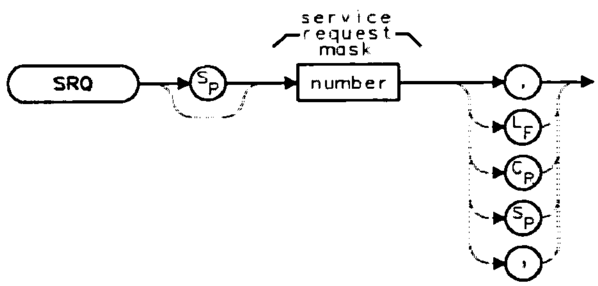
The SQUELCH command adjusts the squelch level for demodulation. When this function is on, a dashed line indicating the squelch level appears on the display. A marker must be active and above the squelch line for demodulation to occur. Refer to the DEMOD command. The default value is −120 dBm.

Query Response



SRQ
Service Request

Syntax



Example

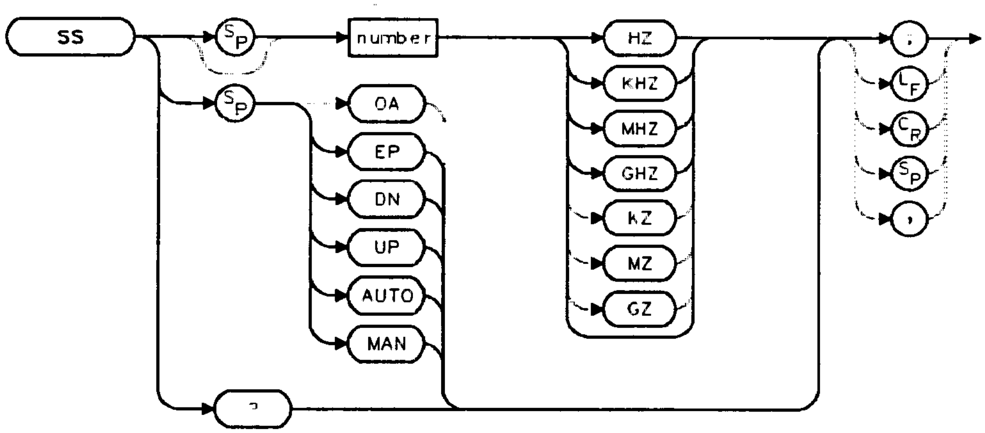
```
10 OUTPUT 718;"IP;SNGLS;CF 300 MHZ;TS;"
20 OUTPUT 718;"RQS 16;"
30 ON INTR 7 GOTO Srq
40 ENABLE INTR 7;2
50 OUTPUT 718;"SRQ 16;"
60       Idle:    GOTO Idle
70       Srq:          Sbyte=SPOLL(718)
80            PRINT Sbyte
90           PRINT "INTERRUPT GENERATED"
100    OUTPUT 718;"RQS 0;"
110    LOCAL 718
120 END
```

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 Chapter 4.

SS
Center Frequency Step-Size

Syntax



Item	Description/Default	Range
number	real	100 to maximum frequency

UP/DN: increments in a 1, 2, 5, 10 sequence.

Example

```
33 CLEAR 718
40 OUTPUT 718;"IP;SNGLS;CF300MHZ;SP20MZ;TS;"
50 OUTPUT 718;"MKPK HI;MKRL;TS;MKF?;MKA?;"
60 ENTER 718 USING "K";Mk_freq,Mk_amp
70 OUTPUT 718;"SS ";Mk_freq;"HZ"
80 OUTPUT 718;"CF UP;TS;MKPK HI;MKA?;"
90 ENTER 718;Mk_ampl
100 PRINT "The fundamental is ";Mk_amp-MK_ampl;"
   db above the first harmonic"
110 END
```

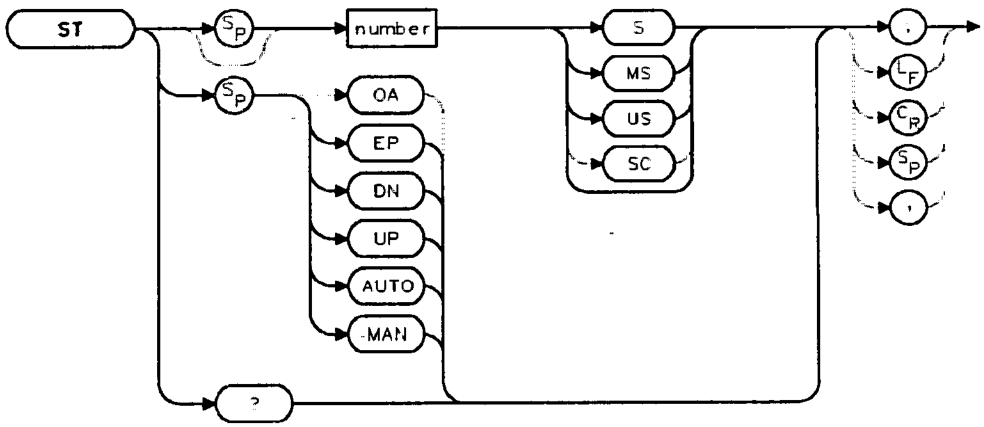
Description

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% of span.

Query Response

ST
Sweep Time

Syntax



Item	Description/Default	Range
number	real	Span > 0 Hz: 50E−3 to 100 Span = 0 Hz: 50E−6 to 60

Preset State: Coupled mode; 50 ms

UP/DN: increments in a 1, 2, 5, 10 sequence.

Example

```
10 OUTPUT 718;"ST 500MSEC;"
20 OUTPUT 718;"ST DN;"
30 OUTPUT 718;"ST?;";
40 ENTER 718;St
50 PRINT St
60 END
```

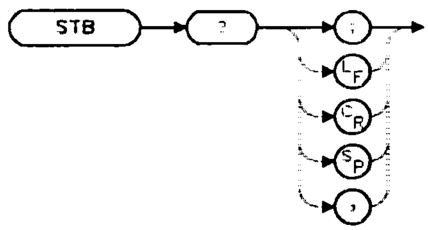
Description

The ST command sets the sweep time. This is normally a coupled function which is automatically set to the optimum value allowed by the current instrument settings. Alternatively, you may 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 MEASUREMENT UNCAL appears on the display.

Query Response

STB
Status Byte Query

Syntax



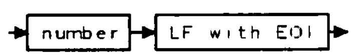
Example

```
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
```

Description

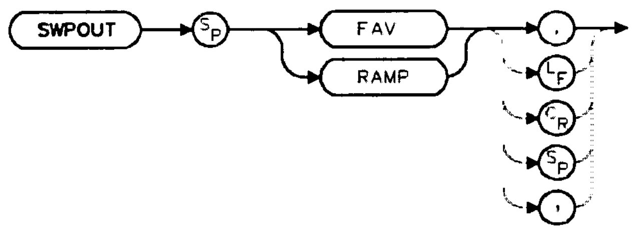
The STB command returns to the controller the decimal equivalent of the bits set in the status byte (see the RQS and SRQ commands). STB is equivalent to a serial poll command. The RQS and associated bits are cleared in the same way that a serial poll command would clear them. For more information, refer to Chapter 4.

Query Response



SWPOUT
Sweep Output

Syntax



Preset State: 0-10V LO Sweep Ramp

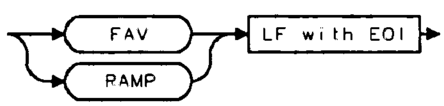
Example

```
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
```

Description

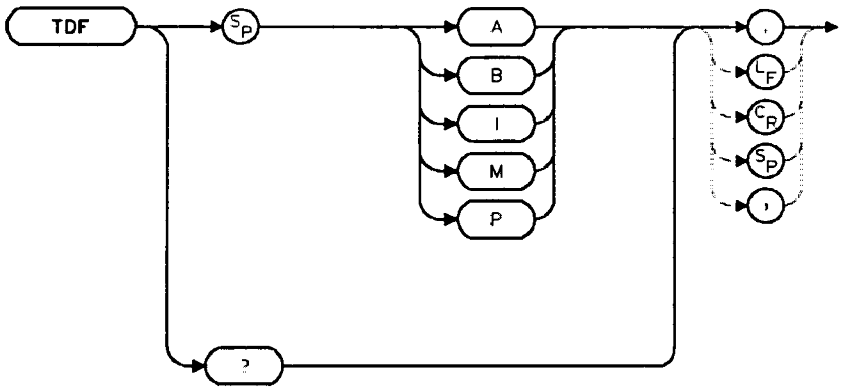
The SWPOUT command selects the sweep-related signal that is available from J8 on the rear panel. FAV provides a dc ramp of 0.5V/GHz from 0—22 GHz. RAMP provides a 0—10 V ramp corresponding to the sweep ramp that tunes the first local oscillator (LO). In multiband sweeps, one ramp is provided for each frequency band.

Query Response



TDF
Trace Data Format

Syntax



A: specifies A-block data format.

B: specifies binary data format.

I: specifies I-block data format.

M: specifies ASCII data format.

P: specifies real number output format. Numbers are in Hz, volts, watts, dBm, dBmV, dBμV, dBV, or seconds.

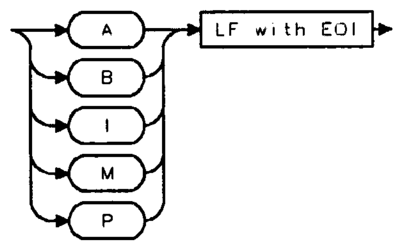
Example

```
10 REAL A(1:601)
20 OUTPUT 718;"IP;CF 300MHZ;SP 20MHZ;SNGLS;TS;"
30 CALL Get_data(Fa,Fb,R1,Rb,Vb,St,Lg,Aunits$)
40 OUTPUT 718;"TDF P;TRA?;"
50 ENTER 718;A(*)
60 PRINT "PRESS CONTINUE TO RETURN DATA TO THE ANALYZER" 70 PAUSE
80 OUTPUT 718;"IP;TDF P;TS;VIEW TRA;"
90 CALL Enter_data(Fa,Fb,R1,Rb,Vb,St,Lg,Aunits$)
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
```

Description

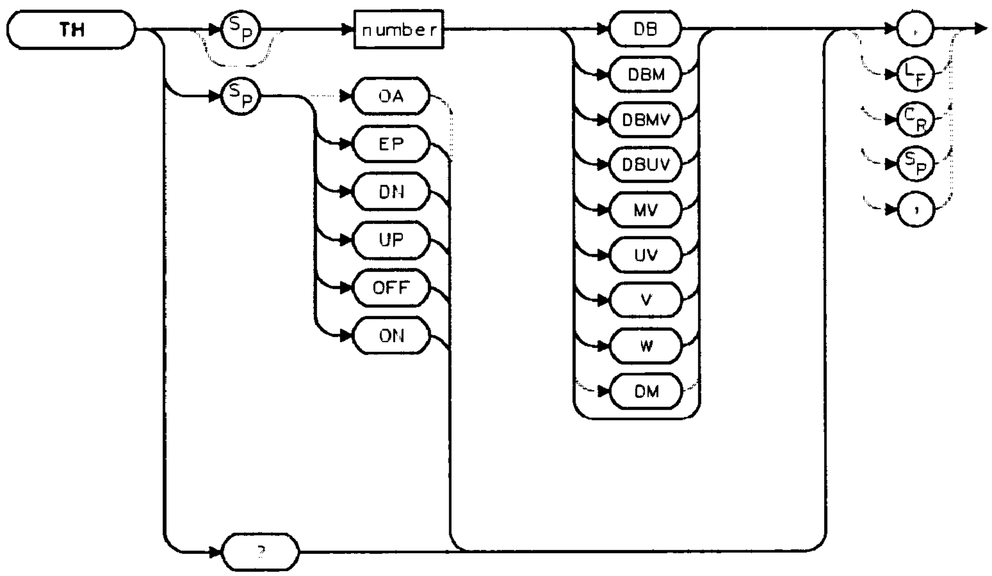
The TDF command selects the format used to input and output trace data (see the TRA/TRB command or refer to Chapter 4). You must specify the desired format when transferring data from the spectrum analyzer to a computer; this is optional when transferring data to the analyzer.

Query Response



TH
Threshold

Syntax



Item	Description/Default	Range
number	real	−220 to 30

Preset State: Off

UP/DN: increments by one vertical division.

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
```

Description

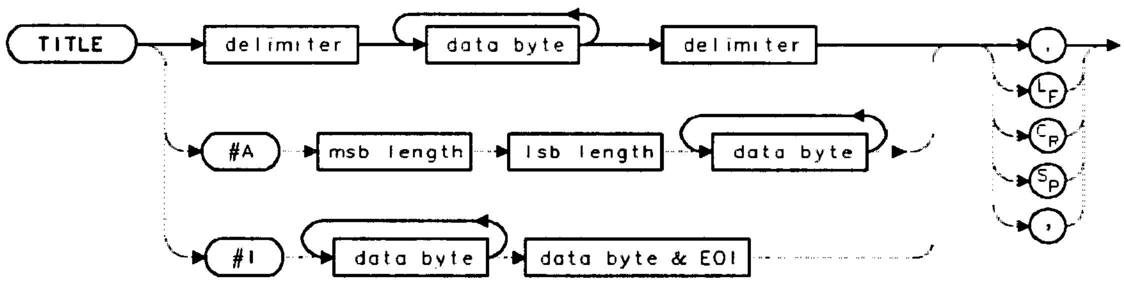
The TH command sets the minimum amplitude level and clips data at this value. Default value is −90 dBm. See also MKPT. MKPT does not clip data below its threshold.

Note When a trace is in view or max-hold mode, if the threshold is raised above any of the trace data, the data below the threshold will be permanently lost.

Query Response

TITLE
Title Entry

Syntax



Item	Description/Default	Range
msb length lsb length	represents the length of the title as two 8-bit bytes	integer

Example

```
10 OUTPUT 718;"TITLE@This is a title@;"
20 END
```

Description

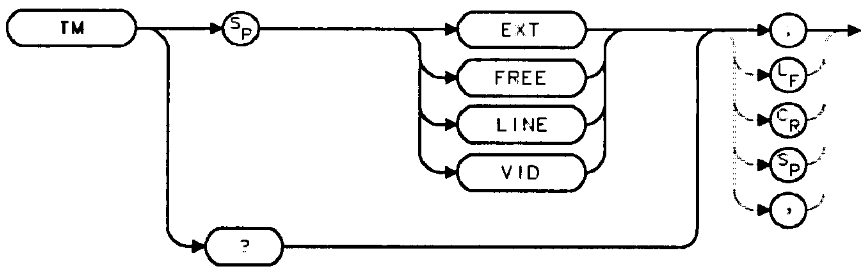
The TITLE command places character data in the title area of the display, which is in the upper-right corner. A title can be up to two rows of sixteen characters each and can include the special characters shown in Table 5-8. Carriage return and line feed characters are not recommended. For more information on creating titles, refer to Chapter 4 of this manual.

Table 5-9. 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

TM
Trigger Mode

Syntax



Preset State: Free-run mode

EXT: selects the external mode. Connect an external trigger source to J5 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 the selected level.

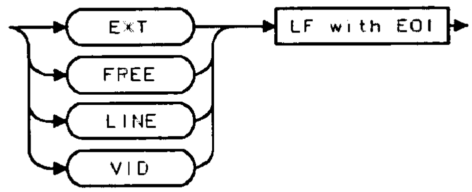
Example

```
10 OUTPUT 718;"TM VID;"
20 OUTPUT 718;"VTL -20DBM;"
30 END
```

Description

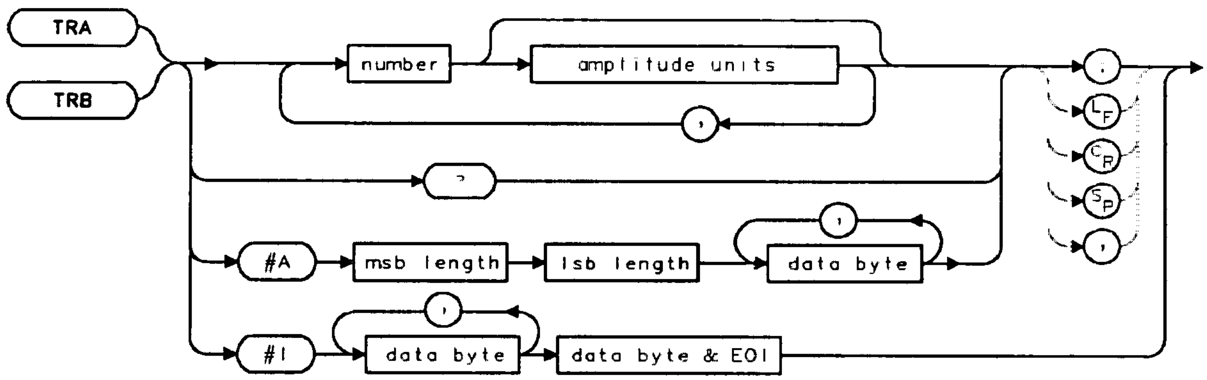
The TM command selects a trigger mode. Selected trigger conditions must be met in order for a sweep to occur. The available trigger modes are listed below. When any trigger mode other than free run is selected, a T appears on the left edge of the display.

Query Response



TRA/TRB
Trace Data Input/Output

Syntax



Item	Description/Default	Range
msb length	represents the length of	integer
lsb length	the title as two 8-bit bytes	

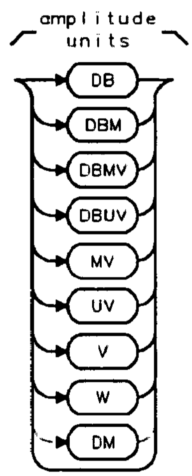
Example

```
10 REAL A(1:601)
20 OUTPUT 718;"IP;CF 300MHZ;SP 20MHZ;SNGLS;TS;"
30 CALL Get_data(Fa,Fb,R1,Rb,Vb,St,Lg,Aunits$)
40 OUTPUT 718;"TDF P;TRA?;"
50 ENTER 718;A(*)
60 PRINT "PRESS CONTINUE TO RETURN DATA TO THE ANALYZER" 70 PAUSE
80 OUTPUT 718;"IP;TDF P;TS;VIEW TRA;"
90 CALL Enter_data(FA,Fb,R1,Rb,Vb,St,Lg,Aunits$)
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
```

Description

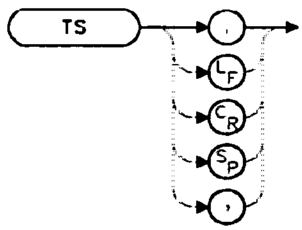
The TRA and TRB commands provide a method for transferring trace data to or from a computer. The available data formats are real number (P) format, binary (B) format, A-block format, I-block format, or measurement units (M) format. Transfers to the computer must be completed within 30 seconds or the transfer will be aborted. For instructions on transferring data and more examples, refer to Chapter 4.

Query Response



TS
Take Sweep

Syntax



Example

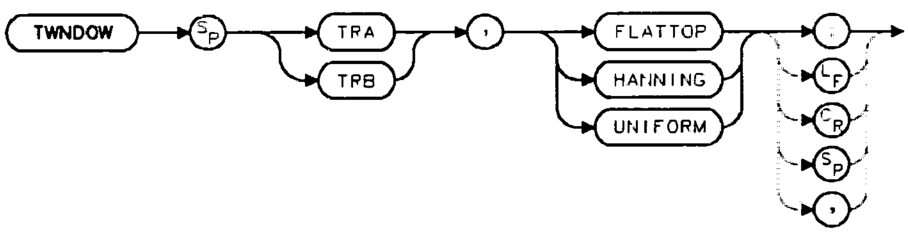
```
10 OUTPUT 718;"IP;SNGLS;"
20 OUTPUT 718;"TS;DONE?;"
30 ENTER 718;Done
40 PRINT Done
50 END
```

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 4.

TWNDOW
Trace Window

Syntax



Preset State: HANNING

Example

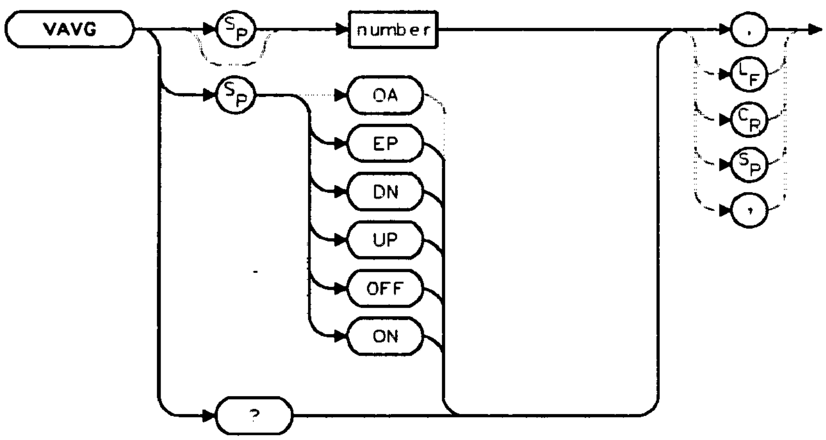
```
10  OUTPUT 718;"IP;"
20  OUTPUT 718;"CF 300MHZ;"
30  OUTPUT 718;"SP 0HZ;ST 50MSEC;"
40  OUTPUT 718;"TWNDOW TRA, UNIFORM;"
50  OUTPUT 718;"CLRW TRB;"
60  OUTPUT 718;"SNGLS;TS;TS"
70  OUTPUT 718;"FFT TRA,TRB,TRA;"
80  OUTPUT 718;"BLANK TRB;"
90  OUTPUT 718;"VIEW TRA;"
100 END
```

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, or FLATTOP. When used with the FFT command, the three algorithms give resultant passband shapes that represent a give-and-take between amplitude uncertainty, sensitivity, and frequency resolution. Refer to FFT for more information about these algorithms and the FFT function.

VAVG
Video Average

Syntax



Item	Description/Default	Range
number	integer	1 to 999

Preset State: 100

UP/DN: increments by 1.

Example

```
10 OUTPUT 718;"SNGLS;VAVG 20;TS;"
20 END
```

Description

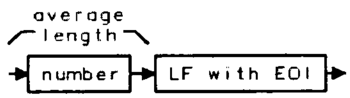
The VAVG command activates the video averaging function. Video averaging smoothes the displayed trace without using a narrow bandwidth. VAVG sets the IF detector to sample mode (see the DET command) and smoothes the trace by averaging successive traces with each other. If desired, you can change the detector mode after VAVG is executed.

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.

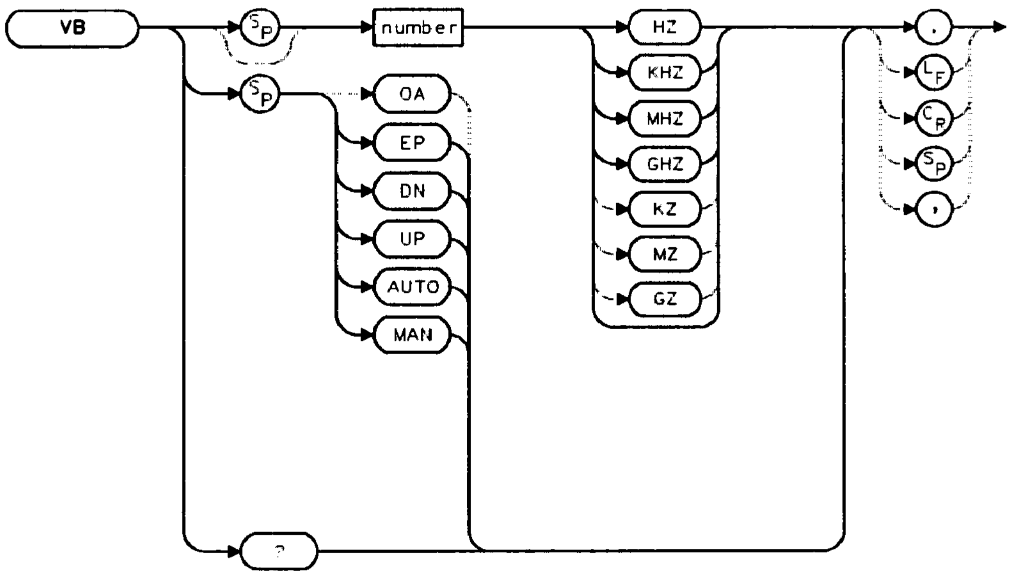
Video averaging, though requiring more sweeps, uses faster sweep times; in some cases, it can produce a smooth trace faster than a video filter.

Query Response



VB
Video Bandwidth

Syntax



Item	Description/Default	Range
number	integer	1 to 1E+6

Preset State: Coupled mode, 1 MHz

UP/DN: increments in a 1, 3, 10 sequence.

Example

```
10 OUTPUT 718;"IP;"
20 OUTPUT 718;"CF 12GHZ;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
```

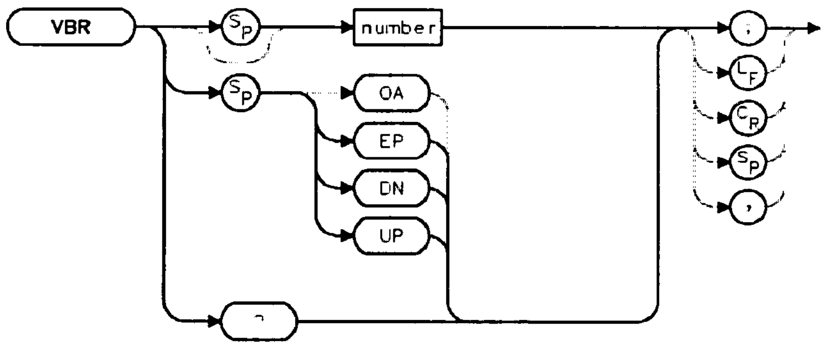
Description

The VB command specifies the video bandwidth. 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, 1.0, is used instead.) Video bandwidth filters (or smoothes) post-detected video information. The bandwidth, which ranges from 1 Hz to 3 MHz, may also be selected manually. If the specified video bandwidth is less than 300 Hz, the IF detector is set to sample mode.

Query Response

VBR
Video Bandwidth to Resolution Bandwidth Ratio

Syntax



Example

```
10 OUTPUT 718;"IP;"
20 OUTPUT 718;"CF 12GHZ;SP 2GHZ;"
30 INPUT "SELECT THE VIDEO BANDWIDTH TO RESOLUTION BANDWIDTH
   RATIO", B_RATIO
40 OUTPUT 718;"VBR ";B_ratio;";"
50 INPUT "SELECT THE VIDEO BANDWIDTH, IN KHZ",B_width
60 OUTPUT 718;"VB ";B_width;"KHZ;"
70 OUTPUT 718;"VB?;";
80 ENTER 718;B_width
90 PRINT "SELECTED BANDWIDTH IS ",B_width,"HZ"
100 END
```

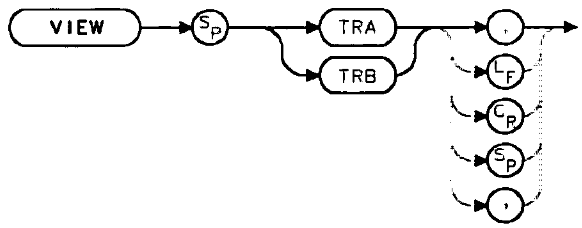
Description

The VBR command specifies the coupling ratio between the video bandwidth and the resolution bandwidth. The ratio ranges from 0.003 to 3 in a 1, 3, 10 sequence. The default ratio is 1.

Query Response

VIEW
View Trace

Syntax



Example

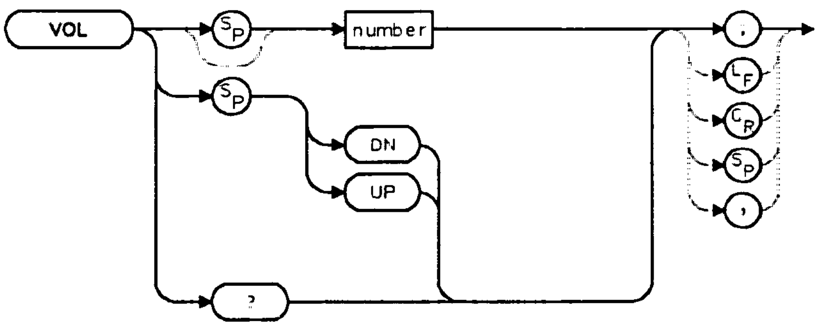
```
10 OUTPUT 718;"CLRW TRA;TS;VIEW TRA;"
20 END
```

Description

The VIEW command displays the current contents of the selected trace, but does not update the contents.

VOL
Volume

Syntax



Item	Description/Default	Range
number	integer	0 to 15

UP/DN: increments by 1.

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)", Dtime
80  OUTPUT 718;"DEMODT ";Dtime;"SEC;"
90  OUTPUT 718;"SQUELCH EP;"
100 INPUT "ADJUST SQUELCH AS NECESARY; PRESS HOLD, THEN ENTER",A$
110 OUTPUT 718;"DEMOD FM;"
120 OUTPUT 718;"VOL?;"
130 ENTER 718;Vol
140 IF Vol>3 THEN
150   OUTPUT 718;"VOL 3;"
160 END IF
170 LOCAL 718
180 END
```

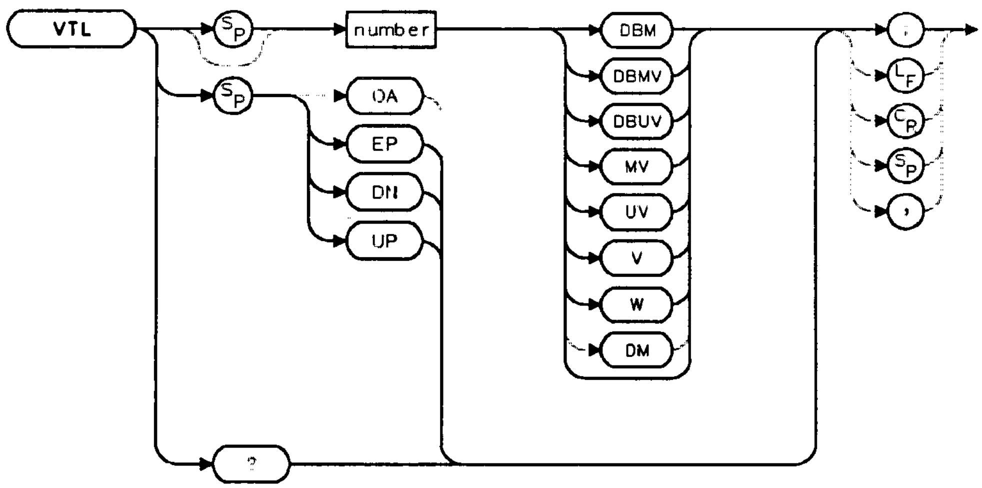
Description

The VOL command adjusts the volume of the built-in speaker and earphone jack.

Query Response

VTL
Video Trigger Level

Syntax



Item	Description/Default	Range
number	real	−220 to 30

UP/DN: increments by 1 vertical division.

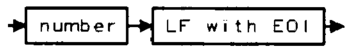
Example

```
10 OUTPUT 718;"TM VID;"
20 OUTPUT 718;"VTL -20DBM;"
30 END
```

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 level. The default value is 0 dBm.

Query Response



Appendixes

A

Softkey Cross Reference

Use this appendix to locate a softkey. For each softkey listed, a corresponding front panel key is listed. Pressing this key presents the menu containing the desired softkey.

Table A-1. Softkey Cross Reference

Softkey	Hardkey
0→10V LO SWP	SWEEP
.5 V/GHz (FAV)	SWEEP
10 MHz IN EXT	FREQUENCY
99% POWER BW	ON
A	
ADJCURR IF STATE	AMPLITUDE
A EXCH B	TRACE
AGC ON OFF	DEMOD
ALL	AUTO COUPLE
AM DEMOD ON OFF	DEMOD
AMPTD CORRECT	EXT
ANNOT ON OFF	DISPLAY
ATTEN	AMPLITUDE
ATTEN AUTO MAN	AMPLITUDE
AVERAGE CNV LOSS	EXT
A+B→A	TRACE
A−B→A ON OFF	TRACE
A−B+DL→A ON OFF	TRACE

Table A-1. Softkey Cross Reference (continued)

Softkey	Hardkey
B	
BACK SPACE	(DISPLAY)
BIAS	(EXT)
BIAS OFF	(EXT)
BLANK A	(TRACE)
BLANK B	(TRACE)
B−DL→B	(TRACE)
C	
CENTER FREQ	(FREQUENCY)
CF STEP	(FREQUENCY)
CF STEP AUTO MAN	(FREQUENCY)
CHAR SET 1 2	(TRACE)
CLR-WRT A	(TRACE)
CLR-WRT B	(TRACE)
CNV LOSS VS FREQ	(EXT)
COLOR PRINT	(DISPLAY)
CONT	(SWEEP), (TRIG)
COUNTER ON OFF	(FREQ COUNT)
COUNTER RES	(FREQ COUNT)
CRT ADJ PATTERN	(RECALL)
D	
dBm	(AMPLITUDE)
dBmV	(AMPLITUDE)
dBuV	(AMPLITUDE)

Table A-1. Softkey Cross Reference (continued)

Softkey	Hardkey
D (continued)	
DEMOD TIME	DEMOD
DETECTOR MODES	TRACE
DETECTOR NEG PEAK	TRACE
DETECTOR NORMALL	TRACE
DETECTOR POS PEAK	TRACE
DETECTOR SAMPLE	TRACE
DISPLAY LINE	DISPLAY
DISP LIN ON OFF	DISPLAY
E	
ELAPSED TIME	RECALL
ERASE TITLE	DISPLAY
EXTERNAL	TRIG
F	
FACTORY PRSEL PK	RECALL
FFT	TRACE
FM DEMOD ON OFF	DEMOD
FOCUS	DISPLAY
FREE RUN	TRIG
FREQ DIAGNOSE	RECALL
FREQ DSP OFF	DISPLAY
FREQ OFFSET	FREQUENCY
FULL BAND	EXT
FULL IF ADJ	AMPLITUDE
FULL SPAN	SPAN

Table A-1. Softkey Cross Reference (continued)

Softkey	Hardkey
G	
GRAT ON OFF	(DISPLAY)
H	
HP-IB ADDRESS	(PRESET)
I	
IF ADJ ON OFF	(AMPLITUDE)
IF ADJUST	(AMPLITUDE)
INTEN	(DISPLAY)
L	
LAST SPAN	(SPAN)
LAST STATE	(PRESET)
LINE	(TRIG)
LINEAR	(AMPLITUDE)
LOCK HARMONIC	(EXT)
LOCK ON OFF	(EXT)
LO FREQ	(RECALL)
LOG dB/DIV	(AMPLITUDE)
M	
MAIN ROLLER	(RECALL)
MARKER DELTA	(FREQ COUNT), (MKR→), (ON), (PEAK SEARCH)
MARKER NORMAL	(DEMOD), (FREQ COUNT), (ON), (MKR→), (EXT)
MARKER→CF	(MKR→), (PEAK SEARCH)
MARKER→CF STEP	(MKR→)
MARKER→REF LVL	(MKR→)
MARKER 1/DELTA	(ON)

Table A-1. Softkey Cross Reference (continued)

Softkey	Hardkey
M (continued)	
MAX HOLD A	TRACE
MAX HOLD B	TRACE
MAX MXR LEVEL	AMPLITUDE, AUTO COUPLE
MAX NO. VID AVGS	BW
MKRNOISE ON OFF	ON, PEAK SEARCH
MKRΔ→CF	MKR→
MKRΔ→CF STEP	MKR→
MKRΔ→SPAN	MKR→
MKR 1/Δ→CF	MKR→
MKR 1/Δ→CF STEP	MKR→
MORE TRC MATH	TRACE
N	
NEGATIVE BIAS	EXT
NEXT PEAK	DEMOD, FREQ COUNT, PEAK SEARCH, EXT
NEXT PEAK LEFT	PEAK SEARCH
NEXT PEAK RIGHT	PEAK SEARCH
O	
OFFSET ROLLER	RECALL
P	
PEAK EXCURSN	PEAK SEARCH
PEAK SEARCH	DEMOD, FREQ COUNT, MKR→, EXT
PEAK THRSHLD	PEAK SEARCH
PLOT	DISPLAY
PLOT ANNOT	DISPLAY

Table A-1. Softkey Cross Reference (continued)

Softkey	Hardkey
P (continued)	
PLOT GRATICUL	DISPLAY
PLOT OPTIONS	DISPLAY
PLOT ORG DSP GRAT	DISPLAY
PLOT TRACE A	DISPLAY
PLOT TRACE B	DISPLAY
POSITIVE BIAS	EXT
PRESEL AUTO PK	INT
PRESEL MAN ADJ	INT
PRINT	DISPLAY
PRINT PLOT	DISPLAY
PWR ON STATE	SAVE
R	
RBW:SPAN	AUTO COUPLE
REALIGN LO & IF	PRESET
REAR PNL OUTPUT	SWEEP
RECALL ERRORS	RECALL
RECALL PRSEL PK	RECALL
RECALL PWR ON	PRESET
RECALL STATE	RECALL
RECALL TO TRA	RECALL
RECALL TO TRB	RECALL

Table A-1. Softkey Cross Reference (continued)

Softkey	Hardkey
R (continued)	
REF LVL	(AMPLITUDE)
REF LVL CAL	(AMPLITUDE)
REF LVL OFFSET	(AMPLITUDE)
RES BW	(BW)
RES BW AUTO MAN	(BW)
S	
SAMPLER FREQ	(RECALL)
SAMPLER HARMONIC	(RECALL)
SAVELOCK ON OFF	(SAVE)
SAVE PRSEL PK	(SAVE)
SAVE STATE	(SAVE)
SAVE TRACE A	(SAVE)
SAVE TRACE B	(SAVE)
SCREEN TITLE	(DISPLAY)
SELECT CHAR	(DISPLAY)
SIG ID AT MKR	(EXT), (INT)
SID ID ON OFF	(EXT), (INT)
SIGID→CF	(EXT), (INT)
SIGNAL IDENT	(EXT)
SIG TRK ON OFF	(ON), (PEAK SEARCH)

Table A-1. Softkey Cross Reference (continued)

Softkey	Hardkey
S (continued)	
SINGLE	(SWEEP), (TRIG)
SPACE	(DISPLAY)
SPAN WIDTH	(SPAN)
SQUELCH	(DEMOD)
SQUELCH ON OFF	(DEMOD)
START FREQ	(FREQUENCY)
STATE #	(RECALL), (SAVE)
STOP FREQ	(FREQUENCY)
SWEEP TIME	(SPAN), (SWEEP)
SWP TIME AUTO MAN	(SPAN), (SWEEP)
T	
THRESHLD	(DISPLAY)
THRESHLD ON OFF	(DISPLAY)
TITLE DONE	(DISPLAY)
TRACE A	(TRACE)
TRACE B	(TRACE)
TRANSFER ROLLER	(RECALL)
U	
UNITS	(AMPLITUDE)
UNITS AUTO MAN	(AMPLITUDE)

Table A-1. Softkey Cross Reference (continued)

Softkey	Hardkey
V	
VBW:RBW	AUTO COUPLE
VIDEO AVG ON OFF	BW
VIDEO	TRIG
VIDEO BW	BW
VIDEO BW AUTO MAN	BW
VIEW A	TRACE
VIEW B	TRACE
VOLTS	AMPITUDE
VOLUME	DEMODE,
W	
WATTS	AMPLITUDE
Z	
ZERO SPAN	SPAN

B

Programming Commands vs. Front-Panel Key

Table B-1. Commands vs. Keys

Command	Name	Key
ADJALL	Execute Turn-on Adjustments	
ADJCRT	CRT Adjustment Pattern	CRT ADJ PATTERN
ADJIF	Execute IF Adjustments	FULL IF ADJ
AMB	Trace A Minus Trace B	A—B→A ON OFF
AMBPL	Trace A Minus Trace B Plus Display Line	A—B+DL→A ON OFF
ANNOT	Annotation On/Off	ANNOT ON OFF
APB	Trace A Plus Trace B	A+B→A
AT	Input Attenuator	ATTEN ATTEN AUTO MAN
AUNITS	Absolute Amplitude Units	UNITS
AUTOCPL	Autocouple All "AUTO" Functions	ALL
AXB	Trace A Exchange Trace B	A EXCH B
BLANK	Blank Trace	BLANK A BLANK B
BML	Trace A Minus Display Line	B—DL→B
CF	Center Frequency	(FREQUENCY) CENTER FREQ
CLRW	Clear/Write Trace	CLR-WRT A CLR-WRT B
CNVLOSS	External Mixer Conversion Loss	CNV LOSS VS FREQ
CONTS	Continuous Sweep	CONT
COUPLE	HP 8561A Couple ac or dc input	COUPLING AC DC
DEMOD	Demodulation	AM DEMOD ON OFF FM DEMOD ON OFF
DEMODAGC	Demodulation Automatic Gain Control	
DEMODT	Demodulation Time	DEMOD TIME
DET	Detection Mode	DETECTOR MODES
DL	Display Line	DISP LIN ON OFF
DONE	Done	

Table B-1. Commands vs. Keys (continued)

Command	Name	Key
ERR	Command Error	
ET	Elapsed Time	ELAPSED TIME
FA	Start Frequency	START FREQ
FB	Stop Frequency	STOP FREQ
FDIAG	Frequency Diagnostics	FREQ DIAGNOSE
FDSP	Frequency Display	FREQ DSP OFF
FFT	Fast Fourier Transform	FFT
FOFFSET	Frequency Offset	FREQ OFFSET
FREF	Frequency Reference	10 MHz INT EXT
FS	Full Span	FULL SPAN
FULBAND	Full Band	FULL BAND
GRAT	Graticule On/Off	GRAT ON OFF
HD	Hold	HOLD
HNLOCK	Harmonic Number Lock	LOCK ON OFF
HNUNLK	Unlock Harmonic Number	LOCK ON OFF
ID	Output Identification	
IDCF	Signal Identification Frequency to Center Frequency	SIGID→CF
IDFREQ	Signal Identification to Frequency Found	
IP	Instrument Preset	PRESET RECALL PWR ON
LG	Logrithmic Display Scale	LOG dB/DIV
LN	Linear Display Scale	LINEAR
MBIAS	Mixer Bias	BIAS
MINH	Minimum Trace Hold	
MKA	Marker Amplitude	
MKCF	Marker to Center Frequency	MARKER→CF
MKD	Marker Delta	MARKER DELTA
MKDR	Marker Delta Reciprocal	MARKER 1/DELTA
MKF	Marker Frequency	
MKFC	Marker Frequency Count	COUNTER ON OFF
MKFCR	Marker Frequency Count Resolution	COUNTER RES

Table B-1. Commands vs. Keys (continued)

Command	Name	Key
MKMIN	Marker to Minimum	
MKN	Marker Normal	MARKER NORMAL
MKNOISE	Marker Noise	MKRNOISE ON OFF
MKOFF	Marker Off	(OFF)
MKPK	Marker Peak Search	(PEAK SEARCH), PEAK SEARCH
MKPX	Marker Peak Excursion	PEAK EXCURSN
MKREAD	Marker Readout	
MKRL	Marker to Reference Level	MARKER→REF LVL
MKSP	Marker Delta to Span	MKRΔ→SPAN
MKSS	Marker to Center Frequency Step Size	MARKER→CF STEP
MKT	Marker Time	MARKER 1/DELTA (when span >0 Hz)
MKTRACK	Marker Signal Track	SIG TRK ON OFF
ML	Mixer Level	MAX MXR LEVEL
MXMH	Maximum Hold	MAX HOLD A MAX HOLD B
OP	Output Display Parameters	
PLOT	Plot Display	PLOT
PP	Preselector Peak	PRESEL AUTO PK
PRESEL	Preselector Data	RECALL PRSEL PK FACTORY PRSEL PK
PRINT	Print display	PRINT COLOR PRINT
PSTATE	Protect State	SAVELOCK ON OFF
PWRBW	Trace Power Bandwidth	99% POWER BW
RB	Resolution Bandwidth	RES BW AUTO MAN
RBR	Resolution Bandwidth to Span Ratio	RBW:SPAN
RCLS	Recall State Register	RECALL STATE
RCLT	Recall Trace Register	RECALL TO TRA RECALL TO TRB
REV	Output Revision Number	
RL	Reference Level	(AMPLITUDE) REF LVL
RLCAL	Reference Level Calibration	REF LVL CAL

Table B-1. Commands vs. Keys (continued)

Command	Name	Key
ROFFSET	Reference Level Offset	REF LVL OFFSET
RQS	Request Service Conditions	
SAVES	Save State	SAVE STATE
SAVET	Save Trace	SAVE TRACE A SAVE TRACE B
SER	Serial Number	
SIGDEL	Signal Amplitude Delta	
SIGID	Signal Identify	SIG ID ON OFF
SNGLS	Single Sweep	SINGLE
SP	Frequency Span	(SPAN)
SQUELCH	Squelch for Demodulation	SQUELCH
SRQ	Service Request	
SS	Center Frequency Step Size	CF STEP AUTO MAN
ST	Sweep Time	SWP TIME AUTO MAN
STB	Status Byte Query	
SWPOUT	Sweep Output	REAR PNL OUTPUT
TDF	Trace Data Format (Parameter Units ASCII or Binary)	
TITLE	Title Entry	SCREEN TITLE
TM	Trigger Mode	(TRIG)
TRA	Trace A Data Input/Output	
TRB	Trace B Data Input/Output	
TS	Take Sweep	
TWNDOW	Trace window	
VAVG	Video Average	VID AVG ON OFF
VB	Video Bandwidth	VIDEO BW AUTO MAN
VBR	Video Bandwidth Resolution Bandwidth Ratio	VBW:RBW
VIEW	View Trace	VIEW A VIEW B
VOL	Volume	(((•))) VOLUME
VTL	Video Trigger Level	VIDEO

C

HP-IB Errors

This appendix contains the possible error messages that can appear in the lower-right corner of the display during remote operation. Another aid for determining programming errors is the ERRORS softkey. If an HP-IB error is generated in the analyzer during remote operation, ERRORS appears on the analyzer screen. Press this key to read the errors. The cause of the error appears in the active function block. After reviewing the errors, press CLR ALL & EXIT to return the previous spectrum analyzer display.

Table C-1. Error Codes

Error Code	Error	Probable Cause
100	NO PWRON	Power-on state not valid; adefault state was loaded instead
101	NO STATE	Recalled state not valid or not saved
106	ABORTED!	Aborted operation
107	HELLO ??	NO HP-IB listener on bus
108	TIME OUT	Controller time out
109	CTRLFAIL	Take control of HP-IB failed
110	NOT CTRL	Not a controller
111	# ARGMTS	Command does not have enough arguments
112	??CMD??	Command not recognized
113	FREQ NO!	Command cannot have frequency units
114	TIME NO!	Command cannot have time units
115	AMPL NO!	Command cannot have amplitude units
116	?UNITS??	Units not recognized
117	NOP NUM	Command cannot have numeric units
118	NOP EP	Enable parameter cannot be used
119	NOP UPDN	Up/down are not valid arguments for the command
120	NOP ONOF	On/off are not valid arguments for the command
121	NOP ARG	Auto/man are not valid arguments for the command
122	NOP TRC	Trace register not valid for the command
123	NOP ABLK	A-block not valid for the command
124	NOP IBLK	I-block not valid for the command
125	NO STRNG	Strings are ot valid for the command
126	NO ?	Query is not allowed for the command
127	BAD DTMD	Detector mode is not valid
128	PK WHAT?	Peak-search parameter is not valid
129	PRE TERM	Premature termination

Table C-1. Error Codes (continued)

Error Code	Error	Probable Cause
130	BAD TDF	Arguments are valid only for the TDF command
131	?? AM/FM	AM/FM are not valid arguments for the command
132	'FAV/RMP	FAV/RAMP are not valid arguments for the command
133	!INT/EXT	ENT/EXT are not valid arguments for the command
134	??? ZERO	ZERO is not a valid argument for the command
135	??? CURR	CURR is not a valid argument for the command
136	??? FULL	FULL is not a valid argument for the command
137	??? LAST	LAST is not a valid arguent for the command
138	!GRT/DSP	GRT/DDSP is not a valid argument for the command
139	PLOTONLY	Use argument only with the PLOT command
140	??PWRON	PWRON is not a valid argument for the command
141	BAD ARG	Argument is valid only for the FDIAG command
142	BAD ARG	Query is expected for the FDIAG command
143	NO PRESL	Preselector hardware is required
144	NEXT 44	Next error space

D

Backward-Compatible Commands

The following list of commands are used by the HP 8566A and HP 8568A spectrum analyzers and are recognized by the HP 8561A and HP 8562A/B. This allows the HP 8561A and HP 8562A/B to use programs written for these Hewlett-Packard spectrum analyzers with only minor modifications. It is recommended that only the HP 8561A and HP 8562A/B commands be used when writing new programs.

Backward-Compatible Commands

Old Command	HP 8561A and HP 8562A/B 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
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

Backward-Compatible Commands (continued)

Old Command	HP 8561A and HP 8562A/B Command	Description
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
TB	TRB?	Trace B Data

Simplified Block Diagram

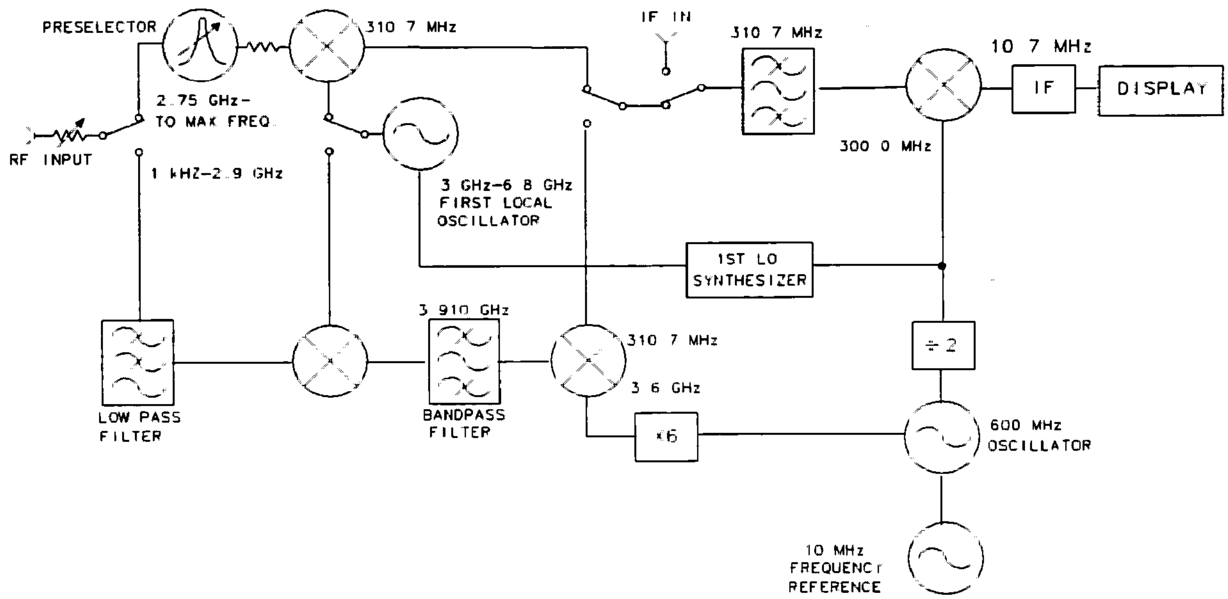


Figure E-1. Simplified Block Diagram

Index

Index

CHAPTER 7A

PRINTING REMOTELY

In addition to print functions available from the front panel, the HP 8562A/B allows remote printing. This chapter describes how you can print remotely.

PRINTER REQUIREMENTS

The HP 8562A/B supports the following printers: the HP 3630A PaintJet printer, HP 2225A/B/D ThinkJet printer, and many other printers with IEEE-488 interface and raster graphics.

Set the printer address to one (see Figure 7A.1). If you want to use a different remote address, be sure to modify the example accordingly. Remember, to print from the spectrum analyzer front panel, you must reset the address to one.

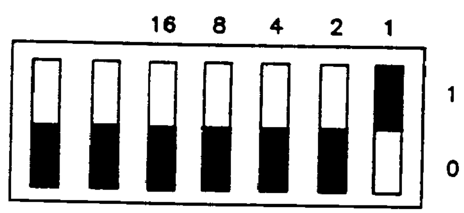


Fig. 7A.1. Printer address set to one.

PRINTING

To print, connect the printer via HP-IB to the computer and execute example 1.

Example 1

```
10        OUTPUT 718;"PRINT"
20        SEND 7; UNL LISTEN 1 TALK 18 DATA
30        END
```

PRINTING OPTIONS

PRINT At the execution of the PRINT command, the display is printed on the HP 2225A/B/D ThinkJet printer, HP 3630A PaintJet printer (in black and white only), and many other printers with IEEE-488 interface and raster graphics capability.

PRINT 0 Same as PRINT

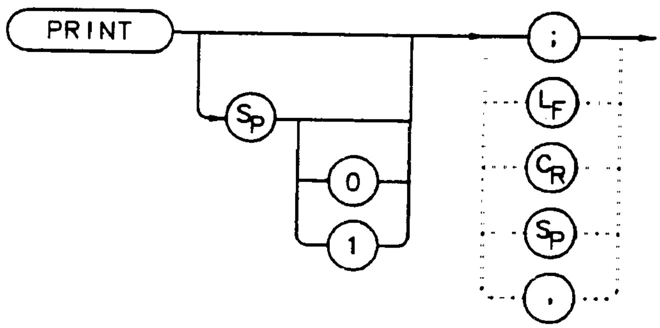
PRINT 1 At the execution of the PRINT 1 command, the display is printed on the HP 3630A PaintJet printer. Colors of the printed trace are fixed by the spectrum analyzer.

NOTE

If the HP 3630A PaintJet printer is not connected at the execution of the PRINT 1 command, erroneous information will be printed.

PRINT
PRINT DISPLAY

SYNTAX



DESCRIPTION

The PRINT command copies the specified display contents onto HP 2225A/B/D ThinkJet, HP 3630A PaintJet, or any other printer with HP-IB interface and raster graphics capability. Set the printer address to one. Once PRINT is executed, no subsequent commands are executed until PRINT is done. For more information, refer to Chapter 7A.

PRINT At the execution of the PRINT command, the display is printed on the HP 2225A/B/D ThinkJet, HP 3630A PaintJet (in black and white only), and many other printers with IEEE-488 interface and raster graphics capability.

PRINT 0 Same as PRINT

PRINT 1 At the execution of the PRINT 1 command,the display is printed on the HP 3630A PaintJet printer. Colors of the printed trace are fixed by the spectrum analyzer.

NOTE

If the HP 3630A PaintJet printer is not connected at the execution of the PRINT 1 command, erroneous information will be printed.