Installation and Verification Manual

HP 8561B Spectrum Analyzer

HEWLETT
PACKARD

HP Part No. 08561-90053
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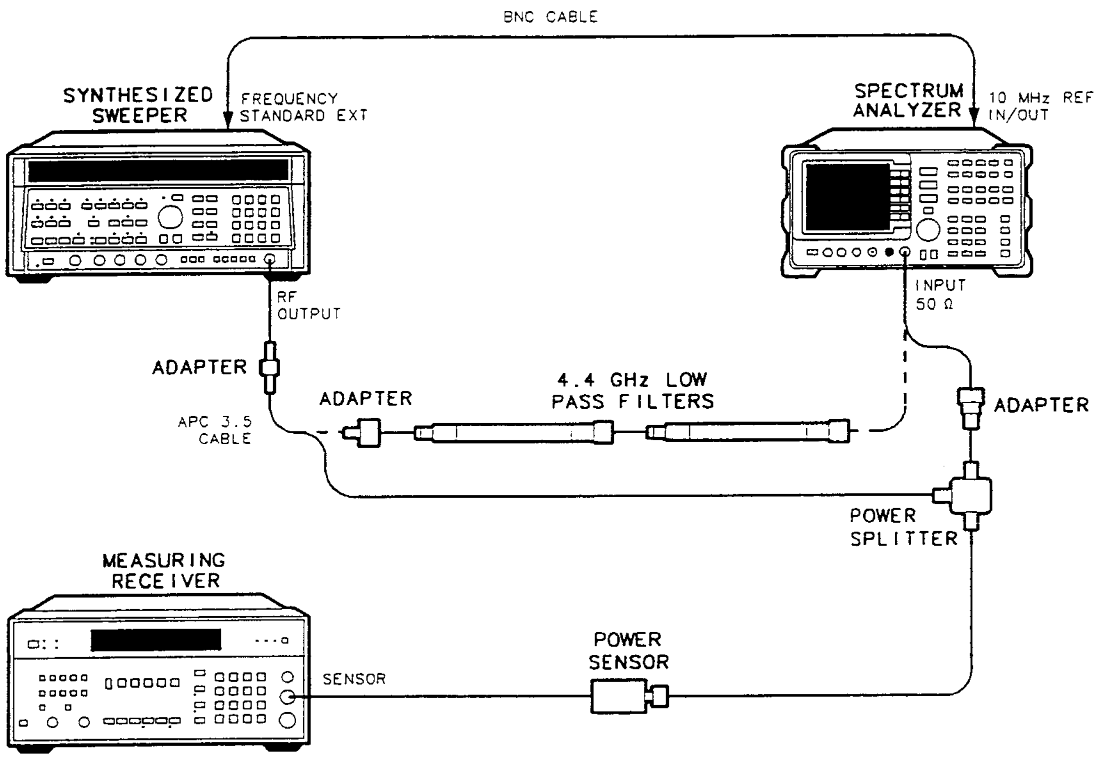

Figure 3-17. Second Harmonic Distortion Test Setup, Band 1

Equipment

Synthesized Sweeper	HP 8340A/B
Synthesizer/Level Generator	HP 3335A
Measuring Receiver	HP 8902A
Power Sensor	HP 8485A
50 MHz Low Pass Filter	0955-0306
4.4 GHz Low Pass Filter *(two required)*	HP 11689A
12 MHz Low Pass Filter	0955-0518
Power Splitter	HP 11667B

Adapters

Type N (m) to BNC (f) *(two required)*	1250-1476
Type N (m) to SMA (f)	1250-1250
Type N (f) to APC 3.5 (f)	1250-1745
Type N (m) to APC 3.5 (m)	1250-1743
APC 3.5 (f) to APC 3.5 (f)	5061-5311

Cables

BNC, 122 cm (48 in.) *(two required)*	HP 10503A
APC 3.5, 91 cm (36 in.)	8120-4921

1212 Valley House Drive, Rohnert Park, CA 94928-4999, USA

15. Second Harmonic Distortion

Specification

For applied signal frequencies 50 Hz to 10 MHz: <−60 dBc for a −40 dBm mixer level*

For applied signal frequencies 10 MHz to 1.45 GHz: <−72 dBc for a −40 dBm mixer level*

For applied signal frequencies 1.45 GHz to 3.25 GHz: <−100 dBc for a −10 dBm mixer level*

*(mixer level = input level − input attenuation)

Related Adjustment

There is no related adjustment procedure for this performance test.

Description

A synthesizer/level-generator (or synthesized sweeper) and low pass filter provide the signal for measuring second harmonic distortion. The low pass filter eliminates any harmonic distortion originating at the signal source. The spectrum analyzer's frequency response is calibrated out for the >2.9 GHz test. The synthesizer (synthesized sweeper) is phase-locked to the spectrum analyzer's 10 MHz reference.

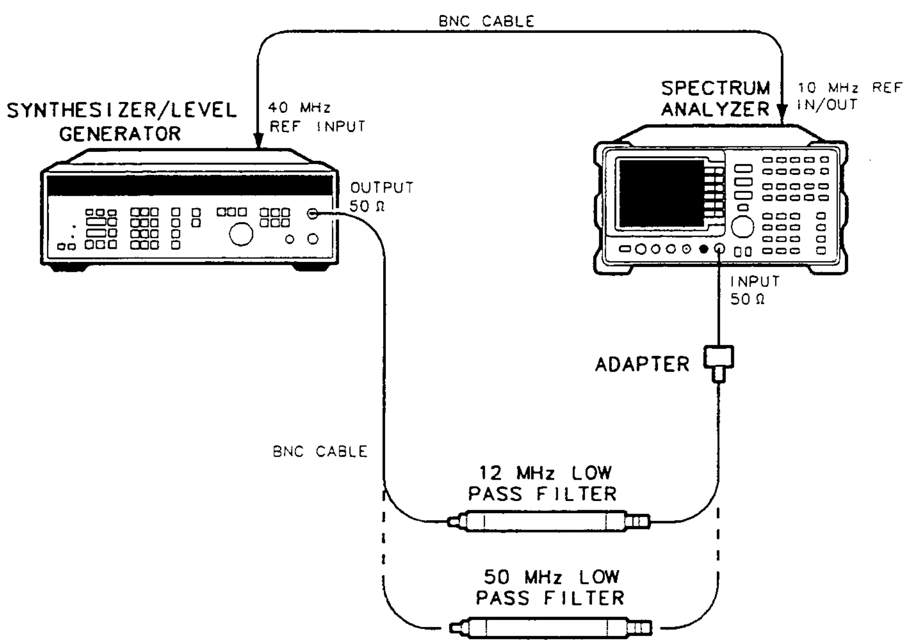

Figure 3-16. Second Harmonic Distortion Test Setup, Band 0

Certification

Hewlett-Packard Company certifies that this product met its published specifications at the time of shipment from the factory. Hewlett-Packard further certifies that its calibration measurements are traceable to the United States National Institute of Standards and Technology, to the extent allowed by the Institute's calibration facility, and to the calibration facilities of other International Standards Organization members.

Warranty

This Hewlett-Packard instrument product is warranted against defects in material and workmanship for a period of one year from date of shipment. During the warranty period, Hewlett-Packard Company will, at its option, either repair or replace products which prove to be defective.

For warranty service or repair, this product must be returned to a service facility designated by HP. Buyer shall prepay shipping charges to HP and HP shall pay shipping charges to return the product to Buyer. However, Buyer shall pay all shipping charges, duties, and taxes for products returned to HP from another country.

HP warrants that its software and firmware designated by HP for use with an instrument will execute its programming instructions when properly installed on that instrument. HP does not warrant that the operation of the instrument, or software, or firmware will be uninterrupted or error-free.

Limitation of Warranty

The foregoing warranty shall not apply to defects resulting from improper or inadequate maintenance by Buyer, Buyer-supplied software or interfacing, unauthorized modification or misuse, operation outside of the environmental specifications for the product, or improper site preparation or maintenance.

NO OTHER WARRANTY IS EXPRESSED OR IMPLIED. HP SPECIFICALLY DISCLAIMS THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

Exclusive Remedies

THE REMEDIES PROVIDED HEREIN ARE BUYER'S SOLE AND EXCLUSIVE REMEDIES. HP SHALL NOT BE LIABLE FOR ANY DIRECT, INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, WHETHER BASED ON CONTRACT, TORT, OR ANY OTHER LEGAL THEORY.

Assistance

Product maintenance agreements and other customer assistance agreements are available for Hewlett-Packard products.

For any assistance, contact your nearest Hewlett-Packard Sales and Service Office.

8. On the 8116A, use the RANGE switch to set FREQ to 14.4 kHz.
9. On the spectrum analyzer, press (SGL SWP) (PEAK SEARCH). In Table 3-24, record the Marker Amplitude Reading as the Max level for 14.4 kHz PRF.
10. Press (MKR). Using the knob, move the marker until it is at the lowest point on the trace. In Table 3-24, record the Marker Amplitude Reading as the Min level for 14.4 kHz PRF.
11. On the spectrum analyzer, press (AMPLITUDE) LINEAR, (TRIG) CONT, (AMPLITUDE) REF LVL. Adjust the reference level to place the trace one division below the top of the screen.
12. Repeat steps 5 through 10.
13. On the spectrum analyzer, press (BW) RES BW 2 (MHz).
14. Repeat steps 5 through 12.
15. For each row of entries in Table 3-24 for the Log 5 dB/DIV scale, subtract the lowest Min Marker Amplitude Reading from the highest Max Marker Amplitude Reading. Record the result as the PDU (pulse digitization uncertainty).
16. For each row of entries in Table 3-24 for the Linear scale, calculate the PDU as a percentage of reference level using the equation below.

PDU = 100 × [(highest Max Marker Amplitude – lowest Min Marker Amplitude)/ Reference level setting.

Table 3-24. Pulse Digitization Uncertainty

Res BW	Scale	Marker Amplitude Readings				PDU	Specification
		144 kHz PRF		14.4 kHz PRF			
		Max.	Min.	Max.	Min.		
1 MHz	Log 5 dB/DIV	____dBm	____dBm	____dBm	____dBm	____dB	1.25 dB
1 MHz	Linear	____ mV	____ mV	____ mV	____ mV	____ %	4%
2 MHz	Log 5 dB/DIV	____dBm	____dBm	____dBm	____dBm	____dB	3 dB
2 MHz	Linear	____ mV	____ mV	____ mV	____ mV	____ %	12%

Safety Symbols

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

Caution

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

Warning

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

General Safety Considerations

Warning

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

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

Warning

There are many points in the instrument which can, if contacted, cause personal injury. Be extremely careful.

Any adjustments or service procedures that require operation of the instrument with protective covers removed should be performed only by trained service personnel.

Caution

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

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

Equipment

Synthesized Sweeper	HP 8340A/B
Pulse/Function Generator	HP 8116A
Adapters	
Type N (m) to APC 3.5 (f)	1250-1744
APC 3.5 (f) to APC 3.5 (f)	5061-5311
Cables	
BNC, 122 cm (48 in.) *(two required)*	HP 10503A
APC 3.5, 91 cm (36 in.)	8120-4921

Procedure

1. Connect the equipment as shown in Figure 3-15.
2. On the HP 8340A/B, press (INSTR PRESET). Set the controls as follows:

   CW .... 2500 MHz
   MODULATION .... PULSE
   POWER LEVEL .... −15 dB
   RF .... ON
   LEVELING .... INT
   FREQUENCY STANDARD Switch (rear panel) .... EXT

3. Set the HP 8116A controls as follows:

   FUNCTION .... PULSE
   FREQ .... 144 kHz
   WID .... 200 ns
   AMP .... 5.0 V
   OFS .... 0.0 V
   MODE .... NORM
   CTRL .... OFF

4. On the spectrum analyzer, press (PRESET) (TRACE) MORE 1 OF 3 DETECTOR MODES DETECTOR POS PEAK. Set the controls as follows:

   CENTER FREQ .... 2500 MHz
   SPAN .... 0 Hz
   REF LVL .... −10 dBm
   RES BW .... 1 MHz
   VIDEO BW .... 3 MHz
   SWEEPTIME .... 50 ms
   dB/DIV .... 5 dB

5. On the HP 8116A, use the RANGE switch to set FREQ to 144 kHz.
6. On the spectrum analyzer, press (SGL SWP) (SGL SWP) (PEAK SEARCH). In Table 3-24, record the Marker Amplitude Reading as the Max level for 144 kHz PRF.
7. Press (MKR). Using the knob, move the marker until it is at the lowest point on the trace. In Table 3-24, record the Marker Amplitude Reading as the Min level for 144 kHz PRF.

HP 8561B Spectrum Analyzer Documentation Outline

Instruments of the HP 856X family of spectrum analyzers are documented to varying levels of detail. Certain documents cover several instruments and others are unique to an individual instrument. The available documentation for the HP 8561B is described below.

Manuals Supplied with the Instrument

Installation and Verification Manual

Installation and verification manuals are unique to given instrument. Topics covered by this manual include installation, specifications, verification of spectrum analyzer operation, and what to do if a failure occurs.

Operation and Programming Manual

This is a generic manual applicable to the HP 8560A, HP 8561B, and HP 8563A instruments. Topics include preparation for use, spectrum analyzer functions, and softkey definitions, programming fundamentals and definitions for remote programming commands.

Quick Reference Guide

The Quick Reference Guide is an abbreviated version of the operating and programming manual providing a list of all remote programming commands.

Manuals Available Separately

Service Manual

This manual provides information for servicing an instrument to the assembly level. The manual includes instrument adjustments, troubleshooting, major assembly replaceable parts lists, and replacement procedures. For ordering information, contact a Hewlett-Packard Sales and Service Office. This manual is not always immediately available for new products. Some earlier service manuals are titled *Support Manual*.

Component-Level Information

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

14. Pulse Digitization Uncertainty

Specification

Pulse Digitization Uncertainty (PDU) for Pulse Repetition Frequency (PRF)>720/Sweep Time

LOG:	<1.25 dB peak-to-peak for RES BW ≤1 MHz <3 dB peak-to-peak for 2 MHz RES BW
LINEAR:	<4% of reference level peak-to-peak for RES BW ≤1 MHz <12% of reference level peak-to-peak for 2 MHz RES BW

Related Adjustment

There is no related adjustment procedure for this performance test.

Description

This test measures the ability of the spectrum analyzer analog-to-digital circuitry to respond to pulsed RF signals. The synthesized sweeper is phase-locked to the spectrum analyzer's 10 MHz reference. The only log scale tested is 5 dB/DIV, because this is the worst case. Linear scale is also tested.

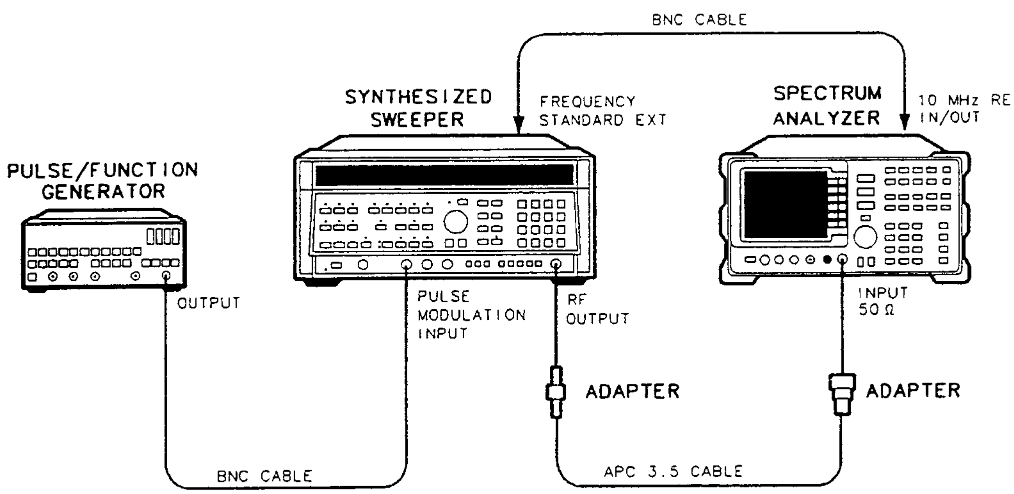

Figure 3-15. Pulse Digitization Uncertainty Test Setup

13. Frequency Readout/Frequency Count MKR Accuracy

Table 3-22. Frequency Readout Accuracy

HP 8340A/B Frequency (GHz)	HP 8561B		Marker Reading			Measurement Uncertainty (Hz)
	Span	Center Freq	Min. (GHz)	Actual	Max. (GHz)	
1.5	1 MHz	1.5 GHz	1.499948	________	1.500052	±1
1.5	10 MHz	1.5 GHz	1.49949	________	1.50052	±1
1.5	20 MHz	1.5 GHz	1.49896	________	1.50105	±1
1.5	50 MHz	1.5 GHz	1.49746	________	1.50255	±1
1.5	100 MHz	1.5 GHz	1.4949	________	1.5052	±1
1.5	1 GHz	1.5 GHz	1.450	________	1.550	±1
4.0	1 MHz	4 GHz	3.999948	________	4.000052	±1
4.0	10 MHz	4 GHz	3.999948	________	4.00053	±1
4.0	20 MHz	4 GHz	3.99895	________	4.00106	±1
4.0	50 MHz	4 GHz	3.99745	________	4.00256	±1
4.0	100 MHz	4 GHz	3.9949	________	4.0052	±1
4.0	1 GHz	4 GHz	3.950	________	4.050	±1

Table 3-23. Frequency Count Marker Accuracy

HP 8340A/B Frequency (GHz)	HP 8561B Frequency (GHz)	Marker Frequency			Measurement Uncertainty (Hz)
		Min. (GHz)	Actual (GHz)	Max. (GHz)	
1.5	1.5	1.499999949	________	1.500000051	±1
4.0	4.0	3.999999949	________	4.000000051	±1

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Equipment

Synthesized Sweeper	HP 8340A/B
Adapters	
Type N (m) to APC 3.5 (f)	1250-1744
APC 3.5 (f) to APC 3.5 (f)	5061-5311
Cables	
APC 3.5, 91 cm (36 in.)	8120-4921
BNC, 122 cm (48 in.)	HP 10503A

Procedure

1. Connect the equipment as shown in Figure 3-14. The spectrum analyzer provides the frequency reference for the synthesized sweeper.

Frequency Readout Accuracy

2. On the HP 8340A/B, press (INSTR PRESET). Set the controls as follows:

   CW .... 1.5 GHz
   POWER LEVEL .... −10 dBm
   FREQUENCY STANDARD Switch (rear panel) .... EXT

3. On the spectrum analyzer, press (PRESET). Set the controls as follows:

   CENTER FREQ .... 1.5 GHz
   SPAN .... 1 MHz

4. On the spectrum analyzer, press (PEAK SEARCH).
5. Record the MKR frequency in Table 3-22 as the Actual Marker Reading.
6. Repeat step 5 for all frequency/span combinations listed in Table 3-22.

Frequency Count Marker Accuracy

7. On the spectrum analyzer press (SPAN) 1 (MHz) (FREQ COUNT) COUNTER RES 1 (Hz).
8. Key in the HP 8340A/B CW frequencies and the spectrum analyzer center frequencies as indicated in Table 3-23. For the pair of settings, press (PEAK SEARCH) on the spectrum analyzer, and record the MKR frequency at each point, in Table 3-23.

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13. Frequency Readout/Frequency Count MKR Accuracy

Specification

Frequency Readout Accuracy: <±[(Frequency Readout × Frequency Reference Accuracy)+(5% of Span)+(15% of RES BW)+350 Hz]

Frequency Count Marker Accuracy: <±[(Marker Frequency × Frequency Reference Accuracy)+(50 Hz)+1 LSD]

Related Adjustment

YTO Adjustment
10 MHz Frequency Reference Adjustment

Description

The accuracy of the spectrum analyzer frequency readout/frequency count marker is tested with an input signal of known frequency. The spectrum analyzer provides the frequency reference for the synthesized sweeper, thus eliminating the (Frequency Readout × Frequency Readout Accuracy) term. Performing the appropriate 10 MHz Reference Output Accuracy test satisfies checking the effect of this term.

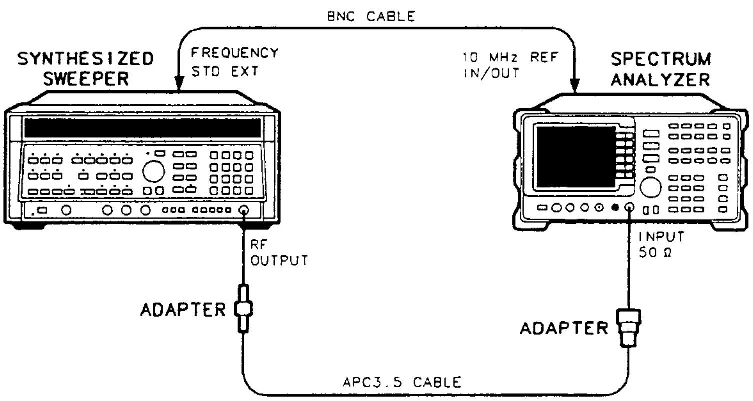

Figure 3-14. Frequency Readout/Frequency Count MKR Accuracy Test Setup

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Band 1 Responses

9. On the spectrum analyzer, press (FREQUENCY) CENTER FREQUENCY 4 (GHz).
10. On the HP 8340A/B, set CW to 4 GHz.
11. Enter the power sensor's 4 GHz calibration factor into the HP 8902A.
12. On the spectrum analyzer, press (AUX CTRL) INTERNAL MIXER PRESEL AUTO PK. Wait for the peaking message to disappear, then press (MARKER) MARKERS OFF.
13. Repeat steps 5 through 8 for the HP 8340A/B frequencies listed in Table 3-21 for Band 1.
14. Record the maximum response amplitude from Table 3-21 for Band 0 and Band 1 entries for HP 8340A/B CW frequencies less than 6.5 GHz.

    Maximum Image, Multiple, and Out-of-Band Response Amplitude: ________ dBc

15. Record the maximum response amplitude from Table 3-21 for Band 0 and Band 1 entries for HP 8340A/B CW frequencies greater than 6.5 GHz.

    Maximum Out-of-Range Response Amplitude: ________ dBc

Table 3-21. Image, Multiple, and Out-of-Range Responses

Band	HP 8561B Center Freq (GHz)	HP 8340A/B CW (MHz)	Response Amplitude (dBc)	Measurement Uncertainty (dB)
0	2.0	1978.6*	________	+1.52/−1.57
	2.0	2021.4*	________	+1.52/−1.57
	2.0	1378.6*	________	+1.52/−1.57
	2.0	2621.4*	________	+1.52/−1.57
	2.0	9821.6†	________	+1.52/−1.57
	2.0	3289.3‡	________	+1.52/−1.57
	2.0	1810.7§	________	+1.52/−1.57
	2.0	289.3§	________	+1.52/−1.57
1	4.0	8610.7†	________	+1.52/−1.56
	4.0	3978.6*	________	+1.52/−1.56
	4.0	4021.4*	________	+1.52/−1.56
	4.0	3378.6*	________	+1.52/−1.56
	4.0	4621.4*	________	+1.52/−1.57
	4.0	289.3‡	________	+1.52/−1.56
	4.0	3721.4§	________	+1.52/−1.56

* Image response
† Out-of-range response
‡ Out-of-band response
§ Multiple response

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Measuring Receiver	HP 8902A
Power Sensor	HP 8485A
Power Splitter	HP 11667B
Adapter	
Type N (m) to APC 3.5 (m)	1250-1743
Cables	
BNC, 122 cm (48 in.)	HP 10503A
APC 3.5, 91 cm (36 in.)	8120-4921

Procedure

1. Connect the equipment as shown in Figure 3-13, but do not connect the power sensor to the power splitter.
2. On the HP 8340A/B, press (INSTR PRESET). Set the controls as follows:

   CW .... 2 GHz
   POWER LEVEL .... −10 dBm
   FREQUENCY STANDARD Switch (rear panel) .... EXT

3. On the spectrum analyzer, press (PRESET). Set the controls as follows:

   CENTER FREQ .... 2 GHz
   SPAN .... 10 kHz
   REF LVL .... −10 dBm
   ATTEN .... 0 dB
   RES BW .... 1 kHz

4. Zero and calibrate the HP 8902A and the HP 8485A. Enter the power sensor's 2 GHz calibration factor into the HP 8902A. Connect the HP 8485A to the HP 11667B Power Splitter.
5. Adjust the HP 8340A/B power level for a −10 dBm ±0.1 dB reading on the HP 8902A.
6. On the spectrum analyzer, press (PEAK SEARCH) (MKR▶) MARKER▶ REF LVL (SGL SWP) (PEAK SEARCH) MARKER DELTA.
7. For each of the frequencies listed in Table 3-21, do the following:
   a. Set the HP 8340A/B to the listed CW key frequency.
   b. Enter the appropriate power sensor calibration factor into the HP 8902A.
   c. Set the HP 8340A/B power level for a −10 dBm reading on the HP 8902A.
   d. On the spectrum analyzer, press (SGL SWP). Wait for completion of the sweep before continuing.
   e. On the spectrum analyzer, press (PEAK SEARCH), and record the Δ MKR amplitude in Table 3-21 as the Response Amplitude.
8. On the spectrum analyzer, press (MARKER) MARKERS OFF (TRIG) CONT.

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12. Image, Multiple, Out-of-Band, and Out-of-Range Responses

Specification

Image, Multiple, and Out-of-Band Responses:	<−70 dBc, 50 Hz to 6.5 GHz
Out-of-Range Responses:	<−70 dBc, 50 Hz to 6.5 GHz, due to input signals from 6.5 to 12.0 GHz

Related Adjustment

There is no related adjustment procedure for this performance test.

Description

Image, multiple, out-of-band, and out-of-range responses are tested by first applying a signal to the analyzer that is at the tuned frequency, and making a reference amplitude measurement. The source is then tuned to a frequency which causes either an image, multiple, out-of-band, or out-of-range response. The amplitude displayed on the spectrum analyzer is measured and recorded.

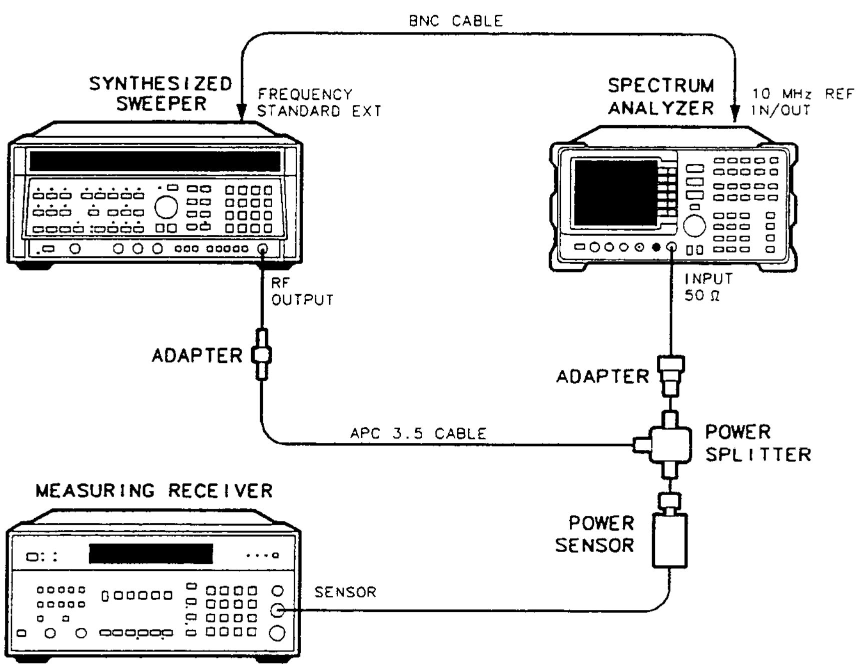

Figure 3-13. Image, Multiple, Out-of-Band, and Out-of-Range Responses Test Setup

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3. On the spectrum analyzer, press (PRESET). Set the controls as follows:

   CENTER FREQ .... 2.5 GHz
   CF STEP .... 10 kHz
   SPAN .... 1 MHz
   REF LVL .... −10 dBm
   ATTEN .... 0 dB

4. Press (PEAK SEARCH) (MKR) SIG TRK ON (SPAN) 10 (kHz). Wait for the completion of two sweeps, then press (MKR) SIG TRK OFF (BW) RES BW 1 (kHz) (SPAN) ZERO SPAN (BW) VIDEO BW 1 (Hz).
5. Adjust the HP 8663A amplitude as necessary to place the peak of the signal at the spectrum analyzer reference level.
6. On the spectrum analyzer, press (SGL SWP) (SGL SWP). Wait for the sweep to be completed, then press (MKR) MKR NOISE ON MARKER DELTA.
7. Press (FREQUENCY) (▲) (SGL SWP). Wait for completion of the sweep, then record the Δ MKR amplitude in Table 3-20, column 2, as Single Sideband Noise for +10 kHz offset.
8. On the spectrum analyzer, press (FREQUENCY) (▼) (▼).
9. Press (SGL SWP). Wait for completion of the sweep, then record the Δ MKR amplitude in Table 3-20, column 2, as the Single Sideband Noise for −10 kHz offset.
10. Press (▲).
11. Repeat steps 6 through 10 with CF STEP set to 30 kHz. Record the Δ MKR amplitudes in Table 3-20, column 2, as Single Sideband Noise for +30 kHz and −30 kHz.
12. Press (▲).
13. Repeat steps 6 through 10 with CF STEP set to 100 kHz. record the Δ MKR amplitudes in Table 3-20, column 2, as Single Sideband Noise for +100 kHz and −100 kHz.

Table 3-20. Noise Sidebands

Offset (kHz)	Δ MKR Reading		Measurement Uncertainty (dB)
	Actual (dBc/Hz)	Max. (dBc/Hz)	
+10	________	−86	+1.51/−1.53
−10	________	−86	+1.51/−1.53
+30	________	−100	+1.51/−1.53
−30	________	−100	+1.51/−1.53
+100	________	−110	+1.51/−1.53
−100	________	−110	+1.51/−1.53

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11. Noise Sidebands

Specification

Noise Sidebands:	<−86 dBc/Hz at ±10 kHz offset from carrier
	<−100 dBc/Hz at ±30 kHz offset from carrier
	<−110 dBc/Hz at ±100 kHz offset from carrier

Related Adjustment

There is no related adjustment procedure for this performance test.

Description

The noise sidebands of a 2.5 GHz, −15 dBm signal are measured at offsets of 10 kHz, 30 kHz, and 100 kHz from the carrier with a 1 kHz resolution bandwidth.

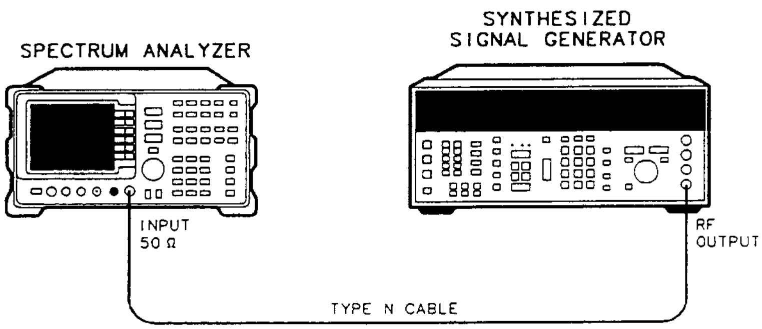

Figure 3-12. Noise Sidebands Test Setup

Equipment

Synthesized Signal Generator	HP 8663A
Cable Type N, 183 cm (72 in.)	HP 11500A

Procedure

1. Connect the equipment as shown in Figure 3-12.
2. Set the HP 8663A controls as follows:

FREQUENCY .... 2500 MHz
CW OUTPUT .... −15 dBm

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10. Residual FM

24. On the HP 8566A/B, press (PEAK SEARCH) Δ. Use the knob to place the active marker at the minimum point of the trace.
25. Record the absolute value of the MKR Δ amplitude below as the deviation.

Deviation: ________ dB

26. Calculate the residual FM by multiplying the deviation in step 25 by the slope in step 13.

Residual FM = Deviation × Slope

Residual FM: ________ Hz

1

Introducing the HP 8561B Spectrum Analyzer

What You'll Find in This Chapter

This chapter introduces you to the HP 8561B RF High-Performance Portable Spectrum Analyzer, and its options and accessories that tailor the unit to your specific needs. To acquaint you with the analyzer's full capabilities, the specifications and characteristics are also provided.

Introducing Your New Spectrum Analyzer

The HP 8561B RF High-Performance Portable Spectrum Analyzer is capable of measuring signals from −130 dBm to +30 dBm over a frequency range of 50 Hz to 6.5 GHz.

The analyzer is a complete, self-contained instrument that needs only an external ac power source for operation. An ac power cable, suitable for use in the country to which the analyzer is originally shipped, is included with the unit.

Accessories Supplied

See Figure 1-1 for a listing of the accessories supplied with your spectrum analyzer.

8. On the HP 8566A/B, set (LOG dB/DIV) to 1 dB. Press (SIGNAL TRACK) (OFF) (PEAK SEARCH) (MKR ▶ REF LVL).
9. Decrease the HP 8566A/B reference level by 5 dB. For example, if the current reference level setting is −13.3 dBm, set the reference level to −18.3 dBm. The signal will appear clipped above the reference level.
10. On the HP 8566A/B, press (SINGLE). Wait for the completion of a new sweep.
11. Press (NORMAL) on the HP 8566A/B. Rotate the knob counterclockwise until the marker is four divisions below the reference level on the left side of the signal.
12. Press (Δ) and rotate the knob counterclockwise until the MKR Δ amplitude reads approximately −2 dB.
13. Calculate the slope of the 10 Hz resolution bandwidth by dividing the MKR Δ frequency by the MKR Δ amplitude. Record the result below as the slope.

    MKR Δ Frequency / MKR Δ Amplitude = Slope

Slope: ________ Hz/dB

14. Set the HP 8566A/B controls as follows:

CENTER FREQ	4.8 kHz
FREQUENCY SPAN	5 kHz
REFERENCE LEVEL	+10 dBm
LOG dB/DIV	10 dB
SWEEP	CONT

15. On the HP 8566A/B, press (NORMAL) (PEAK SEARCH) (SIGNAL TRACK) (ON) (FREQUENCY SPAN) 100 (Hz). Wait for the signal to be centered in the 100 Hz span setting (this may require several analyzer sweeps).
16. Press (PEAK SEARCH) (MKR ▶ REF LVL) and wait for the completion of a new sweep.
17. Set LOG dB/DIV to 1 dB, then press (SIGNAL TRACK) (OFF) (PEAK SEARCH) (MKR ▶ REF LVL).
18. Decrease the HP 8566A/B reference level by 5 dB. For example, if the current reference level setting is +0.8 dBm, set the reference level to −4.2 dBm. The signal will appear to be clipped above the reference level.
19. Press (NORMAL) on the HP 8566A/B. Rotate the knob counterclockwise until the marker is approximately five divisions below the reference level on the left side of the signal.
20. Press (MKR ▶ CF) on the HP 8566A/B. Wait for the completion of a new sweep.
21. Press (FREQUENCY SPAN) 0 (Hz) on the HP 8566A/B. Ideally, the trace should be five divisions below the reference level.
22. If the trace is not approximately five divisions below the reference level, press (CENTER FREQUENCY). Use the knob to adjust the center frequency until the trace is five divisions below the reference level.
23. Press (SWEEP TIME) 20 (ms) (SINGLE) on the HP 8566A/B and wait for the new sweep to be completed.

Accessories Available

A number of accessories are available from Hewlett-Packard to help you configure the spectrum analyzer for your specific needs.

HP 85620A Mass Memory Module The module is connected to the analyzer's rear panel to expand user memory and allow storage and execution of downloadable programs (DLPs). The module allows you to save, time-date stamp, and recall trace data, limit-lines, and automatic DLP execution operations.

HP 85629B Test and Adjustment Module The HP 85629B Test and Adjustment Module, when connected to the rear panel of the HP 8561B, assists the user in testing and repairing the analyzer. Four procedures are made available to the user:

- Functional Tests.
- Adjustment Procedures.
- Diagnostic (troubleshooting) Procedures.
- Automatic Alignment Routines.

The module displays menus, procedures, and results on the spectrum analyzer CRT. While testing with the module, the spectrum analyzer controls other instruments over HP-IB, reads data, and formats that data for the user. In addition to a large program stored in ROM, the module has the necessary hardware for troubleshooting. This includes dc signal injection and detection.

Preamplifier The HP 8447D Preamplifier provides a minimum of 26 dB gain from 100 kHz to 1.3 GHz to enhance measurements of very low-level signals.

Preamplifier The HP 8449A Preamplifier provides a minimum of 28 dB gain from 2 to 22 GHz to enhance measurements of very low-level signals.

Preamplifier The HP 10855A Preamplifier provides a minimum of 22 dB gain from 2 MHz to 1300 MHz to enhance measurements of very low-level signals. It operates conveniently from the PROBE POWER output of the HP 8561B.

Close Field Probe The HP 11940A or 11941A Close-Field Probes are small, hand-held, electromagnetic-field sensors. The HP 11940A Close-Field probe provides repeatable, absolute, magnetic-field measurements from 30 MHz to 1 GHz (9 kHz to 30 MHz with the HP 11941A). When attached to a source, the probe generates a localized magnetic field for electromagnetic interference (EMI) susceptibility testing.

75 to 50 ohm Minimum-Loss Pad The minimum-loss pad, HP part number 08568-60122, is a low-VSWR device required for measurements on 75-ohm devices.

75 to 50 ohm Adapter The HP 11687A allows you to make measurements in 75-ohm systems. Amplitude calibration is retained by using the reference level offset to compensate for the loss through the pad. It is effective over a frequency range of dc to 1300 MHz.

Equipment

Synthesized Sweeper	HP 8340A/B
Spectrum Analyzer	HP 8566A/B
Blocking Capacitor Assembly*	08553-60169
Adapters	
Type N (m) to APC 3.5 (f)	1250-1744
APC 3.5 (f) to APC 3.5 (f)	5061-5311
Type N (m) to SMC (f)	1250-1152
Cables	
APC 3.5, 91 cm (36 in.)	8120-4921
BNC 122 cm (48 in.) *(two required)*	HP 10503A

Procedure

1. Connect the equipment as shown in Figure 3-11.

Caution Damage to the HP 8566A/B will result if the dc blocking capacitor is not used.

2. Press [INSTR PRESET] on the HP 8340A/B and set the controls as follows:

   CW .... 2.8 GHz
   REF LVL .... −5 dBm

3. Press [PRESET] on the HP 8561B Spectrum Analyzer. Set the controls as follows:

   CENTER FREQ .... 2.8 GHz
   SPAN .... 5 kHz

4. On the HP 8561B, press [PEAK SEARCH] **MARKER ▶ CF**. Wait for a new sweep to finish. Press [SPAN] 100 [Hz], [SGL SWP]. Wait for the sweep to finish.

5. On the HP 8566A/B, press [0-2.5 GHz] and set the controls as follows:

   CENTER FREQ .... 0 Hz
   FREQUENCY SPAN .... 5 kHz

6. On the HP 8566A/B, press [PEAK SEARCH] [SIGNAL TRACK] (ON), [FREQUENCY SPAN] 100 [Hz]. Wait for the signal to be centered in the 100 Hz span setting (this may require several analyzer sweeps).

7. On the HP 8566A/B, press [PEAK SEARCH] [MKR ▶ REF LVL]. Wait for the completion of a new sweep.

* Other blocking capacitors may be used provided they do not exhibit severe (more than 5 dB) roll-off at 4.8 kHz. The recommended blocking capacitor exhibits no significant roll-off down to 1 kHz.

Microwave Limiter The HP 11693A Limiter protects the analyzer input circuits from damage due to high power levels and operates over a frequency range of 0.4 to 12.4 GHz.

HP-IB Cable Use HP 10833A/B/C/D HP-IB cables.

Controllers The spectrum analyzer is fully HP-IB programmable. The preferred controllers are HP 9000 Series 300 computers. Consult your local Hewlett-Packard service representative for other recommended controllers and available software.

Plotter The HP ColorPro 7440A Graphics Plotter adds color printout capability to the analyzer for permanent records of important measurements. The eight-pen HP ColorPro produces color plots with 0.025 mm (0.001 in.) resolution on either 8.5 × 11-inch paper or transparency film. Other HP-IB plotters are available from Hewlett-Packard.

Printer The HP 2225A ThinkJet or the HP 3630A PaintJet Printers may be used with the HP 8561B Spectrum Analyzer.

Rack Slide Kit This kit (HP part number 1494-0060) provides the hardware to adapt Rack Mount Kits (Options 908 and 909) for mounting the analyzer in an HP System II cabinet.

Transit Case The transit case (HP part number 9211-5604) provides extra protection for frequent travel situations. The HP transit case protects your instrument from hostile environments, shock, vibration, moisture, and impact while providing a secure enclosure for shipping.

Testmobile The HP 1008A Testmobile provides a sturdy, mobile platform for your analyzer.

10. Residual FM

Specification

Residual FM: <10 Hz peak-to-peak in 20 ms, 10 Hz RES BW

Related Adjustment

There is no related adjustment for this performance test.

Description

A stable signal source is applied to the input of the HP 8561B. Since the HP 8561B Spectrum Analyzer does not allow zero span in the 10 Hz RES BW setting, an HP 8566A/B Spectrum Analyzer is used to slope-detect the IF of the HP 8561B. The slope of the 10 Hz RES BW in the HP 8566A/B is characterized using the LO feedthrough. The HP 8566A/B is then tuned to the IF of the HP 8561B, then set to zero span. The peak-to-peak amplitude deviation is measured. Multiplying this deviation by the slope (in Hz per dB) yields the residual FM.

Caution For RES BW settings of 10, 30, and 100 Hz, the VIDEO OUTPUT of the HP 8561B is actually an IF output with a nominal frequency of 4.8 kHz. There is a dc offset on this output, so a blocking capacitor is used to protect the dc-coupled input of the HP 8566A/B.

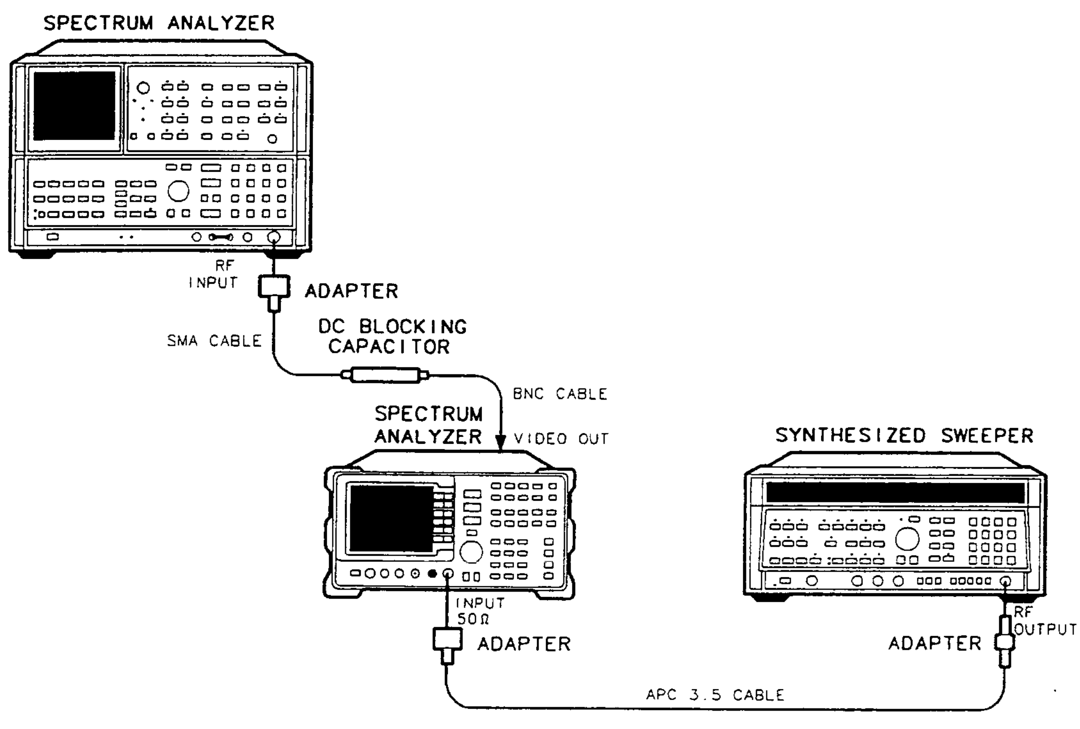


Figure 3-11. Residual FM Test Setup

Analyzers Covered by This Manual

This manual applies to analyzers with the serial number prefixes listed under "Serial Numbers" on the title page.

Serial Numbers

Hewlett-Packard makes frequent improvements to its products to enhance their performance, usability, or reliability. HP service personnel have access to complete records of design changes to each type of equipment, based on the equipment's serial number. Whenever you contact Hewlett-Packard about your analyzer, have the complete serial number available to ensure obtaining the most complete and accurate information possible.

The serial number label is attached to the rear of the analyzer. The serial number has two parts: the prefix (the first four numbers and a letter), and the suffix (the last five numbers). See Figure 1-2.

The first four numbers of the prefix are a code identifying the date of the last major design change incorporated in your analyzer. The letter identifies the country in which the unit was manufactured. The five-digit suffix is a sequential number and is different for each unit. Whenever you list the serial number or refer to it in obtaining information about your analyzer, be sure to use the complete number, including the full prefix and the suffix.

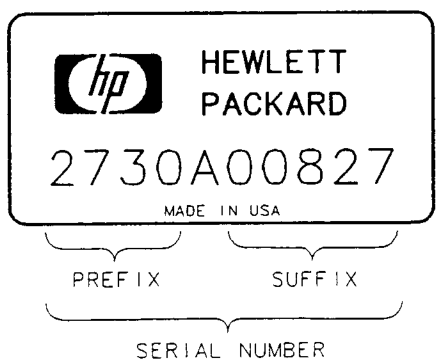


Figure 1-2. Serial Number Label Example

9. Scale Fidelity

Table 3-18. 2 dB/Div Log Scale Fidelity

HP 3335A Amplitude* (dBm, nominal)	dB from REF LVL (nominal)	Actual Δ MKR Reading (dB)	Incremental Error (dB)	Measurement Uncertainty (dB)
+10	0	0 (Ref.)	0 (Ref.)	0
+6	4	________	________	±0.06
+2	8	________	________	±0.06
−2	12	________	________	±0.06
−6	16	________	________	±0.06
−8	18	________	________	±0.06

* These are nominal amplitude values only, assuming the signal is at the reference level with the HP 3335A set to +10 dBm. Use the INCR keys to step the amplitude in precise 4 dB (or 2 dB) steps.

Table 3-19. Linear Scale Fidelity

HP 3335A Amplitude* (dBm, nominal)	dB from REF LVL (nominal)	Actual Δ MKR Reading (dB)	Measurement Uncertainty (dB)
+10	0	0 (Ref.)	0
+8	−2	________	+0.033/−0.033
+6	−4	________	+0.034/−0.034
+4	−6	________	+0.037/−0.037
+2	−8	________	+0.041/−0.041
0	−10	________	+0.046/−0.047
−2	−12	________	+0.054/−0.054
−4	−14	________	+0.064/−0.065
−6	−16	________	+0.078/−0.079
−8	−18	________	+0.118/−0.12

* These are nominal amplitude values only, assuming the signal is at the reference level with the HP 3335A set to +10 dBm. Use the INCR keys to step the amplitude in precise 4 dB (or 2 dB) steps.

Specifications and Characteristics

Table 1-1 lists the analyzer's specifications. Unless stated otherwise, all specifications describe the analyzer's warranted performance under the following conditions:

- Five-minute warm-up in ambient conditions.
- Auto-coupled controls.
- Digital trace display.
- IF ADJ ON.
- REF LVL CAL adjusted.
- 1ST LO OUTPUT terminated in 50 ohms.
- 2ND IF OUTPUT (Option 001 analyzers) terminated in 50 ohms.
- One-year calibration cycle.
- Environmental requirements met.

After a 30-minute warm-up at ambient temperature range of 20°C to 30°C, the preselector does not have to be peaked at each signal of interest. Factory preselector-peak values are sufficient to meet all specifications.

Note REF LVL CAL uses the CAL OUTPUT signal to calibrate the reference level. How often this adjustment should be performed depends on internal temperature changes. Amplitude temperature drift is a nominal 1 dB/10°C. The nominal temperature drift is 10°C, most of which occurs during the first 30 minutes after power-on. Internal temperature equilibrium is reached after 2 hours of operation at a stable ambient temperature.

Characteristics provide useful information in the form of typical, nominal, or approximate values for analyzer performance. See Table 1-2 for a list of analyzer characteristics.

Calibration Cycle

The performance tests in Chapter 3 should be used to check the analyzer against its specifications every 12 months. Specifications are listed in Table 1-1.

Table 3-17. 10 dB/Div Log Scale Fidelity (RES BW <300 Hz)

HP 3335A Amplitude* (dBm, nominal)	dB from REF LVL (nominal)	Actual Δ MKR Reading (dB)	Incremental Error (dB)	Measurement Uncertainty (dB)
+10	0	0 (Ref.)	0 (Ref.)	0
+6	−4	________	________	+0.24/−0.25
+2	−8	________	________	+0.24/−0.25
−2	−12	________	________	+0.24/−0.25
−6	−16	________	________	+0.24/−0.25
−10	−20	________	________	+0.24/−0.25
−14	−24	________	________	+0.24/−0.25
−18	−28	________	________	+0.24/−0.25
−22	−32	________	________	+0.241/−0.255
−26	−36	________	________	+0.241/−0.255
−30	−40	________	________	+0.241/−0.255
−34	−44	________	________	+0.241/−0.255
−38	−48	________	________	+0.241/−0.255
−42	−52	________	________	+0.255/−0.270
−46	−56	________	________	+0.255/−0.270
−50	−60	________	________	+0.255/−0.270
−54	−64	________	________	+0.255/−0.270
−58	−68	________	________	+0.255/−0.270
−62	−72	________	________	+0.255/−0.270
−66	−76	________	________	+0.255/−0.270
−70	−80	________	________	+0.255/−0.270
−74	−84	________	________	+0.255/−0.270
−78	−88	________	________	+0.255/−0.270
−82	−92	________	________	+0.255/−0.270
−86	−96	________	________	+0.255/−0.270
−88†	−98	________	________‡	+0.255/−0.270

* These are nominal amplitude values only, assuming the signal is at the reference level with the HP 3335A set to +10 dBm. Use the INCR keys to step the amplitude in precise 4 dB (or 2 dB) steps.
† INCR keys cannot be used to set this step; key in the amplitude from the previous step (−86 dBm, nominal), minus 2 dB.
‡ This value should not exceed ±0.2 dB.

Table 1-1. HP 8561B Specifications

FREQUENCY		
Frequency Range		
Internal Mixing		
AC Coupled	100 kHz to 6.5 GHz	
DC Coupled	50 Hz to 6.5 GHz	
Internal Mixing Bands	**Frequency Band**	**Harmonic Mixing Mode N***
	50 Hz to 2.9 GHz	1−
	2.75 GHz to 6.5 GHz	1−
External Mixing	18 GHz to 325 GHz	
External Mixing Bands		
Frequency Band	**Frequency Range**	**Harmonic Mixing Mode N***
K	18.0 to 26.5	6−
A	26.5 to 40.0	8−
Q	33.0 to 50.0	10−
U	40.0 to 60.0	10−
V	50.0 to 75.0	14−
E	60.0 to 90.0	16−
W	75.0 to 110.0	18−
F	90.0 to 140.0	24−
D	110.0 to 170.0	30−
G	140.0 to 220.0	36−
Y	170.0 to 260.0	44−
J	220.0 to 325.0	54−
Frequency Readout Accuracy		
Accuracy of START, CENTER, STOP or MARKER frequency	<±(frequency readout × frequency reference accuracy† + 5% of frequency span + 15% of resolution bandwidth + 350 Hz)	

* N is the harmonic mixing mode. The desired 1st LO harmonic is always higher than the tuned frequency by the 1st IF frequency (3.9107 GHz for the 50 Hz to 2.9 GHz band, and 310.7 MHz for all other bands).

† Frequency Reference Accuracy = (aging × period of time since last adjustment) + initial achievable accuracy + temperature stability

9. Scale Fidelity

Table 3-16. 10 dB/Div Log Scale Fidelity (RES BW ≥300 Hz)

HP 3335A Amplitude* (dBm, nominal)	dB from REF LVL (nominal)	Actual Δ MKR Reading (dB)	Incremental Error (dB)	Measurement Uncertainty (dB)
+10	0	0 (Ref.)	0 (Ref.)	0
+6	−4	______	______	+0.24/−0.25
+2	−8	______	______	+0.24/−0.25
−2	−12	______	______	+0.24/−0.25
−6	−16	______	______	+0.24/−0.25
−10	−20	______	______	+0.24/−0.25
−14	−24	______	______	+0.24/−0.25
−18	−28	______	______	+0.24/−0.25
−22	−32	______	______	+0.241/−0.255
−26	−36	______	______	+0.241/−0.255
−30	−40	______	______	+0.241/−0.255
−34	−44	______	______	+0.241/−0.255
−38	−48	______	______	+0.241/−0.255
−42	−52	______	______	+0.255/−0.270
−46	−56	______	______	+0.255/−0.270
−50	−60	______	______	+0.255/−0.270
−54	−64	______	______	+0.255/−0.270
−58	−68	______	______	+0.255/−0.270
−62	−72	______	______	+0.255/−0.270
−66	−76	______	______	+0.255/−0.270
−70	−80	______	______	+0.255/−0.270
−74	−84	______	______	+0.255/−0.270
−78	−88	______	______	+0.255/−0.270
−80†	−90	______	______‡	+0.255/−0.270

* These are nominal amplitude values only, assuming the signal is at the reference level with the HP 3335A set to +10 dBm. Use the INCR keys to step the amplitude in precise 4 dB (or 2 dB) steps.

† INCR keys cannot be used to set this step; key in the amplitude from the previous step (−78 dBm, nominal), minus 2 dB.

‡ This value should not exceed ±0.2 dB.

Table 1-1. HP 8561B Specifications (continued)

FREQUENCY (continued)	
Frequency Count Marker	
Frequency Count Marker Resolution	Selectable from 1 Hz to 1 MHz
Frequency Count Marker Accuracy (for signal-to-noise ratio ≥25 dB)	<±(marker frequency × frequency reference accuracy* + 50 Hz × N† + 1 LSD)
Delta Frequency Count Accuracy (for signal-to-noise ratio ≥25 dB)	<±(delta frequency × frequency reference accuracy† + 100 Hz × N† + 2 LSD)
Frequency Reference Accuracy (Non-Option 003)	
Aging	$<\pm 2 \times 10^{-6}$/year
Settability	$<\pm 1 \times 10^{-6}$
Temperature Stability	$<\pm 1 \times 10^{-6}$, −10°C to +55°C, referenced to 25°C
Frequency Reference Accuracy (Option 003)	
Aging	$<\pm 1 \times 10^{-7}$/year
Settability	$<\pm 1 \times 10^{-8}$
Temperature Stability	$<\pm 1 \times 10^{-8}$, −10°C to +55°C, referenced to 25°C
Stability	
Residual FM (span ≤1 MHz, 10 Hz RES BW)	<10 Hz × N† peak-to-peak in 20 ms
Noise Sidebands	
10 kHz offset	<(−86 + 20 LOG N†) dBc/Hz
30 kHz offset	<(−100 + 20 LOG N†) dBc/Hz
100 kHz offset	<(−110 + 20 LOG N†) dBc/Hz
Frequency Span	
Range	
Internal Mixing	0 Hz, 100 Hz to 6.5 GHz over the 10-division CRT horizontal axis, variable in approximately 1% increments, or in a 1, 2, 5 sequence
External Mixing‡	Minimum span = 100 Hz × N†
Accuracy	<±5%

* Frequency Reference Accuracy = (aging × period of time since last adjustment) + initial achievable accuracy + temperature stability

† N is the harmonic mixing mode. The desired 1st LO harmonic is always higher than the tuned frequency by the 1st IF frequency (3.9107 GHz for the 50 Hz to 2.9 GHz band, and 310.7 MHz for all other bands).

‡ Resolution banwidths ≤100 Hz are not available in external mixing.

38. Adjust the HP 355C and the HP 355D until the spectrum analyzer marker reads between −10 dBm and −11 dBm.
39. On the HP 3335A, press (AMPLITUDE) and use the INCR keys to adjust the HP 3335A amplitude until the spectrum analyzer marker reads exactly −10.00 dBm.
40. On the HP 3335A, set (AMPTD INCR) to 2 dB and press (AMPLITUDE).
41. On the spectrum analyzer, press (SGL SWP) (SGL SWP) (MKR) **MARKER DELTA**.
42. Set the HP 3335A amplitude to the next nominal value listed in Table 3-18, using INCR (▼).
43. On the spectrum analyzer, press (SGL SWP). Record the Δ MKR amplitude reading in Table 3-18, column 4.
44. Repeat steps 42 and 43 for each HP 3335A (nominal) amplitude setting listed in Table 3-18.
45. In Table 3-16, locate the Actual Δ MKR Reading with the greatest deviation from its corresponding dB from REF LVL (nominal), column 2. Add the dB from REF LVL to the Actual Δ MKR Reading, and record the result here:

    Maximum cumulative 10 dB Log Scale Fidelity (RES BW ≥300 Hz): ________ dB

46. Also in Table 3-16, locate the Incremental Error with the greatest deviation from 0 dB, and record it here:

    Maximum 10 dB Log Scale Incremental Error (RES BW ≥300 Hz): ________ dB

47. In Table 3-17, locate the Actual Δ MKR Reading with the greatest deviation from its corresponding column 2 (dB from nominal REF LVL). Add the dB from REF LVL to the Actual Δ MKR Reading, and record the result here:

    Maximum Cumulative 10 dB Log Scale Fidelity (RES BW <300 Hz): ________ dB

48. Also in Table 3-17, locate the Incremental Error with the greatest deviation from 0 dB, and record it here:

    Maximum 10 dB Log Scale Incremental Error (RES BW <300 Hz): ________ dB

49. In Table 3-18, locate the Actual Δ MKR Reading with the greatest deviation from its corresponding column 2 (dB from nominal REF LVL). Add the dB from REF LVL to the Actual Δ MKR Reading, and record the result here:

    Maximum Cumulative 2 dB Log Scale Fidelity: ________ dB

50. Also in Table 3-18, locate the Incremental Error with the greatest deviation from 0 dB, and record it here:

    Maximum 2 dB Log Scale Incremental Error: ________ dB

Table 1-1. HP 8561B Specifications (continued)

FREQUENCY (continued)	
Resolution Bandwidths (−3 dB)	
Range*	10 Hz to 1 MHz (selectable in a 1, 3, 10 sequence) and 2 MHz
Accuracy	
1 and 2 MHz RES BW	<±25%
300 kHz to 10 Hz RES BW	<±10%
Selectivity (60 dB/3 dB bandwidth ratio, RES BW ≥300 Hz)	<15:1
Bandwidth Shape	
1 and 2 MHz RES BW	Approximately Gaussian
300 Hz to 300 kHz	Synchronously tuned, 4-pole filters
10 Hz to 100 Hz	Digital, approximately Gaussian
Video Bandwidth (Post-detection low-pass filter averages displayed noise for a smooth trace.)	
Range	1 Hz to 3 MHz in a 1, 3, 10 sequence
AMPLITUDE MEASUREMENT RANGE	
Maximum Safe Input Power	
Average Continuous Power (input attenuation ≥10 dB)	+30 dBm (1 W)
Peak Pulse Power (input attenuation ≥30 dB)	+50 dBm (100 W) for pulse widths ≤10 μs and ≤1% duty cycle
DC Voltage	
AC Coupled	50 V
DC Coupled	0 V
Gain Compression	
10 MHz to 2.9 GHz (≤−5 dBm at input mixer†)	<1.0 dB
2.75 GHz to 6.5 GHz (≤−3 dBm at input mixer†)	<1.0 dB

* Resolution bandwidths ≤100 Hz are not available in external mixing.

† Mixer level = input level − input attenuation

2 dB/DIV Log Scale

24. Set the spectrum analyzer controls as follows:

    SPAN .... 0 Hz
    TRIG .... CONT
    dB/DIV .... 2 dB
    RES BW .... 1 kHz

25. Set the HP 3335A controls as follows:

    AMPLITUDE .... +10 dBm
    AMPTD INCR .... 0.01 dB

26. On the spectrum analyzer, press (MKR) MARKER NORMAL .
27. Adjust the HP 355C and the HP 355D until the spectrum analyzer marker reads between −10 dBm and −11 dBm.
28. On the HP 3335A, press (AMPLITUDE). Use the HP 3335A INCR keys to adjust the amplitude until the spectrum analyzer marker reads exactly −10.00 dBm.
29. Set the HP 3335A (AMPTD INCR) to 4 dB, and press (AMPLITUDE).
30. On the spectrum analyzer, press (SGL SWP) (SGL SWP) (MKR) MARKER DELTA .
31. Set the HP 3335A amplitude to the next nominal value listed in Table 3-18, using INCR (▼). Set (AMPTD INCR) to 2 dB before setting the HP 3335A amplitude to the last power level.
32. On the spectrum analyzer, press (SGL SWP) and wait for the completion of a new sweep. Record the Δ MKR amplitude reading in Table 3-18, column 4. Repeat this step for each HP 3335A (nominal) amplitude setting.
33. For each Δ MKR reading in Table 3-18, subtract the previous Δ MKR reading. Add 4 dB to this number and record the result as the Incremental Error in Table 3-18.

    Incremental Error = current Δ MKR − previous Δ MKR + 4 dB

34. For the last step:

    Incremental Error = current Δ MKR − previous Δ MKR + 2 dB

Linear Scale

35. Set the spectrum analyzer controls as follows:

    TRIG .... CONT
    AMPLITUDE SCALE .... LINEAR
    AMPL UNITS .... dBm

36. Set the HP 3335A controls as follows:

    AMPLITUDE .... +10 dBm
    AMPL INCR .... 0.01 dB

37. On the spectrum analyzer, press (MKR) MARKER NORMAL .

Table 1-1. HP 8561B Specifications (continued)

AMPLITUDE MEASUREMENT RANGE (continued)		
Displayed Average Noise Level	**Frequency Range**	**Noise Level**
With no signal at input, 10 Hz resolution bandwidth, 1 Hz video bandwidth, and 0 dB input attenuation.	50 Hz	<−60 dBm
	100 Hz	<−60 dBm
	1 kHz	<−85 dBm
	10 kHz	<−103 dBm
	100 kHz	<−110 dBm
	1 MHz to 2.9 GHz	<−130 dBm
	2.9 GHz to 6.5 GHz	<−131 dBm
Spurious Responses	**Frequency Range**	**Distortion**
(all input-related spurious responses, except as noted below, with ≤−40 dBm mixer level*)	10 MHz to 6.5 GHz	<−60 dBc†
Second Harmonic Distortion	50 Hz to 10 MHz	<−60 dBc
	10 MHz to 2.9 GHz	<−72 dBc (−40 dBm mixer level*)
	2.75 GHz to 6.5 GHz	<−72 dBc (−20 dBm mixer level*)
Third Order Intermodulation Distortion (with two −30 dBm input signals at input mixer*, spaced ≥1 kHz apart)	50 Hz to 10 MHz	<−64 dBc
	10 MHz to 2.9 GHz	<−70 dBc
	2.75 GHz to 6.5 GHz	<−75 dBc
Image, Multiple, and Out-of-Band Responses	50 Hz to 6.5 GHz	<−70 dBc
Out-of-Range Responses (due to input signals from 6.5 to 12.0 GHz)	50 Hz to 6.5 GHz	<−70 dBc
Residual Responses		
200 kHz to 6.5 GHz, with no signal at input, 0 dB input attenuation		<−90 dBm

* Mixer Level = input level − input attenuation
† ≥1 kHz offset from the carrier.

11. For each Δ MKR reading, subtract the previous Δ MKR reading. Add 4 dB to this number and record the result as the Incremental Error in Table 3-16.

    Incremental Error = current Δ MKR − previous Δ MKR + 4 dB

12. For the last step:

    Incremental Error = current Δ MKR − previous Δ MKR + 2 dB

10 dB/DIV Log Scale (RES BW $\leq$100 Hz)

13. Set the spectrum analyzer controls as follows:

    TRIG .... CONT
    SPAN .... 100 Hz
    RES BW .... 10 Hz

14. Set the HP 3335A controls as follows:

    AMPLITUDE .... +12 dBm
    AMPTD INCR .... 0.05 dB

15. On the spectrum analyzer, press (PEAK SEARCH) MARKER NORMAL.

16. Adjust the HP 355C and the HP 355D until the spectrum analyzer marker reads between −10 dBm and −11 dBm.

17. On the HP 3335A, press (AMPLITUDE). Use the HP 3335A INCR keys to adjust the amplitude until the spectrum analyzer marker reads exactly −10.00 dBm.

18. Set the HP 3335A (AMPTD INCR) to 4 dB, and press (AMPLITUDE).

19. On the spectrum analyzer, press (SGL SWP) (SGL SWP) (PEAK SEARCH) MARKER DELTA.

20. Set the HP 3335A amplitude to the next nominal value listed in Table 3-17, using INCR (▼). Set (AMPTD INCR) to 2 dB before setting the HP 3335A amplitude to the last power level.

21. On the spectrum analyzer, press (SGL SWP) and wait for the completion of a new sweep. Press (PEAK SEARCH). Record the Δ MKR amplitude reading in Table 3-17, column 4. Repeat this step for each HP 3335A (nominal) amplitude setting.

22. For each Δ MKR reading in Table 3-17, subtract the previous Δ MKR reading. Add 4 dB to this number and record the result as the Incremental Error in Table 3-17.

    Incremental Error = current Δ MKR − previous Δ MKR + 4 dB

23. For the last step:

    Incremental Error = current Δ MKR − previous Δ MKR + 2 dB

Table 1-1. HP 8561B Specifications (continued)

AMPLITUDE DISPLAY RANGE	
Amplitude Scale	10 vertical CRT divisions, with the reference level (0 dB) at the top graticule line
Calibration	
LOG	10 dB/DIV for 90 dB display from reference level* 5 dB/DIV for 50 dB display expanded from reference level† 2 dB/DIV for 20 dB display expanded from reference level 1 dB/DIV for 10 dB display expanded from reference level†
LINEAR	10% of reference level per division over the top nine divisions (top 10 divisions for RES BW ≤100 Hz) when calibrated in voltage.
Reference Level Range	
LOG, adjustable in 0.1 dB steps	
50 Hz to 6.5 GHz	−120 dBm to +30 dBm
LINEAR, settable in 1% steps	
50 Hz to 6.5 GHz	2.2 μV to 7.07 V
AMPLITUDE ACCURACY	
Reference Level Uncertainty	
Frequency Response	
(with 10 dB input attenuation)	
In-Band	
DC Coupled	
50 Hz to 2.9 GHz	<±1.35 dB
2.9 GHz to 6.5 GHz	<±1.5 dB
AC Coupled	
100 kHz to 2.9 GHz	<±1.45 dB
2.9 GHz to 6.5 GHz	<±2.0 dB
Referenced to CAL OUTPUT (300 MHz)	
DC Coupled	
50 Hz to 2.9 GHz	<±1.75 dB
2.9 GHz to 6.5 GHz	<±2.5 dB
AC Coupled	
100 kHz to 2.9 GHz	<±1.95 dB
2.9 GHz to 6.5 GHz	<±3.5 dB

* 10 dB/DIV for 100 dB display from reference level for RES BW ≤100 Hz
† These scales are available only in sweep times ≥30 ms (digital display mode).

Equipment

Synthesizer/Level Generator	HP 3335A
10 dB Coaxial Fixed Attenuator	HP 8491B, Option 010
1 dB VHF Step Attenuator	HP 355C
10 dB VHF Step Attenuator	HP 355D
Adapter	
Type N (m) to BNC (f)	1250-1476
Cable	
BNC, 122 cm (48 in.) *(three required)*	HP 10503A

Procedure

1. Connect the equipment as shown in Figure 3-10. The spectrum analyzer provides the frequency reference for the HP 3335A.
2. Set the HP 3335A controls as follows:

   FREQUENCY .... 50 MHz
   AMPLITUDE .... +10 dBm
   AMPTD INCR .... 0.05 dB
   OUTPUT 50Ω

3. On the spectrum analyzer, press (PRESET) (CAL) REALIGN LO & IF. Wait for the adjustments to finish. Set the controls as follows:

   CENTER FREQ .... 50 MHz
   SPAN .... 0 Hz
   REF LVL .... −10 dBm
   ATTEN .... 0 dB
   RES BW .... 300 Hz
   VIDEO BW .... 30 Hz

4. Set the HP 355C and the HP 355D to 0 dB.
5. On the spectrum analyzer, press (MKR).
6. Adjust the HP 355C and the HP 355D until the spectrum analyzer marker reads between −10 dBm and −11 dBm.

10 dB/DIV Log Scale (RES BW ≥300 Hz)

7. On the HP 3335A, press (AMPLITUDE) and use INCR to adjust the amplitude until the spectrum analyzer marker reads exactly −10.00 dBm ±0.17 dB.
8. On the HP 3335A, set (AMPTD INCR) to 4 dB, and press (AMPLITUDE).
9. On the spectrum analyzer, press (SGL SWP) (SGL SWP) (MKR) MARKER DELTA.
10. Using INCR (▼), set the HP 3335A amplitude to the next nominal value listed in Table 3-16. Set (AMPTD INCR) to 2 dB before setting the HP 3335A amplitude to the last power level. On the spectrum analyzer, press (SGL SWP). Record the Δ MKR amplitude reading in Table 3-16, column 4. Repeat this step for each HP 3335A setting.

Table 1-1. HP 8561B Specifications (continued)

AMPLITUDE ACCURACY (continued)	
Reference Level Uncertainty (continued)	
Band Switching Uncertainty (Additional uncertainty added to In-Band Frequency Response for measurements between the two bands.)	<±1.0 dB
Calibrator Uncertainty	
−10 dBm, 300 MHz	<±0.3 dB
Input Attenuator Switching Uncertainty (20 to 70 dB settings, referenced to 10 dB input attenuation)	
50 Hz to 6.5 GHz	<±0.6 dB/10 dB step, 1.8 dB max.
IF Gain Uncertainty (0 dBm to −80 dBm reference levels with 10 dB input attenuation)	<±1.0 dB
Resolution Bandwidth Switching Uncertainty* (Referenced to 300 kHz resolution bandwidth at the reference level)	<±0.5 dB
IF Alignment Uncertainty (additional uncertainty when using 300 Hz resolution bandwidth)	<±0.5 dB
Pulse Digitization Uncertainty (Pulse response mode, PRF >720/sweep time)	
LOG	
Resolution bandwidth ≤1 MHz	<1.25 dB peak-to-peak
Resolution bandwidth = 2 MHz	<3 dB peak-to-peak
LINEAR	
Resolution bandwidth ≤1 MHz	<4% of reference level peak-to-peak
Resolution bandwidth = 2 MHz	<12% of reference level peak-to-peak

* Scale fidelity is not the same for RES BW ≤100 Hz as for RES BW ≥300 Hz. Therefore, signals not at the reference level will experience the difference in scale fidelities when switching between these two sets of resolution bandwidths.

9. Scale Fidelity

Specification

LOG Scale Fidelity:	<±0.4 dB/4 dB from the reference level to a maximum of ±1.5 dB over 0 to −90 dB range (RES BW ≥300 Hz) <±0.4 dB/4 dB from the reference level to a maximum of ±1.5 dB over 0 to −100 dB range (RES BW ≤100 Hz)
LINEAR Scale Fidelity:	<±3% of Reference Level

Related Adjustment

IF Amplitude Adjustment

Description

The 10 dB, 2 dB, and linear scales are tested for fidelity. A −10 dBm signal is displayed at the reference level for each scale. As the input signal level is decreased, the displayed signal level is compared to the reference level. The test also measures the incremental step error. The synthesizer/level-generator is phase-locked to the spectrum analyzer's 10 MHz reference.

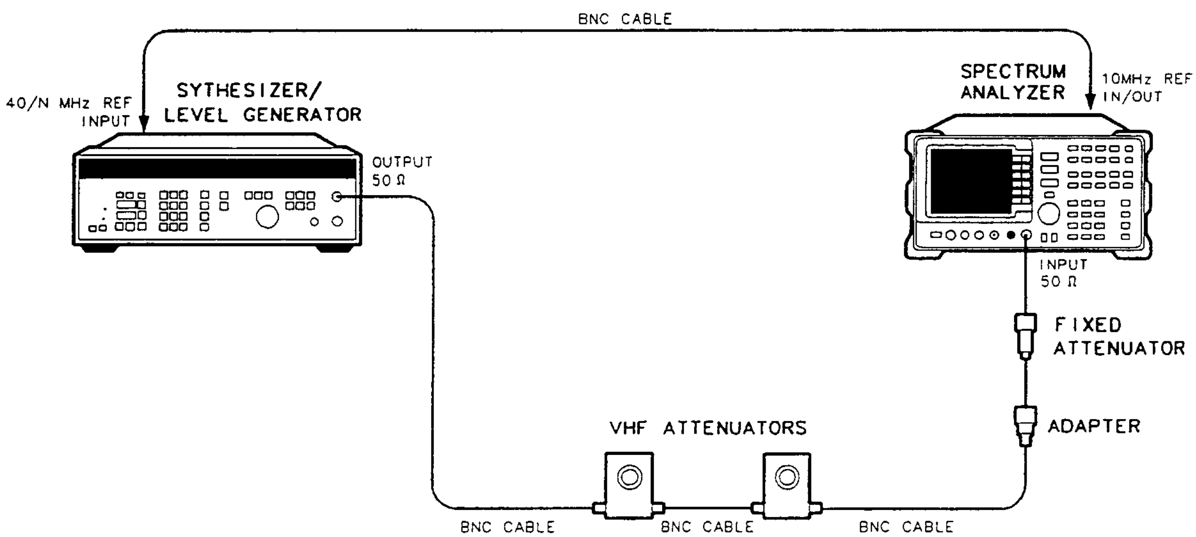


Figure 3-10. Scale Fidelity Test Setup

Table 1-1. HP 8561B Specifications (continued)

AMPLITUDE ACCURACY (continued)	
Resolution Bandwidth Switching Uncertainty*	<±0.5 dB
Referenced to 300 kHz RES BW at the reference level.	
IF Alignment Uncertainty (additional uncertainty when using 300 Hz RES BW)	<±0.5 dB
Pulse Digitization Uncertainty (Pulse response mode, PRF >720/sweep time)	
LOG	
RES BW ≤1 MHz	<1.25 dB peak-to-peak
RES BW of 2 MHz	<3 dB peak-to-peak
LINEAR	
RES BW ≤1 MHz	<4% of reference level peak-to-peak
RES BW of 2 MHz	<12% of reference level peak-to-peak
Scale Fidelity	
LOG	
RES BW ≥300 Hz	<±0.4 dB/4 dB from reference level to a maximum of ±1.5 dB over 0 to −90 dB range
RES BW ≤100 Hz	<±0.4 dB/4 dB from reference level to a maximum of ±1.5 dB over 0 to −100 dB range
LINEAR	<±3% of reference level

* Scale fidelity is not the same for RES BW ≤100 Hz as for RES BW ≥300 Hz. Therefore, signals not at the reference level will experience an additional amplitude difference when switching between these two sets of RES BW settings, due to differences in scale fidelity.

8. IF Gain Uncertainty

Table 3-14. Log IF Gain Uncertainty (1 dB Steps)

HP 8561B REF LVL (dBm)	HP 3335A Amplitude (dBm)	Actual Δ MKR Reading (dB)	Measurement Uncertainty (dB)
0	+10 (Ref.)	0 (Ref.)	±0.035
−1	+9	________	±0.035
−2	+8	________	±0.035
−3	+7	________	±0.035
−4	+6	________	±0.035
−5	+5	________	±0.035
−6	+4	________	±0.035
−7	+3	________	±0.035
−8	+2	________	±0.035
−9	+1	________	±0.035
−10	0	________	±0.035
−11	−1	________	±0.035
−12	−2	________	±0.035

Table 3-15. Linear IF Gain Uncertainty

HP 8561B REF LVL (dBm)	HP 3335A Amplitude (dBm)	Actual Δ MKR Reading (dB)	Measurement Uncertainty (dB)
0	+10 (Ref.)	0 (Ref.)	±0.038
−10	0	________	±0.038
−20	−10	________	±0.038
−30	−20	________	±0.038
−40	−30	________	±0.041
−50	−40	________	±0.041
−60	−50	________	+0.094/−0.097
−70	−60	________	+0.094/−0.097
−80	−70	________	+0.094/−0.097

Table 1-1. HP 8561B Specifications (continued)

SWEEP	
Sweep Time	
Range	
Span= 0*	
RES BW ≥300 Hz (analog display)	50 μs to <30 ms
RES BW ≥300 Hz (digital display)	30 ms to 60 s
Span = ≥100 Hz × N†	
RES BW ≥300 Hz (digital display)	50 ms to 100 s
RES BW ≤100 Hz	67 ms to 100,000 s (auto coupled mode only)
Accuracy (Span = 0)*	
Sweep time 30 ms to 60 s	<±1%
Sweep time <30 ms	<±10%
Sweep Trigger	Free Run, Single, Line, External, or Video‡
INPUTS AND OUTPUTS	
IF INPUT	
Connector	SMA female, front panel
Input level for full-screen deflections (external mixing mode, 0 dBm reference level, 30 dB conversion loss)	−30 dBm ±1.5 dB
HP-IB	
Connector	IEEE-488 bus connector
Interface Functions	SH1, AH1, T6, TE0, L4, LE0, SR1, RL1, PP1, DC1, DT0, C1, C28
Direct Plotter Output	Supports HP 7225A, HP 7440A, HP 7470A, HP 7475A, HP 7550A
Direct Printer Output	Supports HP 3630A PaintJet, HP 2225A ThinkJet
CAL OUTPUT	
Connector	BNC female, front panel
Frequency	300 MHz ±(300 MHz × frequency reference accuracy*)
Amplitude	−10 dBm ±0.3 dB

* Span = 0 is not available for RES BW ≤100 Hz.
† N is the harmonic mixing mode.
‡ Video trigger is not available in RES BW settings ≤100 Hz.
§ Frequency Reference Accuracy = (aging × period of time since last adjustment) + initial + achievable accuracy + temperature stability.

31. In Table 3-13, locate the Actual Δ MKR Reading with the greatest deviation from its corresponding REF LVL setting. Subtract the REF LVL setting from that Δ MKR reading, and record the result here:

Maximum Log IF Gain Uncertainty (10 dB steps): ________ dB

32. In Table 3-14, locate the Actual Δ MKR reading with the greatest deviation from its corresponding REF LVL setting. Subtract the REF LVL setting from that Δ MKR reading, and record the result here:

Maximum Log IF Gain Uncertainty (1 dB steps): ________ dB

33. In Table 3-15, locate the Actual Δ MKR reading with the greatest deviation from its corresponding REF LVL setting. Subtract the REF LVL setting from that Δ MKR reading, and record the result here:

Maximum Linear IF Gain Uncertainty: ________ dB

Table 3-13. Log IF Gain Uncertainty (10 dB Steps)

HP 8561B REF LVL (dBm)	HP 3335A Amplitude (dBm)	Actual Δ MKR Reading (dB)	Measurement Uncertainty (dB)
0	+10 (Ref.)	0 (Ref.)	±0.035
−10	0	________	±0.035
−20	−10	________	±0.035
−30	−20	________	±0.035
−40	−30	________	+0.038/−0.039
−50	−40	________	+0.038/−0.039
−60	−50	________	+0.093/−0.095
−70	−60	________	+0.093/−0.095
−80	−70	________	+0.093/−0.095

Table 1-1. HP 8561B Specifications (continued)

INPUTS AND OUTPUTS (continued)	
1ST LO OUTPUT	
Connector	SMA female, front panel
Amplitude	+16.5 dBm ±2.0 dB
10 MHz REF IN/OUT	
Connector	BNC female, rear panel
Frequency	10 MHz ±(10 MHz × frequency reference accuracy*)
GENERAL	
Environmental Specifications	MIL-T-28800C, Type III, Class 3, Style C, as follows:
Calibration Interval	1 year
Warmup	5 minutes from ambient conditions†
Temperature	
Operating	−10°C to +55°C
Non-operating	−62°C to +85°C
Humidity	95% at 40°C for 5 days
Altitude	
Operating	15000 feet
Non-operating	50000 feet
Rain resistance	Drip-proof at 16 liters/hour/square foot
Vibration	
5 to 15 Hz	0.060 inch peak-to-peak excursion
15 to 25 Hz	0.040 inch peak-to-peak excursion
25 to 55 Hz	0.020 inch peak-to-peak excursion
Pulse Shock	
Half Sine	30 g for 11 ms duration
Transit Drop	8-inch drop on 6 faces and 8 corners

* Frequency Reference Accuracy = (aging × period of time since last adjustment) + initial + achievable accuracy + temperature stability.

† Two hours for conditions of internal condensation, 30 minutes to meet frequency response specifications without preselector peaking. When operating outside the 20°C to 30°C ambient temperature range, preselector peaking is always required to meet frequency response specifications.

Log Gain Uncertainty (1 dB Steps)

13. On the HP 3335A, press (AMPLITUDE) 10 (+dBm) (AMPTD INCR) 1 (dB).
14. Set the spectrum analyzer controls as follows:

MARKER	NORMAL
REF LVL	0 dBm
LOG dB/DIV	1 dB
TRIGGER	CONT

15. Adjust the HP 355C to place the signal 2 to 3 dB (two to three divisions) below the spectrum analyzer reference level.
16. On the spectrum analyzer, press (SGL SWP) (SGL SWP) (MKR) MARKER DELTA.
17. On the HP 3335A, press (AMPLITUDE), INCR (▼).
18. On the spectrum analyzer, press (AMPLITUDE) (▼) (SGL SWP). Wait for the sweep to finish.
19. Record the spectrum analyzer Δ MKR amplitude reading in Table 3-14 as the Actual Δ MKR Reading. The Δ MKR reading should be within the limits shown.
20. Repeat steps 17 through 19 for the remaining spectrum analyzer REF LVL settings listed in Table 3-14.

Linear Gain Uncertainty

21. On the HP 3335A, press (AMPLITUDE) 10 (+dBm) (AMPTD INCR) 10 (dB).
22. Set the controls on the spectrum analyzer under test to the following:

MARKER	NORMAL
REF LVL	0 dBm
AMPLITUDE SCALE	LINEAR
UNITS	dBm
TRIGGER	CONT

23. Adjust the HP 355C to place the signal two to three divisions below the spectrum analyzer reference level. The marker should read between −2 dBm and −3 dBm.
24. On the spectrum analyzer, press (SGL SWP) (SGL SWP) (MKR) MARKER DELTA.
25. On the HP 3335A, press (AMPLITUDE).
26. On the HP 3335A, press INCR (▼).
27. Set the spectrum analyzer REF LVL to −10 dBm.
28. On the spectrum analyzer, press (SGL SWP).
29. Record the spectrum analyzer Δ MKR amplitude reading in Table 3-15 as the Actual Δ MKR Reading.
30. Repeat steps 25 through 29 for the remaining spectrum analyzer REF LVL settings listed in Table 3-15. The Δ MKR reading should be within the limits shown.

Table 1-1. HP 8561B Specifications (continued)

GENERAL (continued)	
Electromagnetic Compatibility	
Military Specification	Conducted and radiated interference is in compliance with CISPR, Publication 11 (1985), and Messempfaenger-Postverfuegung 526/527/79 (Kennzeichnung Mit F-Nummer/Funkschutzzeichen). Meets the requirements of MIL-STD-461B, Part 4, with the exceptions shown below:
Conducted Emissions	
CE01 (Narrowband)	1 kHz to 15 kHz only
CE03 (Narrowband)	Full limits
CE03 (Broadband)	20 dB relaxation from 15 kHz to 100 kHz
Conducted Susceptibility	
CS01	Full Limits
CS02	Full Limits
CS06	Full Limits
Radiated Emissions	
RE01	15 dB relaxation to 30 kHz (exceptioned from 30 kHz to 50 kHz)
RE02	Full limits to 1 GHz
Radiated Susceptibility	
RS01	Full Limits
RS02	Exceptioned
RS03	Limited to 1 V/m from 14 kHz to 1 GHz with 20 dB relaxation at IF frequencies (30 dB relaxation at IF frequencies for Option 001)

Equipment

Synthesizer/Level Generator	HP 3335A
10 dB Coaxial Fixed Attenuator	HP 8491B, Option 010
1 dB VHF Step Attenuator	HP 355C
Adapter	
Type N (m) to BNC (f)	1250-1476
Cable	
BNC, 122 cm (48 in.) *(four required)*	HP 10503A

Procedure

1. Connect the equipment as shown in Figure 3-9. The spectrum analyzer under test provides the frequency reference for the HP 3335A.

Log Gain Uncertainty (10 dB Steps)

2. Set the HP 3335A controls as follows:

   FREQUENCY .... 50 MHz
   AMPLITUDE .... +10 dBm
   AMPTD INCR .... 10 dB
   OUTPUT 50Ω

3. On the spectrum analyzer, press (PRESET) (CAL) REALIGN LO & IF . Wait for the adjustments to finish.
4. Set the controls as follows:

   CENTER FREQ .... 50 MHz
   SPAN .... 0 Hz
   LOG dB/DIV .... 1 dB
   RES BW .... 1 kHz
   VIDEO BW .... 1 Hz

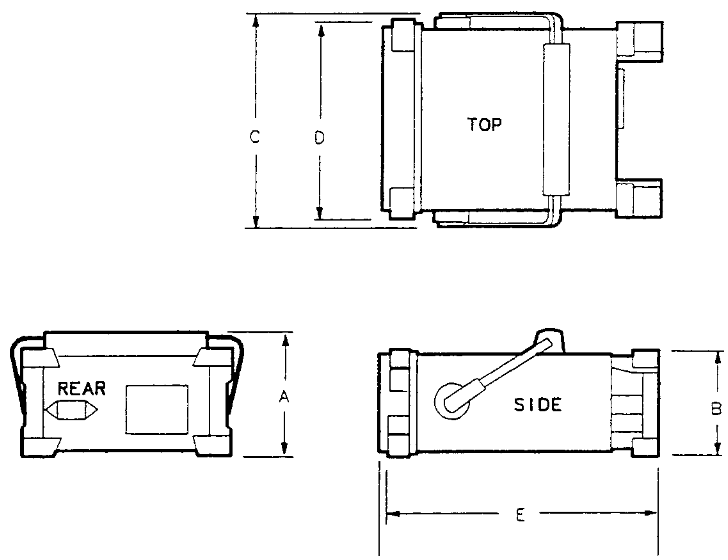
5. Set the HP 355C and 355D to 0 dB attenuation.
6. On the spectrum analyzer, press (MKR).
7. Adjust the HP 355C to place the signal 2 or 3 dB (two to three divisions) below the spectrum analyzer reference level.
8. On the spectrum analyzer, press (SGL SWP) (SGL SWP) (MKR) MARKER DELTA .
9. On the HP 3335A, press (AMPLITUDE), then INCR (▼).
10. Set spectrum analyzer reference level: (AMPLITUDE) REF LVL 10 (−dBm) (SGL SWP). Wait for the sweep to finish.
11. Record the spectrum analyzer Δ MKR amplitude reading in Table 3-13 as the Actual Δ MKR Reading. The Δ MKR reading should be within the limits shown.
12. Repeat steps 9 through 11 for the remaining spectrum analyzer REF LVL settings listed in Table 3-13.

Table 1-1. HP 8561B Specifications (continued)

GENERAL (continued)	
Power Requirements	
115 V ac Operation	
Voltage	90 V to 140 V rms
Current	3.2 A rms maximum
Frequency	47 Hz to 440 Hz
230 V ac Operation	
Voltage	180 V to 250 V rms
Current	1.8 A rms maximum
Frequency	47 Hz to 66 Hz
Maximum Power Dissipation	180 W
Weight	20 kg (44 lb)

Dimensions

(A) 200 mm (8 in.) high
(B) 184 mm (7-1/4 in.) high
(C) 373 mm (14-11/16 in.) wide
(D) 337 mm (13-1/4 in.) wide
(E) 460 mm (18-1/8 in.) deep
(F) 500 mm (19-1/4 in.) deep



8. IF Gain Uncertainty

Specification

<±1.0 dB, reference levels 0 dBm to −80 dBm with 10 dB input attenuation

Related Adjustment

IF Amplitude Adjustment

Description

This test measures the log (10 dB and 1 dB) and linear IF gain uncertainties. A 0 dBm signal is displayed near the reference level for each test. The input signal level is decreased as the spectrum analyzer reference level is decreased (IF gain increased). Since the signal level decreases in accurate steps, any error between the reference level and the signal level is caused by the analyzer's IF gain. The synthesizer/level-generator is phase-locked to the spectrum analyzer's 10 MHz reference.

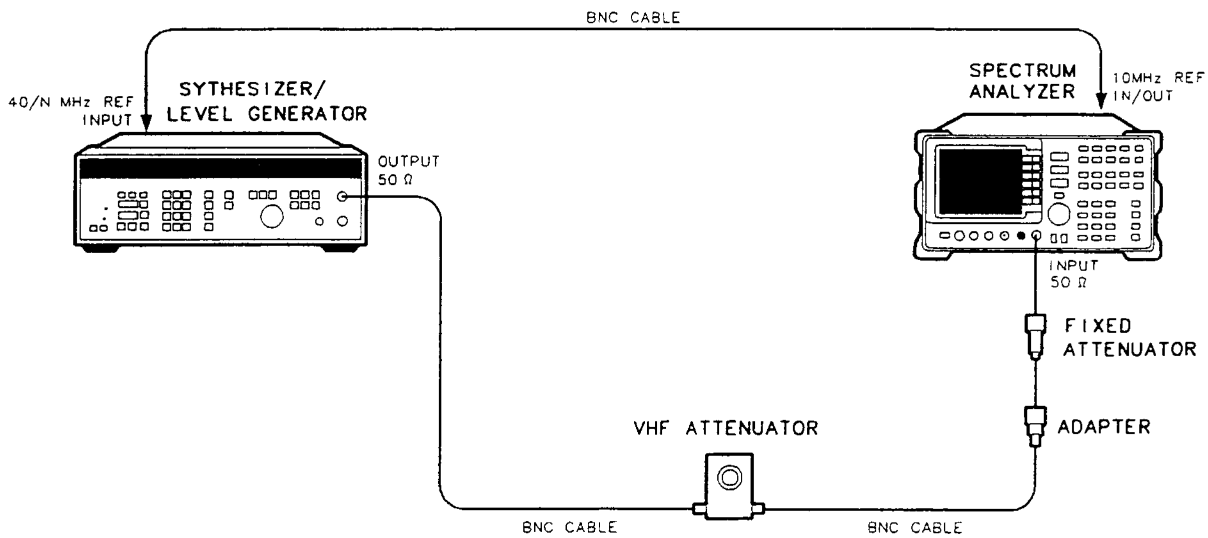


Figure 3-9. IF Gain Uncertainty Test Setup

Table 1-2. HP 8561B Characteristics

NOTE: These are not specifications. Characteristics provide useful information about instrument performance.	
FREQUENCY	
Frequency Reference Accuracy (Non-Option 003)	
Initial Achievable Accuracy	$<\pm 1 \times 10^{-6}$
Frequency Reference Accuracy (Option 003)	
Initial Achievable Accuracy (includes gravitational sensitivity, retrace, and settability)	$<\pm 2.2 \times 10^{-8}$
Daily Aging (average over 7 days after being powered on for 7 days)	$<\pm 5 \times 10^{-10}$
Warmup (Internal frequency reference selected)	
After 5 minutes	$<\pm 1 \times 10^{-7}$ of final frequency* (0°C to +55°C)
	$<\pm 1 \times 10^{-6}$ of final frequency* (−10°C)
After 15 minutes	$<\pm 1 \times 10^{-8}$ of final frequency* (−10°C to +55°C)
Bandwidth Selectivity	
RES BW ≤100 Hz	<4.5:1
RES BW = 1 MHz	<8:1
RES BW = 2 MHz	<5.5:1
DYNAMIC RANGE	
Nominal Sensitivity (10 Hz RBW, 1 Hz Video BW 0 dB input attenuation)	
1 MHz to 2.9 GHz	−138 dBm
2.75 GHz to 6.5 GHz	−136.5 dBm
* Final frequency is defined as frequency 60 minutes after power-on with analyzer set to internal frequency reference.	

Table 3-12. Input Attenuator Switching Uncertainty, 2.9 GHz

HP 8561B ATTEN (dB)	Δ MKR Reading (dB)	IF Gain Correction (dB)	Cumulative Switching Uncertainty (dB)	Incremental Switching Uncertainty (dB)	Measurement Uncertainty (dB)
10	0 (Ref.)	0 (Ref.)	0 (Ref.)	0 (Ref.)	0 (Ref.)
20	________	________[(−30)−(−20)]	________	________	±0.23
30	________	________[(−40)−(−20)]	________	________	±0.23
40	________	________[(−50)−(−20)]	________	________	±0.23
50	________	________[(−60)−(−20)]	________	________	±0.23
60	________	________[(−70)−(−20)]	________	________	±0.23
70	________	________[(−80)−(−20)]	________	________	±0.24

Table 1-2. HP 8561B Characteristics (continued)

NOTE: These are not specifications. Characteristics provide useful information about instrument performance.	
AMPLITUDE ACCURACY	
Band-to-Band Frequency Response (Frequency response uncertainty for measurements between the two internal mixing bands. Equivalent to the sum of the two In-Band Frequency Response values plus Band Switching Uncertainty.)	
dc Coupled	<3.5 dB
ac Coupled	<4.4 dB
Input Attenuator Repeatability	<±0.2 dB
Pulse Digitization Uncertainty (Pulse response mode, PRF >720/sweep time)	
Standard Deviation	<0.2 dB
AMPLITUDE MEASUREMENT RANGE	
Spurious Responses (all input related spurious responses <1 kHz from the carrier)	**Frequency Range/Distortion** 10 MHz to 2.9 GHz/<−55 dBc
SWEEP	
Sweep Time	
Accuracy (span ≥100 Hz)	<±15%
DEMODULATION	
Spectrum Demodulation	
Modulation Type	AM and FM (5 kHz peak deviation)
Audio Output	Internal speaker and phone jack with volume control
Pause Time at Marker Frequency	100 ms to 60 s
INPUTS AND OUTPUTS	
INPUT 50Ω	
Connector Type	Precision Type N female, front panel
Impedance	50Ω
VSWR (at tuned frequency)	<1.5:1 for <2.9 GHz and ≥10 dB input attenuation <3.0:1 for 0 dB input attenuation

7. Input Attenuator Switching Uncertainty

Table 3-10. Input Attenuator Switching Uncertainty, 50 MHz

HP 3335A Amplitude (dBm)	HP 8561B		Δ MKR Reading		Cumulative Switching Uncertainty (dB)	Incremental Switching Uncertainty (dB)	Measurement Uncertainty (dB)
	REF LVL (dBm)	ATTEN (dB)	Ideal (dB)	Actual (dB)			
−50	−70	10	0 (Ref.)	0 (Ref.)	0 (Ref.)	0 (Ref.)	0 (Ref.)
−40	−60	20	+10	________	________	________	±0.178
−30	−50	30	+20	________	________	________	±0.178
−20	−40	40	+30	________	________	________	±0.178
−10	−30	50	+40	________	________	________	±0.178
0	−20	60	+50	________	________	________	±0.178
+10	−10	70	+60	________	________	________	±0.178

Table 3-11. IF Gain Deviation

HP 8561B Ref Lvl (dBm)	HP 3335A Amplitude (dBm)	Δ MKR Reading		IF Gain Deviation * (dB)
		Actual (dB)	Ideal (dB)	
−10	+5	________	0 (Ref.)	________
−20	−5	________	−10	________
−30	−15	________	−20	________
−40	−25	________	−30	________
−50	−35	________	−40	________
−60	−45	________	−50	________
−70	−55	________	−60	________
−80	−65	________	−70	________

Table 1-2. HP 8561B Characteristics (continued)

INPUTS AND OUTPUTS (continued)	
LO Emission Level (average)	
10 dB input attenuation	<−70 dBm
IF INPUT	
Connector Type	SMA female, front panel
Impedance	50Ω
Frequency	310.7 MHz
Noise Figure	7 dB
1 dB Gain Compression Level	−23 dBm
Full Screen Level	−30 dBm
(Gain Compression and Full Screen Levels apply with 30 dB conversion loss setting and 0 dBm reference level.)	
1ST LO OUTPUT	
Connector	SMA female, front panel
Impedance	50Ω
Frequency Range	3.0000 GHz to 6.8107 GHz
CAL OUTPUT	
Connector	BNC female, front panel
Impedance	50Ω
10 MHz REF IN/OUT	
Connector	BNC female, rear panel
Impedance	50Ω
Output Amplitude	0 dBm
Input Amplitude	−2 to +10 dBm
VIDEO OUTPUT*	
Connector	BNC female, rear panel
Impedance (dc coupled)	50Ω
Amplitude (into 50Ω load) for RES BW ≥300 Hz	0 to +1 full scale
Scale RES BW ≥300 Hz	Linear or Log 100 dB/V
IF Signal, RES BW ≤100 Hz	4.8 kHz, autoranged level with dc offset

* The VIDEO OUTPUT is a video signal for RES BW ≥300 Hz with switching transients and IF ADJ signals between sweeps. For RES BW ≤100 Hz, the output is an IF signal with transients and IF ADJ signals between and during sweeps.

26. On the HP 8340A/B, press (INSTR PRESET) and set the controls as follows:

    CW .... 2.9 GHz
    POWER LEVEL .... 0 dBm

27. On the spectrum analyzer, press (PEAK SEARCH).
28. Adjust the HP 8340A/B (POWER LEVEL) for a spectrum analyzer MKR amplitude reading of −13 dBm ±0.05 dB.
29. On the spectrum analyzer, press (MKR) **MARKER DELTA** (AMPLITUDE) **ATTEN** 20 (dB).
30. After a new sweep has finished, record the spectrum analyzer Δ MKR amplitude reading in Table 3-12 as the Δ MKR Reading (column 2).
31. Set the spectrum analyzer (ATTEN) to the settings indicated in Table 3-12. Repeat step 30 for each ATTEN setting.
32. For each ATTEN setting in Table 3-12, subtract the IF Gain Correction from the Δ MKR Reading (column 2) and record the result as the CSU.
33. For each attenuator setting from 20 through 70 dB, subtract the previous CSU from the current CSU and record the result in Table 3-12 as the Incremental Switching Uncertainty (ISU).

    Incremental Switching Uncertainty = Current CSU − Previous CSU

Test Results

34. Locate the CSU in Table 3-10 having the greatest deviation, positive or negative, from 0 dB. Record the value as the Maximum CSU (50 MHz) below:

    Maximum CSU (50 MHz): ________ dB

35. Locate the Incremental Switching Uncertainty in Table 3-10 having the greatest deviation, positive or negative, from 0 dB. Record the value as the Maximum ISU (50 MHz) below:

    Maximum ISU (50 MHz): ________ dB

36. Locate the CSU in Table 3-12 having the greatest deviation, positive or negative, from 0 dB and record the value as the Maximum CSU (2.9 GHz) below:

    Maximum CSU (2.9 GHz): ________ dB

37. Locate the Incremental Switching Uncertainty in Table 3-12 having the greatest deviation, positive or negative, from 0 dB and record the value as the Maximum ISU (2.9 GHz) below:

    Maximum ISU (2.9 GHz): ________ dB

Table 1-2. HP 8561B Characteristics (continued)

NOTE: These are not specifications. Characteristics provide useful information about instrument performance.	
INPUTS and OUTPUTS (continued)	
LO SWP | 0.5 V/GHz OUTPUT	
Connector	BNC female, rear panel
Impedance (dc coupled)	2 kΩ
LO SWP OUTPUT (no load)	0 to +10 V
0.5 V/GHz OUTPUT (no load)	0.5 V/GHz of tuned frequency
BLANKING OUTPUT	
Connector	BNC female, rear panel
Amplitude	
During sweep	Low TTL Level (sink 150 mA maximum)
During retrace	High TTL Level (source 0.5 mA maximum)
Maximum Input (high TTL state)	+40 V
EXT TRIG INPUT	
Connector	BNC female, rear panel
Impedance	10 kΩ
Trigger Level	Rising edge of TTL level
PROBE POWER (front panel)	
Voltage	+15 V dc, −12.6 V dc
Current	150 mA maximum, each
EARPHONE	
Connector	1/8 inch miniature monophonic jack, rear panel
Power Output	0.25 W into 4Ω
2ND IF OUT (Option 001 instruments only)	
Connector	SMA female, rear panel
Impedance	50Ω
Frequency	310.7 MHz
Frequency Range	**3 dB BW** **Noise Figure** **Conversion Gain**
1 kHz to 2.9 GHz	>30 MHz 24 dB −5.6 dB
2.75 GHz to 6.5 GHz	>20 MHz 24 dB −3.6 dB

16. On the spectrum analyzer, press (PRESET) (CAL) REALIGN LO AND IF. Set the controls as follows:

CENTER FREQ	50 MHz
SPAN	0 Hz
REF LVL	−10 dBm
ATTEN	0 dB
LOG dB/DIV	1 dB
RES BW	1 kHz
VIDEO BW	1 Hz

17. Set the HP 355C to 5 dB and replace the HP 8491B with the HP 8493C 10 dB attenuator.
18. Adjust the HP 355C to place the signal two to three divisions below the reference level.
19. On the spectrum analyzer, press (MKR) MARKER DELTA.
20. Set the HP 3335A (AMPLITUDE) and the spectrum analyzer REF LVL according to Table 3-11. Record the spectrum analyzer's Δ MKR reading for each setting as the Actual Δ MKR Reading.
21. For each row in Table 3-11, subtract the Ideal Δ MKR Reading from the Actual Δ MKR reading. Record the result as the IF Gain Deviation.

Calculating IF Gain Correction

22. Calculate and record the IF Gain Correction factors in Table 3-12 as described in the following steps:
    a. For each IF Gain Correction entry, there is a pair of numbers in parentheses. These numbers represent HP 8561B REF LVL settings from Table 3-11.
    b. Look up the IF Gain Deviation values in Table 3-11 that correspond to these REF LVL settings.
    c. Substitute test values for the numbers in parentheses in the IF Gain Correction entry and calculate the correction value. As an example, when calculating Table 3-12 IF Gain Correction for the 20 dB ATTEN setting, look up the IF Gain Deviation values listed in Table 3-11 for the −30 and −20 dBm REF LVL settings.
    d. If the IF Gain Deviation for the −30 dBm REF LVL is +0.2 dB and the IF Gain Deviation for the −20 dBm REF LVL is −0.3 dB, the IF Gain Correction for the 20 dB ATTEN setting is then:

       $(+0.2) - (-0.3) = +0.5$ dB

Input Attenuator Switching Uncertainty, 2.9 GHz

23. Connect the equipment as shown in Figure 3-8 using the HP 8493C 10 dB attenuator. The HP 8561B provides the frequency reference for the HP 8340A/B.
24. On the spectrum analyzer, press (FREQUENCY) 2.9 (GHz).
25. On the spectrum analyzer, press (AMPLITUDE) 10 (−dBm) (MKR) MARKERS OFF.

2

Preparation

What You'll Find in This Chapter

This chapter describes how to prepare the spectrum analyzer for use. The process includes initial inspection, setting up for the correct ac power source, and performing trace alignment and reference level calibration procedures. There is also information about analyzer service needs, including checking for basic problems, calling an Hewlett-Packard Sales and Service Office, and returning the analyzer to the factory for service, if necessary.

Initial Inspection

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

If the contents are incomplete or the analyzer fails the verification tests in Chapter 3, notify one of the Hewlett-Packard Sales and Service Offices listed in Table 2-4. Show any container or cushioning materials damages to the carrier. The Hewlett-Packard Sales and Service Office will arrange for repair or replacement without waiting for a claim settlement.

The shipping container and cushioning materials are shown in Figure 2-1. Instructions for repackaging the analyzer are included at the end of this chapter.

Preparing the Spectrum Analyzer for Use

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

Caution DO NOT connect the analyzer to an ac power source before verifying that the line voltage is correct, the line-voltage selector switch located on the analyzer rear panel is set to the correct voltage (refer to the following paragraphs), and the proper fuse is installed. Failure to verify that these items are correct could result in equipment damage.

3. On the spectrum analyzer, press (PRESET) (CAL) REALIGN LO & IF. Set the controls as follows:

   CENTER FREQ .... 50 MHz
   SPAN .... 0 Hz
   REF LVL .... −70 dBm
   LOG dB/DIV .... 1 dB
   RES BW .... 3 kHz
   VIDEO BW .... 1 Hz
   AC COUPLED/DC COUPLED .... DC COUPLED

4. Set the HP 355C to 0 dB.
5. Adjust the HP 355C Step Attenuator to place the peak of the signal two to three divisions below the spectrum analyzer reference level.
6. On the spectrum analyzer, press (SGL SWP) (SGL SWP).
7. Wait for a new sweep to finish. Press (MKR) MARKER DELTA.
8. Set the HP 3335A amplitude as indicated in row 2 of Table 3-10 by pressing (AMPLITUDE) and entering the next dBm value.
9. On the spectrum analyzer, set (AMPLITUDE) REF LVL 60 (−dBm) ATTEN 20 (dB) as indicated in row 2 of Table 3-10.
10. On the spectrum analyzer, press (SGL SWP).
11. Wait for a sweep to finish. Record the Δ MKR amplitude in Table 3-10 as the Actual Δ MKR Reading.
12. Repeat steps 8 through 11 for each row of instrument settings in Table 3-10.
13. For each attenuator setting other than 10 dB, subtract the Actual Δ MKR Reading from the Ideal Δ MKR Reading in Table 3-10 and record the result as the Cumulative Switching Uncertainty (CSU).

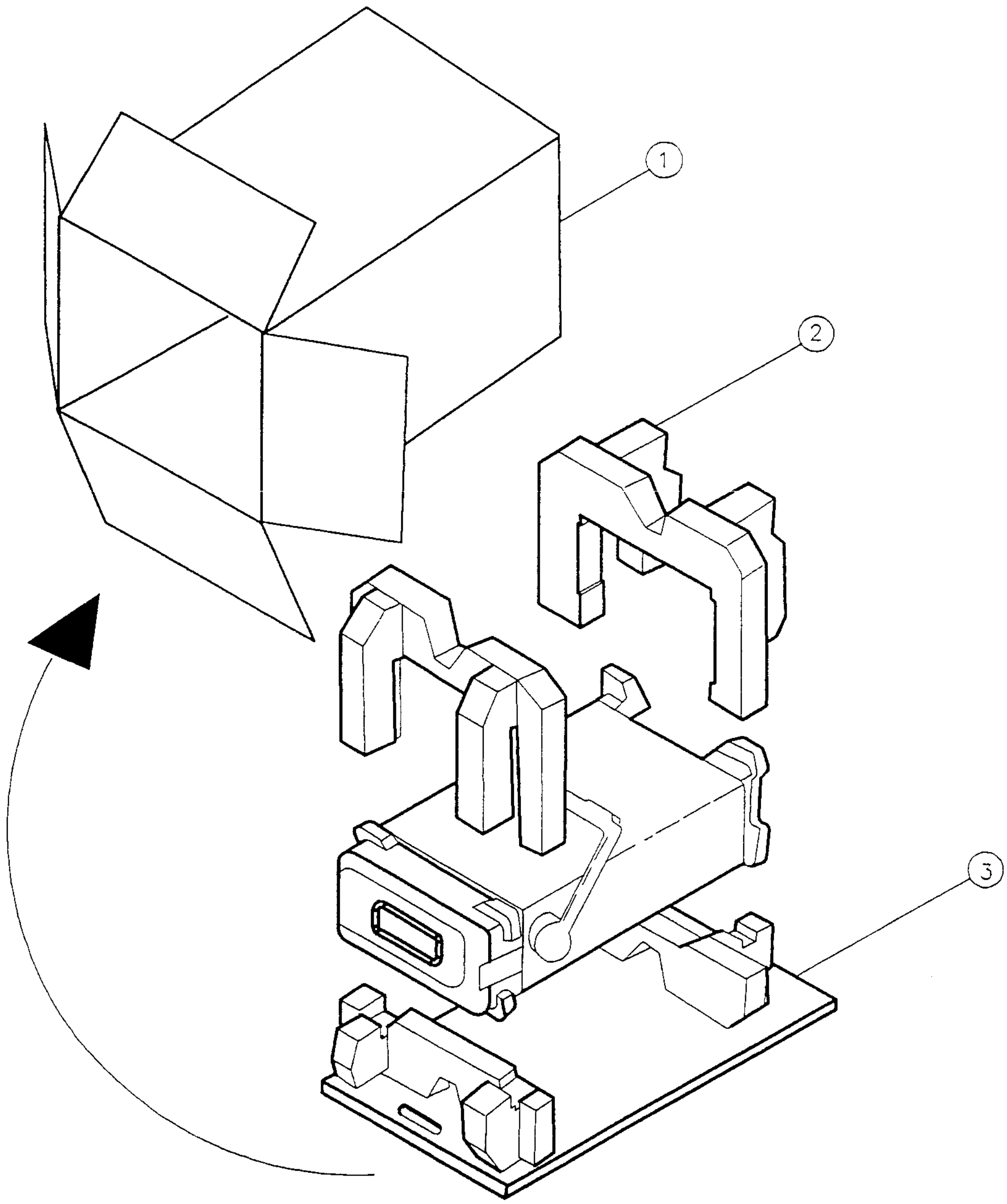
    CSU = Ideal Δ MKR Reading − Actual Δ MKR Reading

14. For attenuator settings from 20 through 70 dB, subtract the previous CSU from the current CSU and record the result in Table 3-10 as the Incremental Switching Uncertainty.

    Incremental Switching Uncertainty = Current CSU − Previous CSU

15. Set the HP 3335A controls as follows:

   FREQUENCY .... 50 MHz
   AMPLITUDE .... −50 dBm
   AMPTD INCR .... 5 dB
   OUTPUT 50Ω



Item	HP Part Number	Description
1	Outer Carton	9211-5636
2	Pads (2)	08590-80013
3	Bottom Tray	08590-80014

Figure 2-1. HP 8561B Shipping Container and Cushioning Materials

7. Input Attenuator Switching Uncertainty

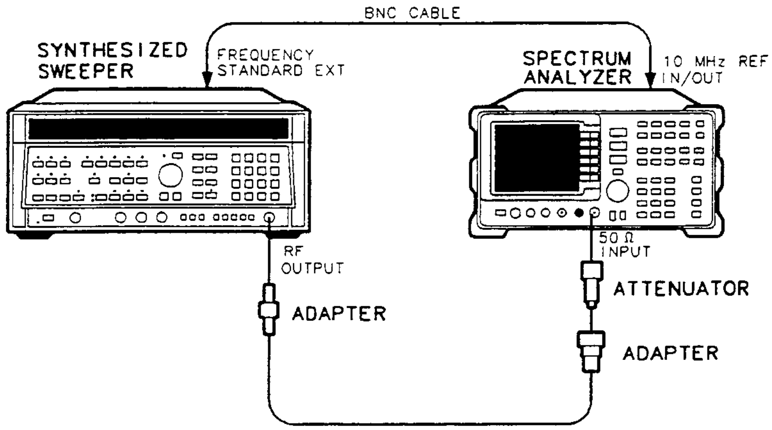


Figure 3-8. Input Attenuator Test Setup, ≥50 MHz

Equipment

Synthesized Sweeper	HP 8340A/B
Synthesizer/Level Generator	HP 3335A
20 dB Coaxial Fixed Attenuator	HP 8491B (Option 020)
10 dB Coaxial Fixed Attenuator	HP 8493C (Option 010)
1 dB VHF Step Attenuator	HP 355C
Adapters	
Type N (m) to BNC (f)	1250-1476
Type N (m) to APC 3.5 (f)	1250-1744
APC 3.5 (f) to APC 3.5 (f)	5061-5311
Cables	
BNC, 122 cm (48 in.) *(three required)*	HP 10503A
APC 3.5, 91 cm (36 in.)	8120-4921

Procedure

Attenuator Switching Uncertainty

1. Connect the equipment as shown in Figure 3-7. The spectrum analyzer provides the frequency reference for the HP 3335A.
2. Set the HP 3335A controls as follows:

FREQUENCY .... 50 MHz
AMPLITUDE .... −50 dBm
AMPTD INCR .... 10 dB
OUTPUT 50Ω

Power Requirements

The power requirements for the spectrum analyzer are listed in Table 2-1.

Table 2-1. Operating Power Requirements

Line Input	Power Requirements	
	115 V ac Operation	**230 V ac Operation**
Line Voltage	90 V to 140 V rms	180 V to 280 V rms
Current	3.2 A rms max.	1.8 A rms max.
Frequency	47 Hz to 440 Hz	47 Hz to 66 Hz

Setting the Line-Voltage Selector Switch

Set the instrument's rear-panel voltage selector switch to the line voltage range (115 V or 230 V) corresponding to the available ac voltage. See Figure 2-2. Insert a small screwdriver or similar tool in the slot and slide the switch until the proper voltage label is visible.

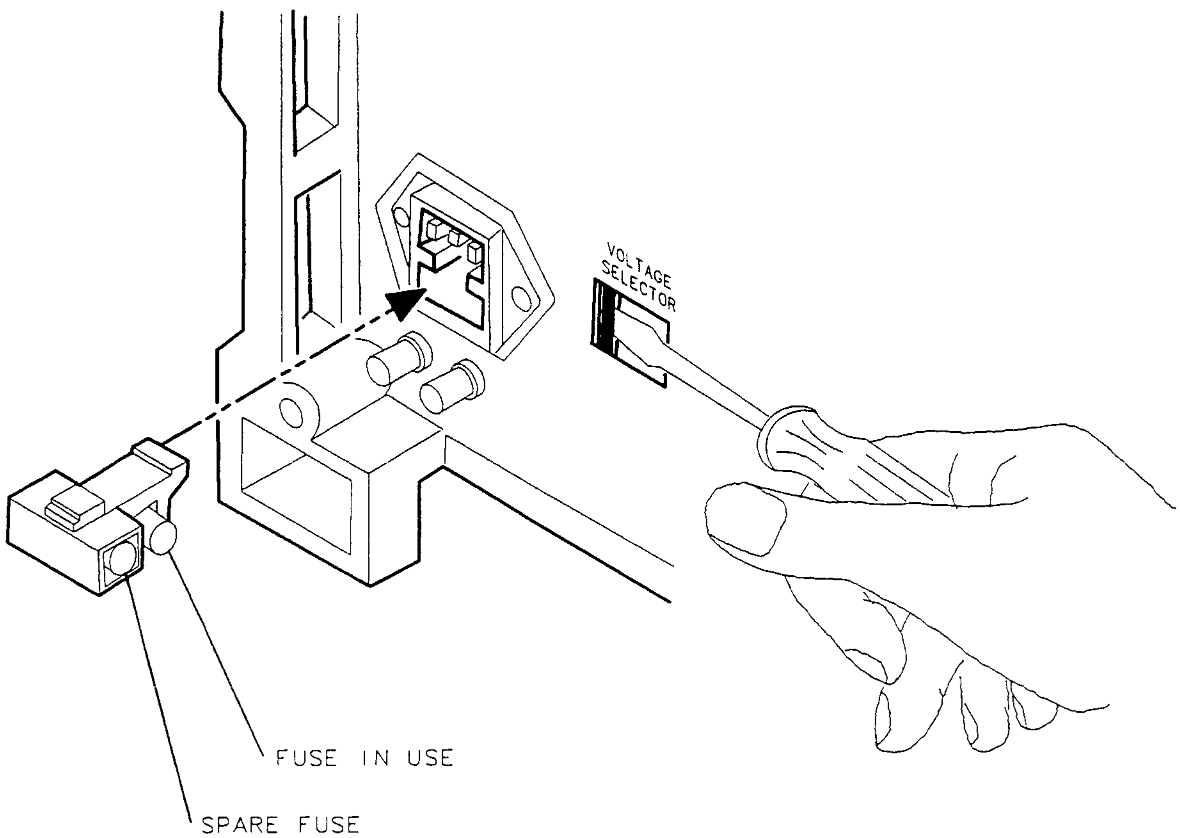


Figure 2-2. Voltage Selection Switch and Line Fuse Locations

7. Input Attenuator Switching Uncertainty

Specification

Accuracy (10 dB input attenuation as a reference for 20 to 70 dB settings):

50 Hz to 2.9 GHz: <±0.6 dB/10 dB step to a maximum of ±1.8 dB

Related Adjustment

There is no related adjustment procedure for this performance test.

Description

This test measures the input attenuator's switching uncertainty over the full 70 dB range at 50 MHz. The synthesizer/level generator is phase-locked to the spectrum analyzer's 10 MHz reference. Switching uncertainty is referenced to the 10 dB attenuator setting. The attenuator in the synthesizer/level-generator is the measurement standard.

The input attenuator's switching uncertainty at 2.9 GHz is measured using IF substitution. The IF gains are characterized at 50 MHz.

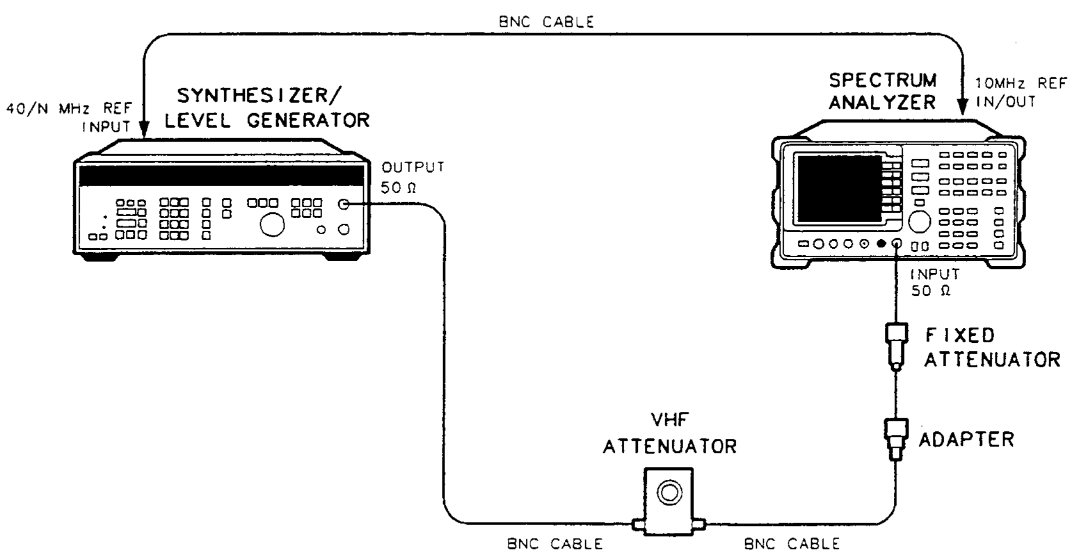


Figure 3-7. Input Attenuator Test Setup, 50 MHz

Checking the Fuse

The type of ac line input fuse depends on the input line voltage. Use the following fuses:

115 V operation:	5 A 125 V UL/CSA (HP part number 2110-0756)
230 V operation:	5 A 250 V IEC (HP part number 2110-0709)

The line fuse is housed in a small container located on the rear-panel power connector. The container provides space for storing a spare fuse, as shown in the Figure 2-2.

To check the fuse, use the tip of a screwdriver inserted into the container slot to gently pry the cover off. Verify that replacement fuses are installed in the correct position as illustrated in the figure.

Power Cable

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

Warning

Failure to ground the instrument properly can result in personal injury. Before turning on the spectrum analyzer, you must connect its protective earth terminals to the protective conductor of the main power cable. Insert the main power cable plug only into a socket outlet that has a protective earth contact. DO NOT defeat the earth-grounding protection by using an extension cable, power cable, or auto transformer without a protective ground conductor. If you are using an auto transformer, make sure its common terminal is connected to the protective earth contact of the power source socket.

Various power cables are available for the power outlets unique to specific geographic areas. The appropriate cable is included with the instrument when it is shipped to an area requiring one of these cables. You can order additional ac power cables listed in Table 2-2 for use in different areas. Table 2-2 also illustrates the plug configurations and identifies the geographic area in which each cable is appropriate.

6. Resolution Bandwidth Accuracy and Selectivity

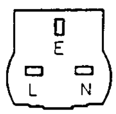
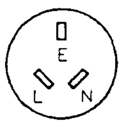
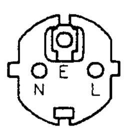
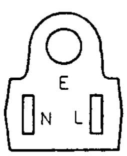
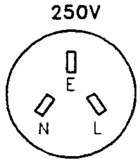
Table 3-8. 60 dB Bandwidth Instrument Settings

HP 8561B Settings		HP 3335A Frequencies		Measurement Uncertainty (%)
RES BW	SPAN	F1 (MHz)	F2 (MHz)	
2 MHz	40 MHz	24.0	56.0	±3.5
1 MHz	20 MHz	32.0	48.0	±3.5
300 kHz	5 MHz	38.0	42.0	±3.5
100 kHz	2 MHz	39.2	40.8	±3.5
30 kHz	500 kHz	39.8	40.2	±3.5
10 kHz	200 kHz	39.92	40.08	±3.5
3 kHz	50 kHz	39.98	40.02	±3.5
1 kHz	20 kHz	39.992	40.008	±3.5
300 Hz	5 kHz	39.998	40.002	±3.5

Table 3-9. 60 dB Bandwidth Measurement Data

Res BW Setting	Span Measurement		60 dB Bandwidth		Selectivity (xx:1)
	Ideal	Actual	Measured	Corrected	
2 MHz	32 MHz	______ MHz	______	______	______
1 MHz	16 MHz	______ MHz	______	______	______
300 kHz	4 MHz	______ MHz	______	______	______
100 kHz	1.6 MHz	______ MHz	______	______	______
30 kHz	400 kHz	______ kHz	______	______	______
10 kHz	160 kHz	______ kHz	______	______	______
3 kHz	40 kHz	______ kHz	______	______	______
1 kHz	16 kHz	______ kHz	______	______	______
300 Hz	4 kHz	______ kHz	______	______	______

Table 2-2. AC Power Cables Available

PLUG TYPE **	CABLE HP PART NUMBER	PLUG DESCRIPTION	CABLE LENGTH CM (INCHES)	CABLE COLOR	FOR USE IN COUNTRY
250V 	8120-1351 8120-1703	Straight* BS1363A 90°	229 (90) 229 (90)	Mint Gray Mint Gray	Great Britain, Cyprus, Nigeria, Singapore, Zimbabwe
250V 	8120-1369 8120-0696	Straight* NZSS198/ASC112 90°	201 (79) 221 (87)	Gray Gray	Argentina, Australia, New Zealand, Mainland China
250V 	8120-1689 8120-1692	Straight* CEE7-Y11 90°	201 (79) 201 (79)	Mint Gray Mint Gray	East and West Europe, Central African Republic, United Arab Republic (unpolarized in many nations)
125V 	8120-1348 8120-1538	Straight* NEMA5-15P 90°	203 (80) 203 (80)	Black Black	United States Canada, Japan (100 V or 200 V), Brazil, Colombia, Mexico, Phillipines, Saudia Arabia, Taiwan
	8120-1378 8120-4753 8120-1521 8120-4754	Straight* NEMA5-15P Straight 90° 90°	203 (80) 230 (90) 203 (80) 230 (90)	Jade Gray Jade Gray Jade Gray Jade Gray	
250V 	8120-5182 8120-5181	Straight* NEMA5-15P 90°	200 (78) 200 (78)	Jade Gray Jade Gray	Israel

* Part number for plug is industry identifier for plug only. Number shown for cable is HP Part Number for complete cable, including plug.

** E = Earth Ground; L = Line; N = Neutral.

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Table 3-6. 3 dB Bandwidth Instrument Settings

HP 8561B Settings		HP 3335A Frequencies		Measurement Uncertainty (%)
RES BW	SPAN	F1 (MHz)	F2 (MHz)	
2 MHz	5 MHz	38.0	42.0	±1.5
1 MHz	2 MHz	39.2	40.8	±1.5
300 kHz	500 kHz	39.8	40.2	±1.5
100 kHz	200 kHz	39.92	40.08	±1.5
30 kHz	50 kHz	39.98	40.02	±1.5
10 kHz	20 kHz	39.992	40.008	±1.5
3 kHz	5 kHz	39.998	40.002	±1.5
1 kHz	2 kHz	39.9992	40.0008	±1.5
300 Hz	500 Hz	39.9998	40.0002	±1.5
100 Hz	200 Hz	39.99992	40.00008	±1.5
30 Hz	100 Hz	39.99996	40.00004	±1.5
10 Hz	100 Hz	39.99996	40.00004	±1.5

Table 3-7. 3 dB Bandwidth Measurement Data

RES BW Setting	Span Measurement		3 dB BW Measurement		3 dB BW Error (%)
	Ideal	Actual	Measured	Corrected	
2 MHz	4 MHz	________ MHz	________	________	________
1 MHz	1.6 MHz	________ MHz	________	________	________
300 kHz	400 kHz	________ kHz	________	________	________
100 kHz	160 kHz	________ kHz	________	________	________
30 kHz	40 kHz	________ kHz	________	________	________
10 kHz	16 kHz	________ kHz	________	________	________
3 kHz	4 kHz	________ kHz	________	________	________
1 kHz	1.6 kHz	________ kHz	________	________	________
300 Hz	400 Hz	________ Hz	________	________	________
100 Hz	160 Hz	________ Hz	________	________	________
30 Hz	80 Hz	________ Hz	________	________	________
10 Hz	80 Hz	________ Hz	________	________	________

Electrostatic Discharge

Electrostatic discharge (ESD) can damage or destroy electronic components. Therefore, all work performed on assemblies consisting of electronic components should be done at a static-free workstation. Figure 2-3 is an example of a static-safe workstation using two kinds of ESD protection which may be used together or separately:

- Conductive table mat and wrist-strap combination.
- Conductive floor mat and heel-strap combination.

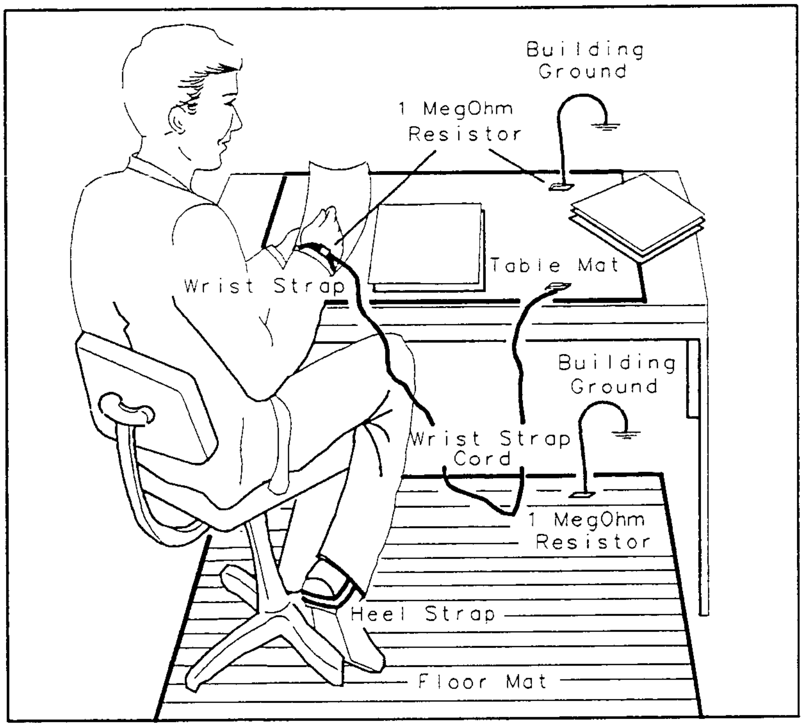

Figure 2-3. Example of a Static-Safe Workstation

Reducing Potential for ESD Damage

Following are suggestions that may help reduce ESD damage that occurs during testing and servicing operations.

- Before connecting any coaxial cable to an analyzer connector for the first time each day, momentarily ground the center and outer connectors of the cable.
- Personnel should be grounded with a resistor-isolated wrist strap before touching the center in of any connector and before removing any assembly from the unit.
- Be sure all instruments are properly earth-grounded to prevent build-up of static discharge.

38. Record the Δ MKR reading as the Measured 60 dB Bandwidth in Table 3-9 for the current RES BW setting.

39. Calculate the Corrected 60 dB Bandwidth as shown below, then record the result in Table 3-9.

    Corrected 60 dB BW = (Actual Span/Ideal Span) × Measured 60 dB BW

    Example:
    RES BW Setting = 1 MHz
    Ideal Span = 16 MHz
    Actual Span = 17 MHz
    Measured 60 dB BW = 9.82 MHz

    Corrected 60 dB BW = (17/16) × 9.82 MHz = 10.43 MHz

40. Record the Corrected 60 dB BW in Table 3-9 for the current RES BW setting.

41. Calculate the Selectivity by dividing the Corrected 60 dB BW by the Corrected 3 dB BW (from Table 3-7), then record the result in Table 3-9.

    Selectivity = Corrected 60 dB BW / Corrected 3 dB BW

    Example:

    Selectivity = 10.43 MHz / 0.9415 MHz = 11.08

42. Press (MKR) **MARKERS OFF** on the spectrum analyzer.

43. Repeat steps 24 through 42 for the remaining RES BW and SPAN settings listed in Table 3-8 and Table 3-9.

Static-Safe Accessories

Table 2-3 lists static-safe accessories that can be obtained from Hewlett-Packard by ordering the HP part numbers shown.

Table 2-2. Static-Safe Accessories

HP Part Number	Description
9300-0797*	set includes: 3M static control mat 0.6 m × 1.2 m (2 ft × 4 ft) and 4.6 cm (15 ft) ground wire. (The wrist-strap and wrist-strap cord are not included. They must be ordered separately.)
9300-0980*	Wrist-strap cord 1.5 m (5 ft)
9300-1383*	Wrist-strap, color black, stainless steel, without cord, has four adjustable links and a 7 mm post-type connection.
9300-1169*	ESD heel-strap (reusable 6 to 12 months).
*Order through any Hewlett-Packard Sales and Service Office.	
92175A **	Black, hard-surface, static control mat, 1.2 m × 1.5 m (4 ft × 5 ft)
92175B **	Brown, soft-surface, static control mat, 2.4 m × 1.2 m (8 ft × 4 ft)
92175C **	Small, black, hard-surface, static control mat, 1.2 m × 0.9 m (4 ft × 3 ft)
92175T **	Tabletop static control mat, 58 cm × 76 cm (23 in × 30 in)
92176A **	Natural color antistatic carpet, 1.8 m × 1.2 m (6 ft × 4 ft)
92176C **	Russet color antistatic carpet, 1.8 m × 1.2 m (6 ft × 4 ft)
92176B **	Natural color antistatic carpet, 2.4 m × 1.2 m (8 ft × 4 ft)
92176D **	Russet color antistatic carpet, 2.4 m × 1.2 m (8 ft × 4 ft)
**Order by calling HP DIRECT Phone (800) 538-8787 or through any Hewlett-Packard Sales and Service Office.	

Turning the Spectrum Analyzer On for the First Time

When you turn your analyzer on for the first time, you should perform the following trace alignment and reference level calibration procedures. The HP-IB address may also be set if needed. Perform the three steps below before continuing with the verification procedures:

1. Press (LINE).
2. The analyzer takes about half a minute to perform a series of self-diagnostic and adjustment routines. At completion, the screen displays the analyzer's model number (HP 8561B) and the firmware date (for example, 890603 indicates June 3, 1989). Record the firmware date here for future reference:

   Today's Date: ____________
   Firmware Date: ____________

   If you should ever need to call Hewlett-Packard for service or have any questions regarding your analyzer, it is helpful to have the firmware date readily available.

Resolution Bandwidth Selectivity

23. Set the spectrum analyzer controls as follows:

    SPAN .... 50 MHz
    RES BW .... 2 MHz
    VIDEO BW .... 300 Hz
    LOG dB/DIV .... 10 dB
    SWEEP .... CONT

24. Set the HP 3335A as follows:

    AMPLITUDE .... −3 dBm
    AMPTD INCR .... 1 dB

25. On the spectrum analyzer, press (CAL) ADJ CURR IF STATE. Wait for the IF ADJUST STATUS: message to disappear before continuing. Press (PEAK SEARCH) (SAVE) SAVE STATE STATE 0, then press (AUTO COUPLE) ALL.
26. Adjust the HP 3335A AMPLITUDE until the spectrum analyzer's MKR amplitude reads 0 dBm ±0.17 dB.
27. Set the HP 3335A (AMPTD INCR) to 60 dB.
28. Set the HP 3335A frequency to F1 as indicated in Table 3-8 for the current spectrum analyzer RES BW setting.
29. Press (PEAK SEARCH) MARKER DELTA on the spectrum analyzer.
30. Set the HP 3335A frequency to F2 as indicated in Table 3-8 for the current spectrum analyzer RES BW setting.
31. Press (PEAK SEARCH) on the spectrum analyzer. Record the Δ MKR frequency as the Actual SPAN Measurement in Table 3-9 for the RES BW setting to be measured.
32. Set the HP 3335A frequency to 40 MHz. Press (AMPLITUDE) (▼).
33. On the spectrum analyzer, press (RECALL) RECALL STATE STATE 0, then press (PEAK SEARCH) MARKER DELTA.
34. On the HP 3335A, press (AMPLITUDE) (▲).
35. On the spectrum analyzer, press (SGL SWP) and wait for the completion of a new sweep.
36. Press (MKR) on the spectrum analyzer. Rotate the knob counterclockwise until the Δ MKR amplitude reads 0 dB ±0.17 dB. The marker should be on the left-hand skirt of the signal. If the marker cannot be set to exactly 0 dB, note whether the marker is just above or just below the actual 60 dB point.
37. Press MARKER DELTA on the spectrum analyzer. Rotate the knob clockwise until the Δ MKR amplitude reads 0 dB ±0.17 dB. The active marker should be on the right-hand skirt of the signal. If the marker was set just above the 60 dB point in the preceding step, set the marker just below the 60 dB point. If the marker was set just below the 60 dB point in the preceding step, set the marker just above the 60 dB point.

3. Allow the analyzer a 5-minute warm up. Refer to the warm up specification in Chapter 1, Table 1-1.

Trace Alignment Procedure

1. Press (PRESET) (CAL) MORE 1 OF 2 CRT ADJ PATTERN.
2. Consider whether the trace alignment needs to be adjusted. If it does, continue with the rest of the procedure; otherwise, press (PRESET) to return to normal operation.
3. Adjust the rear-panel TRACE ALIGN until the leftmost line of the test pattern is parallel with the CRT bezel. See Figure 2-4.
4. Adjust the rear-panel X POSN until the leftmost @ characters and the softkey labels appear just inside the left and right edges of the CRT bezel.
5. Adjust the rear-panel Y POSN until the softkey labels align with the appropriate softkeys.
6. Press (PRESET) to return the analyzer to normal operation.

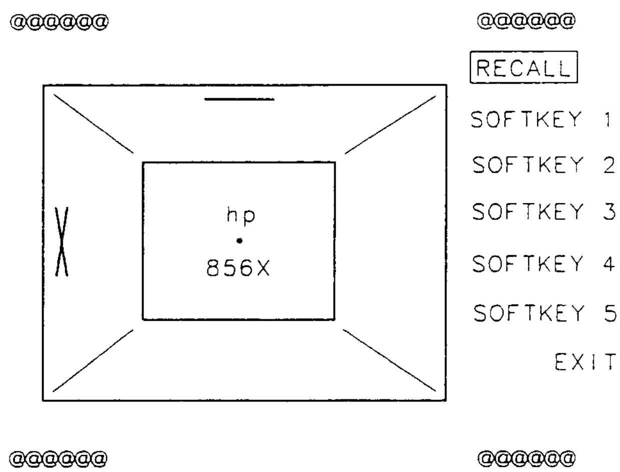

Figure 2-4. CRT Adjustment Pattern

Reference Level Calibration

1. Press (PRESET).
2. Connect a 50Ω coaxial cable (such as HP 10503A) between the front-panel CAL OUTPUT and INPUT 50Ω connectors.
3. Set the analyzer's center frequency to 300 MHz by pressing (FREQUENCY) 300 (MHz).
4. Set the analyzer's span to 20 MHz by pressing (SPAN) 20 (MHz).
5. Press (PEAK SEARCH).
6. Set the analyzer's reference level to −10 dBm by pressing (AMPLITUDE) 10 (−dBm).
7. Press (CAL) REF LVL ADJ .

16. Perform this step for RES BW settings of 100 Hz to 10 Hz.
    a. Press (PEAK SEARCH) **MARKER DELTA** on the spectrum analyzer. Rotate the knob counterclockwise until the Δ MKR amplitude reads −3 dB ±0.017 dB. The marker should be on the left-hand skirt of the signal. If the marker cannot be set exactly to 0 dB, note whether the marker is just above or just below the act: . 3 dB point.
    b. Press **MARKER DELTA** (PEAK SEARCH), then rotate the knob clockwise until the Δ MKR amplitude reads 0 dB ±0.017 dB. The active marker should be on the right-hand skirt of the signal. If the marker was set just above the 3 dB point in step 16a, set the marker just below the 3 dB point. If the marker was set just below the 3 dB point in step 16a, set the marker just above the 3 dB point.
17. Record the Δ MKR reading as the Measured 3 dB Bandwidth in Table 3-7 for the RES BW setting to be measured.
18. Calculate the corrected 3 dB bandwidth as shown below and record the result in Table 3-7.

    Corrected 3 dB BW = (Actual Span / Ideal Span) × Measured 3 dB BW

    Example:

    RES BW Setting = 1 MHz
    Ideal Span = 1.6 MHz
    Actual Span = 1.65 MHz
    Measured 3 dB BW = 913 kHz

    Corrected 3 dB BW = (1.65/1.60) × 913 kHz = 941.5 kHz
19. Record the Corrected 3 dB Bandwidth in Table 3-7.
20. Calculate the 3 dB BW Error shown below and record the result in Table 3-7 for the current RES BW setting.

    3 dB BW Error = 100 × (Corr'd 3 dB BW − RES BW Setting)/RES BW Setting

    Following the example above:

    3 dB BW Error = 100 × (0.9415 MHz − 1.0 MHz RES BW Setting)/1.0 MHz RES BW Setting = −5.85%
21. On the spectrum analyzer, press (MKR) **MARKER NORMAL**.
22. Repeat steps 5 through 21 for the remaining RES BW and SPAN settings listed in Table 3-6 and Table 3-7.

8. Rotate the analyzer's front-panel knob until the marker reads −10.00 dBm ±0.17 dB. There is a slight delay in time between adjusting the knob and the change in marker value. Notice that the displayed REF LEVEL CAL value changes.

9. Press STORE REF LVL .

10. Press (PRESET).

HP-IB Address Selection

1. The HP-IB address for the analyzer is preset at the factory to a decimal value of 18. Valid addresses range from 0 to 30. To view the HP-IB address, press (PRESET) (CONFIG) ANALYZER ADDRESS .

2. To change the address value, enter the new address number using the front-panel data keys. Terminate the entry by pressing a units key. For example, enter an address of 18 by pressing the (PRESET) (CONFIG) ANALYZER ADDRESS 18 (Hz).

3. Press STORE HPIB ADDRESS . The key label changes to read HP-IB ADDRESS once the analyzer address is stored.

4. Press (PRESET) to return the analyzer to normal operation mode.

When the trace alignment and reference level calibration procedures have been completed successfully, the analyzer is ready for normal operation.

Analyzer Servicing

Your spectrum analyzer is built to provide dependable service. If you should encounter problems, desire additional information, or need to order parts, options, or accessories, Hewlett-Packard's worldwide sales and service organization is ready to provide the support you need.

In general, problems are caused by hardware failures, software errors, or user errors. Perform the quick checks listed in "Check the Basics." These checks may eliminate the problem altogether, or may give a clearer idea of its cause. If you have an HP 85629B Test and Adjustment Module, you can use its automatic fault isolation routine. Refer to "Running the Automatic Fault Isolation Routine," in this section.

If the problem is a hardware problem, you have the following options:

- Repair it yourself. Refer to "Service Options," in this section.
- Return the analyzer to Hewlett-Packard for repair:
  - ☐ If the analyzer is still under warranty or covered by an Hewlett-Packard maintenance contract, it is repaired based on the terms of the warranty or maintenance contract (the warranty is printed in the front of this manual).
  - ☐ If the analyzer is no longer under warranty or covered by an Hewlett-Packard maintenance contract, Hewlett-Packard will notify you of the cost of the repair after examining the unit.

Resolution Bandwidth Accuracy (3 dB)

4. Adjust the HP 3335A output amplitude to place the signal two to three divisions (two dB to 3 dB) below the reference level. Set the HP 3335A (AMPTD INCR) to 3 dB.
5. On the spectrum analyzer, press (CAL) ADJ CURR IF STATE. Wait for the IF ADJUST STATUS: message to disappear before continuing. Press (SAVE) SAVE STATE STATE 0, then press (AUTO COUPLE) ALL.
6. Set the HP 3335A frequency to F1 as indicated in Table 3-6 for the analyzer's current RES BW setting.
7. Press (PEAK SEARCH) MARKER DELTA on the spectrum analyzer.
8. Set the HP 3335A frequency to F2 as indicated in Table 3-6 for the analyzer's current RES BW setting.
9. Press (PEAK SEARCH) on the spectrum analyzer. Record the Δ MKR frequency reading as the Actual SPAN Measurement in Table 3-7 for the RES BW setting to be measured. Press (RECALL) RECALL STATE STATE 0.
10. Set the HP 3335A frequency to 40 MHz.

Note Perform steps 11 through 13 only for RES BW settings from 2 MHz to 300 Hz.

11. Press (AMPLITUDE) (▼) on the HP 3335A.
12. On the spectrum analyzer, press (PEAK SEARCH) MARKER DELTA.
13. On the HP 3335A, press (AMPLITUDE) (▲).
14. On the spectrum analyzer, press (SGL SWP) and wait for the completion of a new sweep.
15. Perform this step for RES BW settings of 2 MHz through 300 Hz.
    a. Press (MKR), then rotate the knob counterclockwise until the Δ MKR amplitude reads 0 dB ±0.017 dB. The marker should be on the left-hand skirt of the signal. If the marker cannot be set exactly to 0 dB, note whether the marker is just above or just below the actual 3 dB point.
    b. Press MARKER DELTA (PEAK SEARCH), then rotate the knob clockwise until the Δ MKR amplitude reads 0 dB ±0.017 dB. The active marker should be on the right-hand skirt of the signal. If the marker was set just above the 3 dB point in step 15a, set the marker just below the 3 dB point. If the marker was set just below the 3 dB point in step 15a, set the marker just above the 3 dB point.

Refer to "Calling Hewlett-Packard Sales and Service Offices" and "Returning Your Analyzer for Service" for more information.

Before Calling Hewlett-Packard

Check the Basics

Before calling Hewlett-Packard or returning the analyzer for service, please make the checks listed below. Often problems may be solved by repeating what was being done when the problem occurred. A few minutes spent in performing these simple checks may eliminate waiting for instrument repair.

- Is the analyzer plugged into the proper ac power source? Does the line socket have power?
- Is the rear-panel voltage selector switch set correctly? Is the line fuse good?
- Is the analyzer turned on?
- If other equipment, cables, and connectors are being used with the spectrum analyzer, are they connected properly and operating correctly?
- Review the test procedure that was being used when the problem occurred. Are all the settings correct?
- Is the test that is being performed and the expected results within the specifications and capabilities of the spectrum analyzer? Refer to Table 1-1, "Specifications," and Table 1-2, "Characteristics," in Chapter 1.
- Is the spectrum analyzer displaying an error message? If so, refer to Chapter 5.
- Perform the Trace Alignment and Reference Level Calibration procedures in this chapter. If the necessary test equipment is available, perform the verification tests in Chapter 3. Record all results in Table 3-39, "Performance Test Record."

HP 85629B Test and Adjustment Module

A powerful feature of the Test and Adjustment Module (TAM) is the Automatic Fault Isolation routine. If a problem with the spectrum analyzer is suspected, in most cases Automatic Fault Isolation can determine whether or not a fault exists in the analyzer. There are some problems, such as excessive residual FM, that Automatic Fault Isolation will not be able to detect. As a minimum, the display and keyboard must be operational to execute Automatic Fault Isolation.

Running the Automatic Fault Isolation Routine

To start the Automatic Fault Isolation routine, press (MODULE) and DIAGNOSE. Rotate the front-panel knob until the arrow points to Automatic Fault Isolation. Press EXECUTE. The CAL OUTPUT must be connected to the INPUT 50Ω. A BNC cable and Type N-to-BNC adapter is shipped with each analyzer in the front cover. Press CONTINUE, and the Automatic Fault Isolation routine will begin.

The Automatic Fault Isolation routine will perform checks of five sections of the analyzer. The routine's progress is displayed on the CRT. The routine will stop as soon as it detects a

6. Resolution Bandwidth Accuracy and Selectivity

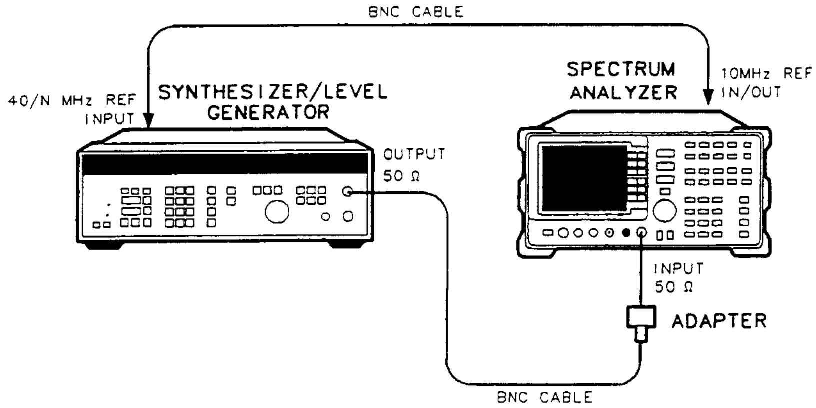

Figure 3-6. Resolution Bandwidth Accuracy and Selectivity Test Setup

Equipment

Synthesizer/Level Generator	HP 3335A
Adapter	
BNC (f) to Type N (m)	1250-1476
Cable	
BNC, 122 cm (48 in.) *(two required)*	HP 10503A

Procedure

1. Connect the equipment as shown in Figure 3-6. The spectrum analyzer provides the frequency reference for the HP 3335A.
2. Set the HP 3335A controls as follows:

   FREQUENCY . . . . 40 MHz
   AMPLITUDE . . . . −5 dBm
   AMPTD INCR . . . . 1 dB

3. On the spectrum analyzer, press (PRESET) (CAL) FULL IF ADJ . Wait for the IF ADJUST STATUS: message to disappear. Press IF ADJ OFF (SAVE) SAVELOCK OFF . Set the controls as follows:

   CENTER FREQ . . . . 40 MHz
   SPAN . . . . 5 MHz
   LOG dB/DIV . . . . 1 dB
   RES BW . . . . 2 MHz
   VIDEO BW . . . . 300 Hz

failure. If no failures are detected, the Automatic Fault Isolation routine will take about 90 seconds to complete.

If a failure is detected, either continue troubleshooting using the service manual or return the analyzer to the nearest HP Service Center as described in "How to Return Your Analyzer for Service." If an HP-IB printer is available and properly connected and configured, a hard-copy printout of the Automatic Fault Isolation results can be obtained by pressing PRINT PAGE. Include a copy of this printout with the analyzer if it is being returned to an Hewlett-Packard Service Center for repair.

Read the Warranty

The warranty for your spectrum analyzer is printed at the front of this manual. Please read it and become familiar with its terms. If your analyzer is covered by a separate maintenance agreement, please be familiar with its terms.

Service Options

Hewlett-Packard offers several maintenance plans to service your analyzer after warranty expiration. Call your Hewlett-Packard Sales and Service Office for full details.

If you want to service the analyzer yourself after warranty expiration, contact your Hewlett-Packard Sales and Service Office to obtain the most current test and maintenance information. A Product Support Kit, HP part number 08562-60021, is also available through the sales and service Office. The kit contains the following accessories:

- PC board prop
- Power Line Switch Assembly
- Power Line Assembly
- SMB cable puller
- Option Module extender cable
- Two test cables, BNC to SMB
- Contact Extractor Tool

Calling Hewlett-Packard Sales and Service Offices

Hewlett-Packard has sales and service offices around the world to provide complete support for your spectrum analyzer. To obtain servicing information or to order replacement parts, contact the nearest Hewlett-Packard Sales and Service Office listed in Table 2-4. In any correspondence or telephone conversations, refer to the analyzer by its model number and full serial number and firmware date recorded under "Turning the Spectrum Analyzer On for the First Time" in this chapter. With this information, the Hewlett-Packard representative can quickly determine whether your unit is still within its warranty period.

Equipment

Synthesizer/Level Generator	HP 3335A
Adapter Type N (m) to BNC (f)	1250-1476
Cable BNC, 122 cm (48 in.) (*2 required*)	HP 10503A

Procedure

1. Connect the equipment as shown in Figure 3-5. The spectrum analyzer provides the frequency reference for the HP 3335A.
2. Set the HP 3335A controls as follows:

   FREQUENCY .... 50 MHz
   AMPLITUDE .... −5 dBm
   AMPTD INCR .... 0.01 dB

3. Press (PRESET) (CAL) FULL IF ADJ on the spectrum analyzer. Wait for the IF ADJUST STATUS: message to disappear, then set the controls as follows:

   CENTER FREQ .... 50 MHz
   SPAN .... 1 MHz
   LOG dB/DIV .... 1 dB
   RES BW .... 300 kHz

4. On the spectrum analyzer, press (CAL) IF ADJ OFF. Press (PEAK SEARCH) (MKR ▸) MARKER ▸ REF LVL. Wait for the completion of a new sweep.
5. Press (PEAK SEARCH) MARKER DELTA.
6. Set the spectrum analyzer controls as follows:

   SPAN .... 10 MHz
   RES BW .... 2 MHz
   VBW/RBWR RATIO 0.100

7. Press (CAL) ADJ CURR IF STATE. Wait for the IF ADJUST STATUS message to disappear.
8. Press (PEAK SEARCH) on the spectrum analyzer.
9. Press (AMPLITUDE) on the HP 3335A, then use the INCR keys to adjust the amplitude until the marker amplitude displayed on the spectrum analyzer reads 0 dB ±0.017 dB.
10. Record the HP 3335A amplitude setting in table Table 3-5.
11. Calculate the amplitude difference by adding 5 dBm to the HP 3335A AMPLITUDE setting. Record the result in the Amplitude Difference column of Table 3-5.

    Amplitude Difference = HP 3335A AMPLITUDE Setting + 5 dBm

12. Repeat steps 6 through 11 for the remaining spectrum analyzer SPAN and RES BW settings in Table 3-5.

Returning Your Analyzer for Service

Service Tag

If you are returning the analyzer to Hewlett-Packard for servicing, fill in and attach a blue service tag. A sheet of service tags is supplied at the rear of this chapter.

Please be as specific as possible about the nature of the problem. Please send a copy of any or all of the following information:

- Any recorded error messages that appeared on the screen.
- A completed Performance Test Record.
- Any other specific data on the performance of the analyzer.

Original Packaging

Before shipping, pack the unit in the original factory packaging materials if they are available. If the original materials are unavailable, identical packaging materials may be acquired through any Hewlett-Packard Sales and Service Office. Descriptions of the packaging materials are listed in the legend for Figure 2-1.

Other Packaging

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

Repackage the analyzer as explained below in the original packaging materials or with commercially available materials described in steps 4 and 5.

1. Attach a completed service tag to the instrument.
2. Install the front-panel cover on the instrument.
3. Wrap the instrument in anti-static plastic to reduce the possibility of damage caused by electrostatic discharge.
4. Use the original materials or a strong shipping container that is double-walled, corrugated cardboard carton with 159 kg (350 lb) bursting strength. The carton must be both large enough and strong enough to accommodate the analyzer and allows at least 3 to 4 inches on all sides of the analyzer for packing material.
5. Surround the equipment with at least three to four inches of packing material, or enough to prevent the equipment from moving in the carton. If packing foam is unavailable, the best alternative is SD-240 Air Cap™ from Sealed Air Corporation (Commerce, CA 90001). Air Cap looks like a plastic sheet covered with 1-1/4 inch air-filled bubbles. Use the pink-colored Air Cap to reduce static electricity. Wrap the equipment several times in this material to both protect the equipment and prevent it from moving in the carton.

5. Resolution Bandwidth Switching and IF Alignment Uncertainty

Specification

Resolution Bandwidth Switching Uncertainty:
<±0.5 dB (referenced to 300 kHz RES BW)

IF Alignment Uncertainty:
<±0.5 dB 300 Hz RES BW only

Related Adjustment

There is no related adjustment procedure for this performance test.

Description

A signal source is applied to the input of the spectrum analyzer and an amplitude reference is set with the RES BW at 300 kHz. At each of the analyzer resolution bandwidth settings, the amplitude of the source is adjusted to place the signal at the analyzer's reference level. The source amplitude is compared with the amplitude at the analyzer's 300 kHz RES BW setting. The difference between the settings equals the RES BW switching uncertainty. For the 300 Hz resolution bandwidth setting, the difference between the settings equals the sum of the RES BW switching uncertainty and the IF alignment uncertainty.

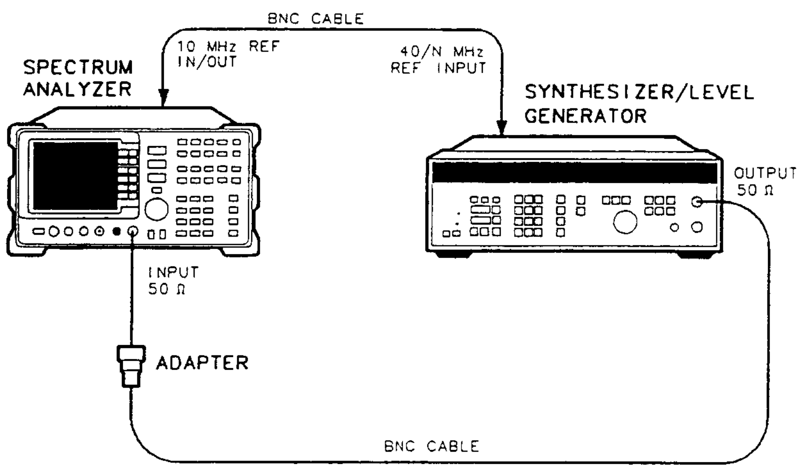

Figure 3-5. Resolution BW Switching and IF Alignment Uncertainty Test Setup

6. Seal the shipping container securely with strong nylon adhesive tape.
7. Mark the shipping container "FRAGILE, HANDLE WITH CARE" to ensure careful handling.
8. Retain copies of all shipping papers.

16. Press (MKR ▶) MARKER ▶ CF. Set the controls as follows:

    SPAN .... 1170 kHz
    RES BW .... 10 Hz
    VIDEO BW .... 1 Hz
    VID AVG .... ON
    TRIG .... CONT

17. Press (TRACE) CLEAR WRITE A. Wait until VAVG 10 is displayed above the graticule.

    Press (SGL SWP) (MKR) MKRNOISE ON. Read the marker amplitude and add 7.7 dB to the reading. Record the results in Table 3-4 as the Displayed Average Noise Level from 1 MHz to 2.9 GHz.

18. If any of the displayed average noise level entries in Table 3-4 are within 1.10 dB of the appropriate specification, repeat steps 5 through 17, setting the number of video averages in step 6 to 100.

19. Set the spectrum analyzer controls as follows:

    START FREQ .... 2.9 GHz
    STOP FREQ .... 6.5 GHz
    MARKERS .... OFF
    RES BW .... 1 MHz
    VIDEO BW .... 10 kHz
    VID AVG .... OFF

20. Repeat steps 15 through 16.

21. Press (TRACE) CLEAR WRITE A. Wait until VAVG 10 is displayed above the graticule. Press (SGL SWP) (MKR) MKRNOISE ON. Read the marker amplitude, add 7.7 dB to the reading, and record the amplitude in Table 3-4 as the displayed average noise level from 2.9 GHz to 6.5 GHz.

Table 3-4. Displayed Average Noise Level

Frequency	Displayed Average Noise Level (dBm)	Specification	Measurement Uncertainty (dB)
50 Hz	__________	<−60	+1.74/−1.98
100 Hz	__________	<−60	+1.74/−1.98
1 kHz	__________	<−85	+1.74/−1.98
10 kHz	__________	<−103	+1.74/−1.98
100 kHz	__________	<−110	+1.74/−1.98
1 MHz to 2.9 GHz	__________	<−130	+1.74/−1.98
2.9 GHz to 6.5 GHz	__________	<−131	+1.74/−1.98

Table 2-3. Hewlett-Packard Sales and Service Offices

US FIELD OPERATIONS HEADQUARTERS
Hewlett-Packard Company
19320 Pruneridge Avenue
Cupertino, CA 95014, USA
(408) 973-1919

California
Hewlett-Packard Co.
1421 South Manhattan Ave.
Fullerton, CA 92631
(714) 999-6700

Hewlett-Packard Co.
301 E. Evelyn
Mountain View, CA 94041
(415) 694-2000

Colorado
Hewlett-Packard Co.
24 Inverness Place, East
Englewood, CO 80112
(303) 649-5000

Georgia
Hewlett-Packard Co.
2000 South Park Place
Atlanta, GA 30339
(404) 955-1500

Illinois
Hewlett-Packard Co.
5201 Tollview Drive
Rolling Meadows, IL 60008
(708) 255-9800

New Jersey
Hewlett-Packard Co.
120 W. Century Road
Paramus, NJ 07653
(201) 599-5000

Texas
Hewlett-Packard Co.
930 E. Campbell Rd.
Richardson, TX 75081
(214) 231-6101

EUROPEAN OPERATION HEADQUARTERS
Hewlett-Packard S.A.
150, Route du Nant-d'Avril
1217 Meyrin 2/Geneva
Switzerland
(41 22) 780.8111

France
Hewlett-Packard France
1 Avenue Du Canada
Zone D'Activite De Courtaboeuf
F-91947 Les Ulis Cedex
France
(33 1) 69 82 60 60

Germany
Hewlett-Packard GmbH
Berner Strasse 117
6000 Frankfurt 56
West Germany
(49 69) 500006-0

Great Britain
Hewlett-Packard Ltd.
Eskdale Road, Winnersh Triangle
Wokingham, Berkshire RG11 5DZ
England
(44 734) 696622

INTERCON OPERATIONS HEADQUARTERS
Hewlett-Packard Company
3495 Deer Creek Rd.
Palo Alto, California 94304-1316
(415) 857-5027

Australia
Hewlett-Packard Australia Ltd.
31-41 Joseph Street
Blackburn, Victoria 3130
(61 3) 895-2895

Canada
Hewlett-Packard (Canada) Ltd.
17500 South Service Road
Trans-Canada Highway
Kirkland, Quebec H9J 2X8
Canada
(514) 697-4232

Japan
Yokogawa-Hewlett-Packard Ltd.
1-27-15 Yabe, Sagamihara
Kanagawa 229, Japan
(81 427) 59-1311

People's Republic of China
China Hewlett-Packard, Ltd.
38 Bei San Huan X1 Road
Shuang Yu Shu
Hai Dian District
Beijing, China
(86 1) 256-6888

Singapore
Hewlett-Packard Singapore
Pte. Ltd.
1150 Depot Road
Singapore 0410
(65) 273 7388

Taiwan
Hewlett-Packard Taiwan
8th Floor, H-P Building
337 Fu Hsing North Road
Taipei, Taiwan
(886 2) 712-0404

Note

Adding 7.7 dB to the reading accounts for the noise marker's normalization to a 1 Hz bandwidth and the corrections for the log amplifiers and envelope detector.

7. Press (MKR) 100 (Hz). Read the marker amplitude. Add 7.7 dB to the marker amplitude (displayed in dBm/Hz) and record the result in Table 3-4 as the Displayed Average Noise Level at 100 Hz.
8. Press (MKR) 1 (kHz) (the displayed marker frequency will be 999 Hz). Read the marker amplitude. Add 7.7 dB to the marker amplitude (displayed in dBm/Hz) and record the result in Table 3-4 as the Displayed Average Noise Level at 1 kHz.
9. Set the spectrum analyzer controls as follows:

   SPAN .... 1170 Hz
   REF LVL .... −50 dBm
   CENTER FREQ .... 10 kHz
   MARKERS .... OFF
   TRIG .... CONT

10. Press (TRACE) CLEAR WRITE A . Wait until VAVG 10 is displayed above the graticule. Press (SGL SWP) (MKR) MKRNOISE ON . Read the marker amplitude. Add 7.7 dB to the marker amplitude (displayed in dBm/Hz) and record the result in Table 3-4 as the Displayed Average Noise Level at 10 kHz.
11. Set the spectrum analyzer controls as follows:

    CENTER FREQ .... 99 kHz
    MARKERS .... OFF
    TRIG .... CONT

Note

A residual response exists at 100 kHz. Tuning to 99 kHz avoids this response's being displayed, while yielding a conservative estimate of the displayed average noise reading.

12. Press (TRACE) CLEAR WRITE A . Wait until VAVG 10 is displayed above the graticule. Press (SGL SWP) (SGL SWP) (MKR) MKRNOISE ON . Read the marker amplitude and add 7.7 dB to the reading.
13. Record the results in Table 3-4 as the Displayed Average Noise Level at 100 kHz.
14. Set the spectrum analyzer controls as follows:

    START FREQ .... 1 MHz
    STOP FREQ .... 2.9 GHz
    MARKERS .... OFF
    RES BW .... 1 MHz
    VIDEO BW .... 10 kHz
    VID AVG .... OFF

15. Press (SGL SWP) and wait for a new sweep to finish. Press (MKR) MKRNOISE ON PEAK SEARCH .

3

Performance Tests

What You'll Find in This Chapter

This chapter contains procedures that test the electrical performance of the spectrum analyzer against the specifications listed in Table 1-1. None of the test procedures requires removing the cover of the instrument. This chapter also provides instructions for using the HP 85629B Test and Adjustment Module functional tests.

What Is Performance Verification?

The highest-level testing, called **performance verification**, verifies that the analyzer's performance meets all specifications in Chapter 1, Table 1-1. It is time-consuming and requires extensive test equipment. Performance verification consists of all performance tests. Table 3-1 is a complete listing of those tests.

Note

Specifications included with each test description are approximate. Refer to Table 1-1 in Chapter 1 for exact specifications.

Performance Tests versus Operation Verification

Operation verification tests are a subset of performance tests and checks only the most critical specifications of the analyzer. These tests require much less time and equipment to run than do the complete performance verification test procedures. They are recommended for verification of overall instrument operation, either as part of incoming inspection or after repair. In Chapter 4, "Operation Verification," Table 4-1 lists the performance tests and test equipment used for operation verification.

Equipment

50Ω Termination	HP 908A
Adapter Type N (m) to BNC (f)	1250-1476
Cable BNC, 122 cm (48 in.)	HP 10503A

Procedure

Displayed Average Noise

1. Connect CAL OUTPUT to INPUT 50Ω. On the spectrum analyzer, press (PRESET). Set the controls as follows:

   SPAN .... 100 Hz
   CENTER FREQ .... 300 MHz
   REF LVL .... −10 dBm
   ATTEN .... 0 dB
   LOG dB/DIV .... 1 dB
   RES BW .... 10 Hz
   VIDEO BW .... 1 Hz

2. Press (PEAK SEARCH) (CAL) REF LVL ADJ .
3. Use the knob or step keys to adjust the REF LVL CAL value until the MKR amplitude reading is −10.00 dBm ±0.17 dB.
4. Connect the HP 908A 50Ω termination to the spectrum analyzer INPUT 50Ω as shown in Figure 3-4.
5. Set the spectrum analyzer controls as follows:

   SPAN .... 1170 Hz
   LOG dB/DIV .... 10 dB
   CENTER FREQ .... 500 Hz
   MARKERS .... OFF

6. Press (BW) VID AVG ON 10 (Hz). Press (TRACE) CLEAR WRITE A . Wait until VAVG 10 is displayed above the graticule. Press (SGL SWP) (MKR) 50 (Hz) MKRNOISE ON .Read the marker amplitude. Add 7.7 dB to the marker amplitude (displayed in dBm/Hz) and record the result in Table 3-4 as the Displayed Average Noise Level at 50 Hz.

   Example:

   If the marker amplitude reads −85 dBm/Hz:
   Displayed Average Noise Level = −85 dBm/Hz + 7.7 dB = −77.3 dBm.

Table 3-1. Performance Tests

Test Number	Test Name
1	10 MHz Reference Output Accuracy
2	10 MHz Reference Output Accuracy (Option 003)
3	Calibrator Amplitude Accuracy
4	Displayed Average Noise Level
5	Resolution Bandwidth Switching and IF Alignment Uncertainty
6	Resolution Bandwidth Accuracy and Selectivity
7	Input Attenuator Switching Uncertainty
8	IF Gain Uncertainty
9	Scale Fidelity
10	Residual FM
11	Noise Sidebands
12	Image, Multiple, Out-of-Band, and Out-of-Range Responses
13	Frequency Readout Accuracy/Frequency Count Marker Accuracy
14	Pulse Digitization Uncertainty
15	Second Harmonic Distortion
16	Frequency Response
17	Frequency Span Accuracy
18	Third Order Intermodulation Distortion
19	Gain Compression
20	1ST LO OUTPUT Amplitude
21	Sweep Time Accuracy
22	Residual Responses
23	IF Input Amplitude Accuracy

4. Displayed Average Noise Level

Specification

Frequency	Average Noise Level
50 Hz	−60 dBm
100 Hz	−60 dBm
1 kHz	−85 dBm
10 kHz	−103 dBm
100 kHz	−110 dBm
1 MHz to 2.9 GHz	−130 dBm

Related Adjustment

Frequency Response Adjustment

Description

This test measures the displayed average noise level. The spectrum analyzer's input is terminated in 50Ω. The test first measures the average noise at discrete frequencies in a narrow span. Then the test tunes the analyzer frequency across the band, using the marker to locate the frequency with the highest response, and reads the average noise in a narrow span.

The noise marker is used to average several points around the frequency of interest. The noise marker automatically normalizes to a 1 Hz noise bandwidth and adds amplitude corrections, log amplifier response, and envelope detector response. These corrections are not necessary and must be subtracted out to determine the displayed average noise level.

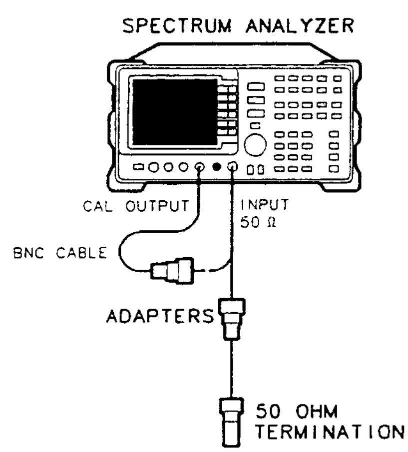

Figure 3-4. Displayed Average Noise Test Setup

Before You Start

There are three things you must do *before* starting performance verification or operation verification:

1. Switch the analyzer on and let it warm up in accordance with warm-up specifications in Table 1-1.
2. After the analyzer has warmed up as specified, perform "Trace Alignment Procedure and Reference Level Calibration" in Chapter 2, "Preparation."
3. Read the rest of this section before you start any of the tests.

Test Equipment You'll Need

Table 3-3 lists the recommended test equipment for the performance tests. Any equipment that meets the critical specifications given in the table can be substituted for the recommended model(s). The table also lists the recommended equipment for the analyzer's adjustment procedures, which are located in the Service Manual.

Recording Test Results

Record test results in the Performance Test Record located at the end of this chapter. The table lists test specifications and acceptable limits. We recommend that you make a copy of this table, record the complete test results on the copy, and keep the copy for your calibration test record. This record could prove invaluable in tracking gradual changes in test results over long periods of time.

If the Analyzer Doesn't Meet Specifications

If the analyzer doesn't meet one or more of the specifications during testing, complete any remaining tests and record all test results on a copy of the test record. Refer to Chapter 5, "Error Messages," for instructions on how to solve the problem. If an error message is displayed, press (PRESET) (CAL), and select REALIGN LO & IF. If the error message persists after the automatic RF, LO, and IF adjustments are completed, refer to Chapter 5.

Calibration Cycle

The Performance Tests should be used to check the analyzer against its specifications, listed in Table 1-1, every 12 months.

Procedure

1. Zero the HP 8902A and calibrate the HP 8482A Power Sensor at 300 MHz as described in the *HP 8902A Operation Manual*. Enter the power sensor's 300 MHz calibration factor into the HP 8902A.
2. Connect the power sensor through an adapter directly to the CAL OUTPUT connector, as illustrated in Figure 3-3. Read the power meter display.

Calibrator Amplitude:____________________dBm

HP 85629B Functional Tests

The HP 85629B Test and Adjustment Module (TAM) can be used to perform several automatic functional tests on the spectrum analyzer. These tests provide increased confidence in analyzer operation while requiring very little equipment or operator attention. Hard-copy results are possible with an HP-IB printer. Because these functional tests have greater measurement uncertainties than their related performance tests, they should not be used as part of a calibration. The greater measurement uncertainties in the functional tests are a result of the limited set of test equipment.

Table 3-2 lists the functional tests, their corresponding performance tests, and the types of test equipment required for each test. The recommended test equipment for the functional tests is indicated in Table 3-3 by the letter "M" in the "Use" column.

Spectrum-Analyzer/TAM Compatibility

An HP 85629B Firmware Note, HP part number 85629-90030, supplied with each spectrum analyzer and TAM, provides compatability information. Refer to this note to determine which tests are valid for a particular version of TAM firmware.

Table 3-2. TAM Functional Tests

Functional Tests	Corresponding Performance Test	Equipment Required
Noise Sidebands	11	None
Residual FM	10	None
IF Gain Uncertainty	8	Source
Scale Fidelity	9	Source
Input Attenuator Accuracy	7	Source
Frequency Marker Accuracy	13	Source
Image, Multiple, and Out-of-Range Responses	12	Source
RES BW Accuracy and Selectivity	5, 6	Source
2nd Harmonic Distortion	15	Source, 50 MHz LPF
Frequency Span Accuracy	17	Source
Gain Compression	19	Source
Third Order Intermodulation Distortion	18	Source
Frequency Response	16	Source, Power Meter
1ST LO OUTPUT Amplitude	20	Power Meter
Displayed Average Noise	4	50Ω Termination
Residual Responses	22	50Ω Termination

3. Calibrator Amplitude Accuracy

Specification

Amplitude: −10 dBm ±0.3 dB

Related Adjustment

Calibrator Amplitude Adjustment

Description

The amplitude accuracy of the analyzer's CAL OUTPUT signal is checked for −10 dBm ±0.3 dB. Performing the appropriate 10 MHz Reference Output Accuracy test is sufficient for checking the calibrator frequency accuracy, since the calibrator frequency is a function of the 10 MHz reference.

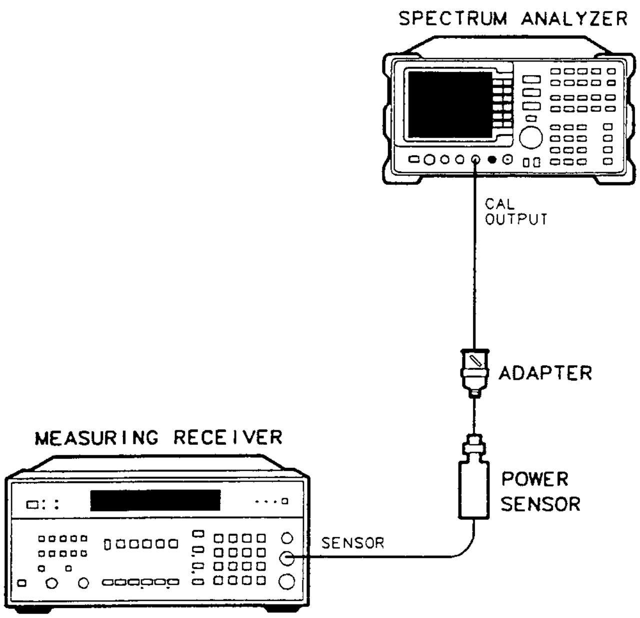

Figure 3-3. Calibrator Accuracy Test Setup

Equipment

Measuring Receiver	HP 8902A
Power Sensor	HP 8482A
Adapter	
Type N (f) to BNC (m)	1250-1477

Running the Functional Tests

Connect the TAM to the rear panel of the spectrum analyzer. The instrument should be allowed to warm up for at least 5 minutes before running any functional test. Perform the following steps to run the tests:

Caution The spectrum analyzer power must be turned OFF before removing or installing a TAM or any option module. If the analyzer is powered ON during removal or installation, damage will result.

1. Perform a REF LVL CAL (reference level calibration), as described in Chapter 2, before continuing.
2. Press (MODULE) to access the TAM's main menu. If any error message appears, refer to the "Error Messages" section of the *Test and Adjustment Module Supplement*. Error messages are displayed either in one of the corners of the screen, at the bottom line of the main menu, or in the active function block.
3. Press `Config` to access the configuration menu. Verify that the TAM is properly configured and the test equipment is properly connected to HP-IB. Refer to the "System Configuration Menu" section of the *Test and Adjustment Module Supplement* for more configuration information. If a printer is configured and available, functional test results may be sent to the printer instead of the screen. If everything is properly configured, return to the main menu and press `Test`.
4. Pressing `All Test` executes all the tests listed in the order they appear. To perform an individual test, rotate the knob to locate the arrow beside the desired test. Press `Execute`.
5. Use the `Repeat` operation to find suspected intermittent problems. If an HP-IB printer is configured and connected, `Repeat` activates the selected test continuously until you press `ABORT`. The results are sent to the printer. If a printer is unavailable, the `Repeat` mode pauses at the end of each test to display test results, then continues after you press `RETURN`. This sequence continues until you press `ABORT`.

13. Wait at least two gate times for the frequency counter to settle. Record the frequency counter reading below as reading #3 with 0.001 Hz resolution.

Reading #3: ________________ Hz

14. Calculate the 5-minute warm-up error by subtracting reading #3 from reading #1 and dividing the result by 10 MHz.

5-minute warm-up error = (Reading #1 − Reading #3)/1×10^7 Hz

5-Minute Warm-up Error: ________________

15. Calculate the 15-minute warm-up error by subtracting reading #3 from reading #2 and dividing the result by 10 MHz.

15-minute warm-up error = (Reading #2 − Reading #3)/1×10^7 Hz

15-Minute Warm-up Error: ________________

Table 3-3. Recommended Test Equipment

Equipment	Critical Specifications	Recommended Model	Use*
Spectrum Analyzer	Frequency Range: 4 kHz to 7 GHz Typical Residual FM: <1 Hz pk-to-pk in 20 ms	HP 8566A/B	P, A, T
Synthesized Sweeper *(two required)*	Frequency Range: 10 MHz to 12 GHz Frequency Accy (CW): 1×10^{-9}/day Leveling Modes: Internal and External Modulation Modes: AM and Pulse Power Level Range: −35 dBm to +16 dBm	HP 8340A/B†	P, A, M, T, V
Synthesizer/Level Generator	Frequency Range: 200 Hz to 80 MHz Frequency Accy: 1×10^{-7}/mo Flatness: ±0.15 dB Attenuator Accuracy: <±0.09 dB	HP 3335A†	P, M, T, V
Synthesized Signal Generator	Frequency Range: 100 kHz to 2.5 GHz Residual SSB Phase Noise at 10 kHz offset (320 MHz < fc < 640 MHz): <−131 dBc/Hz	HP 8663A	P, V
Pulse/Function Generator	Frequency Range: 10 kHz to 50 MHz Pulse Width: 200 ns Output Amplitude: 5 V pk-to-pk Functions: Pulse and Triangle TTL Sync Output	HP 8116A	P
AM/FM Signal Generator	Frequency Range: 1 MHz to 200 MHz Frequency Modulation Mode Modulation Oscillator Frequency: 1 kHz FM Peak Deviation: 5 kHz	HP 8640B	A
Microwave Frequency Counter	Frequency Range: 9 MHz to 22 GHz Timebase Accy (Aging): $<5 \times 10^{-10}$/day External Frequency Reference Input	HP 5343A Option 001	P, A, M, V

* P=Performance Tests; A=Adjustments; M=Test and Adjustment Module; T=Troubleshooting; V=Operation Verification
† Part of Microwave Workstation

3. Set the frequency counter controls as follows:

   FUNCTION/DATA .... FREQ A
   INPUT A
   ×10 ATTN .... OFF
   AC .... OFF
   50Ω .... OFF
   AUTO TRIG .... ON
   100 kHz FILTER A .... OFF

4. On the frequency counter, select a 10-second gate time by pressing (GATE TIME) 10 (GATE TIME). Offset the displayed frequency −10 MHz by pressing MATH (SELECT/ENTER) (CHS/EEX) 10 (CHS/EEX) 6. Press (SELECT/ENTER) and (SELECT ENTER). The frequency counter should now display the difference between the INPUT A signal and 10.0 MHz with 0.001 Hz resolution.
5. Perform the next step *5 minutes* after the power-on time recorded in step 2.
6. Wait at least two gate times for the frequency counter to settle. Record the frequency counter reading below as reading #1 with 0.001 Hz resolution.

   Reading #1: ______________ Hz

7. Proceed with the next step *15 minutes* after the power-on time recorded in step 2.
8. Record the frequency counter reading below as reading #2 with 0.001 Hz resolution.

   Reading #2: ______________ Hz

9. Perform the next step 60 minutes after the power-on time recorded in step 2. During this waiting period, other performance tests may be executed, under the following conditions:
   a. The analyzer is powered on at all times.
   b. The analyzer is always at room temperature.
   c. The analyzer is never placed in EXT REFERENCE mode.
10. Connect the equipment as shown in Figure 3-2.
11. Set the frequency counter controls as follows:

   FUNCTION/DATA .... FREQ A
   INPUT A
   ×10 ATTN .... OFF
   AC .... OFF
   50Ω .... OFF
   AUTO TRIG .... ON
   100 kHz FILTER A .... OFF

12. On the frequency counter, select a 10-second gate time by pressing (GATE TIME) 10 (GATE TIME). Offset the displayed frequency −10 MHz by pressing MATH (SELECT/ENTER) (CHS/EEX) 10 (CHS/EEX) 6. Press (SELECT/ENTER) and (SELECT/ENTER). The frequency counter should now display the difference between the INPUT A signal and 10.0 MHz with 0.001 Hz resolution.

Table 3-3. Recommended Test Equipment (continued)

Equipment	Critical Specifications	Recommended Model	Use*
Frequency Counter	Frequency Range: 100 Hz to 10 MHz Resolution: 1 mHz (for Option 003 Only) External Frequency Reference Input Modes: TI A ▶ B, Frequency Count Time Interval Measurement Range: 45 μs to 120 s Timebase Accuracy: <3 × 10^7/mo	HP 5334A/B	P
Oscilloscope	Bandwidth (3 dB): dc to 100 MHz Minimum Vertical Deflection Factor: ≤2 mV/div	HP 1980A/B†	A
Measuring Receiver	Compatible with Power Sensors dB Relative Mode Resolution: 0.01 dB Reference Accuracy: <±1.2%	HP 8902A†	P, A, M, T, V
Power Sensor	Frequency Range: 250 MHz to 350 MHz Power Range: 100 nW to 10 μW Maximum SWR: 1.15 (250 to 350 MHz)	HP 8484A	P, A
Power Sensor	Frequency Range: 100 kHz to 2.9 GHz Maximum SWR: 1.1 (1 MHz to 2.0 GHz) Maximum SWR: 1.30 (2.0 GHz to 2.9 GHz)	HP 8482A†	P, A, T, M, V
Power Sensor	Frequency Range: 50 MHz to 12 GHz Maximum SWR: 1.15 (50 to 100 MHz) Maximum SWR: 1.10 (100 MHz to 2 GHz) Maximum SWR: 1.15 (2.0 to 12.4 GHz)	HP 8485A†	P, A, T, M, V
Amplifier	Frequency Range: 2.0 to 7.0 GHz Minimum Output Power (Leveled): 2.0 to 7.0 GHz: +16 dBm Output SWR (Leveled): <1.7	HP 11975A	P

* P=Performance Tests; A=Adjustments; M=Test and Adjustment Module; T=Troubleshooting; V=Operation Verification
† Part of Microwave Workstation

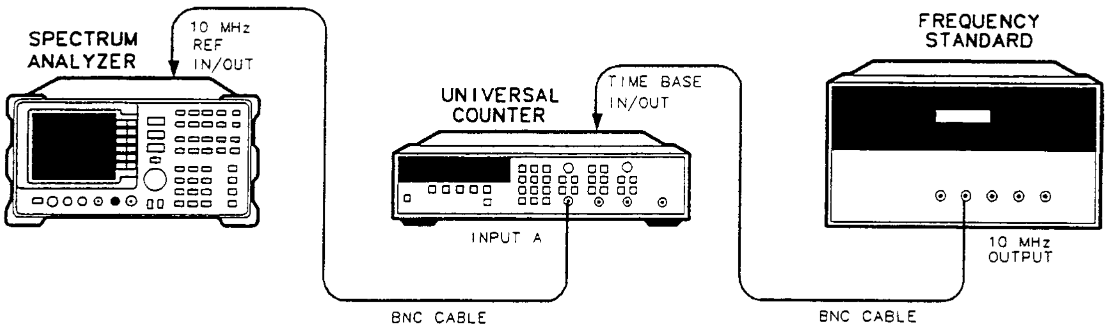

Figure 3-2. Frequency Reference Accuracy (Option 003) Test Setup

Equipment

Microwave Frequency Counter	HP 5334A/B
Frequency Standard External	HP 5061B Cesium Beam Standard (or any 10 MHz frequency standard with aging rate $<\pm 1 \times 10^{-10}$ per day)
Cable	
BNC, 122 cm (48 in.) (*2 required*)	HP 10503A

Procedure

Note To simulate a cold start adequately, the spectrum analyzer must have been allowed to sit at room temperature, with power off, at least 60 minutes before beginning this test.

1. After a 60 minute cool-down with power off, connect the equipment as shown in Figure 3-2.
2. Set the spectrum analyzer line switch on. Record the power-on time below. If an X is displayed to the left side of the display, press (PRESET), then record the current time as the power-on time. An X denotes that the analyzer is in external frequency reference mode (internal oscillator is turned off). Pressing (PRESET) sets the analyzer to the internal frequency reference.

Power-On Time (hours/minutes/seconds): ________________

Table 3-3. Recommended Test Equipment (continued)

Equipment	Critical Specifications	Recommended Model	Use*
Digital Voltmeter	Range: −15 V dc to +120 V dc Accuracy: <±1 mV on 10 V Range Input Impedance: ≥1 MΩ	HP 3456A†	A
DVM Test Leads	≥36 inches long, alligator clips, probe tips	HP 34118A	A, T
Power Supply	Output Voltage: ≥24 V dc Output Voltage Accuracy: <±0.2 V	HP 6114A	A
10 dB Step Attenuator	Attenuation Range: 30 dB Frequency Range: dc to 80 MHz Connectors: BNC female	HP 355D	P, V
1 dB Step Attenuator	Attenuation Range: 12 dB Frequency Range: dc to 80 MHz Connectors: BNC female	HP 355C	P, V, A
20 dB Fixed Attenuator	Attenuation Accy: <±1 dB Frequency Range: dc to 7 GHz Maximum SWR: 1.2 (dc to 7 GHz)	HP 8491B Option 020	P, V
10 dB Fixed Attenuator	Attenuation Accy: <±0.6 dB Frequency Range: dc to 7 GHz Maximum SWR: 1.2 (dc to 7 GHz)	HP 8491B Option 010	P, V
10 dB Fixed Attenuator	Attenuation Accy: <±0.3 dB Frequency Range: dc to 2.9 GHz Maximum SWR: 1.25 (dc to 2.9 GHz)	HP 8493C Option 010	P, V
Signature Multimeter	Clock Frequency >10 MHz	HP 5005A/B	T
Reference Attenuator	Supplied with HP 8484A	HP 11708A	P, A

* P=Performance Tests; A=Adjustments; M=Test and Adjustment Module; T=Troubleshooting; V=Operation Verification

2. 10 MHz Reference Output Accuracy (Option 003)

(This test is for **Option 003** analyzers only.)

Specification

Aging: $<\pm 1 \times 10^{-7}$/year

Warm-up (Characteristic):

After 5 minutes from cold start * $<\pm 1 \times 10^{-7}$ of final stabilized frequency †
After 15 minutes from cold start * $<\pm 1 \times 10^{-8}$ of final stabilized frequency †

Related Adjustment

10 MHz Frequency Reference Adjustment (Option 003)

Description

This test measures the warm-up characteristics of the 10 MHz reference oscillator. The ability of the 10 MHz oscillator to meet its warm-up characteristics gives a high level of confidence that it also meets its yearly aging specification.

The analyzer is cooled for 60 minutes. A frequency counter connected to the 10 MHz REF IN/OUT, then a frequency measurement is made 5 minutes after turning the analyzer on. The frequency measurement is recorded. Another frequency measurement is made 10 minutes later (15 minutes after turning the analyzer on) and the measurement is recorded. A final frequency measurement is made 60 minutes after power is applied. The difference between each of the first two measurements and the final measurement is calculated. The results are recorded.

* A cold start is defined as the analyzer's being powered ON after being off for at least 60 minutes.
† The final stabilized frequency is the frequency 60 minutes after the analyzer has been powered on.

Table 3-3. Recommended Test Equipment (continued)

Equipment	Critical Specifications	Recommended Model	Use*
Termination	Frequency Range: dc to 7 GHz Impedance: 50Ω Maximum SWR: <1.22 Connector: APC 3.5	HP 909D	P, M, V
Blocking Capacitor	Frequency Range: 4 kHz to 1 MHz Impedance: 50Ω nominal	08553-60169	P
Low Pass Filter	Cutoff Frequency: 50 MHz Rejection at 80 MHz: >50 dB	0955-0306	P, M, V
Low Pass Filter	Cutoff Frequency: 12 MHz Rejection at 18 MHz: >45 dB 0.1 dB ripple	0955-0518	P
Low Pass Filter *(two required)*	Cutoff Frequency: 4.4 GHz Rejection at 5.5 GHz: >50 dB	HP 11689A	P, V
Directional Bridge	Frequency Range: 5 MHz to 80 MHz Coupling: 6 dB Directivity: >30 dB Insertion Loss: 6 dB (nominal)	HP 8721A	P
Directional Coupler	Frequency Range: 1.7 to 7 GHz Coupling: 16.0 dB (nominal) Max. Coupling Deviation: ±1 dB Directivity: 14 dB minimum Flatness: 0.75 dB maximum VSWR: <1.45 Insertion Loss: <1.3 dB	0955-0125	P
Power Splitter	Frequency Range: 1 kHz to 12 GHz Insertion Loss: 6 dB (nominal) Output Tracking: <0.25 dB Equivalent Output SWR: <1.22	HP 11667B	P, A, M, V

* P=Performance Tests; A=Adjustments; M=Test and Adjustment Module; T=Troubleshooting; V=Operation Verification

Procedure

1. Connect the equipment as shown in Figure 3-1.
2. Set the HP 5343A controls as follows:

SAMPLE RATE .... midrange
50Ω—1 MΩ SWITCH 50Ω
10 Hz—500 MHz/500 MHz—26.5 GHz SWITCH .... 10 Hz—500 MHz

---

Note The HP 5343A should have either an Option 001 timebase or should be connected to a house standard with an aging rate better than 5×10^{-10}/day.

---

3. On the spectrum analyzer, press (PRESET).

Note The spectrum analyzer must be allowed to warm up for at least 5 minutes with the frequency reference set to INTERNAL. If the spectrum analyzer is warmed up with the frequency reference set to EXTERNAL, wait at least 5 minutes after pressing (PRESET) before proceeding with step 4.

---

4. Wait for the frequency counter to settle. This may take two or three gate times.
5. Read the frequency counter display.

Calibrator Frequency: ____________________

Note The frequency reading is invalid if any error message is displayed, especially a synthesizer-related error message. Error messages are listed in Chapter 5 of this manual.

Table 3-3. Recommended Test Equipment (continued)

Equipment	Critical Specifications	Recommended Model	Use*
Service Accessory Kit	No Substitute	08562-60021	A
Adapter	Type N (f) to BNC (m)	1250-1477	A
Adapter *(three required)*	Type N (m) to BNC (f)	1250-1476	P, A, M, V
Adapter	Type N (f) to APC 3.5 (m)	1250-1750	A
Adapter *(two required)*	Type N (m) to SMA (f)	1250-1250	P, V
Adapter *(two required)*	Type N (m) to APC 3.5 (m)	1250-1743	P, A, M, V
Adapter	Type N (m) to APC 3.5 (f)	1250-1744	P, V, A
Adapter	Type N (f) to BNC (f)	1250-1474	P, V
Adapter	Type N (f) to SMA (f)	1250-1772	P, A
Adapter	BNC (f) to BNC (f)	1250-0059	A
Adapter	BNC Tee (f) (m) (f)	1250-0781	P, A, M, V
Adapter	BNC (f) to SMA (m)	1250-1200	P, A, V
Adapter *(two required)*	Type N (f) to APC 3.5 (f)	1250-1745	P, V

* P=Performance Tests; A=Adjustments; M=Test and Adjustment Module; T=Troubleshooting; V=Operation Verification

1. 10 MHz Reference Output Accuracy (Non-Option 003)

(This test is for analyzers not equipped with Option 003.)

Note If the spectrum analyzer is equipped with Option 003, do not perform this test. Instead, perform Test 2 in this chapter, "10 MHz Reference Output Accuracy (Option 003)."

Specification

Frequency: $<\pm 4 \times 10^{-6}$/year

Related Adjustment

10 MHz Frequency Reference Adjustment (TCXO)

Description

The 300 MHz CAL OUTPUT signal is measured to verify the 10 MHz reference signal accuracy. The CAL OUTPUT signal uses the 10 MHz signal as a reference. Measuring the CAL OUTPUT signal yields higher resolution than measuring the 10 MHz reference directly.

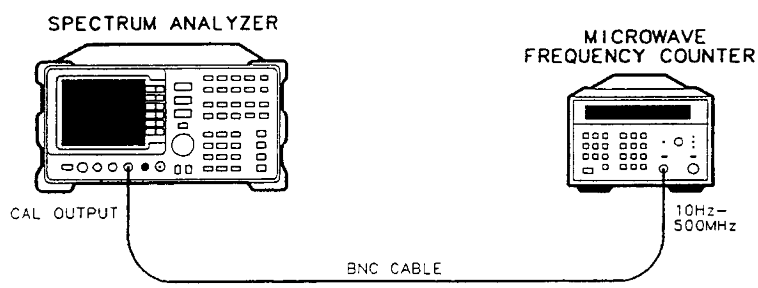

Figure 3-1. Frequency Reference Accuracy Test Setup (Non-Option 003)

Equipment

Microwave Frequency Counter	HP 5343A
Cable	
BNC, 122 cm (48 in.)	HP 10503A

Table 3-3. Recommended Test Equipment (continued)

Equipment	Critical Specifications	Recommended Model	Use*
Adapter *(two required)*	APC 3.5 (f) to APC 3.5 (f)	5061-5311	P, A, M, V
Adapter	BNC (f) to Dual Banana Plug	1251-2816	A
Cable	RG-214/U with Type N (m) connectors Length: ≥36 in	HP 11500A	P, V
Cable *(five required)*	48 in, 50Ω, coaxial cable with BNC (m) connectors on both ends	HP 10503A	P, A, V
Cable *(two required)*	Frequency Range: 1 kHz to 12 GHz Maximum SWR: <1.4 at 12 GHz Length: ≥91 cm (36 in.) Connectors: APC 3.5 (m), both ends Maximum Insertion Loss: 2 dB	8120-4921	P, A, M, V
Cable *(12 required)*	HP-IB (required for using Operation Verification Software and using HP 85629B TAM) Length: 2 m (6.6 ft)	HP 10833B	P, A, M
Test Cable	Connectors: BNC (m) to SMB (f) Length: ≥61 cm (24 in.)	85680-60093	A, M
Controller	Required for using Operation Verification Software, No Substitute	HP 9816A, HP 9836A/C, HP 9000 Model 310	

* P=Performance Tests; A=Adjustments; M=Test and Adjustment Module; T=Troubleshooting; V=Operation Verification

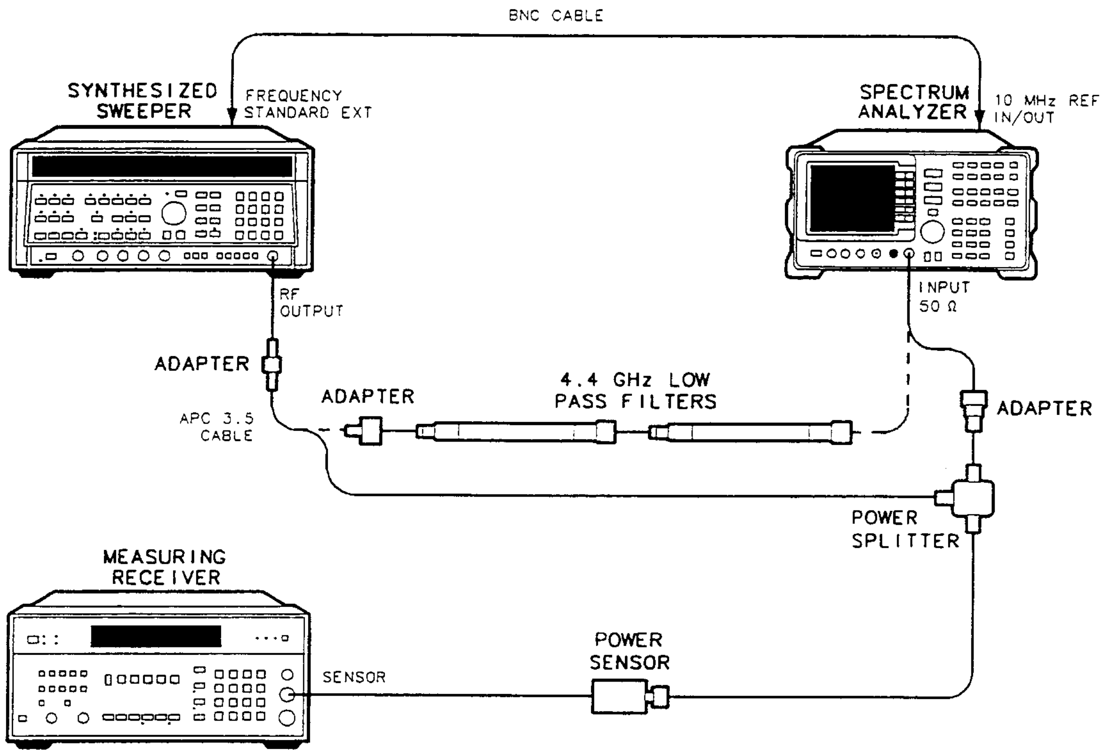

Figure 3-17. Second Harmonic Distortion Test Setup, Band 1

Equipment

Synthesized Sweeper	HP 8340A/B
Synthesizer/Level Generator	HP 3335A
Measuring Receiver	HP 8902A
Power Sensor	HP 8485A
50 MHz Low Pass Filter	0955-0306
4.4 GHz Low Pass Filter *(two required)*	HP 11689A
12 MHz Low Pass Filter	0955-0518
Power Splitter	HP 11667B
Adapters	
Type N (m) to BNC (f) *(two required)*	1250-1476
Type N (m) to SMA (f)	1250-1250
Type N (f) to APC 3.5 (f)	1250-1745
Type N (m) to APC 3.5 (m)	1250-1743
APC 3.5 (f) to APC 3.5 (f)	5061-5311
Cables	
BNC, 122 cm (48 in.) *(two required)*	HP 10503A
APC 3.5, 91 cm (36 in.)	8120-4921

HEWLETT PACKARD

HP Part No. 08561-90048
Printed in USA November 1991

Procedure

Second Harmonic Distortion, <1.45 GHz

1. Connect the equipment as shown in Figure 3-16, using the 12 MHz low pass filter. The spectrum analyzer provides the frequency reference for the synthesizer.
2. Set the HP 3335A controls as follows:

   FREQUENCY .... 9 MHz
   AMPLITUDE .... −30 dBm
   AMPTD INCR .... 0.05 dB
   OUTPUT 50Ω

3. On the spectrum analyzer, press (PRESET). Set the controls as follows:

   CENTER FREQ .... 9 MHz
   SPAN .... 10 kHz
   REF LVL .... −30 dBm

4. On the spectrum analyzer, press (PEAK SEARCH). On the HP 3335A adjust the output power level for a spectrum analyzer marker amplitude reading of −30 dBm ±0.17 dB.
5. On the spectrum analyzer, press (SGL SWP). Wait for the completion of the sweep, then press (PEAK SEARCH) (MKR▶) MARKER ▶ CF STEP .
6. Press (MKR) MARKER DELTA (FREQUENCY) (▲) (SGL SWP).
7. After the spectrum analyzer completes a new sweep, press (PEAK SEARCH). Record the Δ MKR amplitude reading as the Second Harmonic Distortion (<10 MHz).

   Second Harmonic Distortion (<10 MHz):________dBc
   (Measurement Uncertainty: +1.31/−1.40 dB)

8. Replace the 12 MHz low pass filter with the 50 MHz low pass filter.
9. Set the HP 3335A controls as follows:

   FREQUENCY .... 40 MHz
   AMPLITUDE .... −30 dBm
   AMPTD INCR .... 0.05 dB
   OUTPUT 50Ω

10. On the spectrum analyzer, press (PRESET). Set the controls as follows:

    CENTER FREQ .... 40 MHz
    SPAN .... 10 kHz
    REF LVL .... −30 dBm

11. On the spectrum analyzer, press (PEAK SEARCH). On the HP 3335A adjust the output power level for a spectrum analyzer marker amplitude reading of −30 dBm ±0.17 dB.
12. On the spectrum analyzer, press (SGL SWP). Wait for the completion of the sweep, then press (PEAK SEARCH) (MKR▶) MARKER ▶ CF STEP .

13. Press (MKR) MARKER DELTA (FREQUENCY) (▲) (SGL SWP).
14. After the spectrum analyzer completes a new sweep, press (PEAK SEARCH). Record the Δ MKR reading as the Second Harmonic Distortion (>10 MHz).

Second Harmonic Distortion (>10 MHz):__________dBc
(Measurement Uncertainty: +1.31/−1.40 dB)

Second Harmonic Distortion, >1.45 GHz

15. Zero and calibrate the HP 8485A in LOG mode (readout in dBm). Enter the power sensor's 3 GHz calibration factor into the HP 8902A.
16. Connect the equipment as shown in Figure 3-17, without the filters in place.
17. On the spectrum analyzer, set the controls as follows:

    CENTER FREQ .... 2.95 GHz
    CF STEP .... 2.95 GHz
    REF LVL .... 0 dBm

18. On the HP 8340A/B, set the controls as follows:

    CW .... 2.95 GHz
    POWER LEVEL .... −10 dBm

19. On the spectrum analyzer, press (TRIG) (CONT) (MKR) MARKERS OFF (PEAK SEARCH).
20. Press (AMPLITUDE) PRESEL AUTO PK. Wait for the PEAKING message to disappear before continuing to the next step.
21. On the HP 8340A/B, adjust the power level for a spectrum analyzer MKR reading of −5 dBm.
22. On the HP 8902A, press (RATIO). Enter the power sensor's 6 GHz calibration factor into the HP 8902A.
23. Set the HP 8340A/B CW to 5.9 GHz.
24. On the spectrum analyzer, press (FREQUENCY) (▲) (PEAK SEARCH).
25. Press (AMPLITUDE) PRESEL AUTO PK. Wait for the PEAKING message to disappear before continuing to the next step.
26. On the HP 8340A/B, adjust the power level for a spectrum analyzer MKR reading of −5 dBm.
27. Record the HP 8902A reading here, as the Frequency Response Error:

Frequency Response Error:__________dB

28. Connect the equipment as shown in Figure 3-17, with the filter in place.

29. On the HP 8340A/B, set the controls as follows:

    CW .... 2.95 GHz
    POWER LEVEL .... −5 dBm

30. On the spectrum analyzer, press (MKR) **MARKERS OFF** (FREQUENCY) (▼) (PEAK SEARCH).
31. Press (AMPLITUDE) **PRESEL AUTO PK**. Wait for the **PEAKING** message to disappear before continuing.
32. On the HP 8340A/B, adjust the power level for a spectrum analyzer marker amplitude reading of 0 dBm.
33. On the spectrum analyzer, press (SGL SWP) (SGL SWP) (PEAK SEARCH) **MARKER DELTA** (FREQUENCY) (▲).
34. Press (AMPLITUDE) 30 (−dBm), (SGL SWP).
35. Press (PEAK SEARCH) (AMPLITUDE) **PRESEL AUTO PK**. Wait for the **PEAKING** message to disappear before continuing.
36. Wait for completion of a new sweep, then press (PEAK SEARCH). Record the Δ MKR amplitude reading here:

    Δ MKR Amplitude Reading:________dBc

37. Algebraically add the Frequency Response Error recorded in step 19 to the Δ MKR Amplitude Reading in step 28. Record the result here, as the Second Harmonic Distortion (>1.45 GHz).

    Second Harmonic Distortion (>1.45 GHz):________dBc

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16. Frequency Response

Specification

In-Band Frequency Response with 10 dB Input Attenuation:

DC Coupled:

50 Hz to 2.9 GHz: ≤±1.0 dB
2.9 GHz to 6.5 GHz: <±1.5 dB

AC Coupled:

100 kHz to 2.9 GHz: ≤±1.4 dB
2.9 GHz to 6.5 GHz: <±2.0 dB

Frequency Response relative to 300 MHz CAL OUTPUT:

DC Coupled:

50 Hz to 2.9 GHz: ≤±1.5 dB
2.9 GHz to 6.5 GHz: <±2.5 dB

AC Coupled:

100 kHz to 2.9 GHz: <±1.7 dB
2.9 GHz to 6.5 GHz: <±3.5 dB

Band Switching Uncertainty:

<±1.0 dB

Related Adjustment

Frequency Response Adjustment

Description

The output of a synthesized sweeper is fed through a power splitter to a power sensor, then to the spectrum analyzer. The synthesized sweeper's power level is adjusted at 300 MHz to place the displayed signal at the spectrum analyzer's center horizontal graticule line. The measuring receiver, used as a power meter, is placed in ratio mode. At each new synthesized sweeper frequency and spectrum analyzer center frequency, the sweeper's power level is adjusted to place the signal at the center horizontal graticule line. The measuring receiver displays the inverse of the frequency response relative to the calibrator.

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DC Coupled Frequency Response, Band 0 (≥50 MHz)

8. On the spectrum analyzer, press (AMPLITUDE) MORE 1 OF 2 COUPLING DC .
9. Set the HP 8340A/B CW to 50 MHz.
10. On the spectrum analyzer, press (FREQUENCY) CENTER FREQ 50 (MHz).
11. On the HP 8340A/B, adjust the power level for a spectrum analyzer MKR amplitude reading of −10 dBm ±0.05 dB.
12. Record the negative of the power ratio displayed on the HP 8902A in Table 3-25, column 2. Record the power ratio here:

HP 8902A Reading at 50 MHz (dc coupled): ________ dB

13. Set the HP 8340A/B CW to 100 MHz.
14. On the spectrum analyzer, press (FREQUENCY) CENTER FREQ 100 (MHz).
15. On the HP 8340A/B, adjust the power level for a spectrum analyzer MKR amplitude reading of −10 dBm ±0.05 dB.
16. Record the negative of the power ratio displayed on the HP 8902A, in Table 3-25, column 2.
17. On the HP 8340A/B, press (CW) (▲).
18. On the spectrum analyzer, press (FREQUENCY) (▲) to step through the remaining frequencies listed in Table 3-25. At each new frequency, repeat steps 15 through 17, entering the power sensor's calibration factors into the HP 8902A as indicated in Table 3-25.

DC Coupled Frequency Response, Band 1

19. On the spectrum analyzer, press (FREQUENCY) 2.95 (GHz).
20. Set the HP 8340A/B CW to 2.95 GHz.
21. On the spectrum analyzer, press (AUX CTRL) INTERNAL MIXER PRESEL AUTO PK . Wait for the PEAKING message to disappear.
22. On the HP 8340A/B adjust the power level for a spectrum analyzer MKR amplitude reading of −10 dBm ±0.05 dB.
23. Record the negative of the power ratio displayed on the HP 8902A in Table 3-26, column 2.
24. Press (CW) (▲) on the HP 8340A/B.
25. On the spectrum analyzer, press (FREQUENCY) (▲) to step through the remaining frequencies listed in Table 3-26. At each new frequency, repeat steps 21 through 24, entering the power sensor's calibration factors into the HP 8902A as indicated in Table 3-26.

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AC Coupled Frequency Response, Band 0 (≥50 MHz)

26. On the spectrum analyzer, press (AMPLITUDE) MORE 1 OF 2 COUPLING AC .
27. Set the HP 8340A/B CW to 50 MHz.
28. On the spectrum analyzer, press (FREQUENCY) CENTER FREQ 50 (MHz).
29. On the HP 8340A/B, adjust the power level for a spectrum analyzer MKR amplitude reading of −10 dBm ±0.05 dB.
30. Record the negative of the power ratio displayed on the HP 8902A, in Table 3-27, column 2. Record the power ratio below:

HP 8902A Reading at 50 MHz (ac coupled): ________dB

31. Set the HP 8340A/B CW to 100 MHz.
32. On the spectrum analyzer, press (FREQUENCY) CENTER FREQ 100 (MHz).
33. On the HP 8340A/B, adjust the power level for a spectrum analyzer MKR amplitude reading of −10 dBm ±0.05 dB.
34. Record the negative of the power ratio displayed on the HP 8902A, in Table 3-27, column 2.
35. On the HP 8340A/B, press (CW) (▲).
36. On the spectrum analyzer, press (FREQUENCY) (▲) to step through the remaining frequencies listed in Table 3-27. At each new frequency, repeat steps 33 through 35, entering the power sensor's calibration factors into the HP 8902A as indicated in Table 3-27.

AC Coupled Frequency Response, Band 1

37. On the spectrum analyzer, press (FREQUENCY) 2.95 (GHz).
38. Set the HP 8340A/B CW to 2.95 GHz.
39. On the spectrum analyzer, press (AUX CTRL) INTERNAL MIXER PRESEL AUTO PK . Wait for the PEAKING message to disappear.
40. On the HP 8340A/B adjust the power level for a spectrum analyzer MKR amplitude reading of −10 dBm ±0.05 dB.
41. Record the negative of the power ratio displayed on the HP 8902A in Table 3-28, column 2.
42. Press (CW) (▲) on the HP 8340A/B.
43. On the spectrum analyzer, press (FREQUENCY) (▲) to step through the remaining frequencies listed in Table 3-28. At each new frequency, repeat steps 39 through 42, entering the power sensor's calibration factors into the HP 8902A as indicated in Table 3-28.

DC Coupled Frequency Response (<50 MHz)

44. Connect the equipment as shown in Figure 3-19.
45. On the spectrum analyzer, press (AMPLITUDE) MORE 1 OF 2 COUPLING DC. Set the controls as follows:

CENTER FREQ	50 MHz
SPAN	1 kHz
RES BW	10 Hz
MARKER	OFF
VIDEO BW	1 Hz

46. On the HP 3335A, set the controls as follows:

FREQUENCY	50 MHz
AMPLITUDE	−4 dBm
AMPTD INCR	0.01 dB

47. On the spectrum analyzer, press (PEAK SEARCH) (MKR) SIG TRK ON. Press (SPAN) 100 (Hz). Wait until the signal is centered in the 100 Hz span setting.
48. Enter the power sensor's 50 MHz calibration factor into the HP 8902A.
49. Adjust the HP 3335A amplitude until the HP 8902A display reads the same value as recorded in step 12. Record the HP 3335A amplitude here, and in Table 3-28:

HP 3335A Amplitude (50 MHz):__________dBm

50. Replace the HP 8485A Power Sensor with the HP 909D 50Ω termination and adapter.
51. On the spectrum analyzer, press (PEAK SEARCH) MARKER DELTA.
52. Set the spectrum analyzer center frequency and the HP 3335A frequency to the frequencies listed in Table 3-29. At each frequency press (PEAK SEARCH) on the spectrum analyzer and adjust the HP 3335A amplitude for a Δ MKR amplitude reading of 0.00 ±0.05 dB. Record the HP 3335A amplitude setting in Table 3-29, column 2, as the HP 3335A Amplitude.
53. For each of the frequencies listed in Table 3-29, subtract the HP 3335A Amplitude Reading (column 2) from the HP 3335A Amplitude (50 MHz) recorded in step 36. Record the results as the Response Relative to 50 MHz in Table 3-29, column 3.
54. Add to each of the Response Relative to 50 MHz entries in Table 3-29 the HP 8902A Reading for 50 MHz listed in Table 3-25. Use the value from Table 3-29 for the ac coupled frequency. Record the results as the Response Relative to 300 MHz, in Table 3-29, column 4.

ERR 757 SYSTEM	Hardware/firmware interaction, BCDL overflow; check other errors.
ERR 759 SYSTEM	Hardware/firmware interaction, Code invoked for wrong instrument.
ERR 755 SYSTEM	Hardware/firmware interaction, squareroot error; check other errors.

Note

Error codes 800 through 899, MODULE, are reserved for option modules, such as the HP 85629B Test and Adjustment Module or the HP 85620A Mass Memory Module. Refer to the option module's manual for a list of product-specific error messages.

Error codes 900 to 904, relate to user-generated errors.
These errors occur if the operator has entered information incorrectly, or is attempting to use the analyzer inappropriately.

ERR 900 TG UNLVL	Tracking generator output is unleveled.
ERR 901 TGFrqLmt	Tracking generator output unleveled because START FREQ is set below tracking generator frequency limit (300 kHz).
ERR 902 BAD NORM	The state of the stored trace does not match the current state of the analyzer.
ERR 903 A > DLMT	Unnormalized trace A is off screen with trace math or normalization on.
ERR 904 B > DLMT	Calibration trace (trace B) is off screen with trace math or normalization on.
ERR 905 EXT REF	Unable to lock Cal Oscillator when set to external reference. Check that external reference is within tolerance.
ERR 906 OVENCOLD	The OCXO oven is cold.
ERR 907 DO IF CALS	Unit is still performing IF calibration or is in need of IF calibration which were not done due to an OVENCOLD condition.
ERROR 908 BW>>SPCG	Channel bandwidth is too wide, compared to the channel spacing, for a significant computation.
ERROR 909 SPAN<ACP	The frequency span is too small to obtain a valid measurement.
ERROR 910 SPAN>ACP	The frequency span is too wide, compared to the channel bandwidth, to obtain a valid measurement.

AC Coupled Frequency Response (<50 MHz)

55. On the spectrum analyzer, press (AMPLITUDE) MORE 1 OF 2 COUPLING AC.
56. Set the controls as follows:

CENTER FREQ	50 MHz
SPAN	100 Hz
RES BW	10 Hz
MARKER	OFF
VIDEO BW	1 Hz

57. On the HP 3335A, set the controls as follows:

FREQUENCY	50 MHz
AMPLITUDE	−4 dBm
AMPTD INCR	0.01 dB

58. Enter the power sensor's 50 MHz calibration factor into the HP 8902A. Replace the 50Ω termination and the adapter with the power sensor.
59. Adjust the HP 3335A amplitude until the HP 8902A display reads the same value as recorded in step 23. Record the HP 3335A amplitude here and in Table 3-30:

HP 3335A Amplitude (50 MHz):__________dB

60. Replace the HP 8485A power sensor with the HP 909D 50Ω termination and adapter.
61. On the spectrum analyzer, press (PEAK SEARCH) MARKER DELTA.
62. Set the spectrum analyzer center frequency and the HP 3335A frequency to the values listed in Table 3-30. At each frequency, press (PEAK SEARCH) on the spectrum analyzer, and adjust the HP 3335A amplitude for a Δ MKR amplitude reading of 0.00 ±0.05 dB. Record the HP 3335A amplitude setting in Table 3-30, column 2, as the HP 3335A Amplitude.
63. For each of the frequencies listed in Table 3-30, subtract the HP 3335A Amplitude Reading (column 2) from the HP 3335A Amplitude (50 MHz) recorded in step 46. Record the results as the Response Relative to 50 MHz in Table 3-30, column 3.
64. Add to each of the Response Relative to 50 MHz entries in Table 3-30 the HP 8902A Reading for 50 MHz listed in Table 3-25. Record the results as the Response Relative to 300 MHz, in Table 3-30, column 4.
65. Press (PRESET) on the spectrum analyzer.

ERR 705 ROM U306	Checksum error of program ROM A2U306.
ERR 706 ROM U307	Checksum error of program ROM A2U307.
ERR 707 ROM U308	Checksum error of program ROM A2U308.
ERR 708 ROM U309	Checksum error of program ROM A2U309.
ERR 709 ROM U310	Checksum error of program ROM A2U310.
ERR 710 ROM U311	Checksum error of program ROM A2U311.
ERR 711 RAM U303	Checksum error of system RAM A2U303.
ERR 712 RAM U302	Checksum error of system RAM A2U302.
ERR 713 RAM U301	Checksum error of system RAM A2U301.
ERR 714 RAM U300	Checksum error of system RAM A2U300.
ERR 715 RAM U305	Checksum error of system RAM A2U305.
ERR 716 RAM U304	Checksum error of system RAM A2U304.
ERR 717 BAD uP!!	Microprocessor not fully operational.
ERR 718 BATTERY?	Nonvolatile RAM not working; check battery.
ERR 750 SYSTEM	Hardware/firmware interaction, zero divide; check other errors.
ERR 751 SYSTEM	Hardware/firmware interaction, floating overflow; check other errors.
ERR 752 SYSTEM	Hardware/firmware interaction, floating underflow; check other errors.
ERR 753 SYSTEM	Hardware/firmware interaction, LOG error; check other errors.
ERR 754 SYSTEM	Hardware/firmware interaction, Integer overflow; check other errors.
ERR 755 SYSTEM	Hardware/firmware interaction, squareroot error; check other errors.
ERR 756 SYSTEM	Hardware/firmware interaction, Triple underflow; check other errors.

Test Results

66. Enter the results of the dc coupled frequency response, Band 0, below:

a. Enter the most positive number from Table 3-29, column 4:	________ dB
b. Enter the most positive number from Table 3-25, column 2:	________ dB
c. Of (a) and (b), enter whichever number is *more* positive:	________ dB
d. Enter the most negative number from Table 3-29, column 4:	________ dB
e. Enter the most negative number from Table 3-25, column 2:	________ dB
f. Of (c) and (d), enter whichever number is *more* negative:	________ dB
g. Subtract (f) from (c).	________ dB

67. Enter the results of the dc coupled frequency response, Band 1, below:

a. Enter the most positive number from Table 3-26, column 2:	________ dB
b. Enter the most negative number from Table 3-26, column 2:	________ dB
c. Subtract (b) from (a).	________ dB

68. Enter the results of the ac coupled frequency response, Band 0, below:

a. Enter the most positive number from Table 3-30, column 4:	________ dB
b. Enter the most positive number from Table 3-27, column 2:	________ dB
c. Of (a) and (b), enter whichever number is *more* positive:	________ dB
d. Enter the most negative number from Table 3-30, column 4:	________ dB
e. Enter the most negative number from Table 3-27, column 2:	________ dB
f. Of (d) and (e), enter whichever number is *more* negative:	________ dB
g. Subtract (f) from (c).	________ dB

69. Enter the results of the ac coupled frequency response, Band 1, below:

a. Enter the most positive number from Table 3-28, column 4:	________ dB
b. Enter the most negative number from Table 3-28, column 2:	________ dB
c. Subtract (b) from (a).	________ dB

ERR 590 RBW 1M	Unable to adjust 1 MHz RES BW. SYSBW and LCBW disagreement in LCCAL.
ERR 591 LOG AMPL	Unable to adjust amplitude in log scale. No power sweep in find compression point.
ERR 592 LOG AMPL	Unable to adjust amplitude in log scale. No compression BOW in find compression point.
ERR 593 LOG TUNE	lIMIT Cal tune error from DC Logger Calibration.
ERR 594 LOG OFST	Attenuator Calibration Offset error from DC Logger Calibration.
ERR 595 LOG ATTN	Attenuator Calibration Absolute error from DC Logger Calibration.
ERR 596 LOG FID	Fidelity error from DC Logger Calibration.
ERR 597 LOG OFST	Fidelity Offset error from DC Logger Calibration.
ERR 598 LOG OFST	Fidelity Offset unstable from DC Logger Calibration.
ERR 599 LOG GAIN	Fidelity Gain error from DC Logger Calibration.

Error codes 600 through 699 relate to system failures. Instrument service is required.

ERR 600 SYSTEM	Hardware/firmware interaction; check other errors.
ERR 601 SYSTEM	Hardware/firmware interaction; check other errors.
ERR 650 OUTOF RG	ADC input is outside of the ADC range.
ERR 651 NO IRQ	Microprocessor is not receiving interrupt from ADC.

Error codes 700 through 799 relate to digital and checksum failures. Instrument service is required.

ERR 700 EEROM	Checksum error of EEROM A2U501
ERR 701 AMPL CAL	Checksum error of frequency response correction data.
ERR 702 ELAP TIM	Checksum error of elapsed time data.
ERR 703 AMPL CAL	Checksum error of frequency response correction data.
ERR 704 PRESELCT	Checksum error of customer preselector peak data; external preselector data recalled in internal mode; or internal preselector data recalled in external mode.

Band Switching Uncertainty

70. Band 0 to Band 1 results (dc coupled):
    a. Enter the value recorded in step 66 (c): ________ dB
    b. Enter the value recorded in step 67 (b): ________ dB
    c. Compute the absolute value of the difference between these two entries. ________ dB
71. Band 1 to Band 0 results (dc coupled):
    a. Enter the value recorded in step 66 (f): ________ dB
    b. Enter the value recorded in step 67 (a): ________ dB
    c. Compute the absolute value of the difference between these two entries. ________ dB
72. Band 0 to Band 1 results (ac coupled):
    a. Enter the value recorded in step 68 (c): ________ dB
    b. Enter the value recorded in step 69 (b): ________ dB
    c. Compute the absolute value of the difference between these two entries. ________ dB
73. Band 1 to Band 0 results (ac coupled):
    a. Enter the value recorded in step 68 (f): ________ dB
    b. Enter the value recorded in step 69 (a): ________ dB
    c. Compute the absolute value of the difference between these two entries. ________ dB

ERR 569 LOG AMPL	Unable to adjust amplitude in log scale. Low MDACX value in CalLogExpand.
ERR 570 LOG AMPL	Unable to adjust amplitude in log scale. High MDACX value in CalLogExpand.
ERR 571 AMPL	Unable to adjust step gain amplifiers. No TOS_D in CalDetectors.
ERR 572 AMPL 1M	Unable to adjust amplitude of 1 MHz RES BW. No TOS_W in CalWidebandLog.
ERR 573 LOG AMPL	Unable to adjust amplitude in log scale. Video offset error + 0.
ERR 574 LOG AMPL	Unable to adjust amplitude in log scale. Video offset error +1.
ERR 575 LOG AMPL	Unable to adjust amplitude in log scale. Video offset error +2.
ERR 576 LOG AMPL	Unable to adjust amplitude in log scale. Video offset error +3.
ERR 577 LOG AMPL	Unable to adjust amplitude in log scale. Video offset error +4.
ERR 578 LOG AMPL	Lim Calibration error from DC Logger Cal.
ERR 579 LOG AMPL	Attenuator CAL level error from DC Logger Cal.
ERR 580 LOG AMPL	FID CAL level error from DC Logger Cal.
ERR 581 AMPL	Unable to adjust 100 kHz and ≤10 kHz RES BWs. ADC/CALOSC handshake CAL in Sweep Xtal.
ERR 582 AMPL	Unable to adjust 100 kHz and ≤10 kHz RES BWs. Bad CALOSC Calibration in Sweep Rate.
ERR 583 RBW 30K	Unable to adjust 30 kHz RES BW. SYSBW and LCBW disagreement in LCCAL.
ERR 584 RBW 100K	Unable to adjust 100 kHz RES BW. SYSBW and LCBW disagreement in LCCAL.
ERR 585 RBW 300K	Unable to adjust 300 kHz RES BW. SYSBW and LCBW disagreement in LCCAL.
ERR 586 RBW 1M	Unable to adjust 1 MHz RES BW. SYSBW and LCBW disagreement in LCCAL.
ERR 587 RBW 30K	Unable to adjust 30 kHz RES BW. SYSBW and LCBW disagreement in LCCAL.
ERR 588 RBW 100K	Unable to adjust 100 kHz RES BW. SYSBW and LCBW disagreement in LCCAL.
ERR 589 RBW 300K	Unable to adjust 300 kHz RES BW. SYSBW and LCBW disagreement in LCCAL.

16. Frequency Response

Table 3-25. DC Coupled Frequency Response (50 MHz to 2.9 GHz)

Column 1 Frequency (MHz)	Column 2 HP 8902A Reading (dB)	Column 3 Cal Factor Frequency (MHz)	Column 4 Measurement Uncertainty (dB)
50	________	0.050	+0.29/−0.31
100	________	0.010	+0.29/−0.31
200	________	0.30	+0.29/−0.31
300	________	0.30	0 (Ref.)
400	________	0.30	+0.29/−0.31
500	________	0.30	+0.29/−0.31
600	________	0.30	+0.29/−0.31
700	________	1.0	+0.29/−0.31
800	________	1.0	+0.29/−0.31
900	________	1.0	+0.29/−0.31
1000	________	1.0	+0.29/−0.31
1100	________	1.0	+0.29/−0.31
1200	________	1.0	+0.29/−0.31
1300	________	1.0	+0.29/−0.31
1400	________	1.0	+0.29/−0.31
1500	________	2.0	+0.29/−0.31
1600	________	2.0	+0.29/−0.31
1700	________	2.0	+0.29/−0.31
1800	________	2.0	+0.29/−0.31
1900	________	2.0	+0.29/−0.31
2000	________	2.0	+0.29/−0.31
2100	________	2.0	+0.29/−0.31
2200	________	2.0	+0.29/−0.31
2300	________	2.0	+0.29/−0.31
2400	________	2.0	+0.29/−0.31
2500	________	3.0	+0.29/−0.31
2600	________	3.0	+0.29/−0.31
2700	________	3.0	+0.29/−0.31
2800	________	3.0	+0.29/−0.31
2900	________	3.0	+0.29/−0.31

ERR 538 RBW <300	Unable to adjust <300 Hz RES BWs. Noisy shape of 500 Hz IF filter.
ERR 539 RBW <300	Unable to adjust <300 Hz RES BWs. CW CAL OSC not autoranging.
ERR 540 RBW <300	Unable to adjust <300 Hz RES BWs. No SIGLOCK on CW CAL OSC during pretune.
ERR 550 IDCALOSC	CAL Oscillator ID. Indicates incompatible hardware. Cal Osc not expected.
ERR 551 ID LOGBD	LOG Board ID. Indicates incompatible hardware. Log board not expected.
ERR 553 LOG AMPL	Unable to adjust amplitude of log scale. Divide by 0_D in CalLogGain.
ERR 554 LOG AMPL	Unable to adjust amplitude of log scale. Divide by 0_M in CalLogGain.
ERR 555 LOG AMPL	Unable to adjust amplitude in log scale. No TOS_G in CalLogGain.
ERR 556 LOG AMPL	Unable to adjust amplitude in log scale. No TOS_O in CalLogGain.
ERR 557 LOG AMPL	Unable to adjust amplitude in log scale. Insufficient IF gain in CalLogGain.
ERR 558 LOG AMPL	Unable to adjust amplitude in log scale. Negative M,0 in CalLogGain.
ERR 559 LOG AMPL	Unable to adjust amplitude in log scale. Low MDAC value.
ERR 560 LOG AMPL	Unable to adjust amplitude in log scale. High MDAC value.
ERR 561 LOG AMPL	Unable to adjust amplitude in log scale. Second Step Gain/P1 offset in CalLogGain.
ERR 562 LOG AMPL	Unable to adjust amplitude in log scale. Second Step Gain/P2 offset in CalLogGain.
ERR 563 LOG AMPL	Unable to adjust amplitude in log scale. Third Step Gain range problem in CalLogPower.
ERR 564 LOG AMPL	Unable to adjust amplitude in log scale. No Compression in CalLogPower.
ERR 565 LOG AMPL	Unable to adjust amplitude in log scale. Gain Compression Error in CalLogPower.
ERR 566 LOG AMPL	Unable to adjust amplitude in log scale. Unable to set LOG CAL LVL in CalLogPower.
ERR 567 LOG AMPL	Unable to adjust amplitude in log scale. No TOS LX in CalLogExpand.
ERR 568 LOG AMPL	Unable to adjust amplitude in log scale. No LVL LX in CalLogPower.

Table 3-26. DC Coupled Frequency Response (2.9 GHz to 6.5 GHz)

Column 1 Frequency (MHz)	Column 2 HP 8902A Reading (dB)	Column 3 Cal Factor Frequency (MHz)	Column 4 Measurement Uncertainty (dB)
2.95	________	3.0	+0.43/−0.47
3.05	________	0.30	+0.43/−0.47
3.15	________	0.30	+0.43/−0.47
3.25	________	0.30	+0.43/−0.47
3.35	________	0.30	+0.43/−0.47
3.45	________	0.30	+0.43/−0.47
3.55	________	0.30	+0.43/−0.47
3.65	________	4.0	+0.43/−0.47
3.75	________	4.0	+0.43/−0.47
3.85	________	4.0	+0.43/−0.47
3.95	________	4.0	+0.43/−0.47
4.05	________	4.0	+0.43/−0.47
4.15	________	4.0	+0.43/−0.47
4.25	________	4.0	+0.43/−0.47
4.35	________	4.0	+0.43/−0.47
4.45	________	4.0	+0.43/−0.47
4.55	________	4.0	+0.43/−0.47
4.65	________	5.0	+0.43/−0.47
4.75	________	5.0	+0.43/−0.47
4.85	________	5.0	+0.43/−0.47
4.95	________	5.0	+0.43/−0.47
5.05	________	5.0	+0.43/−0.47
5.15	________	5.0	+0.43/−0.47
5.25	________	5.0	+0.43/−0.47
5.35	________	5.0	+0.43/−0.47
5.45	________	5.0	+0.43/−0.47
5.55	________	6.0	+0.43/−0.47
5.65	________	6.0	+0.43/−0.47
5.75	________	6.0	+0.43/−0.47
5.85	________	6.0	+0.43/−0.47
5.95	________	6.0	+0.43/−0.47
6.05	________	6.0	+0.43/−0.47
6.15	________	6.0	+0.43/−0.47
6.25	________	6.0	+0.43/−0.47
6.35	________	6.0	+0.43/−0.47
6.45	________	6.0	+0.43/−0.47
6.50	________	6.0	+0.43/−0.47

ERR 516 RBW 10K	Insufficient gain during crystal BW Cal of 10 kHz RES BW.
ERR 517 RBW 100	Unable to adjust 100 Hz RES BW. XTAL SWP PROB.
ERR 518 RBW 300	Unable to adjust 300 Hz RES BW. XTAL SWP PROB.
ERR 519 RBW 1K	Unable to adjust 1 kHz RES BW. XTAL SWP PROB.
ERR 520 RBW 3K	Unable to adjust 3 kHz RES BW. XTAL SWP PROB.
ERR 521 RBW 10K	Unable to adjust 10 kHz RES BW. XTAL SWP PROB.
ERR 522 RBW 10K	Unable to adjust 10 kHz RES BW. SYM POLE 1.
ERR 523 RBW 10K	Unable to adjust 10 kHz RES BW. SYM POLE 2.
ERR 524 RBW 10K	Unable to adjust 10 kHz RES BW. SYM POLE 3.
ERR 525 RBW 10K	Unable to adjust 10 kHz RES BW. SYM POLE 4.
ERR 526 RBW <300	Unable to adjust <300 Hz RES BWs. Timeout during data sampling.
ERR 527 RBW <300	Step gain correction failed for <300 Hz RES BW. Narrow BW SGO 9dB attn failed.
ERR 528 RBW <300	Unable to adjust <300 Hz RES BWs. DC level at ADC cannot be calibrated.
ERR 529 RBW <300	Unable to adjust <300 Hz RES BWs. Demod data for calibration is bad.
ERR 530 RBW <300	Unable to adjust <300 Hz RES BWs. Narrow BW VCXO Calibration failed.
ERR 531 RBW <300	Flatness correction data not acceptable for <300 Hz RES BWs.
ERR 532 RBW <300	Absolute gain data for <300 Hz RES BWs not acceptable.
ERR 533 RBW <300	Unable to adjust <300 Hz RES BWs. Timeout during data sampling narrow BW chunk.
ERR 534 RBW <300	Unable to adjust <300 Hz RES BWs. Frequency count of CAL OSC using IF downconverter failed.
ERR 535 RBW <300	Unable to adjust <300 Hz RES BWs. Inadequet FM demod range for 500Hz IF filter measurement.
ERR 536 RBW <300	Unable to adjust <300 Hz RES BWs. Unable to autorange the chirp signal.
ERR 537 RBW <300	Unable to adjust <300 Hz RES BWs. CW CAL OSC not autoranging.

16. Frequency Response

Table 3-27. AC Coupled Frequency Response (50 MHz to 2.9 GHz)

Column 1 Frequency (MHz)	Column 2 HP 8902A Reading (dB)	Column 3 Cal Factor Frequency (MHz)	Column 4 Measurement Uncertainty (dB)
50	________	0.050	+0.29/−0.31
100	________	0.010	+0.29/−0.31
200	________	0.30	+0.29/−0.31
300	________	0.30	0 (Ref.)
400	________	0.30	+0.29/−0.31
500	________	0.30	+0.29/−0.31
600	________	0.30	+0.29/−0.31
700	________	1.0	+0.29/−0.31
800	________	1.0	+0.29/−0.31
900	________	1.0	+0.29/−0.31
1000	________	1.0	+0.29/−0.31
1100	________	1.0	+0.29/−0.31
1200	________	1.0	+0.29/−0.31
1300	________	1.0	+0.29/−0.31
1400	________	1.0	+0.29/−0.31
1500	________	2.0	+0.29/−0.31
1600	________	2.0	+0.29/−0.31
1700	________	2.0	+0.29/−0.31
1800	________	2.0	+0.29/−0.31
1900	________	2.0	+0.29/−0.31
2000	________	2.0	+0.29/−0.31
2100	________	2.0	+0.29/−0.31
2200	________	2.0	+0.29/−0.31
2300	________	2.0	+0.29/−0.31
2400	________	2.0	+0.29/−0.31
2500	________	3.0	+0.29/−0.31
2600	________	3.0	+0.29/−0.31
2700	________	3.0	+0.29/−0.31
2800	________	3.0	+0.29/−0.31
2900	________	3.0	+0.29/−0.31

ERR 494 RBW 3K	Unable to adjust 3 kHz RES BW. XTAL SWP GAIN.
ERR 495 RBW 10K	Unable to adjust 10 kHz RES BW. XTAL SWP GAIN.
ERR 496 RBW 100	Unable to adjust 100 Hz RES BW. Inadequate Q.
ERR 497 RBW 100	Unable to adjust 100 Hz RES BW. Alignment.
ERR 498 RBW 100	Unable to adjust 100 Hz RES BW. Gain.
ERR 499 CAL UNLK	Cal Oscillator is unlocked.
ERR 500 AMPL 30K	Unable to adjust amplitude of 30 kHz RES BW.
ERR 501 AMPL .1M	Unable to adjust amplitude of 100 kHz RES BW.
ERR 502 AMPL .3M	Unable to adjust amplitude of 300 kHz RES BW.
ERR 503 AMPL 1M	Unable to adjust amplitude of 1 MHz RES BW.
ERR 504 AMPL 30K	Unable to adjust amplitude of 30 kHz RES BW. CAL Gain.
ERR 505 AMPL .1M	Unable to adjust amplitude of 100 kHz RES BW. CAL Gain.
ERR 506 AMPL .3M	Unable to adjust amplitude of 300 kHz RES BW. CAL Gain.
ERR 507 AMPL 1M	Unable to adjust amplitude of 1 MHz RES BW. CAL Gain.
ERR 508 AMPL 30K	Insufficient gain during LC BW Cal of 30 kHz RES BW.
ERR 509 AMPL .1M	Insufficient gain during LC BW Cal of 100 kHz RES BW.
ERR 510 AMPL .3M	Insufficient gain during LC BW Cal of 300 kHz RES BW.
ERR 511 AMPL 1M	Insufficient gain during LC BW Cal of 1 MHz RES BW.
ERR 512 RBW 100	Insufficient gain during crystal BW Cal of 100 Hz RES BW.
ERR 513 RBW 300	Insufficient gain during crystal BW Cal of 300 Hz RES BW.
ERR 514 RBW 1K	Insufficient gain during crystal BW Cal of 1 kHz RES BW.
ERR 515 RBW 3K	Insufficient gain during crystal BW Cal of 3 kHz RES BW.

Table 3-28. AC Coupled Frequency Response (2.9 GHz to 6.5 GHz)

Column 1 Frequency (MHz)	Column 2 HP 8902A Reading (dB)	Column 3 Cal Factor Frequency (MHz)	Column 4 Measurement Uncertainty (dB)
2.95	________	3.0	+0.43/−0.47
3.05	________	0.30	+0.43/−0.47
3.15	________	0.30	+0.43/−0.47
3.25	________	0.30	+0.43/−0.47
3.35	________	0.30	+0.43/−0.47
3.45	________	0.30	+0.43/−0.47
3.55	________	0.30	+0.43/−0.47
3.65	________	4.0	+0.43/−0.47
3.75	________	4.0	+0.43/−0.47
3.85	________	4.0	+0.43/−0.47
3.95	________	4.0	+0.43/−0.47
4.05	________	4.0	+0.43/−0.47
4.15	________	4.0	+0.43/−0.47
4.25	________	4.0	+0.43/−0.47
4.35	________	4.0	+0.43/−0.47
4.45	________	4.0	+0.43/−0.47
4.55	________	4.0	+0.43/−0.47
4.65	________	5.0	+0.43/−0.47
4.75	________	5.0	+0.43/−0.47
4.85	________	5.0	+0.43/−0.47
4.95	________	5.0	+0.43/−0.47
5.05	________	5.0	+0.43/−0.47
5.15	________	5.0	+0.43/−0.47
5.25	________	5.0	+0.43/−0.47
5.35	________	5.0	+0.43/−0.47
5.45	________	5.0	+0.43/−0.47
5.55	________	6.0	+0.43/−0.47
5.65	________	6.0	+0.43/−0.47
5.75	________	6.0	+0.43/−0.47
5.85	________	6.0	+0.43/−0.47
5.95	________	6.0	+0.43/−0.47
6.05	________	6.0	+0.43/−0.47
6.15	________	6.0	+0.43/−0.47
6.25	________	6.0	+0.43/−0.47
6.35	________	6.0	+0.43/−0.47
6.45	________	6.0	+0.43/−0.47
6.50	________	6.0	+0.43/−0.47

ERR 468 LOG AMPL	Unable to adjust log amplitude scale. AMPL14.
ERR 469 LOG AMPL	Unable to adjust log amplitude scale. AMPL15.
ERR 470 LOG AMPL	Unable to adjust log amplitude scale. AMPL16.
ERR 471 RBW 30K	Unable to adjust 30 kHz RES BW. Lin to Log LC1.
ERR 472 RBW 100K	Unable to adjust 100 kHz RES BW. Lin to LOG LC1.
ERR 473 RBW 300K	Unable to adjust 300 kHz RES BW. Lin to Log LC1.
ERR 474 RBW 1M	Unable to adjust 1 MHz RES BW. Lin to Log LC1.
ERR 475 RBW 30K	Unable to adjust 30 kHz RES BW. Lin to Log LC2.
ERR 476 RBW 100K	Unable to adjust 100 kHz RES BW. Lin to Log LC2.
ERR 477 RBW 300K	Unable to adjust 300 kHz RES BW. Lin to Log LC2.
ERR 478 RBW 1M	Unable to adjust 1 MHz RES BW. Lin to Log LC2.
ERR 483 RBW 10K	Unable to adjust 10 kHz RES BW. Lin to Log XTAL1.
ERR 484 RBW 3K	Unable to adjust 3 kHz RES BW. Lin to Log XTAL2.
ERR 485 RBW 1K	Unable to adjust 1 kHz RES BW. Lin to Log XTAL3.
ERR 486 RBW 300	Unable to adjust 300 Hz RES BW. Lin to Log XTAL4.
ERR 487 RBW 100	Unable to adjust 100 Hz RES BW. Lin to Log XTAL5.
ERR 488 RBW 100	Unable to adjust 100 Hz RES BW.
ERR 489 RBW 100	Unable to adjust 100 Hz RES BW.
ERR 490 RBW 100	Unable to adjust 100 Hz RES BW.
ERR 491 RBW 100	Unable to adjust 100 Hz RES BW. XTAL SWP GAIN.
ERR 492 RBW 300	Unable to adjust 300 Hz RES BW. XTAL SWP GAIN.
ERR 493 RBW 1K	Unable to adjust 1 kHz RES BW. XTAL SWP GAIN.

16. Frequency Response

Table 3-29. DC Coupled Frequency Response (<50 MHz)

Column 1 Frequency	Column 2 HP 3335A Amplitude (dBm)	Column 3 Response Relative to 50 MHz	Column 4 Response Relative to 300 MHz	Column 5 Measurement Uncertainty (dB)
50 MHz	________	0 (Ref.)	________	+0.34/−0.37
20 MHz	________	________	________	+0.34/−0.37
10 MHz	________	________	________	+0.34/−0.37
1 MHz	________	________	________	+0.34/−0.37
100 kHz	________	________	________	+0.34/−0.37
10 kHz	________	________	________	+0.34/−0.37
1 kHz	________	________	________	+0.34/−0.37
500 Hz	________	________	________	+0.34/−0.37
200 Hz	________	________	________	+0.34/−0.37

Table 3-30. AC Coupled Frequency Response (<50 MHz)

Column 1 Frequency	Column 2 HP 3335A Amplitude (dBm)	Column 3 Response Relative to 50 MHz	Column 4 Response Relative to 300 MHz	Column 5 Measurement Uncertainty (dB)
50 MHz	________	0 (Ref.)	________	+0.34/−0.37
20 MHz	________	________	________	+0.34/−0.37
10 MHz	________	________	________	+0.34/−0.37
5 MHz	________	________	________	+0.34/−0.37
1 MHz	________	________	________	+0.34/−0.37
500 kHz	________	________	________	+0.34/−0.37
100 kHz	________	________	________	+0.34/−0.37

ERR 445 RBW 3K	Unable to adjust 3 kHz RES BW. LO Amplitude Pole 4.
ERR 446 RBW 10K	Unable to adjust 10 kHz RES BW. LO Amplitude Pole 1.
ERR 447 RBW 10K	Unable to adjust 10 kHz RES BW. LO Amplitude Pole 2.
ERR 448 RBW 10K	Unable to adjust 10 kHz RES BW. LO Amplitude Pole 3.
ERR 449 RBW 10K	Unable to adjust 10 kHz RES BW. LO Amplitude Pole 4.
ERR 450 IF SYSTM	IF hardware failure. Check other error messages.
ERR 451 IF SYSTM	IF hardware failure. Check other error messages.
ERR 452 IF SYSTM	IF hardware failure. Check other error messages.
ERR 454 AMPL	Linear to Log utility. Check other errors.
ERR 455 AMPL	Lin to Log conversion, fine gain, AMPL1.
ERR 456 AMPL	Lin to Log conversion, fine gain, AMPL2.
ERR 457 AMPL	Lin to Log conversion, fine gain, AMPL3.
ERR 458 AMPL	Lin to Log conversion, step gain 1, AMPL4.
ERR 459 AMPL	Lin to Log conversion, step gain 1, AMPL5.
ERR 460 AMPL	Lin to Log conversion, step gain 1, AMPL6.
ERR 461 AMPL	Lin to Log conversion, step gain 2, AMPL7.
ERR 462 AMPL	Lin to Log conversion, step gain 2, AMPL8.
ERR 463 AMPL	Lin to Log conversion, course gain, AMPL9.
ERR 464 AMPL	Lin to Log conversion, course gain, AMPL10.
ERR 465 AMPL	Lin to Log conversion, course gain, AMPL11.
ERR 466 LIN AMPL	Unable to adjust linear amplitude scale. AMPL12.
ERR 467 LOG AMPL	Unable to adjust log amplitude scale. AMPL13.

17. Frequency Span Accuracy

Specification

<±5% of Actual Frequency Separation

Related Adjustment

YTO Adjustment

Description

The spectrum analyzer's CAL OUTPUT and a synthesized sweeper provide two input signals of known frequencies to the input of the spectrum analyzer. The synthesized sweeper signal is locked to the spectrum analyzer. The marker functions are used to measure the separation between the two signals. The percent error between the measured frequency separation and the actual frequency separation is calculated and recorded.

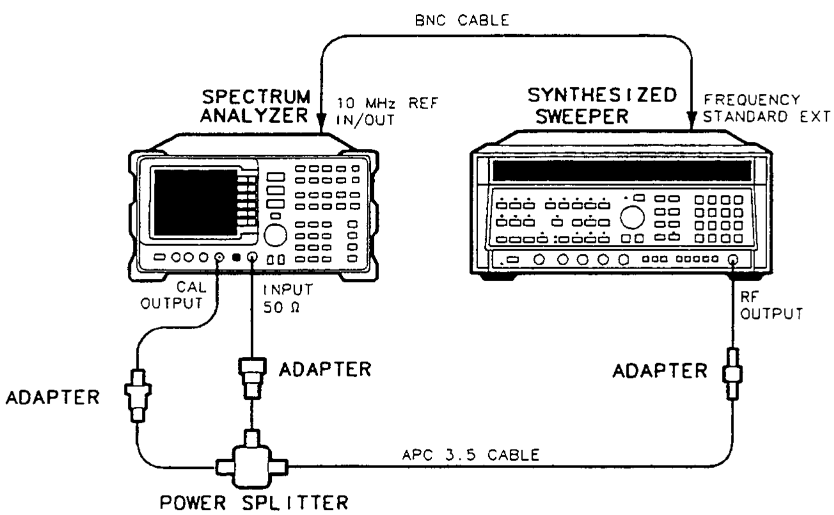

Figure 3-20. Frequency Span Accuracy Test Setup

ERR 423 RBW 10K	Unable to adjust 10 kHz RES BW. Cross PT RG Pole 3.
ERR 424 RBW 10K	Unable to adjust 10 kHz RES BW. Cross PT RG Pole 4.
ERR 425 RBW 3K	Unable to adjust 3 kHz RES BW. Cross PT RG Pole 1.
ERR 426 RBW 3K	Unable to adjust 3 kHz RES BW. Cross PT RG Pole 2.
ERR 427 RBW 3K	Unable to adjust 3 kHz RES BW. Cross PT RG Pole 3.
ERR 428 RBW 3K	Unable to adjust 3 kHz RES BW. Cross PT RG Pole 4.
ERR 429 RBW 100	Unable to adjust 100 Hz RES BW. ADC Handshake.
ERR 430 RBW 300	Unable to adjust 300 Hz RES BW. ADC Handshake.
ERR 431 RBW 1K	Unable to adjust 1 kHz RES BW. ADC Handshake.
ERR 432 RBW 3K	Unable to adjust 3 kHz RES BW. ADC Handshake.
ERR 433 RBW 10K	Unable to adjust 10 kHz RES BW. ADC Handshake.
ERR 434 RBW 300	Unable to adjust 300 Hz RES BW. LO Amplitude Pole 1.
ERR 435 RBW 300	Unable to adjust 300 Hz RES BW. LO Amplitude Pole 2.
ERR 436 RBW 300	Unable to adjust 300 Hz RES BW. LO Amplitude Pole 3.
ERR 437 RBW 300	Unable to adjust 300 Hz RES BW. LO Amplitude Pole 4.
ERR 438 RBW 1K	Unable to adjust 1 kHz RES BW. LO Amplitude Pole 1.
ERR 439 RBW 1K	Unable to adjust 1 kHz RES BW. LO Amplitude Pole 2.
ERR 440 RBW 1K	Unable to adjust 1 kHz RES BW. LO Amplitude Pole 3.
ERR 441 RBW 1K	Unable to adjust 1 kHz RES BW. LO Amplitude Pole 4.
ERR 442 RBW 3K	Unable to adjust 3 kHz RES BW. LO Amplitude Pole 1.
ERR 443 RBW 3K	Unable to adjust 3 kHz RES BW. LO Amplitude Pole 2.
ERR 444 RBW 3K	Unable to adjust 3 kHz RES BW. LO Amplitude Pole 3.

Equipment

Synthesized Sweeper	HP 8340A/B
Power Splitter	HP 11667B
Adapters	
Type N (m) to APC 3.5 (m)	1250-1743
APC 3.5 (f) to APC 3.5 (f)	5061-5311
BNC (f) to SMA (m)	1250-1200
Cables	
BNC, 122 cm (48 in.) *(two required)*	HP 10503A
APC 3.5, 91 cm (36 in.)	8120-4921

Procedure

1. Connect the equipment as shown in Figure 3-20. The spectrum analyzer provides the frequency reference for the synthesized sweeper.
2. Press (INSTR PRESET) on the synthesized sweeper, then set the controls as follows:

   CW .... 300.00008 MHz
   POWER LEVEL .... −15 dBm
   RF .... OFF
   FREQUENCY STANDARD switch (rear panel) .... EXT

3. Press (PRESET) on the spectrum analyzer, then set the controls as follows:

   CENTER FREQ .... 300 MHz
   SPAN .... 1 kHz
   REF LVL .... −10 dBm

4. Press (PEAK SEARCH) on the spectrum analyzer, then MARKER ▸ CF . Wait for the completion of a new sweep.
5. Press (SPAN) 100 (Hz) and wait for the completion of a new sweep. The signal should be near the center graticule line.
6. Press (FREQUENCY) CENTER FREQUENCY (▲) (▲) (▲) (▲). The signal should be one division from the leftmost graticule line.
7. On the synthesized sweeper, set RF to ON.
8. On the spectrum analyzer, press (SGL SWP) and wait for the completion of a new sweep, then press (PEAK SEARCH) MARKER DELTA NEXT PEAK . The active and anchor markers should be on the signals near the second and tenth graticule lines (the leftmost graticule is the first graticule line on the display.)
9. Record the Δ MKR frequency displayed on the spectrum analyzer in Table 3-31.
10. Calculate the span accuracy as shown below and record the result in Table 3-31.

    Span Accuracy = 100 × (ΔMKR Frequency − (0.8 × SPAN))/(0.8 × Span)

11. On the spectrum analyzer, press (MKR) MARKERS OFF .

ERR 401 AMPL 300	Unable to adjust amplitude of 300 Hz RES BW.
ERR 402 AMPL 1K	Unable to adjust amplitude of 1 kHz RES BW.
ERR 403 AMPL 3K	Unable to adjust amplitude of 3 kHz RES BW.
ERR 404 AMPL 10K	Unable to adjust amplitude of 10 kHz RES BW.
ERR 405 RBW 10K	Unable to adjust 10 kHz RES BW Pole 1.
ERR 406 RBW 10K	Unable to adjust 10 kHz RES BW Pole 2.
ERR 407 RBW 10K	Unable to adjust 10 kHz RES BW Pole 3.
ERR 408 RBW 10K	Unable to adjust 10 kHz RES BW Pole 4.
ERR 409 RBW 10K	Unable to adjust 10 kHz RES BW Pole 1.
ERR 410 RBW 10K	Unable to adjust 10 kHz RES BW Pole 2.
ERR 411 RBW 10K	Unable to adjust 10 kHz RES BW Pole 3.
ERR 412 RBW 10K	Unable to adjust 10 kHz RES BW Pole 4.
ERR 413 RBW 10K	Unable to adjust 10 kHz RES BW. No cross PT Pole 1.
ERR 414 RBW 10K	Unable to adjust 10 kHz RES BW. No cross PT Pole 2.
ERR 415 RBW 10K	Unable to adjust 10 kHz RES BW. No cross PT Pole 3.
ERR 416 RBW 10K	Unable to adjust 10 kHz RES BW. No cross PT Pole 4.
ERR 417 RBW 3K	Unable to adjust 3 kHz RES BW. No cross PT Pole 1.
ERR 418 RBW 3K	Unable to adjust 3 kHz RES BW. No cross PT Pole 2.
ERR 419 RBW 3K	Unable to adjust 3 kHz RES BW. No cross PT Pole 3.
ERR 420 RBW 3K	Unable to adjust 3 kHz RES BW. No cross PT Pole 4.
ERR 421 RBW 10K	Unable to adjust 10 kHz RES BW. Cross PT RG Pole 1.
ERR 422 RBW 10K	Unable to adjust 10 kHz RES BW. Cross PT RG Pole 2.

12. Repeat steps 8 through 11 for the remaining spectrum analyzer span, center frequency and HP 8340A/B CW settings listed in Table 3-31.
13. Locate the span accuracy entry in Table 3-31 with the greatest absolute value (treat all percentages as positive percentages). Record this value below with the proper polarity.

Worst Case Span Accuracy: ________ %

Table 3-31. Frequency Span Accuracy

HP 8340A/B Frequency (MHz)	HP 8561B Center Frequency (MHz)	HP 8561B Span	Δ MKR Frequency	Span Accy (%)	Measurement Uncertainty (%)
300.00008	300.00004	100 Hz	________	_____	±0.24
300.00016	300.00008	200 Hz	________	_____	±0.24
300.0004	300.0002	500 Hz	________	_____	±0.24
300.0008	300.0004	1 kHz	________	_____	±0.24
300.0016	300.0008	2 kHz	________	_____	±0.24
300.004	300.002	5 kHz	________	_____	±0.24
300.008	300.004	10 kHz	________	_____	±0.24
300.016	300.008	20 kHz	________	_____	±0.24
300.04	300.02	50 kHz	________	_____	±0.24
300.08	300.04	100 kHz	________	_____	±0.24
300.16	300.08	200 kHz	________	_____	±0.24
300.4	300.2	500 kHz	________	_____	±0.24
300.8	300.4	1 MHz	________	_____	±0.24
301.6	300.8	2 MHz	________	_____	±0.24
304.0	302.0	5 MHz	________	_____	±0.24
308.0	304.0	10 MHz	________	_____	±0.24
316.0	308.0	20 MHz	________	_____	±0.24
340.0	320.0	50 MHz	________	_____	±0.24
380.0	340.0	100 MHz	________	_____	±0.24
460.0	380.0	200 MHz	________	_____	±0.24
700.0	500.0	500 MHz	________	_____	±0.24
1100.0	700.0	1 GHz	________	_____	±0.24
1900.0	1100.0	2 GHz	________	_____	±0.24

ERR 316
FREQ ACC
Sensivity of the Main Roller DAC is zero.

ERR 317
FREQ ACC
Main Coil Course DAC at limits.

ERR 318
FREQ ACC
Main Coil Fine DAC at limits.

ERR 321
FREQ ACC
Main Roller tuning sensitivity is not greater than zero.

ERR 322
FREQ ACC
Main Roller Pretune DAC value set greater than 255.

ERR 324
FREQ ACC
Course Adjust DAC cannot bring MAINSENSE close to zero.

ERR 325
FREQ ACC
Fine Adjust DAC cannot bring MAINSENSE close to zero.

ERR 326
FREQ ACC
Fine Adjust DAC near the end of range.

ERR 327
OFF UNLK
Offset Roller Oscillator PLL is unlocked.

ERR 328
FREQ ACC
Roller Fine Adjust DAC sensitivity less than or equal to zero.

ERR 329
FREQ ACC
Roller Course Adjust DAC sensitivity less than or equal to zero.

ERR 331
FREQ ACC
Invalid YTO frequency.

ERR 333
600 UNLK
600 MHz Reference Oscillator PLL is unlocked.

ERR 334
LO AMPL
1st LO Distribution Amplifier is unleveled.

ERR 335
SMP UNLK
Sampling Oscillator PLL is unlocked.

ERR 336
10 MHz Ref
Cal Oscillator failed to lock when going to internal 10 MHz reference.

Error codes 400 through 599 relate to IF failures. Instrument service is required

These errors are generated when the automatic IF adjustment routine detects a fault. These errors are designed to assist service personnel in IF problem isolation, however, an instrument will function if the suspect functional parameters are not required. This routine adjusts amplitude parameters first, then resolution bandwidths in this sequence: 300 kHz, 1 MHz, 2 MHz, 100 kHz, 30 kHz, 10 kHz, 3 kHz, 1 kHz, 300 Hz, 100 Hz, 30 Hz, and 10 Hz. The routine restarts from the beginning if a fault is detected.

Resolution bandwidth filters adjusted after the routine begins and before the fault is detected should be acceptable; resolution bandwidth filters adjusted later in the sequence are suspect.

If the fault is detected before the first resolution bandwidth (300 kHz) is adjusted, all IF performance is suspect.

ERR 400
AMPL 100
Unable to adjust amplitude of 100 Hz RES BW.

18. Third Order Intermodulation Distortion

Specification

For two −30 dBm input signals at the mixer separated by ≥ 1 kHz:

50 Hz to 10 MHz: <-64 dBc
10 MHz to 2.9 GHz: <-70 dBc
2.75 to 6.5 GHz: <-75 dBc

Related Adjustment

Dual Band Mixer Bias Adjustment

Description

Two synthesized sources provide the signals required for measuring third order intermodulation. The spectrum analyzer and synthesizer/level generator are phase-locked to the synthesized signal generator's 10 MHz reference output. When the two synthesized sweepers are used, the spectrum analyzer provides the 10 MHz reference for the sweepers.

Error codes 200 through 299 relate to ADC hardware/firmware failures. Instrument service is required.

ERR 200 SYSTEM	ADC Driver/ADC Hardware/firmware interaction; check for other errors.
ERR 201 SYSTEM	ADC Controller/ADC Hardware/firmware interaction; check for other errors.
ERR 250 OUTOF RG	ADC input is outside of ADC range.
ERR 251 NO IRQ	Microprocessor not receiving interrupt from ADC.

Error codes 300 through 399 relate to LO and RF hardware/firmware failures. Instrument service is required.

ERR 300 YTO UNLK	YTO (1ST LO) phase-locked loop (PLL) is unlocked.
ERR 301 YTO UNLK	YTO PLL is unlocked.
ERR 302 OFF UNLK	Offset Roller Oscillator PLL is unlocked.
ERR 303 XFR UNLK	Transfer Roller Oscillator PLL is unlocked.
ERR 304 ROL UNLK	Main Roller Oscillator PLL is unlocked.
ERR 305 FREQ ACC	Course Adjust DAC cannot bring MAINSENSE close to zero.
ERR 306 FREQ ACC	Fine Adjust DAC cannot bring MAINSENSE close to zero.
ERR 307 FREQ ACC	Transfer Oscillator Pretune DAC out of range.
ERR 308 FREQ ACC	Offset Oscillator Pretune DAC not within prescribed limits at low frequency.
ERR 309 FREQ ACC	Offset Oscillator Pretune DAC not within prescribed limits at high frequency.
ERR 310 FREQ ACC	Main Roller Pretune DAC set to 255 before MAINSENSE changes to negative polarity.
ERR 311 FREQ ACC	Main Roller Pretune DAC set to 255 before MAINSENSE changes to negative polarity.
ERR 312 FREQ ACC	Fine Adjust DAC cannot bring MAINSENSE close to zero.
ERR 313 FREQ ACC	The combination of Sampler Oscillator and Roller Oscillator frequencies do not correspond to the required YTO start frequency.
ERR 314 FREQ ACC	Span calibration problems. An unlocked Main Roller loop or lack of a sweep ramp.
ERR 315 FREQ ACC	Span calibration problems. Roller Span Attenuator DAC is out of range.

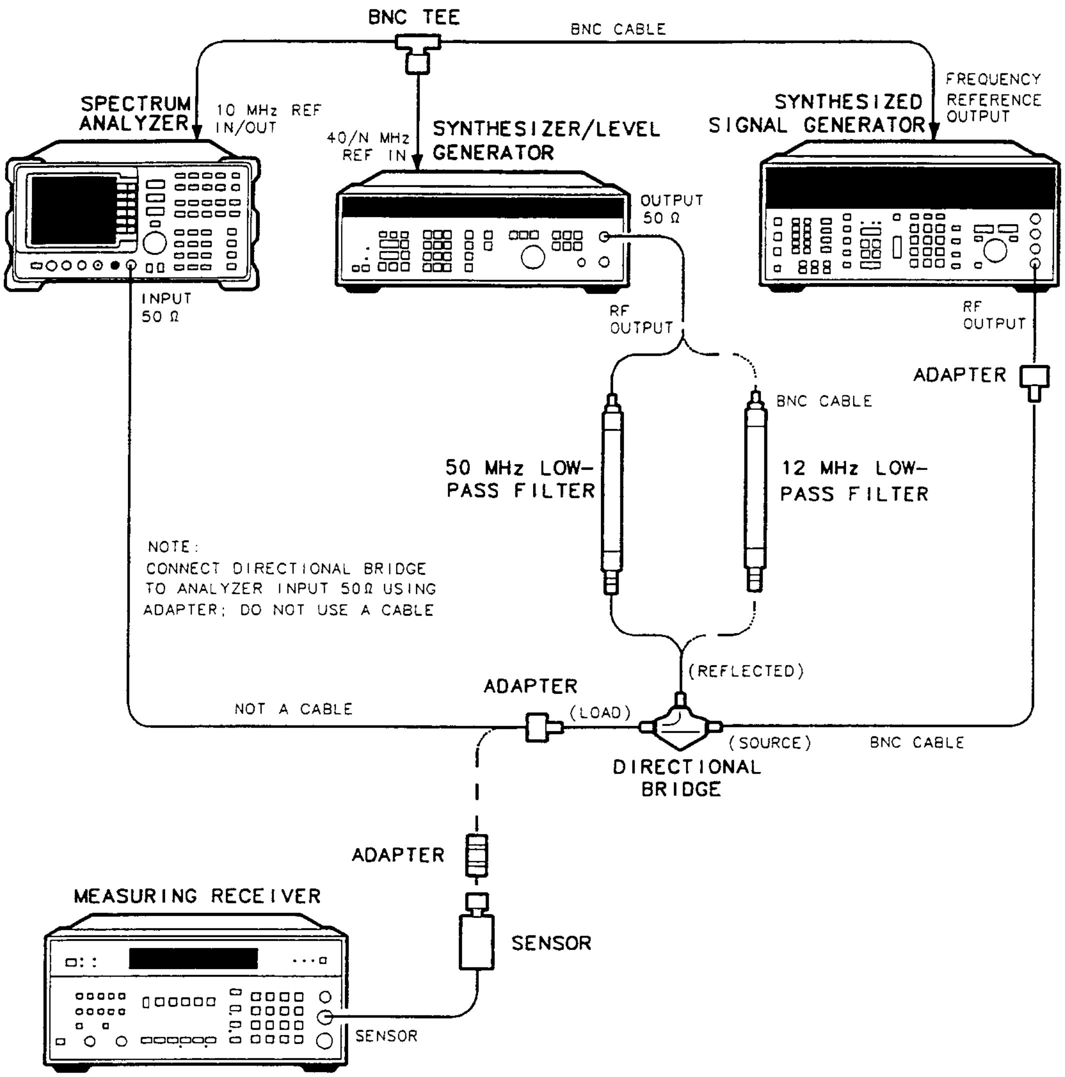

Figure 3-21. Third Order Intermodulation Test Setup (50 Hz to 2.9 GHz)

ERR 124 NOP IBLK	I-block format not valid here.
ERR 125 NOP STRNG	Strings are not valid for this command.
ERR 126 NO ?	This command cannot be queried.
ERR 127 BAD DTMD	Not a valid peak detector mode.
ERR 128 PK WHAT?	Not a valid peak search parameter.
ERR 129 PRE TERM	Premature A-block termination.
ERR 130 BAD TDF	Arguments are only for TDF command.
ERR 131 ?? AM/FM	AM/FM are not valid arguments for this command.
ERR 132 !FAV/RMP	FAV/RAMP are not valid arguments for this command.
ERR 133 !INT/EXT	INT/EXT are not valid arguments for this command.
ERR 134 ??? ZERO	ZERO is not a valid argument for this command.
ERR 135 ??? CURR	CURR is not a valid argument for this command.
ERR 136 ??? FULL	FULL is not a valid argument for this command.
ERR 137 ??? LAST	LAST is not a valid argument for this command.
ERR 138 !GRT/DSP	GRT/DSP are not valid arguments for this command.
ERR 139 PLOTONLY	Argument can only be used with PLOT command.
ERR 140 ?? PWRON	PWRON is not a valid argument for this command.
ERR 141 BAD ARG	Argument can only be used with FDIAG command.
ERR 142 BAD ARG	Query expected for FDIAG command.
ERR 143 NO PRESL	No preselector hardware to use command with.
ERR 144 COUPL??	Invalid COUPLING argument, expected AC or DC.

18. Third Order Intermodulation Distortion

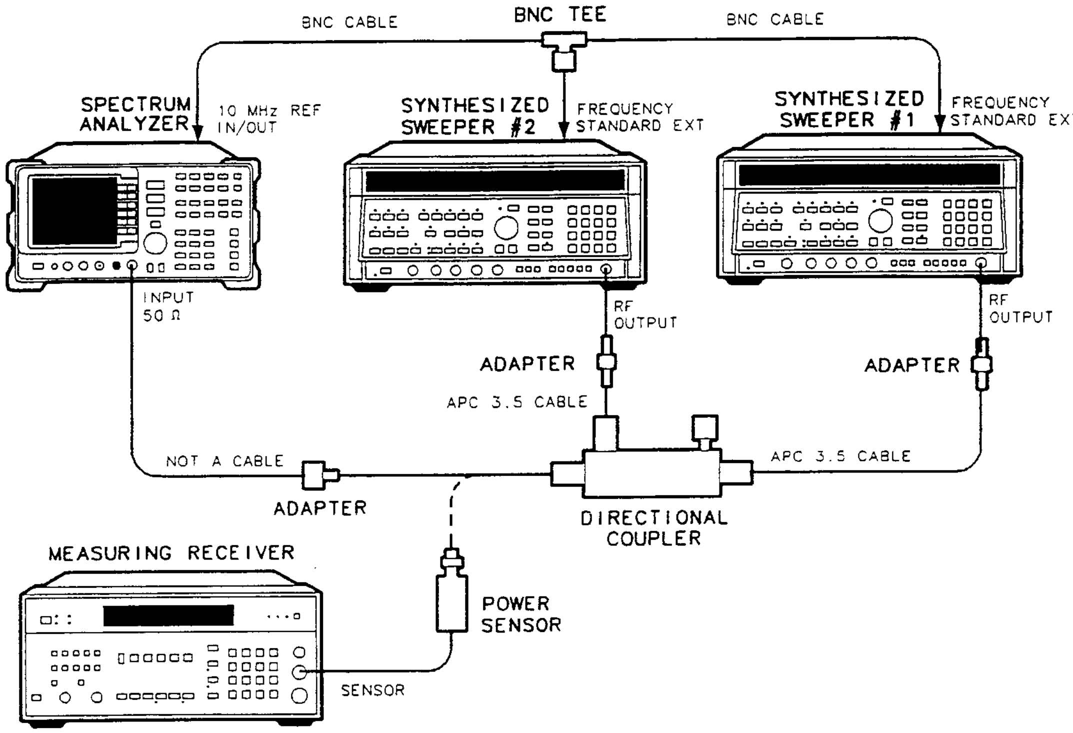

Figure 3-22. Third Order Intermodulation Test Setup (2.75 GHz to 6.5 GHz)

Equipment

Measuring Receiver	HP 8902A
Synthesized Sweeper *(two required)*	HP 8340A/B
Synthesized Signal Generator	HP 8663A
Synthesizer/Level Generator	HP 3335A
Directional Coupler	0955-0125
Power Sensor	HP 8482A
Power Sensor	HP 8485A
Directional Bridge	HP 8721A
12 MHz Low Pass Filter	0955-0518
50 MHz Low Pass Filter	0955-0306
Adapters	
Type N (m) to APC 3.5 (m)	1250-1743
Type N (f) to Type N (f)	1250-1472
Type N (m) to BNC (m)	1250-1473
APC 3.5 (f) to APC 3.5 (f)	5062-5311
BNC Tee (m) (f) (f)	1250-0781
Cables	
BNC, 122 cm (48 in.) *(four required)*	HP 10503A
APC 3.5, 91 cm (36 in.) *(two required)*	8120-4921

Error Code Listing

Error codes and their associated messages are listed in numeric order below.

Error codes 100 to 199 relate to incorrect spectrum analyzer programming

ERR 100 NO PWRON	Power-on state is invalid; default state is loaded.
ERR 101 NO STATE	State to be RECALLed not valid or not SAVEd.
ERR 106 ABORTED!	Current operation is aborted; HP-IB parser reset.
ERR 107 HELLO ??	No HP-IB listener is present.
ERR 108 TIME OUT	Analyzer timed out when acting as controller.
ERR 109 CtrlFail	Analyzer unable to take control of the bus.
ERR 110 NOT CTRL	Analyzer is not system controller.
ERR 111 # ARGMTS	Command does not have enough arguments.
ERR 112 ??CMD??	Unrecognized command.
ERR 113 FREQ NO!	Command cannot have frequency units.
ERR 114 TIME NO!	Command cannot have time units.
ERR 115 AMPL NO!	Command cannot have amplitude units.
ERR 116 ?UNITS??	Unrecognizable units.
ERR 117 NOP NUM	Command cannot have numeric units.
ERR 118 NOP EP	Enable parameter cannot be used.
ERR 119 NOP UPDN	UP/DN are not valid arguments for this command.
ERR 120 NOP ONOF	ON/OFF are not valid arguments for this command.
ERR 121 NOP ARG	AUTO/MAN are not valid arguments for this command.
ERR 122 NOP TRC	Trace registers are not valid for this command.
ERR 123 NOP ABLK	A-block format not valid here.

Procedure

Third Order Intermodulation (10 MHz to 2.9 GHz)

1. Connect the equipment as shown in Figure 3-21 using the 50 MHz low pass filter, but do not connect the directional bridge to the spectrum analyzer.
2. Set the HP 3335A controls as follows:

   FREQUENCY .... 45.050 MHz
   AMPLITUDE .... −86 dBm
   AMPTD INCR .... 0.05 dB
   OUTPUT 50Ω

3. Set the HP 8663A controls as follows:

   FREQUENCY .... 45.000 MHz
   AMPLITUDE .... −14 dBm
   AMPLITUDE INCREMENT .... 0.1 dB
   MODULATION .... OFF

4. On HP 8902A, set the controls as follows:

   FUNCTION .... RF POWER
   LOG/LIN .... LOG

5. Press (PRESET) on the spectrum analyzer, then set the controls as follows:

   CENTER FREQ .... 45.0 MHz
   CF STEP .... 50 kHz
   SPAN .... 1 kHz
   REF LVL .... −20 dBm
   RES BW .... 10 Hz
   10 MHz .... EXT

6. Zero the HP 8902A/HP8482A combination and calibrate the HP 8482A at 50 MHz as described in the HP 8902A Operation Manual.
7. Connect the power sensor to the output of the directional bridge.
8. Adjust the output level of the HP 8663A for a −20 dBm ±0.1 dB reading on the HP 8902A display.
9. Disconnect the power sensor from the directional bridge. Connect the directional bridge directly to the input of the spectrum analyzer using an adapter, not a cable.
10. On the spectrum analyzer, press (PEAK SEARCH) (MKR ▶) MARKER ▶ REF LVL. Wait for the completion of a new sweep, press (MKR) MARKER DELTA (FREQUENCY) (▲).
11. Set the HP 3335A amplitude to −14 dBm.
12. Press (PEAK SEARCH) on the spectrum analyzer.
13. On the HP 3335A, use the INCR keys to adjust the output power level for a Δ MKR amplitude reading of 0.00 dB ±0.17 dB on the spectrum analyzer.

If any error message remains displayed the following actions are suggested:

Error	Action
100 to 199	Programming error detected, refer to the *HP 8560A/8561B/8563A Spectrum Analyzer Operating Manual* for information on programming the spectrum analyzer.
200 to 799	The instrument is in need of service. Refer to Chapter 2 "Preparation" for information about calling Hewlett-Packard.
800 to 899	Option module failures detected. Refer to the appropriate option-module for an explanation of these errors.
900 to 999	User generated errors. Information entered incorrectly or an attempt to use the spectrum analyzer inappropriately.

Recording Error Messages

If returning the analyzer for repair is necessary, include a list of any error codes and messages that appeared when the trouble began. These codes and messages provide troubleshooting information for the service person working on the analyzer.

Viewing Multiple Messages

The spectrum analyzer displays only one error message at a time. More error messages may exist. To check for more error messages, proceed as follows:

1. Press (RECALL), then MORE 1 OF 2.
2. Press RECALL ERRORS. An error message is displayed in the active function block on the analyzer display.
3. Use the (▲) and (▼) keys to scroll through any other error messages which might exist, making note of each error code.

14. On the spectrum analyzer, press (MKR) MARKERS OFF (PEAK SEARCH) MARKER DELTA (FREQUENCY) (▲). Wait for the completion of a new sweep, then press (PEAK SEARCH).
15. Record the spectrum analyzer Δ MKR amplitude reading in Table 3-32 as the upper product suppression for the appropriate frequency.
16. On the spectrum analyzer, press (FREQUENCY) (▼) (▼) (▼). Wait for the completion of a new sweep, then press (PEAK SEARCH).
17. Record the spectrum analyzer Δ MKR amplitude reading in Table 3-32 as the lower product suppression for the appropriate frequency.

Third Order Intermodulation (50 Hz to 10 MHz)

18. Replace the 50 MHz low pass filter with the 12 MHz low pass filter.
19. Enter the power sensor's 10 MHz calibration factor into the HP 8902A.
20. Set the HP 3335A controls as follows:

    FREQUENCY .... 9.050 MHz
    AMPLITUDE .... −86 dBm

21. Set the HP 8663A controls as follows:

    FREQUENCY .... 9.000 MHz
    AMPLITUDE .... −14 dBm

22. Set the spectrum analyzer controls as follows:

    CENTER FREQ .... 9.0 MHz
    REF LVL .... −20 dBm

23. Repeat steps 7 through 17.

Third Order Intermodulation (2.75 GHz to 6.5 GHz)

24. Connect the equipment as shown in Figure 3-22. The spectrum analyzer provides the frequency reference for the synthesized sweepers.
25. On each HP 8340A/B, press (INSTR PRESET). Set the controls as follows:

    POWER LEVEL .... −20 dBm
    MODULATION .... OFF
    RF .... OFF
    FREQUENCY STANDARD SWITCH (rear panel) .... EXT

26. On HP 8340A/B #1, press (CW) 5.0 (GHz).
27. On HP 8340A/B #2, press (CW) 5.00005 (GHz).
28. Replace the HP 8482A Power Sensor with the HP 8485A Power Sensor.

5

Error Messages

Error messages are displayed in the lower right-hand corner of the analyzer's display. A number, or error code, is associated with each error message. Several error codes can correspond to the same error message. These codes are basically provided for service personnel who troubleshoot the spectrum analyzer, however, they also alert the user to errors in spectrum analyzer function or use. Error codes are set up in the following categories:

100 to 199	Programming errors
200 to 299	ADC failures
300 to 399	LO or RF failures
400 to 599	IF failures
600 to 699	Display failures
700 to 799	Digital failures
800 to 899	Option module failures
900 to 999	User generated errors

Eliminating Error Messages

It might be possible to eliminate some error messages by performing a REALIGN LO & IF sequence. Follow this procedure:

1. Press (SAVE), then SAVE STATE.
2. Store the current state in a convenient STATE register.
3. Press (PRESET), (CAL), then REALIGN LO & IF. Wait for the sequence to finish.
4. Press (RECALL), then RECALL STATE.
5. Recall the previously stored STATE.

29. On the spectrum analyzer, press (PRESET) (RECALL) MORE 1 OF 2 FACTORY PRESEL PK. Set the controls as follows:

CENTER FREQ	5.0 GHz
REF LVL	−20 dBm
SPAN	10 kHz
CF STEP	50 kHz
RES BW	1 kHz
VIDEO BW	100 Hz

30. Zero the HP 8902A and calibrate the HP 8485A power sensor at 50 MHz, as described in the *HP 8902A Operation Manual*. Enter the power sensor's 5 GHz calibration factor into the HP 8902A.
31. Connect the HP 8485A Power Sensor to the directional coupler.
32. On HP 8340A/B #1, press (RF) ON. Adjust the power level for a −20 dBm reading on the HP 8902A display.
33. Disconnect the power sensor from the directional coupler. Connect the directional coupler directly to the spectrum analyzer INPUT 50Ω using an adapter. Do not use a cable.
34. On the spectrum analyzer, press (PEAK SEARCH) (MKR ▶) MKR ▶ REF LVL. Wait for the new sweep to finish, then press (MKR) MARKER DELTA (FREQUENCY) (▲).
35. On HP 8340A/B #2, press (RF) ON.
36. On the spectrum analyzer, press (PEAK SEARCH).
37. On HP 8340A/B #2, adjust POWER LEVEL for a Δ MKR reading of 0.0 dB ±0.17 dB on the spectrum analyzer.
38. On the spectrum analyzer, press (MKR) MARKERS OFF (PEAK SEARCH) MARKER DELTA (FREQUENCY) (▲). Wait for the new sweep to finish, then press (PEAK SEARCH).
39. Record the spectrum analyzer Δ MKR reading below, as the Upper Product Suppression.

Upper Product Suppression: _______________ dBc

40. On the spectrum analyzer, press (FREQUENCY) (▼) (▼) (▼). Wait for a new sweep to finish, then press (PEAK SEARCH).
41. Record the spectrum analyzer Δ MKR reading below, as the Lower Product Suppression:

Lower Product Suppression: _______________ dBc

Test Results

42. Between the upper and lower product suppressions recorded in Table 3-32 for the HP 8663A frequency setting of 45 MHz, record the more positive suppression as the third order intermodulation distortion (10 MHz to 2.9 GHz).

Third Order Intermodulation Distortion (10 MHz to 2.9 GHz): ______________ dBc

43. Between the upper and lower product suppressions recorded in Table 3-32 for the HP 8663A frequency setting of 9 MHz, record the more positive suppression below as the third order intermodulation distortion (<10 MHz).

Third Order Intermodulation Distortion (<10 MHz): ______________ dBc

44. Between the upper and lower product suppressions recorded in steps 39 and 40, record the more positive suppression as the third order intermodulation distortion (2.75 GHz to 6.5 GHz).

Third Order Intermodulation Distortion (2.75 GHz to 6.5 GHz): ______________ dBc

Table 3-32. Third Order Intermodulation Distortion

HP 8663A FREQUENCY (MHz)	HP 3335A FREQUENCY (MHz)	Lower Product Suppression (dB)	Upper Product Suppression (dB)	Measurement Uncertainty (dB)
45.000	45.050	________	________	±2.83
9.000	9.050	________	________	±2.83

8662/63 Frequency reference out of tolerance The HP 8662A/63A frequency reference is out of tolerance. Consult the HP 8662A or HP 8663A manual.

8662/63 Malfunction. Origin unknown The HP 8662A/63A has detected a malfunction. Consult the HP 8662A or HP 8663A manual.

8662/63 Oven not yet warmed up The HP 8662A/63A 10 MHz oven oscillator is cold. Allow the oven to warm up.

8662/63 Should be on INTernal reference The HP 8662A/63A is in EXTernal frequency reference mode. Set the HP 8662A/63A to INTernal frequency reference.

Error Messages Beginning with Variables

<filename> file not found The file indicated could not be found at the listed system mass storage file location. Check the filename and the system mass storage file location.

<keyboard entry> is a non-numeric entry The program expected a numeric entry but did not receive one. Enter a numeric entry.

<number of instruments> instruments have HP-IB addresses of <HP-IB address> The indicated number of instruments have all been set to the same HP-IB address. Review the addresses and eliminate the duplication.

<power meter model number> doesn't read signal to be in −1 +/−5 dBm range The power meter (or measuring receiver) does not read a power level within the range indicated. Check for loose connections.

<source model number> +5 dBm signal not in +5 +/−5 dBm range The source indicated was set for +5 dBm output, but the spectrum analyzer measured the amplitude to be outside the ±5 dB range. Check test setup.

<source model number> +5 dBm signal not in −1 +/−5 dBm range The source indicated was set for + 5 dBm output and the source output is fed through a power splitter to the spectrum analyzer under test. The spectrum analyzer should measure the amplitude to be within 5 dB of −1 dBm (6 dB loss through power splitter). Check test setup.

<source model number> +10 dBm signal not in +10 +/−8 dBm range The source indicated was set for a +10 dBm output and the source output is fed through a low-pass filter(s) to the spectrum analyzer under test. The spectrum analyzer should measure the amplitude to be within 8 dB of +10 dBm (the filters have some insertion loss). Check test setup.

<source model number> has a cold oven The 10 MHz reference oven oscillator has not warmed up yet. Allow the oven to warm up.

<source model number> is unlevelled The source indicated has been programmed for an amplitude which results in an unlevelled condition. Check the test setup for loose connections.

19. Gain Compression

Specification

10 MHz to 2.9 GHz: <1.0 dB for total mixer power level* of −5 dBm
2.9 GHz to 6.5 GHz: <1.0 dB for total mixer power level* of −3 dBm

* Total mixer power level – total input power level – input attenuation

Related Adjustment

There is no related adjustment procedure for this performance test.

Description

This test measures the analyzer's gain compression using two signals that are 3 MHz apart. First the test places a −30 dBm signal at the input of the spectrum analyzer (the analyzer's reference level is also set to −30 dBm). Then a +5 dBm signal is input to the analyzer, overdriving its input. The decrease in the first signal's amplitude (gain compression) caused by the second signal is the measured gain compression.

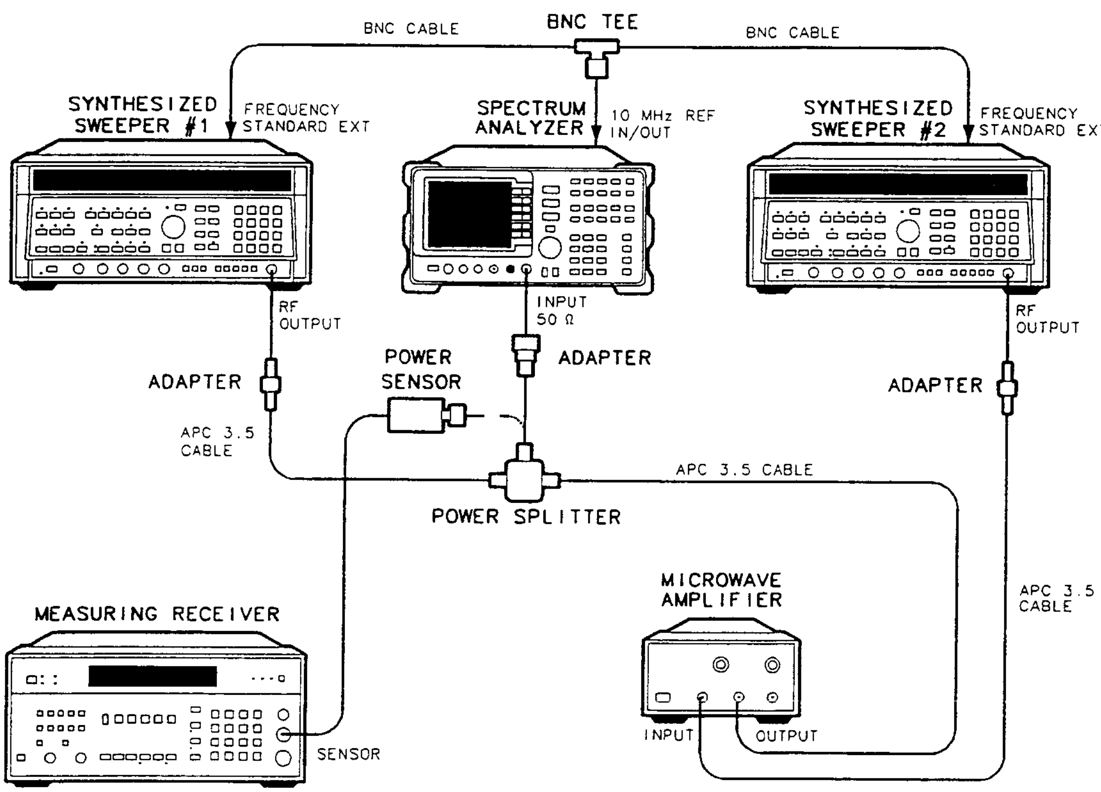

Figure 3-23. Gain Compression Test Setup

Operation Verification Error Messages

Sensor serial number must be from 1 to 99999	The power sensor serial number entered was not in the range indicated. Enter the serial number correctly.
System mass storage file location catalog cannot be read	Program attempted to read the catalog of the system mass storage file location. Check the msus of the system mass storage file location.
Test number must be between 0 and 14	Valid test numbers are in the range 0 and 14 for entering a sequence. Entering a 0 will terminate sequence entry and begin testing sequence. Press any key and enter a valid test number at the next prompt.
Unable to load CONDITIONS file from listed system file location	Program attempted to load the CONDITIONS file from the listed system mass storage file location. Check the msus of the System mass storage file location and the presence of the CONDITIONS file.
Unable to load data from <sensor filename>	Program found power sensor data file, but could not read the data from the file. Use the Sensor Utilities to delete the file and enter new data.
Unable to obtain catalog from <system mass storage file location>	The system could not verify that the system mass storage file location entered was available. Check the msus of the system mass storage file location.
Unable to reach power level of <value> dBm	Program was unable to set the source amplitude for a desired power meter reading. Check the test setup.

Error Messages Beginning with Numeric Characters

8481A Sensor cal data minimum frequency not <= 50 MHz	Program requires the HP 8481A Power Sensor to have a Cal Factor at or below 50 MHz. Use Sensor Utilities to add a Cal Factor at or below 50 MHz.
8481A Sensor cal data maximum frequency not >= 300 MHz	Program requires the HP 8481A Power Sensor to have a Cal Factor at or above 300 MHz. Use Sensor Utilities to add a Cal Factor at or above 300 MHz.
8482A Sensor cal data minimum frequency not <= 50 MHz	Program requires the HP 8482A Power Sensor to have a Cal Factor at or below 50 MHz. Use Sensor Utilities to add a Cal Factor at or below 50 MHz.
8482A Sensor cal data maximum frequency not >= 300 MHz	Program requires the HP 8482A Power Sensor to have a Cal Factor at or above 300 MHz. Use Sensor Utilities to add a Cal Factor at or above 300 MHz.
8485A Sensor cal data minimum frequency not = 50 MHz	Program requires the HP 8485A Power Sensor to have a Cal Factor at 50 MHz. Use Sensor Utilities to add a Cal Factor at 50 MHz.
8485A Sensor cal data maximum frequency not >= 22 GHz	Program requires the HP 8485A Power Sensor to have a Cal Factor at or above 22 GHz. Use Sensor Utilities to add a Cal Factor at or above 22 GHz.
8662/63 Error # <error number>	The HP 8662A/63A generated the error listed. Consult the HP 8662A or HP 8663A manual.

Equipment

Synthesized Sweeper *(two required)*	HP 8340A/B
Measuring Receiver	HP 8902A
Amplifier	HP 11975A
Power Sensor	HP 8485A
Power Splitter	HP 11667B
Adapters	
APC 3.5 (f) to APC 3.5 (f) *(two required)*	5061-5311
Type N (m) to APC 3.5 (m)	1250-1743
BNC Tee (m) (f) (f)	1250-0781
Cables	
BNC, 122 cm (48 in.) *(two required)*	HP 10503A
APC 3.5, 91 cm (36 in.) *(three required)*	8120-4921

Procedure

Gain Compression, Band 0 (<2.9 GHz)

1. Zero the HP 8902A and calibrate the HP 8485A Power Sensor as described in the *HP 8902A Operation Manual*. Enter the power sensor's 2 GHz calibration factor into the HP 8902A.
2. Connect the equipment as shown in Figure 3-23, with the output of the power splitter connected to the HP 8485A Power Sensor.
3. On HP 8340A/B #1, press (INSTR PRESET). Set the controls as follows:

   CW .... 2.0 GHz
   POWER LEVEL .... −24 dBm
   FREQUENCY STANDARD Switch (rear panel) .... EXT

4. On HP 8340A/B #2, press (INSTR PRESET). Set the controls as follows:

   CW .... 2.003 GHz
   POWER LEVEL .... +8 dBm
   FREQUENCY STANDARD Switch (rear panel) .... EXT

5. On the spectrum analyzer, press (PRESET).
6. Set the controls as follows:

   CENTER FREQ .... 2.0 GHz
   REF LVL .... −30 dBm
   SPAN .... 10 MHz
   RES BW .... 300 kHz
   LOG dB/DIV .... 1 dB

7. Adjust the HP 11975A Output Power Level for a +5 dBm reading on the HP 8902A display.
8. On HP 8340A/B #2, adjust the power level to −80 dBm.

Low pass filter(s) don't have at least <value> dB rejection
The low-pass filters are checked for rejection at the second harmonic in the Second Harmonic Distortion test. If insufficient rejection is detected, the part of the test using the tested filter cannot be run.

Maximum cal amplitude <−10 dBm
Program checked that CAL OUTPUT was connected to INPUT 50Ω and found that the REF LVL CAL adjustment could not be set for a marker amplitude of ≥−10 dBm. Check CAL OUTPUT amplitude and REF LVL CAL adjustment range.

No HP-IB address listed for DUT
Program attempted to address the spectrum analyzer (DUT), but no HP-IB address was listed for it. Press any key and enter an address for the spectrum analyzer.

No more tests may be linked; enter 0 at next prompt
When entering a sequence of tests, the sequence string (including commas) cannot exceed 78 characters. Press any key and then a 0 at the next prompt. The testing sequence will begin.

Non-numeric entry other than S entered, or frequency <=0
When entering a frequency of a frequency/Cal-Factor pair to be added, edited, or deleted, the entry must either be a number greater than 0, or S to store the current data.

No sensor file found for <sensor model> S/N <sensor serial #>
A power sensor data file for the indicated power sensor could not be found on the currently specified system mass storage file location specifier. Check the sensor's model and serial numbers and the system mass storage file location.

No 8662/63 reference oscillator. Check INT-EXT switches
No 10 MHz reference oscillator for the HP 8662A/63A was detected. Check the INTernal/EXTernal frequency reference switches on its rear panel. The HP 8662A/63A should be using its internal reference oscillator.

Power meter reads <value> dBm
The power meter has read a value far exceeding the specification of the CAL OUTPUT amplitude; check that power sensor is connected to CAL OUTPUT and press any key. The power will be read once more and assumed to be valid.

Printer not available; cannot perform tests
All test results are sent to the printer. If a printer is not available, tests cannot be performed.

REF LVL CAL adjustment range <5 dB
In checking that the CAL OUTPUT was connected to INPUT 50Ω, the REF LVL CAL adjustment was found to have insufficient range. Check REF LVL CAL range manually.

Select code <value> does not currently support HP-IB operations
The address just entered specified a select code which is not an HP-IB interface. Check the address entered and the select code of the appropriate interface.

9. Remove the power sensor from the power splitter. Connect the power splitter to the spectrum analyzer INPUT 50Ω using an adapter. Do not use a cable.
10. On HP 8340A/B #1, adjust the power level for a signal 1 dB below the spectrum analyzer reference level.
11. On the spectrum analyzer, press (PEAK SEARCH) (MKR) MARKER DELTA.
12. On HP 8340A/B #2, set the power level to +8 dBm.
13. On the spectrum analyzer, press (PEAK SEARCH) NEXT PEAK. The active marker should be on the lower amplitude signal, not on the signal that is off the top of the screen. If it is not on the lower amplitude signal, reposition the marker to this peak, using the front-panel function knob. Read the Δ MKR amplitude. Record the Δ MKR amplitude in Table 3-33 as Gain Compression.

Gain Compression, Band 1 (>2.9 GHz)

14. Set the spectrum analyzer, HP 8340A/B #1, and HP 8340A/B #2 to the frequency indicated in Table 3-33 for Band 1.
15. Enter the power sensor's calibration factor, for the selected spectrum analyzer center frequency, into the HP 8902A.
16. Disconnect the power splitter from the spectrum analyzer; reconnect it to the power sensor.
17. Adjust the HP 11975A output power level for a +7 dBm reading on the HP 8902A display.
18. On the HP 8340A/B #2, set the power level to −80 dBm.
19. Reconnect the power splitter to the spectrum analyzer's INPUT 50Ω connector.
20. On the HP 8340A/B #1, adjust the power level to bring the signal 1 dB (one division) below the spectrum analyzer reference level.
21. On the spectrum analyzer, press (MKR) MARKERS OFF (PEAK SEARCH).
22. Press (AUX CTRL) INTERNAL MIXER PRESEL AUTO PK. Wait for the PEAKING message to disappear, then press (PEAK SEARCH) MARKER DELTA.
23. On the HP 8340A/B #2, set the power level to +8 dBm.
24. On the spectrum analyzer, press (PEAK SEARCH) NEXT PEAK. The active marker should be on the peak of the lower amplitude signal. If it is not, reposition the marker to the lower peak, using the knob. Read the Δ MKR amplitude. Record the Δ MKR reading in Table 3-33.

Operation Verification Error Messages

Operation Verification displays prompts and error messages on the computer display. Error messages are preceded with `ERROR:`. For more information on prompts, refer to "Program Operation" in this chapter.

The error messages listed below are in three groups: messages beginning with alphabetic characters, those beginning with numeric characters, and others beginning with variables such as filenames or instrument model numbers. If an error message is not found in either of the first two groups, it probably begins with a variable. Refer to the third group that begins with variables. The error message descriptions include recommended corrective action.

Error Messages Beginning with Alphabetic Characters

Address must be from 0 to 30 inclusive	HP-IB addresses must be in the range from 0 to 30. Press any key and enter new address in this range.
Cal Factor outside of 0 to 150% range entered	Cal Factor entries must be within this range. Press any key and enter the frequency again. Then enter a Cal Factor in the proper range.
Conditions Menu DUT ID disagrees with responding DUT ID	The model and/or serial number of the spectrum analyzer under test (DUT) listed in the "Conditions Menu" in Chapter 3 does not agree with that of the DUT which is responding over HP-IB. Press any key and follow the instructions in the next three prompts.
Could not set calibrator signal to −10.00 or −10.17 dBm	While attempting the noise sidebands test using the CAL OUTPUT signal, the amplitude of the CAL OUTPUT signal could not be set to one of the values indicated. Check the CAL OUTPUT amplitude and the range of the reference level calibration adjustment.
Counter reads <frequency value> Hz. Check counter setup	The microwave frequency counter read a frequency far exceeding the specification of the 10 MHz reference. Check the test setup and press any key. The counter will read the frequency once more and assume that the value is correct.
Data not accepted, check entry format	The data just entered was not valid. Press any key and try again, checking for the proper entry format.
DUT doesn't respond at address listed	Program attempted to address the spectrum analyzer under test at the address listed, but the spectrum analyzer did not respond. Check the HP-IB connections and the address listed.
File <filename> not found	The filename of the power sensor data file entered could not be found on the currently specified system mass storage file location. Check the filename and the system mass storage file location.
Insufficient equip. to do test <test number> : <test name>	The required HP-IB-controlled test equipment for the test indicated is not available. Press any key and choose another test.

19. Gain Compression

Table 3-33. Gain Compression

Band	HP 8561B Center Freq (GHz)	HP 8340A/B #1 CW (GHz)	HP 8340A/B #2 CW (GHz)	Gain Compression (dB)	Measurement Uncertainty (dB)
0	2.0	2.0	2.003	________	±0.23
1	4.0	4.0	4.003	________	±0.23

Frequency Span Accuracy

Related Performance Test

Frequency Span Accuracy

Test Description

Two synthesized sources provide two signals of precise frequency separation. One source is a synthesized sweeper, and the second source may be either a second synthesized sweeper or the frequency synthesizer. The frequency separation is measured using the spectrum analyzer's delta-marker function and compared to the specification. The frequency reference for both synthesized sources is provided by the spectrum analyzer. Only spans up to 500 MHz will be tested if the frequency synthesizer is used as the second source. The 19.25 GHz span is not tested on HP 8562B Spectrum Analyzers. A Short Pass will occur in either of these two cases if the spans tested are within specification.

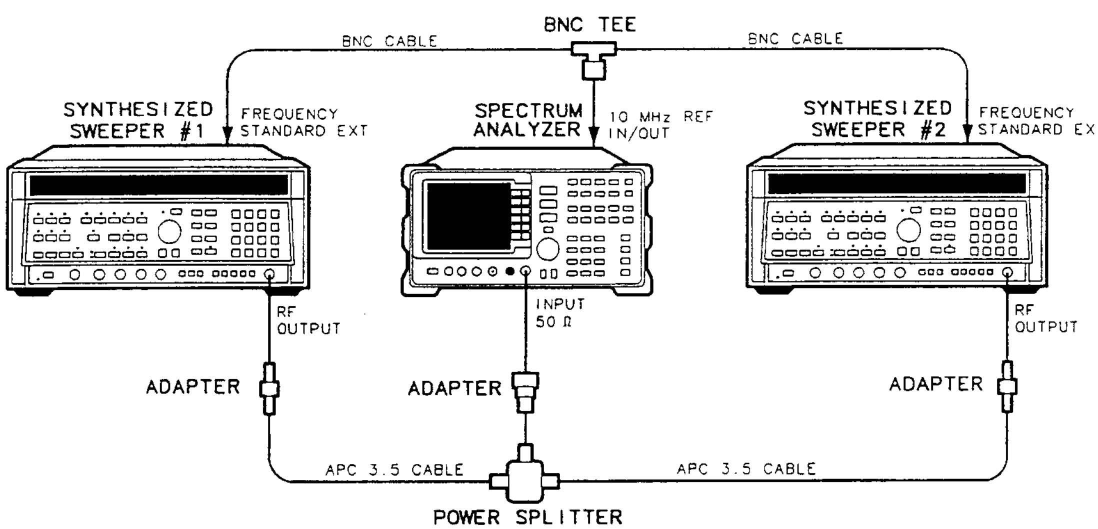

Figure 4-16. Frequency Span Accuracy Test Setup

20. 1ST LO OUTPUT Amplitude

Specification

Amplitude 3.0 to 6.7 GHz: +16.5 dBm ±2.0 dB

Related Adjustment

First LO Distribution Amplifier Adjustment

Description

1ST LO OUTPUT power is measured with a power meter. The spectrum analyzer is placed in external mixing mode and harmonic-locked to N = 6. This allows for the greatest tuning range of the 1ST LO.

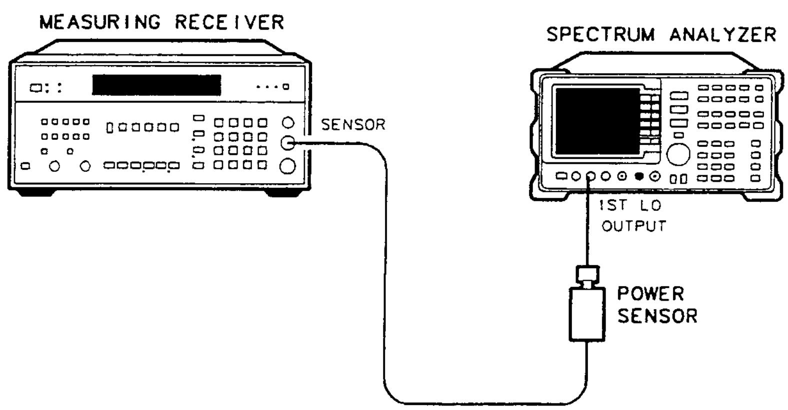

Figure 3-24. 1ST LO OUTPUT Amplitude Test Setup

Equipment

Measuring Receiver	HP 8902A
Power Sensor	HP 8485A

Note The results of this test are valid only if the ambient temperature is between 20°C and 30°C.

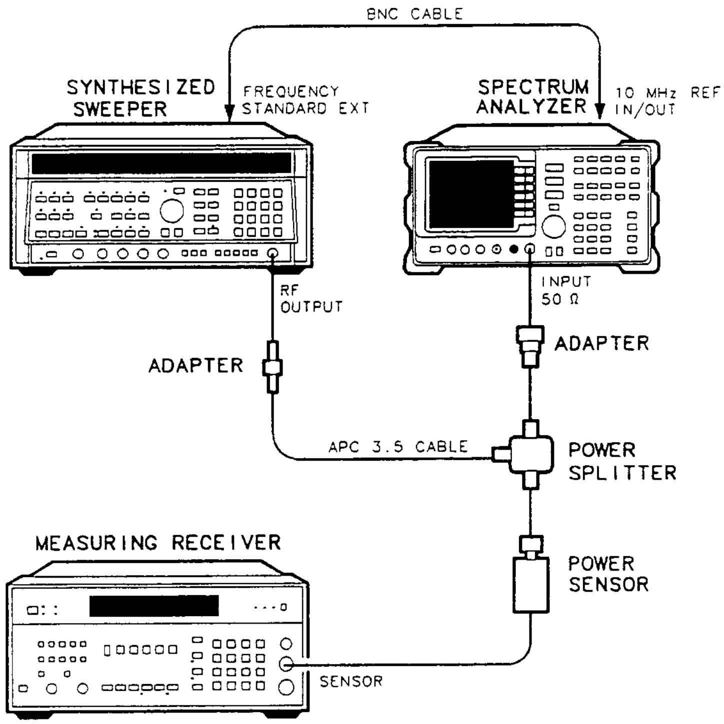

Figure 4-15. Frequency Response Test Setup (50 MHz to 22 GHz)

Procedure

1. Zero the HP 8902A and calibrate the HP 8485A Power Sensor at 50 MHz as described in the *HP 8902A Operation Manual*. Enter the power sensor's 3 GHz calibration factor into the HP 8902A. Set the HP 8902A for dBm output (LOG display).
2. Connect the equipment as shown in Figure 3-24.
3. On the spectrum analyzer, press (PRESET). Set the controls as follows:

   MIXING .... EXT
   LOCK HARMONIC .... #6
   CENTER FREQ .... 18 GHz
   CF STEP .... 1200 MHz
   RES BW .... 1 MHz
   SPAN .... 0 Hz

4. Read the RF Power displayed on the HP 8902A, and record it as the 3.000 GHz entry in Table 3-34, column 5.
5. On the spectrum analyzer, use (FREQUENCY) CENTER FREQ and (▲) to step the 1ST LO frequency in 200 MHz increments (center frequency in 1200 MHz steps). Enter the appropriate power sensor calibration factor into the HP 8902A. At each step, record the power level displayed on the HP 8902A in Table 3-34.
6. Record the maximum 1ST LO OUTPUT Power here:

   Maximum 1ST LO OUTPUT Power:__________dB

7. Record the minimum 1ST LO OUTPUT Power here:

   Minimum 1ST LO OUTPUT Power:__________dB

Frequency Response

Related Performance Test

Frequency Response

Test Description

The spectrum analyzer's frequency response is tested with two setups: the first, using the frequency synthesizer, for frequencies between the spectrum analyzer's minimum frequency and 50 MHz; and the second, using the synthesized sweeper and a measuring receiver or power meter, for frequencies above 50 MHz. If the frequency synthesizer is not available, the frequency response above 50 MHz can still be tested. If the frequency synthesizer is available, but you do not wish to perform the test below 50 MHz, enter a Q when prompted to connect the HP 3335A output to the spectrum analyzer input.

In both parts of this test, a signal of known amplitude is applied to the input of the spectrum analyzer and the analyzer's marker amplitude is read. The frequency response relative to the calibrator frequency (300 MHz), within a given frequency band, is calculated and compared to specification. The band-switching uncertainty specification is verified by calculating the band-to-band frequency response. The band-to-band frequency response specification is equivalent to the sum of the in-band frequency response specifications of the two bands in question and the band-switching uncertainty specification.

While the >50 MHz part of the test is running, a graph of frequency response relative to the CAL OUTPUT signal will be plotted on the computer's display. This graph will be dumped to the printer when the test has been completed. If one of the band-to-band frequency response entries is out-of-tolerance, the <<<< symbol will be placed to the right of the row where the out-of-tolerance condition was detected. It will not necessarily be placed directly to the right of the out-of-tolerance entry. Check each entry in that row against the specification (listed in parentheses) to find the entry that is out of tolerance. A Short Pass will occur if the >50 MHz part of the test is within specification but the <50 MHz part of the test was not performed.

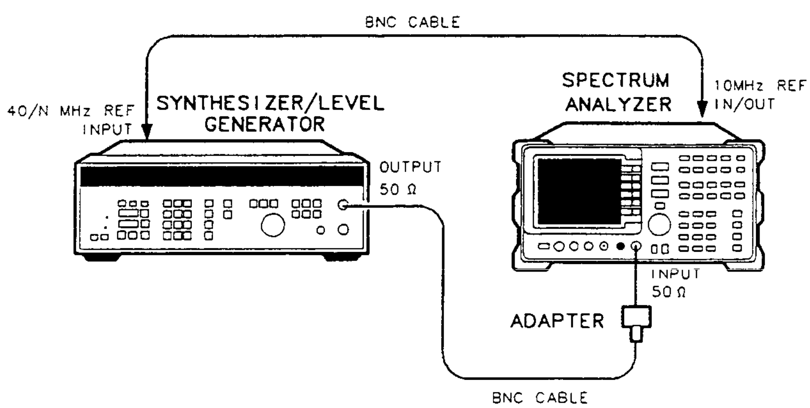

Figure 4-14. Frequency Response Test Setup (<50 MHz)

Table 3-34. 1ST LO OUTPUT Amplitude

1ST LO FREQ* (GHz)	CENTER FREQ (n=6) (GHz)	CAL Factor Frequency (GHz)	1ST LO OUTPUT Power (dBm)	Measurement Uncertainty (dB)
3.0	18	3.0	________	±0.25
3.2	19.2	3.0	________	±0.25
3.4	20.4	3.0	________	±0.25
3.6	21.6	4.0	________	±0.25
3.8	22.8	4.0	________	±0.25
4.0	24.0	4.0	________	±0.25
4.2	25.2	4.0	________	±0.25
4.4	26.4	4.0	________	±0.25
4.6	27.6	5.0	________	±0.25
4.8	28.8	5.0	________	±0.25
5.0	30.0	5.0	________	±0.25
5.2	31.2	5.0	________	±0.25
5.4	32.4	5.0	________	±0.25
5.6	33.6	6.0	________	±0.25
5.8	34.8	6.0	________	±0.25
6.0	36.0	6.0	________	±0.25
6.2	37.2	6.0	________	±0.25
6.4	38.4	6.0	________	±0.25
6.6	39.6	7.0	________	±0.25
6.8	39.99997	7.0	________	±0.25

* Nominal. Actual 1st LO frequency is within 60 MHz of this frequency.

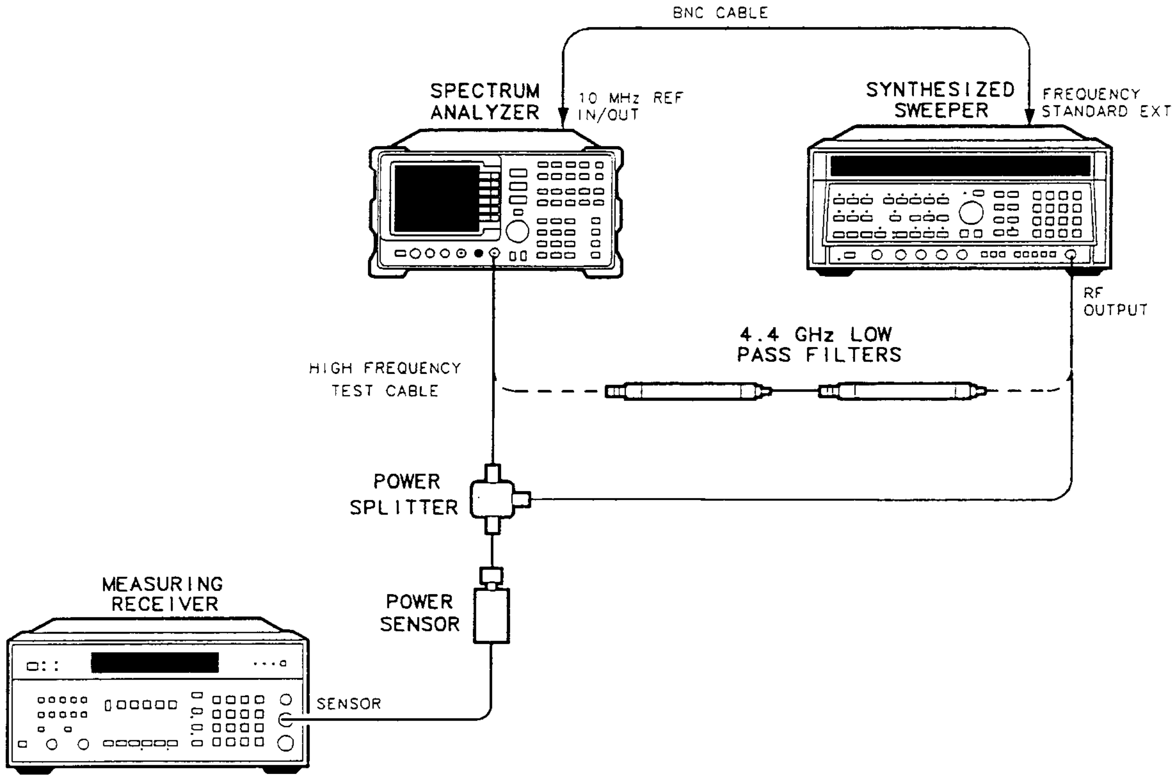

Figure 4-13. High-Band Second Harmonic Distortion Test Setup

21. Sweep Time Accuracy

Specification

For SPAN = 0 Hz:

Sweep time <30 ms: <±15%

Sweep time ≤60 s but ≥30 ms: <±1%

Related Adjustment

Display Adjustments (Fast Zero Span Adjustments)

Description

For sweep times less than 30 ms, an amplitude-modulated signal is displayed on the spectrum analyzer in zero span, and the frequency of the modulating signal (triangle wave) is adjusted to space the peaks evenly across the display. The frequency of the modulating signal is counted and the actual sweep time is calculated and compared to the specification.

For sweep times of 30 ms to 60 seconds, the time interval of the BLANKING OUTPUT's low state is measured. This time interval corresponds to the sweep time. The measured sweep time is compared to the specification.

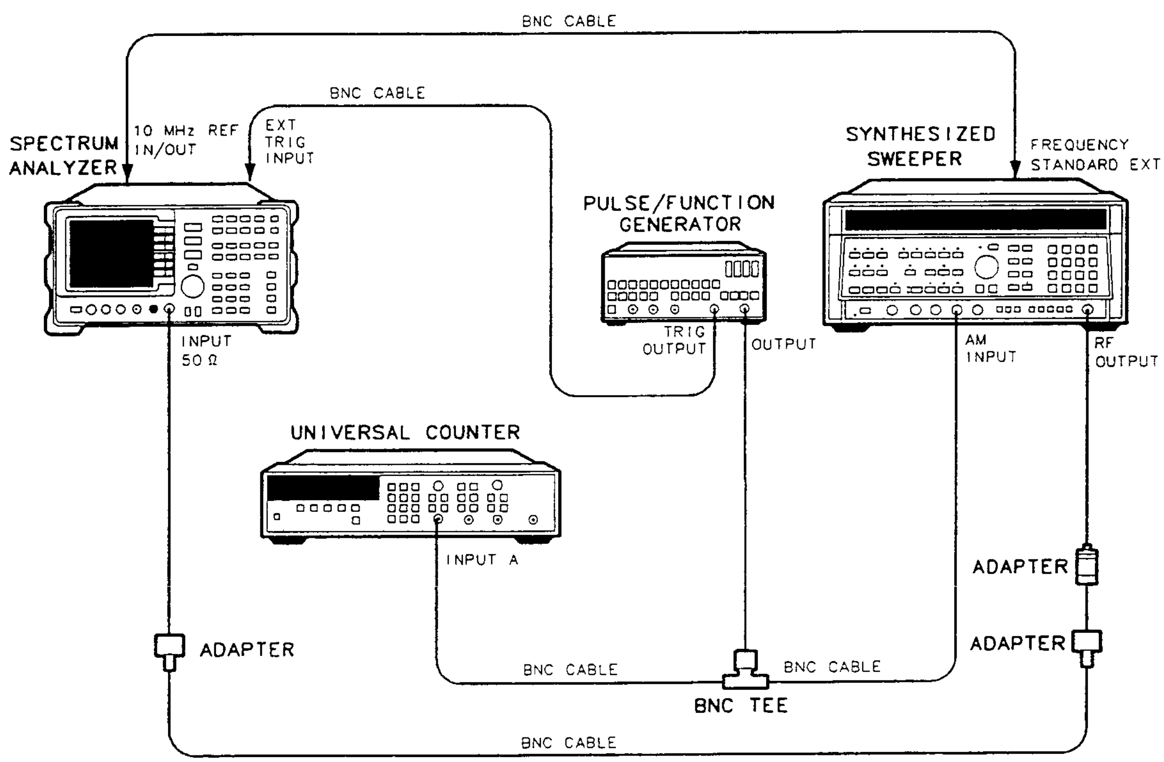

Figure 3-25. Sweep Time Accuracy Test Setup

Second Harmonic Distortion

Related Performance Test

Second Harmonic Distortion

Test Description

This test consists of two parts: a low-band distortion test and a high-band distortion test. The low-band distortion test can be performed using either the frequency synthesizer or the synthesized sweeper. The high-band distortion test can only be performed using a synthesized sweeper. After the low-band distortion test has been completed, if a synthesized sweeper is available, the operator may choose whether or not to perform the high-band distortion test.

Before making the second harmonic distortion measurement, the filters are checked for sufficient rejection at the second harmonic. A warning message will be displayed if the filter has insufficient rejection. If the filter is acceptable, the test will proceed. The test is performed at 50 MHz for low band and at 2.95 GHz for high band (these are the fundamental frequencies).

Before checking the second harmonic distortion in high band, a frequency response check is made to reduce the measurement uncertainty due to the spectrum analyzer's frequency response. Two filters are necessary for the high-band distortion test to ensure sufficient rejection at the second harmonic.

A Short Pass occurs if the low-band distortion test is within specification, and the high-band test is not performed.

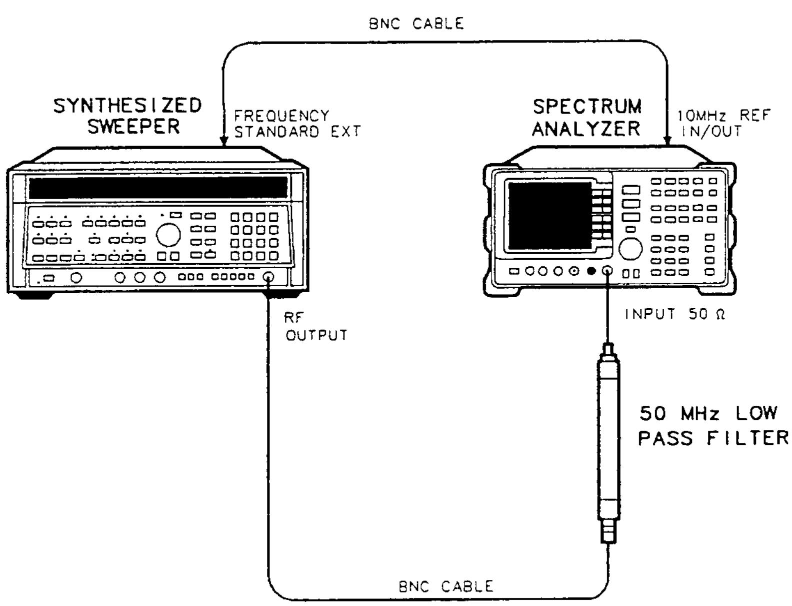

Figure 4-12. Low-Band Second Harmonic Distortion Test Setup

Equipment

Synthesized Sweeper	HP 8340A/B
Universal Counter	HP 5334A/B
Pulse/Function Generator	HP 8116A
Adapters	
Type N (f) to APC 3.5 (f)	1250-1745
Type N (m) to BNC (f) *(two required)*	1250-1476
BNC tee (m) (f) (f)	1250-0781
Cable	
BNC, 122 cm (48 in.) *(five required)*	HP 10503A

Procedure

1. Connect the equipment as shown in Figure 3-25, with the BNC cable from the HP 8116A TRIG OUTPUT connected to the spectrum analyzer EXT TRIG INPUT.
2. On the spectrum analyzer, press [PRESET]. Set the controls as follows:

   CENTER FREQ .... 300 MHz
   SPAN .... 0 Hz
   SWEEP TIME .... 50 μs
   SCALE .... LINEAR

3. Set the HP 5334A/B as follows:

   FUNCTION/DATA .... FREQ A
   INPUT A
   ×10 .... OFF
   AC .... OFF
   50ΩZ .... ON
   AUTO TRIG .... OFF
   100 kHz FILTER A .... OFF
   SENS .... OFF

4. On the HP 5334A/B, press [READ LEVELS] once. Adjust the INPUT A LEVEL/SENS control until the number on the left side of the display reads 0.00 ±0.10. Press [READ LEVELS] [READ LEVELS] [READ LEVELS].
5. If the LED next to the INPUT A LEVEL/SENS control is not flashing, press [SENS] (the LED inside the SENS key should now be lit). Adjust the LEVEL/SENS control until the LED next to the INPUT A LEVEL/SENS control begins to flash.
6. On the HP 8340A/B, press [INSTR PRESET]. Set the controls as follows:

   CW .... 300 MHz
   POWER LEVEL .... −5 dBm
   MODULATION .... AM

7. On the spectrum analyzer, press [TRIG] **EXTERNAL**.

Frequency Readout/Frequency Counter Accuracy

Related Performance Test

Frequency Readout Accuracy/ Frequency Count Marker Accuracy

Test Description

The frequency of the synthesized sweeper signal is measured using both the normal marker and the frequency count marker. Both the "frequency readout × frequency reference accuracy" and "marker frequency × frequency reference accuracy" terms of the specification are zero, since the spectrum analyzer provides the frequency reference for the synthesized sweeper. The marker frequencies are compared to the specification.

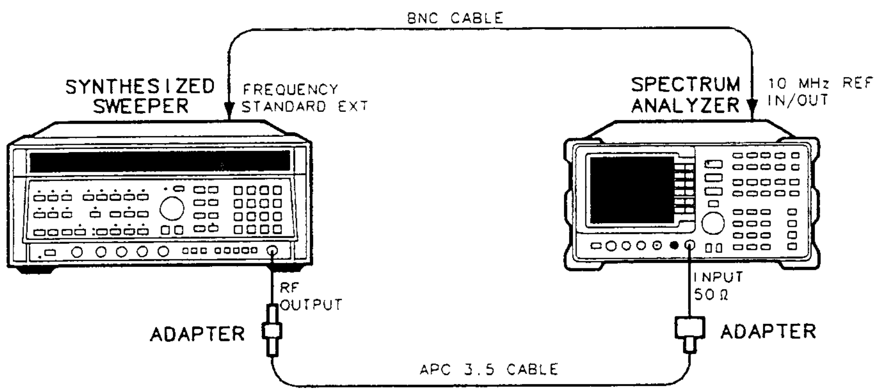

Figure 4-11. Frequency Readout/Counter Accuracy Test Setup

8. On the HP 8116A, set the controls as follows:

   FRQ .... 200 kHz
   DTY 50%
   AMP .... 500 mV
   OFS .... 0 V
   FUNCTION .... TRIANGLE

9. Adjust the HP 8116A frequency for 10 cycles evenly spaced relative to the vertical graticule lines on the analyzer. For example, if the peak of the first cycle is 0.2 divisions to the right of the first graticule line, the peak of the tenth cycle should be set 0.2 divisions to the right of the tenth graticule line.

10. Read the frequency displayed on the HP 5334A/B. Calculate the measured sweep time using the equation below. Record the result as the Measured Sweep Time in Table 3-35, for the 50 μs Sweep Time Setting.

    Measured Sweep Time = 10/HP 5334A/B Frequency Reading

11. Repeat steps 8 through 10 for sweep times between 100 μs and 20 ms, as listed in Table 3-35. Set the initial HP 8116A frequency according to this equation:

    Initial HP 8116A Frequency = 10/Sweep Time Setting

12. Disconnect the BNC cable between the HP 5334A/B and the HP 8116A. Connect a BNC cable from the BLANKING OUTPUT on the spectrum analyzer to INPUT A of the HP 5334A/B.

13. On the spectrum analyzer, press (TRIG) FREE RUN (SWEEP) 30 (ms).

14. On the HP 5334A/B, set the controls as follows:

    FUNCTION/DATA .... TI A ▸ B
    INPUT A
      ×10 .... OFF
      AC .... OFF
      50ΩZ .... OFF
      SLOPE .... ON
    INPUT B
      ×10 .... OFF
      AC .... OFF
      50ΩZ .... ON
      SLOPE .... OFF
    COM A .... ON
    AUTO TRIG .... ON
    100 kHz FILTER A .... ON
    SENS .... OFF

15. On the HP 5334A/B, press (READ LEVELS) once. Adjust the INPUT A LEVEL/SENS control until the number on the left side of the display reads 2.50 ±0.10. Press (READ LEVELS) (READ LEVELS) (READ LEVELS).

16. If the LED next to the INPUT A LEVEL/SENS control is not flashing, press (SENS) (the LED inside the SENS key should now be lit). Adjust the LEVEL/SENS control until the LED next to the INPUT A LEVEL/SENS control begins to flash.

Noise Sidebands

Related Performance Test

Noise Sidebands

Test Description

A clean signal source is applied to the input of the spectrum analyzer and the noise level at frequency offsets above and below the carrier are measured. These sideband levels are compared to the specification.

If the CAL OUTPUT signal is used as the source, the test must pass with at least a 6 dB margin for the test result to be valid. This is due to the phase-coherency of the CAL OUTPUT signal and the internal local oscillators. A Short Pass will occur if the test results are within specification using the CAL OUTPUT signal.

Note

Test results will be invalid if the source and the spectrum analyzer use the same frequency reference.

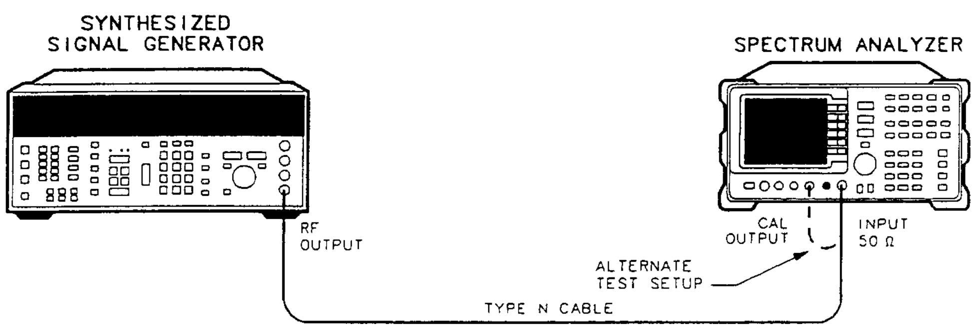

Figure 4-10. Noise Sidebands Test Setup

17. On the HP 5334A/B, press (READ LEVELS) once. Adjust the INPUT A LEVEL/SENS control until the number on the left side of the display reads 2.50 ±0.10. Press (READ LEVELS) (READ LEVELS) (READ LEVELS).
18. If the LED next to the INPUT B LEVEL/SENS control is not flashing, press (SENS) (the LED inside the SENS key should now be lit). Adjust the LEVEL/SENS control until the LED next to the INPUT A LEVEL/SENS control begins to flash.
19. Perform the following steps for the remaining Sweep Time Settings listed in the first column of Table 3-35 (sweep time settings >20 ms):
    a. Set the spectrum analyzer to the sweep time indicated.
    b. Wait for the HP 5334A/B display to settle (usually about three sweeps). Record the HP 5334A/B reading as the Measured Sweep Time in the third column of Table 3-35.

Note It might be necessary to readjust the LEVEL/SENS controls slightly for a stable display.

Table 3-35. Sweep Time Accuracy

Sweep Time Setting	Measured Sweep Time	Measurement Uncertainty
50 μs	________	±101 ns
100 μs	________	±101 ns
200 μs	________	±102 ns
500 μs	________	±103 ns
1 ms	________	±105 ns
2 ms	________	±108 ns
5 ms	________	±119 ns
10 ms	________	±137 ns
20 ms	________	±171 ns
30 ms	________	±209 ns
50 ms	________	±281 ns
100 ms	________	±461 ns
200 ms	________	±821 ns
500 ms	________	±1.901 μs
1 s	________	±3.7 μs
2 s	________	±7.3 μs
5 s	________	±18.1 μs
10 s	________	±36.1 μs
20 s	________	±72.1 μs
50 s	________	±180.1 μs
60 s	________	±216.1 μs

Residual FM

Related Performance Test

Residual FM

Test Description

A clean signal source is connected to the spectrum analyzer, and the analyzer's resolution bandwidth is set to 300 kHz. The slope of the signal is measured for use in calculating the residual FM. The source is tuned to the middle of the slope just measured and the peak-to-peak amplitude is measured. The amplitude is multiplied by the slope (in Hz/dB) to obtain the peak-to-peak residual FM. The residual FM is then compared to the specification.

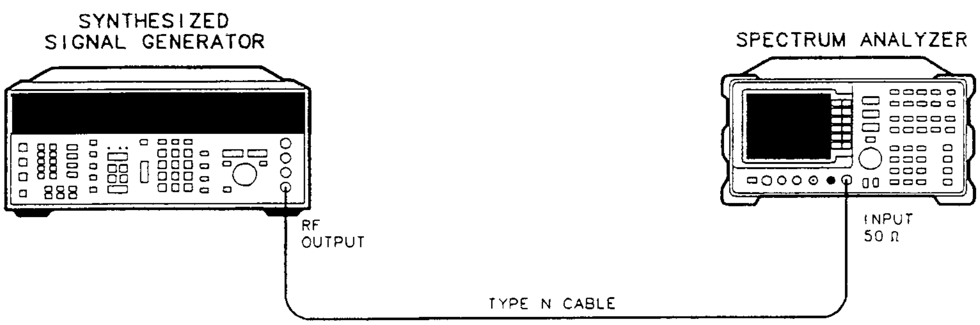

Figure 4-9. Residual FM Test Setup

22. Residual Responses

Specification

200 kHz to 6.5 GHz: <−90 dBm with no signal at input and 0 dB input attenuation.

Related Adjustment

There is no related adjustment for this performance test.

Description

This test checks for residual responses. Any response located above the display line is measured in a narrow frequency span and resolution bandwidth. A 50Ω termination is attached to the spectrum analyzer's INPUT 50Ω.

Equipment

Coaxial 50Ω Termination	HP 909D
Adapters	
Type N (m) to APC 3.5 (f)	1250-1744
Type N (m) to BNC (f)	1250-1476
Type N (f) to APC 3.5 (f)	1250-1745
Cable	
BNC, 122 cm (48 in.)	HP 10503A

Procedure

1. On the spectrum analyzer, press (PRESET). Set the controls as follows:

   CENTER FREQ .... 300 MHz
   SPAN .... 10 kHz
   RES BW .... 300 Hz
   REF LVL .... −10 dBm
   ATTEN .... 0 dB

2. On the spectrum analyzer, connect a BNC cable between CAL OUTPUT and INPUT 50Ω. Press (PEAK SEARCH) (CAL) REF LEVEL ADJUST . Use the data entry knob or the step keys to change the REF LEVEL CAL value until the marker amplitude reads −10.00 dBm ±0.17 dB.

Scale Fidelity

Related Performance Test

Scale Fidelity

Test Description

A signal source of known amplitude is connected to the spectrum analyzer and the source amplitude is adjusted for a top-screen reference. The source amplitude is stepped down and the displayed amplitude is measured at each step. The scale fidelity is tested in 2 dB steps in 2 dB/division and linear, and in 10 dB steps in 10 dB/division.

The amplitude variation with respect to the reference is measured and compared to the specification. In log mode, the amplitude difference between adjacent steps is calculated and compared to the specification.

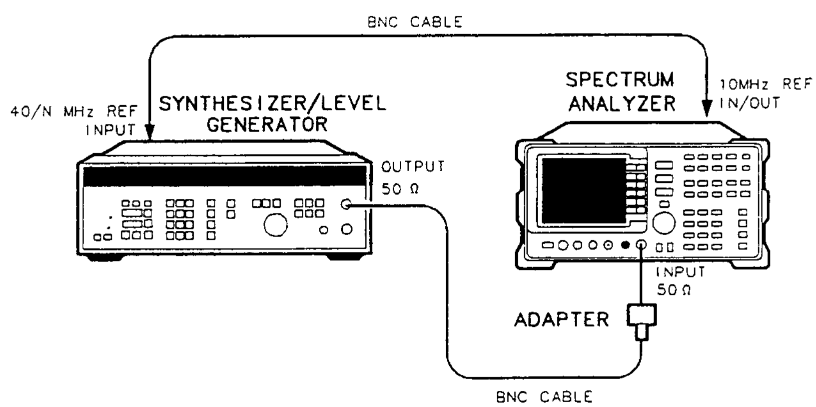

Figure 4-8. Scale Fidelity Test Setup

Residual Responses, Band 0

3. Remove the BNC cable and adapter from INPUT 50Ω. Install the Type N-to-APC 3.5 adapter and 50Ω termination on INPUT 50Ω. Press (PRESET). Set the controls as follows:

CENTER FREQ	15.2 MHz
SPAN	30 MHz
CF STEP	28.5 MHz
REF LVL	−50 dBm
ATTEN	0 dB
RES BW	10 kHz
TRIG	SINGLE
DISPLAY LINE	−90 dBm

4. Press (SGL SWP) to trigger a sweep. The noise level should be at least 6 dB below the display line. If it is not, it will be necessary to reduce SPAN and RES BW to reduce the noise level. If SPAN is reduced, reduce CF STEP to no more than 95% of SPAN.
5. If a residual is suspected, press (SGL SWP) again. A residual response will persist, but a noise peak will not. Make a note of the frequency and amplitude of any responses above the display line.
6. If a response is marginal, verify the response amplitude as follows:
   a. Press (SAVE) SAVE STATE STATE 0.
   b. Press (MKR). Place the marker on the peak of the response in question.
   c. Press (MKR ▶) and MARKER▶CF.
   d. Press (SPAN) (▼) (▼) (▼) (▼) (TRIG) CONT.
   e. Press (BW) RES BW AUTO.
   f. Continue to reduce SPAN until a RES BW of 300 Hz is reached. If the response is a synthesis-related residual, it might disappear as SPAN is reduced. If this is the case, measure the amplitude with the narrowest span possible and a 300 Hz RES BW.
   g. Record the frequency and amplitude of any residual response above the display line.
   h. Press (RECALL) RECALL STATE STATE 0.
7. Check for residuals up to 2.9 GHz, following steps 4 through 6. To change the center frequency, press (FREQUENCY) CENTER FREQ (▲).

Residual Responses, Band 1

8. On the spectrum analyzer, press (FREQUENCY) CENTER FREQ 2.915 GHz.
9. Check for residuals from 2.9 GHz to 6.5 GHz, following steps 4 through 6 above. To change the center frequency, press CENTER FREQ (▲).

IF Gain Uncertainty

Related Performance Test

IF Gain Uncertainty

Test Description

A signal source of known amplitude is connected to the spectrum analyzer and an amplitude reference is set. The signal source amplitude is stepped down as the spectrum analyzer is stepped down, and the signal amplitude is measured at each point. The amplitude variation with respect to the reference is compared to the specification. The test is performed in 1 dB steps from 0 dBm to −12 dBm reference levels, and in 10 dB steps from 0 dBm to −80 dBm reference levels. The 10 dB steps are tested in both log and linear scale factors.

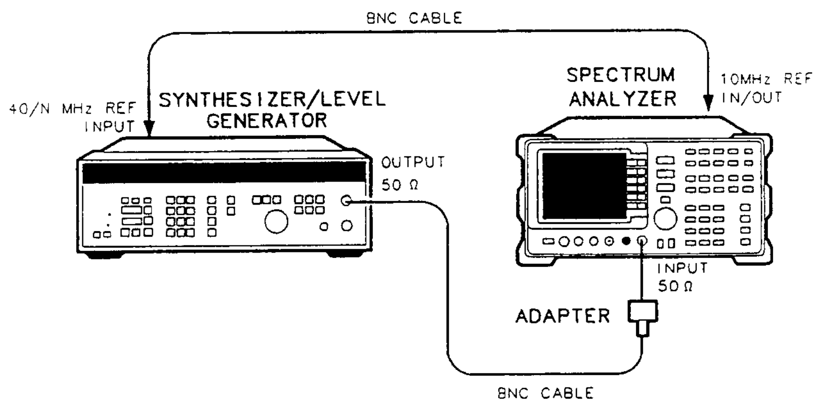

Figure 4-7. IF Gain Uncertainty Test Setup

23. IF INPUT Amplitude Accuracy

Specification

For a signal at the reference level (external mixing mode, REF LVL of 0 dBm, conversion loss of 30 dB) the power applied to the IF INPUT shall be −30 dBm ±1.5 dB.

Related Adjustment

External Mixer Amplitude Adjustment

Description

The user-loaded conversion losses for K-band are recorded and reset to 30 dB. A 310.7 MHz signal is applied to the IF INPUT. The power level of the source is adjusted for a signal at the reference level. The power applied to the spectrum analyzer is measured with a power meter and the measured power is compared to the specification. The previously recorded conversion losses are reentered.

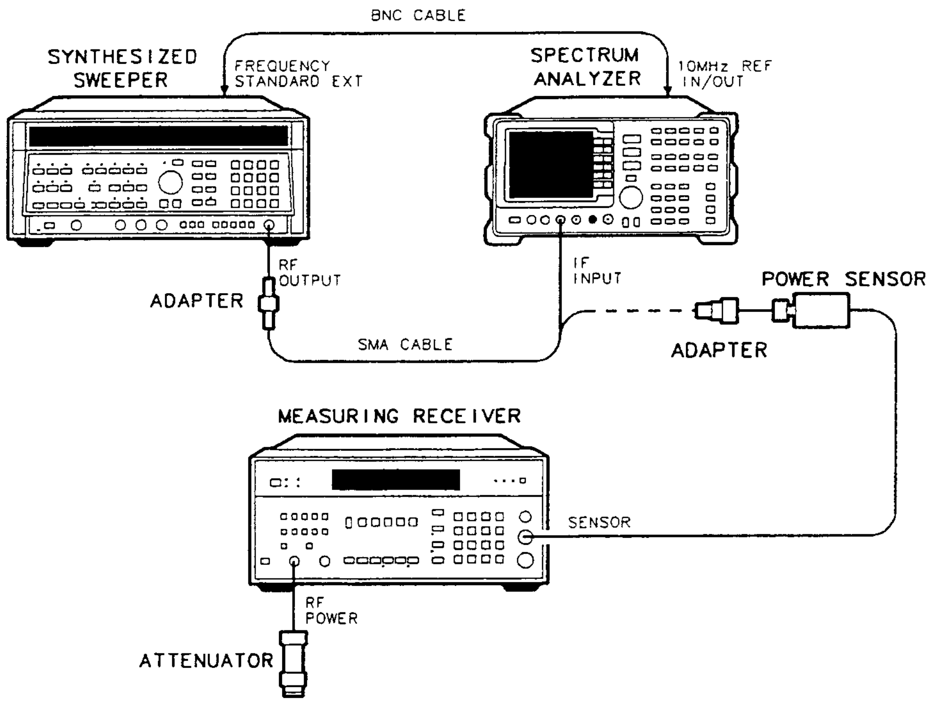

Figure 3-26. IF Input Amplitude Test Setup

Input Attenuator Switching Uncertainty

Related Performance Test

Input Attenuator Accuracy

Description

The output of the HP 3335A is applied to the input of the spectrum analyzer, and an amplitude reference is set. The spectrum analyzer's IF gain uncertainty is characterized using the HP 3335A as the reference. The HP 3335A is then reset to a fixed amplitude and the input attenuator is stepped from 10 dB to 70 dB. At each step, the amplitude deviation from the reference is measured using the marker functions. The input attenuator accuracy is calculated from the marker value and the characterized IF gain uncertainty. The input attenuator accuracy then is compared to the specification.

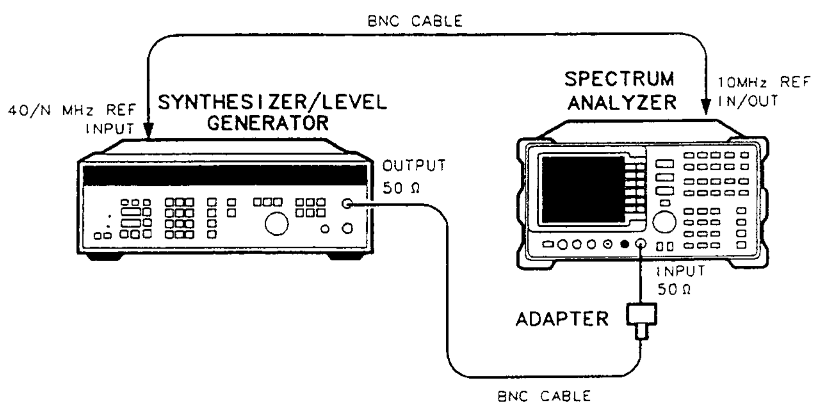

Figure 4-6. Input Attenuator Accuracy Test Setup

Equipment

Synthesized Sweeper	HP 8340A/B
Measuring Receiver	HP 8902A
Power Sensor	HP 8484A
50 MHz Reference Attenuator (supplied with HP 8484A)	HP 11708A
Adapters	
Type N (f) to SMA (f)	1250-1772
APC 3.5 (f) to APC 3.5 (f)	5061-5311
Cables	
BNC, 122 cm (48 in.)	HP 10503A
SMA, 61 cm (24 in.)	8120-1578

Procedure

1. Connect the equipment as shown in Figure 3-26. The spectrum analyzer provides the frequency reference for the HP 8340A/B.
2. On the spectrum analyzer, press (PRESET) (AMPLITUDE) LOG dB/DIV 1 (dB) (MKR). Then press (AUX CTRL) EXTERNAL MIXER (SPAN) ZERO SPAN (AUX CTRL) EXTERNAL MIXER AMPT CORRECT CNV LOSS VS FREQ.
3. Note the conversion loss displayed in the active function block. Use (▲) and (▼) to step through the conversion losses for the other frequencies. If all conversion losses are 30.0 dB, proceed to step 9.
4. Press CNV LOSS VS FREQ.
5. Record the 18 GHz conversion loss in Table 3-36.
6. Enter a conversion loss of 30 dB.
7. Press (▲).
8. Repeat steps 5 through 7 for the remaining frequencies listed in Table 3-36.
9. On the HP 8340A/B, press (INSTR PRESET). Set the controls as follows:

   CW .... 310.7 MHz
   POWER LEVEL .... −30 dBm
10. Zero and calibrate the HP 8902A/HP 8484A combination in Log mode. Enter the power sensor's 50 MHz calibration factor into the HP 8902A.
11. On the HP 8340A/B, adjust the power level until the marker amplitude reads 0 dBm ±0.05 dB.
12. Disconnect the SMA cable from the spectrum analyzer IF INPUT, and connect the cable, through an adapter, to the power sensor.

RES BW Accuracy and Selectivity

Related Performance Test

Resolution Bandwidth Accuracy and Selectivity

Description

The output of a synthesizer/level-generator is connected to the input of the spectrum analyzer. The spectrum analyzer is set to a span approximately three to five times the resolution bandwidth setting (for measuring the 3 dB bandwidth).

The synthesized sweeper output is then reduced in amplitude by 3 dB point. A marker reference is set and the synthesized sweeper output is increased 3 dB to its previous level. A sweep is taken, then the markers are used to measure the 3 dB bandwidth.

The 60 dB bandwidths are measured in a similar manner, with the span set about 15 to 20 times the resolution bandwidth setting. The ratio between the 60 dB and 3 dB bandwidths are calculated and stored.

The 60 dB bandwidths of the 10, 30, and 100 Hz RES BW settings are not measured. These bandwidths are digitally derived; therefore, their shape factors are guaranteed by design to be less than 5:1 (typically, they are 4.5:1). Measurement of the −60 dB and −3 dB bandwidths of these RES BW settings is often obscured by noise sidebands, or "phase noise."

The 2 MHz RES BW is checked, if available on an HP 8562A/B, but a measurement-out-of-tolerance condition is flagged only if the analyzer has a serial prefix greater than 2750A.

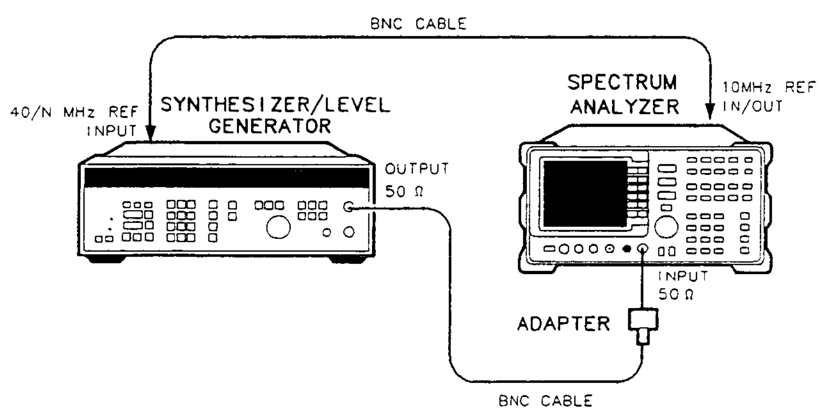

Figure 4-5. RES BW Accuracy and Selectivity Test Setup

13. Read the power displayed on the HP 8902A.

IF INPUT Amplitude: ________dBm

Note

The following steps should be performed only if it was necessary to change the conversion loss values found in step 5.

14. On the spectrum analyzer, press CNV LOSS VS FREQ.
15. Enter the conversion loss at 18 GHz, as recorded in Table 3-36.
16. Press (▲).
17. Repeat steps 15 and 16 for the remaining frequencies listed in Table 3-36.

Table 3-36. IF Input Amplitude Accuracy

Frequency (GHz)	Conversion Loss (dB)
18	________
20	________
22	________
24	________
26	________
27	________

RES BW Switching Uncertainty

(Including IF Alignment Uncertainty)

Related Performance Test

Resolution Bandwidth Switching and IF Alignment Uncertainty

Description

A signal is applied to the input of the spectrum analyzer and the signal amplitude is measured in each resolution bandwidth setting. The amplitude variation with respect to the 300 kHz resolution bandwidth is calculated and compared to the specifications. The 2 MHz RES BW is checked, if available. A measurement-out-of-tolerance condition is flagged only if the analyzer has a serial prefix greater than 2750A.

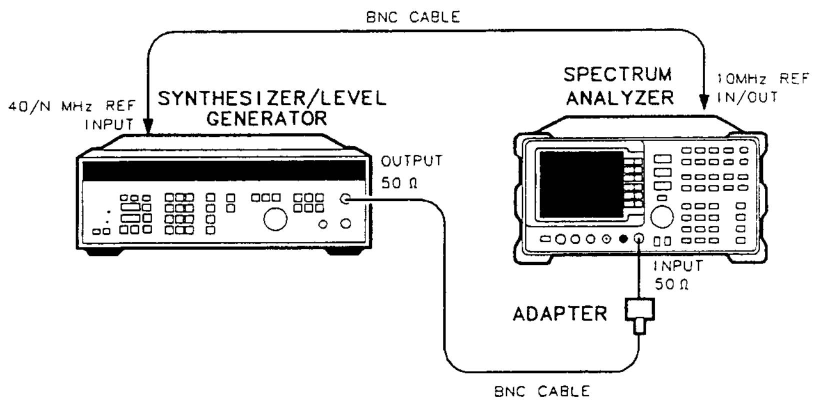

Figure 4-4. RES BW Switching Uncertainty Test Setup

Performance Test Record

Table 3-37. Performance Test Record (1 of 11)

Hewlett-Packard Company

Address: ______________________

____

____

Report No. ______________________

Date ______________________

(e.g. 10 SEP 1989)

Model HP 8561B

Serial No. ______________________

Options ______________________

Firmware Revision______________________

Customer ______________________

Tested by ______________________

Ambient temperature ____________ °C

Relative humidity ____________ %

Power mains line frequency ____________ Hz (nominal)

Test Equipment Used

Description	Model No.	Trace No.	Cal Due Date
Spectrum Analyzer			
Synthesized Sweeper #1			
Synthesized Sweeper #2			
Synthesized Level Generator			
Synthesized Signal Generator			
AM/FM Signal Generator			
Measuring Receiver			
Power Meter			
RF Power Sensor			
Low-Power Power Sensor			
Microwave Power Sensor			

Displayed Average Noise Level

Related Performance Test

Displayed Average Noise Level

Test Description

The spectrum analyzer's INPUT 50Ω is terminated in 50Ω. The resolution bandwidth, video bandwidth, and input attenuation are set according to the specification listed in Table 1-1. The displayed average noise level is measured at several points in each band and the results are compared with the specification.

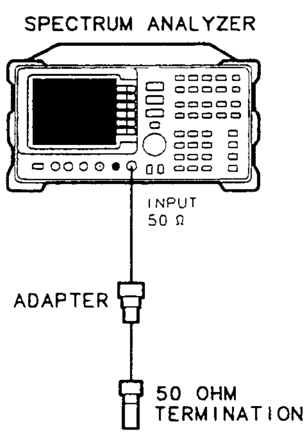

Figure 4-3. Displayed Average Noise Level Test Setup

Table 3-37. Performance Test Record (2 of 11)

Test Equipment Used

Description	Model No.	Trace No.	Cal Due Date
Pulse/Function Generator			
Microwave Frequency Counter			
Frequency Counter			
Amplifier			
Power Splitter			
12 MHz Low Pass Filter			
4.4 GHz Low Pass Filter			
50 MHz Low Pass Filter			
50Ω Termination			
20 dB Fixed Attenuator			
10 dB Fixed Attenuators			
10 dB Step Attenuator			
1 dB Step Attenuators			

Notes/Comments

Calibrator Amplitude Accuracy

Related Performance Test

Calibrator Amplitude and Frequency Accuracy

Test Description

The amplitude of the CAL OUTPUT signal is measured using a power sensor and either the measuring receiver or the power meter. The measured amplitude is compared to the specification.

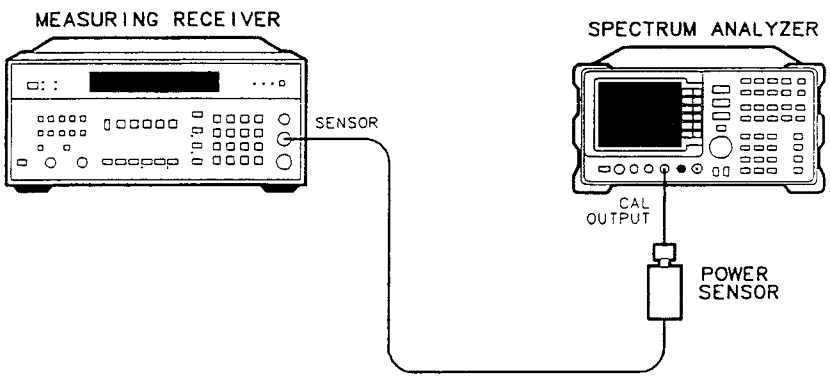

Figure 4-2. Calibrator Amplitude Accuracy Test Setup

Hewlett-Packard Company Model HP 8561B	Report No. ______
Serial No. ______	Date ______

Test No.	Test Description	Results			Measurement Uncertainty
		Minimum	Measured	Maximum	
1	10 MHz Reference Output Accuracy	299.998800 MHz	______	300.0012 MHz	±300 Hz
2	10 MHz Reference Output Accuracy (Opt. 003)				
	5 minute warmup	-1×10^{-7}	______	$+1 \times 10^{-7}$	$\pm 5.10^{-10}$
	15 minute warmup	-1×10^{-8}	______	$+1 \times 10^{-8}$	$\pm 5.10^{-10}$
3	Calibrator Amplitude and Frequency Accuracy				
	Calibrator Amplitude	−10.3 dBm	______	−9.7 dBm	±0.02 dB
4	Displayed Average Noise Level				
	50 Hz		______	−60 dBm	+1.74/−1.98 dB
	100 Hz		______	−60 dBm	+1.74/−1.98 dB
	1 kHz		______	−85 dBm	+1.74/−1.98 dB
	10 kHz		______	−103 dBm	+1.74/−1.98 dB
	100 kHz		______	−110 dBm	+1.74/−1.98 dB
	1 MHz to 2.9 GHz		______	−130 dBm	+1.74/−1.98 dB
	2.9 GHz to 6.46 GHz		______	−131 dBm	+1.74/−1.98 dB
5	Resolution Bandwidth Switching and IF Alignment Uncertainty				
	2 MHz	−0.5 dB	______	+0.5 dB	±0.02%
	1 MHz	−0.5 dB	______	+0.5 dB	±0.02%
	100 kHz	−0.5 dB	______	+0.5 dB	±0.02%
	30 kHz	−0.5 dB	______	+0.5 dB	±0.02%
	10 kHz	−0.5 dB	______	+0.5 dB	±0.02%
	3 kHz	−0.5 dB	______	+0.5 dB	±0.02%
	1 kHz	−0.5 dB	______	+0.5 dB	±0.02%
	300 Hz	−0.5 dB	______	+0.5 dB	±0.02%
	100 Hz	−0.5 dB	______	+0.5 dB	±0.02%
	30 Hz	−0.5 dB	______	+0.5 dB	±0.02%
	10 Hz	−0.5 dB	______	+0.5 dB	±0.02%

10 MHz Reference Accuracy

Related Performance Test

10 MHz Reference Output Accuracy

Test Description

The frequency of the 10 MHz REF IN/OUT of the spectrum analyzer is counted by the microwave frequency counter and is compared to the specification. This test is not to be used to test Option 003 spectrum analyzers (oven-controlled crystal oscillator option).

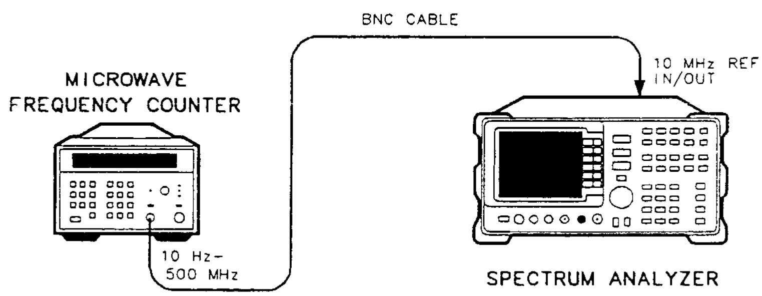

Figure 4-1. 10 MHz Reference Accuracy Test Setup

Table 3-37. Performance Test Record (4 of 11)

Hewlett-Packard Company	
Model HP 8561B	Report No. ______________
Serial No. ______________	Date ______________

Test No.	Test Description	Results			Measurement Uncertainty
		Minimum	Measured	Maximum	
6	Resolution Bandwidth Accuracy				
	2 MHz	1.5 MHz	________	2.5 MHz	±1.5 %
	1 MHz	750 kHz	________	1.25 MHz	±1.5%
	300 kHz	270 kHz	________	330 kHz	±1.5%
	100 kHz	90 kHz	________	110 kHz	±1.5%
	30 kHz	27 kHz	________	33 kHz	±1.5%
	10 kHz	9 kHz	________	11 kHz	±1.5%
	3 kHz	2.7 kHz	________	3.3 kHz	±1.5%
	1 kHz	900 Hz	________	1.1 kHz	±1.5%
	300 Hz	270 Hz	________	330 Hz	±1.5%
	100 Hz	90 Hz	________	110 Hz	±1.5%
	30 Hz	27 Hz	________	33 Hz	±1.5%
	10 Hz	9 Hz	________	11 Hz	±1.5%
6	Resolution Bandwidth Selectivity Ratio				
	2 MHz		________	15:1	−2.1/+5.1%
	1 MHz		________	15:1	−2.1/+5.1%
	300 kHz		________	15:1	−2.1/+5.1%
	100 kHz		________	15:1	−2.1/+5.1%
	30 kHz		________	15:1	−2.1/+5.1%
	10 kHz		________	15:1	−2.1/+5.1%
	3 kHz		________	15:1	−2.1/+5.1%
	1 kHz		________	15:1	−2.1/+5.1%
	300 Hz		________	15:1	−2.1/+5.1%
7	Input Attenuator Accuracy				
	Cumulative Accuracy at 50 MHz				
	20 dB ATTEN	+8.2 dB	________	+11.8 dB	±0.178 dB
	30 dB ATTEN	+18.2 dB	________	+21.8 dB	±0.178 dB
	40 dB ATTEN	+28.2 dB	________	+31.8 dB	±0.178 dB
	50 dB ATTEN	+38.2 dB	________	+41.8 dB	±0.178 dB
	60 dB ATTEN	+48.2 dB	________	+51.8 dB	±0.178 dB
	70 dB ATTEN	+58.2 dB	________	+61.8 dB	±0.178 dB

Test Descriptions

Each of the following test descriptions include specifications, related performance test, and a test setup illustration used in Operation Verification. Operation Verification is designed to test an HP High Performance Portable Spectrum Analyzer operating within a temperature range of 20°C to 30°C.

Table 3-37. Performance Test Record (5 of 11)

Hewlett-Packard Company Model HP 8561B	Report No. ______
Serial No. ______	Date ______

Test No.	Test Description	Results			Measurement Uncertainty
		Minimum	Measured	Maximum	
	Incremental Accuracy at 50 MHz				
	20 dB ATTEN	−0.6 dB	______	+0.6 dB	±0.178 dB
	30 dB ATTEN	−0.6 dB	______	+0.6 dB	±0.178 dB
	40 dB ATTEN	−0.6 dB	______	+0.6 dB	±0.178 dB
	50 dB ATTEN	−0.6 dB	______	+0.6 dB	±0.178 dB
	60 dB ATTEN	−0.6 dB	______	+0.6 dB	±0.178 dB
	70 dB ATTEN	−0.6 dB	______	+0.6 dB	±0.178 dB
	Cumulative Accuracy at 2.9 GHz				
	20 dB ATTEN	+8.2 dB	______	+11.8 dB	±0.23 dB
	30 dB ATTEN	+18.2 dB	______	+21.8 dB	±0.23 dB
	40 dB ATTEN	+28.2 dB	______	+31.8 dB	±0.23 dB
	50 dB ATTEN	+38.2 dB	______	+41.8 dB	±0.23 dB
	60 dB ATTEN	+48.2 dB	______	+51.8 dB	±0.23 dB
	70 dB ATTEN	+58.2 dB	______	+61.8 dB	±0.24 dB
	Incremental Accuracy at 2.9 GHz				
	20 dB ATTEN	−0.6 dB	______	+0.6 dB	±0.23 dB
	30 dB ATTEN	−0.6 dB	______	+0.6 dB	±0.23 dB
	40 dB ATTEN	−0.6 dB	______	+0.6 dB	±0.23 dB
	50 dB ATTEN	−0.6 dB	______	+0.6 dB	±0.23 dB
	60 dB ATTEN	−0.6 dB	______	+0.6 dB	±0.23 dB
	70 dB ATTEN	−0.6 dB	______	+0.6 dB	±0.24 dB
8	IF Gain Uncertainty				
	Log IF Gain Uncertainty (10 dB steps)				
	−10	−1.0 dB	______	+1.0 dB	±0.035
	−20	−1.0 dB	______	+1.0 dB	±0.035
	−30	−1.0 dB	______	+1.0 dB	±0.035
	−40	−1.0 dB	______	+1.0 dB	±0.039
	−50	−1.0 dB	______	+1.0 dB	±0.039
	−60	−1.0 dB	______	+1.0 dB	+0.093/−0.095
	−70	−1.0 dB	______	+1.0 dB	+0.093/−0.095
	−80	−1.0 dB	______	+1.0 dB	+0.093/−0.095

Test Menu

All Tests	Runs all 14 tests in the order listed by the program.
Single Sequence	Allows entry of a test sequence that is run once.
Single Test	Runs the test indicated by the pointer, once.
Repeat Sequence	Allows entry of a test sequence that runs repeatedly until you abort testing.
Repeat Test	Runs the test indicated by the pointer repeatedly until you abort the testing.
Cal Sensor	Allows you to recalibrate the current power sensor and resets the internal "time-since-last-calibration" timer.
List Equip	Lists the required equipment for the test indicated by the pointer.
Cond Menu	Returns to the Conditions Menu.

Table 3-37. Performance Test Record (6 of 11)

Hewlett-Packard Company Model HP 8561B	Report No. ______
Serial No. ______	Date ______

Test No.	Test Description	Results			Measurement Uncertainty
		Minimum	Measured	Maximum	
	Log IF Gain Uncertainty (1 dB steps)				
	−1	−1.0 dB	______	+1.0 dB	±0.035
	−2	−1.0 dB	______	+1.0 dB	±0.035
	−3	−1.0 dB	______	+1.0 dB	±0.035
	−4	−1.0 dB	______	+1.0 dB	±0.035
	−5	−1.0 dB	______	+1.0 dB	±0.035
	−6	−1.0 dB	______	+1.0 dB	±0.035
	−7	−1.0 dB	______	+1.0 dB	±0.035
	−8	−1.0 dB	______	+1.0 dB	±0.035
	−9	−1.0 dB	______	+1.0 dB	±0.035
	−10	−1.0 dB	______	+1.0 dB	±0.035
	−11	−1.0 dB	______	+1.0 dB	±0.035
	−12	−1.0 dB	______	+1.0 dB	±0.035
	Linear IF Gain Uncertainty				
	−10	−1.0 dB	______	+1.0 dB	±0.038
	−20	−1.0 dB	______	+1.0 dB	±0.038
	−30	−1.0 dB	______	+1.0 dB	±0.038
	−40	−1.0 dB	______	+1.0 dB	±0.041
	−50	−1.0 dB	______	+1.0 dB	±0.041
	−60	−1.0 dB	______	+1.0 dB	+0.094/−0.097
	−70	−1.0 dB	______	+1.0 dB	+0.094/−0.097
	−80	−1.0 dB	______	+1.0 dB	+0.094/−0.097
9	Scale Fidelity				
	Linear Scale Fidelity				
	2 dB from REF LVL	−2.33 dB	______	−1.68 dB	±0.033 dB
	4 dB from REF LVL	−4.42 dB	______	−3.60 dB	±0.034 dB
	6 dB from REF LVL	−6.54 dB	______	−5.5 dB	±0.037 dB
	8 dB from REF LVL	−8.68 dB	______	−7.37 dB	±0.041 dB
	10 dB from REF LVL	−10.87 dB	______	−9.21 dB	+0.046/−0.047 dB
	12 dB from REF LVL	−13.10 dB	______	−11.02 dB	+0.054/−0.054 dB
	14 dB from REF LVL	−15.42 dB	______	−12.78 dB	+0.064/−0.065 dB
	16 dB from REF LVL	−17.82 dB	______	−14.49 dB	+0.078/−0.079 dB
	18 dB from REF LVL	−20.36 dB	______	−16.14 dB	+0.118/−0.12 dB

Operation Verification Menu Softkeys

This section provides a brief description of each menu of softkeys. More detailed information is provided in "Program Operation" in this chapter. The softkey order shown below may vary with what appears on the computer display; the order differs depending on whether an HP 9000 Series 200 or Series 300 computer is used.

Conditions Menu

`Test Menu`	Displays the Test Menu, which allows you to run tests once, repeatedly, or in a user-defined sequence. Refer to "Test Menu."
`Load Conds`	Loads the CONDITIONS file from the disk specified by the system mass storage file location.
`Sensor Utils`	Displays the Sensor Utilities Menu, which allows viewing, editing, and adding power sensor data files. Refer to "Sensor Utilities Menu."
`Change Entry`	Permits changing a Conditions Menu entry, indicated by the pointer along the left edge of the computer display. Press the (RETURN) or (ENTER) keys to terminate an entry.
`Verify Bus`	Checks each listed HP-IB address for response. `Verify Bus` does not verify that a particular piece of equipment is at a specified address.
`Query DUT S/N`	Queries the HP-IB for the serial number and model number of the spectrum analyzer under test.
`Store Conds`	Stores the current conditions in the CONDITIONS file on the specified system mass storage file location.
`Exit Program`	Exits the Operation Verification program.

Sensor Utilities Menu

`View/Edit`	Allows user to view and edit power sensor data files.
`Add File`	Creates a new power sensor data file.
`Delete File`	Deletes a power sensor data file. User is asked for confirmation before deletion takes place.
`List Files`	Lists all power sensor data files on the disk currently specified by the system mass storage file location.
`System File`	Allows user to change the currently specified system mass storage file location.
`Cond Menu`	Returns you to the Conditions Menu.

Table 3-37. Performance Test Record (7 of 11)

Hewlett-Packard Company	
Model HP 8561B	Report No. ________
Serial No. ________	Date ________

Test No.	Test Description	Results Minimum	Measured	Maximum	Measurement Uncertainty
	Maximum Cumulative 10 dB				
	Log Scale Fidelity	−1.5 dB	________	+1.5 dB	±0.27 dB
	Maximum Incremental 10 dB				
	Log Scale Fidelity	−0.4 dB	________	+0.4 dB	±0.27 dB
	Maximum Cumulative 2 dB				
	Log Scale Fidelity	−1.5 dB	________	+1.5 dB	±0.06 dB
	Maximum Incremental 2 dB				
	Log Scale Fidelity	−0.4 dB	________	+0.4 dB	±0.06 dB
10	Residual FM		________	10 Hz	±1.3 Hz
11	Noise Sidebands				
	−10 kHz Offset		________	−86 dBc/Hz	±1.53 dB
	+10 kHz Offset		________	−86 dBc/Hz	±1.53 dB
	−30 kHz Offset		________	−100 dBc/Hz	±1.53 dB
	+30 kHz Offset		________	−100 dBc/Hz	±1.53 dB
	−100 kHz Offset		________	−110 dBc/Hz	±1.53 dB
	+100 kHz Offset		________	−110 dBc/Hz	±1.53 dB
12	Image, Multiple, and Out-of-Band Responses				
	Maximum Out-of-Band Response Amplitude		________	−70 dBc	+1.53/−1.59 dB
	Maximum Out-of-Range Response Amplitude		________	−70 dBc	+1.53/−1.59 dB
13	Frequency Readout Accuracy and Frequency Count Marker Accuracy				
	1.5 GHz CENTER FREQ				
	1 MHz SPAN	1.499942 GHz	________	1.500058 GHz	±1 kHz
	10 MHz SPAN	1.49948 GHz	________	1.50052 GHz	±1 kHz
	20 MHz SPAN	1.49895 GHz	________	1.50105 GHz	±1 kHz
	50 MHz SPAN	1.49745 GHz	________	1.50255 GHz	±1 kHz
	100 MHz SPAN	1.4948 GHz	________	1.5052 GHz	±1 kHz
	1 GHz SPAN	1.45 GHz	________	1.55 GHz	±1 kHz

The meaning of Short Pass varies between each test; refer to "Test Descriptions" in this section for more information.

Note A Short Pass is sufficient for passing Operation Verification alone. If Operation Verification is used as part of performance verification, all tests must yield a PASS result.

`MEASUREMENT IS OUT OF TOLERANCE` indicates that one or more of the measurements made during the test did not meet specification limits. If the data is shown in tabular form, the symbol <<<< is placed next to the out-of-tolerance data. In the event of a measurement-out-of-tolerance condition, it is recommended that any related manual performance test be performed to verify out-of-tolerance conditions. The related performance test for each operation verification test is listed at the beginning of each test description in this chapter.

Note Because test results are expected to change over a period of time, Hewlett-Packard warrants only the specification range and not the repeatability of data for any given specification.

Table 3-37. Performance Test Record (8 of 11)

Hewlett-Packard Company Model HP 8561B	Report No. ______
Serial No. ______	Date ______

Test No.	Test Description	Results			Measurement
		Minimum	Measured	Maximum	Uncertainty
	4.0 GHz CENTER FREQ				
	1 MHz SPAN	3.999932 GHz	______	4.000068 GHz	±1 kHz
	10 MHz SPAN	3.99947 GHz	______	4.00053 GHz	±1 kHz
	20 MHz SPAN	3.99894 GHz	______	4.00106 GHz	±1 kHz
	50 MHz SPAN	3.99744 GHz	______	4.00256 GHz	±1 kHz
	100 MHz SPAN	3.9948 GHz	______	4.0052 GHz	±1 kHz
	1 GHz SPAN	3.95 GHz	______	4.05 GHz	±1 kHz
	Frequency Readout Accuracy and Frequency Count Marker Accuracy				
	Frequency Count Marker Accuracy				
	1.5 GHz CENTER FREQ	1.499999949 GHz	______	1.500000051 GHz	±1 Hz
	4.0 GHz CENTER FREQ	3.999999949 GHz	______	4.000000051 GHz	±1 Hz
14	Pulse Digitization Uncertainty				
	LOG, 1 MHz RES BW		______	1.25 dB	±0.13 dB
	LOG, 2 MHz RES BW		______	3.0 dB	±0.30 dB
	LINEAR, 1 MHz RES BW		______	4%	±.028 mV
	LINEAR, 2 MHz RES BW		______	12%	±.084 mV
15	Second Harmonic Distortion				
	<10 MHz		______	−60 dBc	±1.17 dB
	>10 MHz to <2.9 GHz		______	−72 dBc	±1.23 dB
	>2.9 GHz		______	−72 dBc	±1.22 dB
16	Frequency Response				
	DC Coupled, Band 0				
	Maximum Positive Response		______	+1.5 dB	+0.29/−0.31 dB
	Maximum Negative Response	−1.5 dB	______		
	Peak-to-Peak Response		______	+2.0 dB	+0.29/−0.31 dB
	DC Coupled, Band 1				
	Maximum Positive Response		______	+2.5 dB	+0.43/−0.47 dB
	Maximum Negative Response	−2.5 dB	______		
	Peak-to-Peak Response		______	+3.0 dB	+0.43/−0.47 dB

Single Test

Press Single Test to run the test indicated by the pointer. Once the test is running, press Restart to abort and restart the test.

Repeat Sequence

The Repeat Sequence mode performs a user-defined set of tests repeatedly until the sequence is aborted. For example, if the desired sequence is test numbers 6,7,8,6,7,8,6,7,8, ... , press Repeat Sequence and enter the sequence of 6,7,8. When the last test of this sequence is completed, the sequence is repeated.

The ABORT TEST , ABORT SEQUENCE , and Restart softkeys have the same function as in the All Test mode.

Repeat Test

Use the Repeat Test mode to run a single test indefinitely. Move the pointer to the test to be repeated. Testing can be stopped by pressing ABORT REPEAT . Press ABORT TEST to abort and restart the test.

Calibrate Power Sensor

The Operation Verification program keeps track of which power sensor is being used and the elapsed time since it was last calibrated.

The program prompts the user to recalibrate the power sensor if more than 2 hours elapses since the last calibration. Also, if the power sensor is changed, the new power sensor must be calibrated.

If there is a significant change in ambient temperature, or improved power meter accuracy is desired, it is advisable to recalibrate the sensor more often than the program requires. Press Cal Sensor and follow the instructions on the computer screen to recalibrate the power sensor.

List Equipment

To obtain a list of required test equipment for running a test, move the pointer to the test, press List Equip . All HP-IB controlled equipment and passive devices, other than required cables and adapters, are listed. If a test is flagged MISSING ETE but all test equipment appears present, press List Equip to see what is needed, then return to the Conditions Menu and verify that the equipment is present. Press Cond Menu to return to the Conditions Menu from the Test Menu.

Test Results

At the end of each test, a PASS, SHORT PASS, or MEASUREMENT IS OUT OF TOLERANCE message is printed on the test record and displayed next to the test on the computer screen.

PASS indicates that the test is fully completed and all measurements are within specification limits.

SHORT PASS indicates that the test was abbreviated, usually due to equipment limitations, but the measurements made were within specification limits. Not all tests can be abbreviated.

Table 3-37. Performance Test Record (9 of 11)

Hewlett-Packard Company Model HP 8561B	Report No. ______
Serial No. ______	Date ______

Test No.	Test Description	Results			Measurement Uncertainty
		Minimum	Measured	Maximum	
	AC Coupled, Band 0				
	Maximum Positive Response		______	+1.7 dB	+0.29/−0.31 dB
	Maximum Negative Response	−1.7 dB	______		
	Peak-to-Peak Response		______	+2.2 dB	+0.29/−0.31 dB
	AC Coupled, Band 1				
	Maximum Positive Response		______	+3.5 dB	+0.43/−0.47 dB
	Maximum Negative Response	−3.5 dB	______		
	Peak-to-Peak Response		______	+4.0 dB	+0.43/−0.47 dB
	Band Switching Uncertainty				
	Band 0 to Band 1, DC Coupled		______	3.5 dB	+0.72/−0.78
	Band 1 to Band 0, DC Coupled		______	3.5 dB	+0.72/−0.78
	Band 0 to Band 1, AC Coupled		______	4.1 dB	+0.72/−0.78
	Band 1 to Band 0, AC Coupled		______	4.1 dB	+0.72/−0.78
17	Frequency Span Accuracy				
	1.5 GHz CENTER FREQ				
	10 kHz SPAN	7.6 kHz	______	8.4 kHz	±0.24%
	20 kHz SPAN	15.2 kHz	______	16.8 kHz	±0.24%
	50 kHz SPAN	38.0 kHz	______	42.0 kHz	±0.24%
	100 kHz SPAN	76.0 kHz	______	84.0 kHz	±0.24%
	101 kHz SPAN	76.0 kHz	______	84.0 kHz	±0.24%
	200 kHz SPAN	152.0 kHz	______	168.0 kHz	±0.24%
	500 kHz SPAN	380.0 kHz	______	420.0 kHz	±0.24%
	1 MHz SPAN	760 kHz	______	840 kHz	±0.24%
	1.01 MHz SPAN	760 kHz	______	840 kHz	±0.24%
	2 MHz SPAN	1.52 MHz	______	1.68 MHz	±0.24%
	5 MHz SPAN	3.8 MHz	______	4.2 MHz	±0.24%
	10 MHz SPAN	7.6 MHz	______	8.4 MHz	±0.24%
	20 MHz SPAN	15.2 MHz	______	16.8 MHz	±0.24%
	50 MHz SPAN	38 MHz	______	42 MHz	±0.24%
	100 MHz SPAN	76 MHz	______	84 MHz	±0.24%
	200 MHz SPAN	152 MHz	______	168 MHz	±0.24%
	500 MHz SPAN	380 MHz	______	420 MHz	±0.24%
	1 GHz SPAN	760 MHz	______	60 MHz	±0.24%
	2 GHz SPAN	1.520 GHz	______	1.680 GHz	±0.24%

Test Menu

The Test Menu displays all tests that can be performed by the Operation Verification program. Tests may be run in any of five modes. These are listed below.

- All Tests runs all 14 tests in the sequence shown on screen.
- Single Sequence runs a user-defined sequence of tests once.
- Single Test runs one test once.
- Repeat Sequence runs a user-defined sequence of tests until testing is aborted.
- Repeat Test runs a single test until the testing is aborted.

If HP-IB controlled equipment for a given test does not respond over HP-IB, that test is flagged MISSING ETE (missing electronic test equipment). These tests cannot be run and, if they are included as part of a sequence (All Tests, Single Sequence, or Repeat Sequence), they are ignored. See "List Equipment," below.

Equipment connection prompts are displayed on the computer screen. Most tests check equipment connections and only prompt the operator if a misconnection is detected.

If more than one power meter (or the measuring receiver and one of the power meters) are present, the program asks which model to use as the power meter. Enter the model number without the alphabetic character (for example, enter 8902 for an HP 8902A). Similarly, if both frequency counters are present, the program asks which counter to use. Again, enter the model number without the alphabetic character.

The test currently being run and its test number are indicated in the screen title block of the spectrum analyzer under test.

All Tests

To run all 14 tests in the sequence shown, press `All Tests`. The pointer moves to each test as it is being run. All Tests can be run in less than 60 minutes.

Three softkeys are displayed when running All Tests. Press `ABORT TEST` to abort the current test and continue to the next test. Press `ABORT SEQUENCE` to abort the All Test mode. Pressing `Restart` aborts and restarts the current test. If the spectrum analyzer is in the middle of a sweep, no action is taken until the sweep is completed.

Single Sequence

Use this mode to perform a subset of the tests, to run a particular test a specified number of times, or to run all 14 tests in a sequence different from the All Tests sequence. After pressing `Single Sequence`, you are prompted for a test number. The sequence is displayed after each prompt. Up to 25 test numbers may be entered (test number duplication is permitted). Enter a zero to terminate building the sequence and begin testing.

If an error is made in entering the sequence, enter a zero at the next prompt, then press `ABORT SEQUENCE`. Now press `Single Sequence` to reenter the correct sequence.

The `ABORT TEST`, `ABORT SEQUENCE`, and `Restart` softkeys have the same function as in the All Test mode.

Table 3-37. Performance Test Record (10 of 11)

Hewlett-Packard Company
Model HP 8561B — Report No. ______

Serial No. ______ — Date ______

Test No.	Test Description	Results			Measurement
		Minimum	Measured	Maximum	Uncertainty
18	Third Order Intermodulation Distortion				
	TOI Distortion				
	<10 MHz		______	−64 dBc	±2.83 dB
	>10 MHz to <2.9 GHz		______	−70 dBc	±2.83 dB
	<6.5 GHz		______	−75 dBc	±2.83 dB
19	Gain Compression				
	Gain Compression at 2 GHz		______	1.0 dB	±0.23 dB
	Gain Compression at 4 GHz		______	1.0 dB	±0.23 dB
20	1ST LO OUTPUT Amplitude				
	Maximum 1ST LO OUTPUT Power		______	+18.5 dBm	±0.25 dB
	Maximum 1ST LO OUTPUT Power	+14.5 dBm	______		±0.25 dB
21	Sweep Time Accuracy				
	50 μs SWEEP TIME	42.5 μs	______	57.5 μs	±101 ns
	100 μs SWEEP TIME	85 μs	______	115 μs	±101 ns
	200 μs SWEEP TIME	170 μs	______	230 μs	±102 ns
	500 μs SWEEP TIME	425 μs	______	575 μs	±103 ns
	1 ms SWEEP TIME	850 μs	______	1.15 ms	±105 ns
	2 ms SWEEP TIME	1.7 ms	______	2.3 ms	±108 ns
	5 ms SWEEP TIME	4.25 ms	______	5.75 ms	±119 ns
	10 ms SWEEP TIME	8.5 ms	______	11.5 ms	±137 ns
	20 ms SWEEP TIME	17.0 ms	______	23.0 ms	±171 ns
	30 ms SWEEP TIME	29.7 ms	______	30.3 ms	±209 ns
	50 ms SWEEP TIME	49.5 ms	______	50.5 ms	±281 ns
	100 ms SWEEP TIME	99.0 ms	______	101.0 ms	±461 ns
	200 ms SWEEP TIME	198.0 ms	______	202.0 ms	±821 ns
	500 ms SWEEP TIME	495.0 ms	______	505.0 ms	±1.901 μs
	1 s SWEEP TIME	990.0 ms	______	1010.0 ms	±3.7 μs
	2 s SWEEP TIME	1.98 s	______	2.02 s	±7.3 ns
	5 s SWEEP TIME	4.95 s	______	5.05 s	±18.1 μs
	10 s SWEEP TIME	9.9 s	______	10.1 s	±36.1 ns
	20 s SWEEP TIME	19.8 s	______	20.2 s	±72.1 μs
	50 s SWEEP TIME	49.5 s	______	50.5 s	±180.1 ns
	60 s SWEEP TIME	59.4 s	______	60.6 s	±216.1 μs

When prompted for the power sensor's serial number, enter only the last five digits (the serial number suffix). You are then prompted for a cal factor frequency and for the cal factor. These frequency/cal-factor pairs need not be entered in order of increasing frequency; the program inserts the pairs in their proper place. All frequencies should be entered in MHz.

A 50 MHz Cal-Factor must be entered in order to calibrate the power sensor. Some power sensors do not include a 50 MHz Cal-Factor on their chart or calibration record; it is listed as part of the Calibration Procedure on the case of the power sensor.

If a mistake is made entering a cal factor, enter the frequency of the erroneous cal factor at the next frequency prompt. Enter the correct cal factor at the next prompt. If an error was made entering the frequency value, enter the erroneous frequency at the next frequency prompt and a zero for the cal factor to delete that frequency point.

Once all cal factor data for a power sensor is entered, enter an `S` at the next frequency prompt. The power sensor data is then stored on disk.

Viewing and Editing a Power Sensor Data File

Press `View/Edit` to view or edit a power sensor data file. Only data files listed on the screen can be viewed or edited. If a file is created but data is not stored, the filename is listed, but no data is viewed and it cannot be edited.

To change the cal factor at a particular frequency, enter that frequency at the frequency prompt, then enter the new cal factor.

To delete a frequency/cal factor pair, enter the frequency of the pair to be deleted and a cal factor of zero. Add a frequency/cal factor pair by entering the new frequency at the frequency prompt and the new cal factor.

Deleting a File

Press `Delete File` to remove a listed file. At the prompt, enter the filename exactly as it appears on-screen. You are asked for confirmation to delete the file.

Changing the System Mass Storage File Location

To add, edit, or view power sensor data on a disk other than the one currently specified by the system mass storage file location, press `System File`. Enter the msus of the new system mass storage file location. All power sensor files residing on that disk are listed. Upon returning to the Conditions Menu, the system mass storage file location is the one determined in the Sensor Utilities Menu.

Listing Available Power Sensor Data Files

Press `List Files` to list all power sensor data files on the currently specified system mass storage location file.

Returning to the Conditions Menu

Press `Cond Menu` to return to the Conditions Menu.

Table 3-37. Performance Test Record (11 of 11)

Hewlett-Packard Company Model HP 8561B	Report No. __________
Serial No. __________	Date __________

Test No.	Test Description	Results			Measurement Uncertainty
		Minimum	Measured	Maximum	
22	Residual Responses				
	200 kHz to 2.9 GHz		________	−90 dBm	±1.8 dB
	2.9 GHz TO 6.46 GHz		________	−90 dBm	±1.8 dB
23	IF INPUT Amplitude Accuracy	−31.5 dBm	________	−28.5 dBm	±0.02 dB

Verifying the HP-IB

To see which test equipment responds on HP-IB, press `Verify Bus` . This check only verifies that there is a response at the address listed; it cannot tell that a particular piece of equipment is at a particular address. This is useful for verifying HP-IB connections without entering the Test Menu.

Querying the Spectrum Analyzer Serial Number

The Operation Verification program automatically queries the spectrum analyzer serial and model number on three occasions: at program initiation, when loading the CONDITIONS file, and when entering the Test Menu. To query the analyzer's serial and model numbers at any other time, press `Query DUT S/N` . This is helpful for testing multiple spectrum analyzers; You do not have to reload the CONDITIONS file or restart the program.

Exiting Operation Verification

Press `Exit Program` to exit the Operation Verification program.

Dual-Bus Operation

The Operation Verification program may be used on dual HP-IB systems, such as the microwave test set. In these systems, all the test equipment is connected to HP-IB at select code 7, and the device under test (for example, the spectrum analyzer) is connected to HP-IB at select code 8.

To run this program in a dual-bus configuration, enter equipment addresses as described in "Setting HP-IB Addresses" above, making sure that each address properly identifies the bus select code to which it is connected. Program operation is the same for dual-bus and single-bus configuration.

Sensor Utilities Menu

Operation Verification needs to know the cal factors of each power sensor being used. Create, edit, view, and delete data files containing cal factors for each power sensor in the Sensor Utilities Menu. Power sensor data filenames include the last five digits of the power sensor serial number. For example,

for HP 8481A Power Sensors the filename is SEN81NNNNN
for HP 8482A Power Sensors the filename is SEN82NNNNN
for HP 8485A Power Sensors the filename is SEN85NNNNN

where NNNNN represents the last five digits of the power sensor serial number (the serial number suffix). Note that the first two digits in the filename correspond to the last two digits of the power sensor model number.

All power sensor data files available on the system mass storage location file are listed upon entering the Sensor Utilities Menu.

Adding a Power Sensor Data File

To add a new power sensor data file, press `Add File` , and enter the power sensor's model number as requested. An error message is displayed if a disk at the current system mass storage file location is not found.

equipment required for each test and Table 4-3 lists model numbers allowed for a particular type of test equipment.

Entering zero as the test equipment address results in that model number being unavailable in the program (`NA` is displayed in the address field). To minimize possible confusion later, enter a zero for the address of each piece of test equipment that is not available.

Enter the address for each piece of test equipment that is available, including the spectrum analyzer under test. Addresses must contain the select code of the bus to which the equipment is connected followed by the equipment's address on that bus. For example, if the HP 8902A is at address 14 on a bus with a select code of 7, enter an address of 714. If the HP 8902A were on a bus with a select code of 12, you should enter an address of 1214.

A question mark (?) next to an HP-IB address indicates the address has not been checked to verify a response. An asterisk (*) next to an HP-IB address indicates the address was checked and that an instrument responds at that address. If there is neither an asterisk nor a question mark next to an address, the address has been checked and no response was detected.

Storing and Loading the Conditions File

The information in the Conditions Menu may be stored for future use by pressing `Store Conds`. A file named CONDITIONS is created on the disk specified by the system mass storage file location.

When running the Operation Verification program in the future, set the system mass storage file location to read the disk where the CONDITIONS file is located and press `Load Conds`. If the CONDITIONS file resides on the default system mass storage file location, the CONDITIONS file is loaded automatically the next time the program is run.

The default system mass storage file location is computer-dependent. For the HP 9000 Model 216 (HP 9816) and the Model 310 it is `:,700,1`. For the HP 9000 Model 236 (HP 9836) it is `:INTERNAL,4,0`.

Getting to the Test Menu

Once all necessary items in the Conditions Menu are selected, you can run a test by pressing `Test Menu`. Before the Test Menu is displayed, these things occur:

- The appropriate power sensor data files are loaded.
- The HP-IB is checked for a response at each address.
- The serial and model number of the spectrum analyzer under test are queried.
- A reference level calibration is performed.

Refer to "Test Menu" in this chapter for more details on running the tests. If a printer is unavailable, the Conditions Menu is displayed again rather than the Test Menu. All test results must be sent to the printer.

Note Without a printer, Operation Verification tests do not run.

4

Operation Verification

What You'll Find in This Chapter

Operation Verification automates performance tests which are designed to give a high confidence level of spectrum analyzer operation in a reasonable time frame. Operation Verification software performs 80 percent to 85 percent of the manual performance tests in less than 60 minutes. It is designed to test an instrument operating within a 20°C to 30°C temperature range using a minimum set of test equipment. Refer to Table 4-1 in this section for a list of tests performed.

If the analyzer passes all Operation Verification Tests, be assured that the analyzer is performing within the specifications indicated in each test. These specifications are representative of the specifications listed in Chapter 1, Table 1-1. Refer to Table 1-1 for the actual specifications. If a test does not pass, any related manual performance test needs to be run. Related manual performance tests are listed at the top of each Operation Verification test and are their procedures are in Chapter 3, "Performance Tests."

Operation Verification software automates the majority of manual performance tests for analyzer performance verification. Refer to Table 4-2 for the names of manual performance tests that are not included in the automated Operation Verification software.

Getting Started

First, make sure you have a compatible controller (computer), the proper test equipment, and a printer for recording test results. The following paragraphs describe requirements for controllers, test equipment, and printers. Once the proper equipment is identified, proceed to "Equipment Connections."

Controller (Computer)

Operation Verification software requires using any combination of one of the following HP controllers and the HP BASIC operating system:

Controller
HP 9000 Model 216
HP 9000 Model 236
HP 9000 Model 310

Operating System
HP BASIC 2.0 with Extensions 2.1
HP BASIC 3.0 and required BIN files
HP BASIC 4.0 and required BIN files

Addresses, or no address is listed, a message appears where the model and serial numbers are normally displayed.

The program also queries the time and date in the computer. If an HP 9000 Series 200 computer is used, it might be necessary to reset the time and date; HP 9000 Series 300 computers have built-in real-time clocks.

Entries for Operator, Test Conditions, and Other Comments are optional. Blank spaces are provided on the Test Record if no entry is made. To make or to change an entry, move the pointer to the line where the entry is to be made or changed. Press `Change Entry` and type in your new entry. Entries for Operator, Test Conditions, and Other Comments can be up to 37 characters long, but only the first 25 characters of the Operator entry are printed on the Test Record.

System Mass Storage File Location

Calibration factor data for different power sensors and a customized set of conditions may be stored on disk. The mass storage unit specifier (msus) for the disk containing this information should be entered as the system mass storage file location. Refer to the *BASIC Operating Techniques Manual* for information on the syntax of the msus.

The Operation Verification program disk comes write-protected from the factory. If you want to use this disk for storing your power sensor and conditions data files, it is necessary to disable the write-protect mechanism.

Power Sensors

The Operation Verification program supports three models of power sensors, but only one model is necessary to run all the tests. The HP 8481A and HP 8482A may be used interchangeably. The HP 8485A is required for the Frequency Response test of the microwave spectrum analyzer. Refer to "Sensor Utilities" for more information regarding storing, viewing, editing, and purging cal factor data for power sensors.

To select a particular sensor of a certain model number, move the pointer to the desired model number and press `Change Entry`. Enter the last five digits of the power sensor's serial number (that is, the serial number suffix). The program checks to see that a data file containing the cal factor data for that particular sensor exists.

To create, edit, view, or purge power sensor cal factor data files, press `Sensor Utils` to bring up the Sensor Utilities Menu. Refer to "Sensor Utilities Menu" in this chapter for more information.

A `WARNING` message appears if the program does not find a data file for the sensor. If this occurs, check that the system mass storage file location specifies the disk where the power sensor data resides. If the system mass storage file location is correct, the cal factor data for that particular sensor has not been stored.

Refer to "Sensor Utilities Menu" in this chapter for additional information.

Setting HP-IB Addresses

The last 11 lines of the Conditions Menu are for selecting the HP-IB addresses of test equipment used for the Operation Verification program. It is not necessary to use all the test equipment listed. Some model numbers listed are "alternates." Table 4-1 lists the test

There must be at least 250K of free memory for the Operation Verification program.
The computer can have either single or dual HP-IB ports. Refer to "Preparing Operation Verification for Use" under "Program Operation" for information on using the program with dual HP-IB ports.

Test Equipment

Table 4-1 lists the operation verification tests and the test equipment required for each test. You do not need all the test equipment connected to perform operation verification. You need only connect the equipment specified in each test to run that test.

Table 4-3 summarizes the equipment required to run the Operation Verification tests. Some tests, like 10 MHz Reference Accuracy, can use various model numbers of a particular equipment type. Information about selecting the equipment model number you want to use is provided in "Setting HP-IB Addresses" in this chapter under "Preparing Operation Verification for Use."

Note The validity of Operation Verification program measurements depends in part on required test equipment measurement accuracy. Verify proper calibration of test equipment before testing the analyzer with the software.

Printers

All test results are sent to an HP-IB printer. The program does not run without being connected to an HP-IB printer. Virtually any HP-IB graphics workstation printer can work. These tests have been run using the HP ThinkJet, HP 2671G, HP 82906A, and HP 9876G Printers.

Warm-Up Time

Test Equipment Warm-Up

Allow sufficient warm-up time for test equipment. Refer to their individual operating and service manuals for warm-up specifications.

Spectrum Analyzer Warm-Up

Warm the spectrum analyzer up for at least 5 minutes before performing the first test.

Using Operation Verification

Loading the Program

Load HP BASIC into the computer. HP BASIC choices are:

- BASIC 2.0 and Extensions 2.1
- BASIC 3.0 or 4.0, which must include the following binaries:

  MAT 3.0 or 4.0
  IO 3.0 or 4.0
  GRAPH 3.0 or 4.1
  PDEV 3.0 or 4.0
  HPIB 3.0 or 4.0
  MS 3.0 or 4.0

For configuration instructions, refer to the *BASIC Operating Manual*. Next, insert the Operation Verification software disk into the disk drive, then type:

```
LOAD VERIFY_62,1
```

Press (EXECUTE) on HP 9000 Series 200 computers, or (RETURN) on HP 9000 Series 300 computers, to load the software and start the program running.

Program Operation

Operation Verification consists of three menus. They are the Conditions Menu, the Test Menu, and the Sensor Utilities Menu, which are accessed from the Conditions Menu. Program operation is controlled through a combination of softkeys and user prompts. Some prompts, primarily in the Conditions and Sensor Utilities Menus, require computer keyboard entries. Terminate keyboard entries with the (RETURN) or (ENTER) key. Most prompts, however, tell the user what to do next or provide informational messages.

If the message `(any key)` follows a prompt, pressing any key on the keyboard continues the program. If the message `(any key or 'Q' to quit)` follows a prompt, pressing any key except `Q` continues the program. Pressing `Q` terminates the current procedure at the next, most logical point in the program.

Conditions Menu

The first menu screen displayed is the Conditions Menu. The pointer displayed along the left edge of the screen may be moved with the knob (if one is present) or the up (▲) and down (▼) arrow keys. Notice that the menu has two pages. Moving the pointer below the last entry on the page brings up the next page. Similarly, moving the pointer above the first entry on a subsequent page brings up the preceding page. The two pages of the Conditions Menu have a four-line overlap. The last four lines of page 1 appear as the first four lines on page 2.

Test Record Header Information

The information in the first six entries of this menu is printed out as part of the Operation Verification Test Record. The spectrum analyzer model number and serial number are stored in the analyzer's memory. The program queries these numbers via HP-IB and displays them. If the spectrum analyzer under test does not respond at the address listed under HP-IB

Table 4-1. Tests Performed and Equipment Required

Test Number	Test Name	Equipment Required
1	10 MHz Reference Accuracy	HP 5342A *or* HP 5343A
2	Calibrator Amplitude Accuracy	HP 8902A, HP 436A, HP 438A, HP 8481A, *or* HP 8482A
3	Displayed Average Noise Level	HP 909D
4	RES BW Switching Uncertainty	HP 3335A, HP 8340A/B *or* HP 8662/63A
5	RES BW Accuracy/Selectivity	HP 3335A, HP 8340A/B *or* HP 8662/63A
6	Input Attenuator Switching Uncertainty	HP 3335A
7	IF Gain Uncertainty	HP 3335A
8	Scale Fidelity	HP 3335A
9	Residual FM	HP 8662A *or* HP 3335A
10	Noise Sidebands	HP 8662A *or* CAL OUTPUT signal
11	Frequency Readout/Counter Accuracy	HP 8340A/B HP 8120-4921
12	Second Harmonic Distortion	HP 8340A/B HP 8902A *or* HP 436A *or* HP 438A HP 8485A *or* HP 8481A HP 11667B HP 11689A *(2 required)* HP 0955-0306 HP 8120-4921

Equipment Connections

Computer (Controller) Setup

For HP 9000 Model 216 or Model 236 Computers, setup instructions are provided in Chapter 1, "Computer Installation," of the *BASIC Operating Manual*. For HP 9000 Model 310 Computers, setup information is provided in *Configuration Reference Manual* for Series 300 computers.

HP-IB Cables

All HP-IB-controlled test equipment should be connected to the controller's internal HP-IB (select code 7). If the controller has only one HP-IB connector, connect the spectrum analyzer to it as well. If the controller has dual HP-IB connectors, connect the spectrum analyzer under test to the second HP-IB (typically, select code 8).

10 MHz Reference

The 10 MHz REF IN/OUT on the spectrum analyzer under test should be connected to the FREQUENCY STANDARD EXT of the HP 8340A(s) and the 40/N MHz REF INPUT of the HP 3335A. To streamline the tests, connect the 10 MHz REF IN/OUT to the 10 Hz-500 MHz input of the HP 5343A or HP 5342A Microwave Frequency Counter. *Do not* connect the 10 MHz REF IN/OUT to the external frequency reference input of the HP 8663A; doing so invalidates the Noise Sidebands test results.

Note Terminate the HP 3335A 10 MHz REF OVEN OUTPUT in 50Ω. Do not connect the 10 MHz output to the external frequency reference input of any other test equipment.

Test Setups

Test setups for each test are included with the test. These are in the "Test Descriptions" section of this chapter. The program prompts the operator to make appropriate equipment connections if the correct equipment setup is not detected.

Table 4-1. Tests Performed and Equipment Required (continued)

Test Number	Test Name	Equipment Required
13	Frequency Response	HP 8340A/B HP 3335A HP 8902A *or* HP 436A *or* HP 438A HP 8485A HP 11667B HP 8120-4921
14	Frequency Span Accuracy	*two* HP 8340A/Bs *or* *one* HP 8340A/B*and one* HP 3335A HP 11667B HP 8120-4921 *(2 required)*

Table 4-2. Manual Performance Tests that Are Not Automated

Image, Multiple, and Out-of-Range Responses
Pulse Digitization Uncertainty
Third Order Intermodulation Distortion
Gain Compression
1ST LO OUTPUT Amplitude
Sweep Time Accuracy
Residual Responses
IF Input Amplitude Accuracy

Table 4-3. Required Test Equipment Summary

Type of Equipment	HP Model Number
Controller*	HP Series 200 900 Model 216 (HP 9816) HP 900 Model 236 (HP 9836) or HP 900 Model 310
Synthesizer/Level Generator	HP 3335A
Synthesized Sweeper	HP 8340A/B
Synthesized Signal Generator	HP 8662A/8663A
Measuring Receiver	HP 8902A
Power Meter	HP 436A or HP 438A (alternate)
Microwave Frequency Counter	HP 5343A
Microwave Frequency Counter	HP 5342A (alternate)
Power Sensor (100 kHz to 4.2 GHz)	HP 8482A
Power Sensor (10 MHz to 18 GHz)	HP 8481A (alternate)
Power Splitter (DC to 26.5 GHz)	HP 11667B
4.4 GHz Low Pass Filter *(two required)*	HP 11689A
50Ω Termination	HP 909D
12 MHz Low Pass Filter	0955-0518
50 MHz Low Pass Filter	0955-0306
Miscellaneous Cables and Adapters	As Per Test Setup.
HP-IB Printer	See "Printers" below.
*250K of free memory is required for the test program.	