About this Manual

We've added this manual to the Agilent website in an effort to help you support your product. This manual is the best copy we could find; it may be incomplete or contain dated information. If we find a more recent copy in the future, we will add it to the Agilent website.

Support for Your Product

Agilent no longer sells or supports this product. Our service centers may be able to perform calibration if no repair parts are needed, but no other support from Agilent is available. You will find any other available product information on the Agilent Test & Measurement website, www.tm.agilent.com.

HP References in this Manual

This manual may contain references to HP or Hewlett-Packard. Please note that Hewlett-Packard's former test and measurement, semiconductor products and chemical analysis businesses are now part of Agilent Technologies. We have made no changes to this manual copy. In other documentation, to reduce potential confusion, the only change to product numbers and names has been in the company name prefix: where a product number/name was HP XXXX the current name/number is now Agilent XXXX. For example, model number HP8648A is now model number Agilent 8648A.

Calibration Guide

HP 8594L Spectrum Analyzer

Manufacturing Part Number: 08594-90099
Printed in USA
July 1998

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.

Regulatory Information

The specifications and characteristics chapter in this manual contain regulatory information.

Warranty

This Hewlett-Packard instrument product is warranted against defects in material and workmanship for a period of three years 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 Hewlett-Packard. Buyer shall prepay shipping charges to Hewlett-Packard and Hewlett-Packard shall pay shipping charges to return the product to Buyer. However, Buyer shall pay all shipping charges, duties, and taxes for products returned to Hewlett-Packard from another country.

Hewlett-Packard warrants that its software and firmware designated by Hewlett-Packard for use with an instrument will execute its programming instructions when properly installed on that instrument. Hewlett-Packard 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. HEWLETT-PACKARD 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. HEWLETT-PACKARD 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.

Safety Symbols

The following safety notes are used throughout this manual. Familiarize yourself with each of the notes and it's meaning before operating this instrument.

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

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

General Safety Considerations

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

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

CAUTION — Before switching on this instrument, make sure that the line voltage selector switch is set to the voltage of the power supply and the correct fuse is installed.

WARNING — **These servicing instructions are for use by qualified personnel only. To avoid electrical shock, do not perform any servicing unless you are qualified to do so.**

WARNING **The opening of covers or removal of parts is likely to expose dangerous voltages. Disconnect the instrument from all voltage sources while it is being opened.**

WARNING **The power cord is connected to internal capacitors that may remain live for 10 seconds after disconnecting the plug from it's power supply.**

WARNING **For continued protection against fire hazard replace line fuse only with same type and rating (F 5A/250V). The use of other fuses or material is prohibited.**

HP 8594L Spectrum Analyzer Documentation Description

Manuals Shipped with your 8594L Spectrum Analyzer:

HP 8594L Spectrum Analyzer Calibration Guide

Tells you how to test your spectrum analyzer to determine if the spectrum analyzer meets its specifications.

HP 8590 E-Series and L-Series Spectrum Analyzers User's Guide

- Tells you how to make measurements with your spectrum analyzer.
- Describes the spectrum analyzer features.
- Tells you what to do in case of a failure.

HP 8590 Series Spectrum Analyzer Quick Reference Guide

- Describes how to make a simple measurement with your spectrum analyzer.
- Briefly describes the spectrum analyzer functions.
- Lists all the programming commands.

Documentation Options

Option 041 or 043: Programmer's Guide

Describes analyzer operation via a remote controller (computer) for the RS-232 or HP-IB interface.

Option 910: Additional User's Documentation

Provides an additional copy of the user's guide, the calibration guide, and the quick reference guide.

Option 915: Assembly-Level and Component-Level Information

Describes troubleshooting and repair of the spectrum analyzer. Option 915 consists of two manuals:

HP 8590 Series Analyzers Assembly-Level Repair Service Guide

- Describes adjustment and assembly level repair of the analyzer.

HP 8590 Series Spectrum Analyzer Component-Level Information

- Provides information for component-level repair of the spectrum analyzer.

How to Order Guides

Each of the guides listed can be ordered individually. To order, contact your local HP Sales and Service Office.

How to Use This Guide

Where to Start

If you have just received your analyzer and want to get ready for use for the first time, do the following:

- Read Chapters 1 and 2 of your analyzer user's guide.
- Perform the initial self-calibration routines described in Chapter 2 of the analyzer user's guide (these are automatic self-checks and require no test equipment).
- If you need to verify the unit is operating within its specifications, perform the performance verification tests in this guide.

After completing the performance verification, use your user's guide to learn how to use the analyzer and to find more detailed information about the analyzer, its applications, and key descriptions.

This guide uses the following conventions:

Front-Panel Key	A word written in this typeface represents a key physically located on the instrument.
Softkey	A word written in this typeface indicates a "softkey," a key whose label is determined by the instrument's firmware.
`Screen Text`	Text printed in this typeface indicates text displayed on the spectrum analyzer screen.

Contents

1. Calibrating

Figures

Tables

1 Calibrating

This chapter contains performance verification test procedures which test the electrical performance of the spectrum analyzer.

Allow the spectrum analyzer to warm up in accordance with the Temperature Stability specification in Chapter 2 before performing the tests in this chapter.

None of the test procedures involve removing the cover of the spectrum analyzer.

Calibration

Calibration verifies that the spectrum analyzer performance is within all specifications listed in Chapter 2. It is time consuming and requires extensive test equipment. Calibration consists of *all* the performance verification tests. See Table 1-1 for a complete listing of the performance verification tests.

Operation Verification

Operation verification consists of a subset of the performance verification tests. See Table 1-1. Operation verification tests only the most critical specifications of the spectrum analyzer. These tests are recommended for incoming inspection, troubleshooting, or after repair. Operation verification requires less time and equipment than the calibration.

The following table lists the performance verification tests included in this chapter. Perform the tests marked in the OpVer column.

Table 1-1 Performance Verification Tests

	Performance Verification Test Name	OpVer [a]
1.	10 MHz Reference Output Accuracy	x
2.	Frequency Readout and Marker Count Accuracy	x
3.	Noise Sidebands	x
4.	System Related Sidebands	
5.	Frequency Span Readout Accuracy	x
6.	Residual FM	
7.	Sweep Time Accuracy	
8.	Scale Fidelity	x
9.	Reference Level Accuracy	x
10.	Absolute Amplitude Calibration and Resolution Bandwidth Switching Uncertainties	x
11.	Resolution Bandwidth Accuracy	
12.	Calibrator Amplitude Accuracy	x
13.	Frequency Response	x
14.	Other Input Related Spurious Responses	
15.	Spurious Response [b]	x
16.	Gain Compression	
17.	Displayed Average Noise Level	x
18.	Residual Responses	

a. The tests used for both calibration and operation verification are marked with an x.
b. Parts 3 and 4, Third Order Intermodulation Distortion, are not required for operation verification.

Safety

Familiarize yourself with the safety symbols marked on the spectrum analyzer, and read the general safety instructions and the symbol definitions given in the front of this guide *before* you begin verifying the performance of the spectrum analyzer.

Before You Start

There are four things you should do before starting a performance verification test:

- Switch the spectrum analyzer on and let it warm up in accordance with the Temperature Stability specification in Chapter 2 .
- Read "Making a Measurement" in Chapter 2 of the *HP 8590 E-Series and L-Series Spectrum Analyzers User's Guide*.
- After the spectrum analyzer has warmed up as specified, perform the Self-Calibration Procedure documented in "Improving Accuracy With Self-Calibration Routines" in Chapter 2 of the *HP 8590 E-Series and L-Series Spectrum Analyzers User's Guide*. The performance of the spectrum analyzer is only specified after the spectrum analyzer calibration routines have been run and if the spectrum analyzer is autocoupled.
- Read the rest of this section before you start any of the tests, and make a copy of the Performance Verification Test Record described in "Recording the Test Results."

Test equipment you will need

Table 1-2, Table 1-3, and Table 1-4 list the recommended test equipment for the performance verification tests. The tables also lists recommended equipment for the spectrum analyzer adjustment procedures which are located in the *HP 8590 Series Analyzers Assembly-Level Repair Service Guide*. Any equipment that meets the critical specifications given in the table can be substituted for the recommended model.

Recording the test results

A performance verification test record is provided at the end of this chapter.

Each test result is identified as a *TR Entry* in the performance tests and on the performance verification test record. We recommend that you make a copy of the performance verification test record, record the test results on the copy, and keep the copy for your calibration test record. This record could prove valuable in tracking gradual changes in test results over long periods of time.

If the spectrum analyzer doesn't meet specifications

If the spectrum analyzer fails a test, rerun the frequency calibration and amplitude calibration routines by pressing **CAL FREQ & AMPTD**, and **CAL YTF**. Press **CAL STORE**, then repeat the verification test. If the spectrum analyzer still fails one or more specifications, complete any remaining tests and record all test results on a copy of the test record. Then refer to Chapter 3 , “If You Have a Problem” for instructions on how to solve the problem.

Periodically verifying operation

The spectrum analyzer requires periodic verification of operation. Under most conditions of use, you should test the spectrum analyzer at least once a year with either operation verification or the complete set of performance verification tests.

NOTE The following tests verify the electrical performance of the spectrum analyzer. Allow the spectrum analyzer to warm up in accordance with the temperature stability specifications before performing the tests.

Table 1-2 Recommended Test Equipment

Equipment	Critical Specifications for Equipment Substitution	Recommended Model	Use [a]
Digital Voltmeter	Input Resistance: ≥10 megohms Accuracy: ±10 mV on 100 V range	HP 3456A	P,A,T
DVM Test Leads	For use with HP 3456A	HP 34118	A,T
Frequency Counter	Frequency: 10 MHz Resolution: ±0.002 Hz External Timebase	HP 5334A/B	P,A,T
Frequency Standard	Frequency: 10 MHz Timebase Accy (Aging): $<1 \times 10^{-9}$/day	HP 5061B	P,A
Measuring Receiver	Compatible with Power Sensors dB Relative Mode Resolution: 0.01 dB Reference Accuracy: ±1.2%	HP 8902A	P,A,T
Microwave Frequency Counter	Frequency Range: 9 MHz to 7 GHz Timebase Accy (Aging): $<5 \times 10^{-10}$/day	HP 5343A	P,A,T
Oscilloscope	Bandwidth: dc to 100 MHz Vertical Scale Factor of 5 V/Div External Trigger Mode	HP 54501A	T
Power Meter	Power Range: Calibrated in dBm and dB relative to reference power –70 dBm to +44 dBm, sensor dependent	HP 436A	P,A,T
Power Sensor	Frequency Range: 1 MHz to 350 MHz Maximum SWR: 1.60 (100 kHz to 300 kHz) 1.20 (300 kHz to 1 MHz) 1.1 (1 MHz to 2.0 GHz) 1.30 (2.0 to 2.9 GHz)	HP 8482A	P,A,T
Power Sensor	Frequency Range: 50 MHz to 26.5 GHz Maximum SWR: 1.15 (50 MHz to 100 MHz) 1.10 (100 MHz to 2 GHz) 1.15 (2.0 GHz to 12.4 GHz) 1.20 (12.4 GHz to 18.0 GHz) 1.25 (18 GHz to 26.5 GHz)	HP 8485A	P,A,T
Power Sensor, Low-Power	Frequency Range: 300 MHz Amplitude Range: –20 dBm to –70 dBm Maximum SWR: 1.1 (300 MHz)	HP 8484A	P,A,T

Table 1-2 Recommended Test Equipment

Equipment	Critical Specifications for Equipment Substitution	Recommended Model	Use [a]
Signal Generator	Frequency Range: 1 MHz to 1000 MHz Amplitude Range: –35 to +16 dBm SSB Noise: <–120 dBc/Hz at 20 kHz offset	HP 8640B, Option 002 *or* HP 8642A	P,A,T
Synthesized Sweeper	Frequency Range: 10 MHz to 22 GHz Frequency Accuracy (CW): ±0.02% Leveling Modes: Internal and External Modulation Modes: AM Power Level Range: –35 to +16 dBm	HP 8340A/B *or* HP 83630A	P,A,T
Synthesizer/Function Generator	Frequency Range: 0.1 Hz to 500 Hz Frequency Accuracy: ±0.02% Waveform: Triangle	HP 3325B	P,T
Synthesizer/Level Generator	Frequency Range: 500 Hz to 80 MHz Amplitude Range: +12 to –85 dBm Flatness: ±0.15 dB Attenuator Accuracy: ±0.09 dB	HP 3335A	P,A,T

a. P = Performance verification test, A = Adjustment, T = Troubleshooting

Table 1-3 Recommended Cables

Equipment	Critical Specifications for Cable Substitution	Recommended Model	Use [a]
Cable	Frequency Range: 10 MHz to 22 GHz Maximum SWR: <1.4 at 22 GHz Length: ≥91 cm (36 in) Connectors: APC 3.5 (m) both ends Maximum Insertion Loss: 2 dB *(2 required)*	8120-4921	P,A
Cable	Frequency Range: 50 MHz to 7 GHz Length: ≥91 cm (36 in) Connectors: SMA (m) both ends	5061-5458	P,A,T
Cable	Frequency Range: dc to 1 GHz Length: ≥91 cm (36 in) Connectors: BNC (m) both ends *(4 required)*	HP 10503A	P,A,T
Cable	Frequency Range: dc to 310 MHz Length: 20 cm (9 in) Connectors: BNC (m) both ends	HP 10502A	P,A,T
Cable Assembly	Length: approximately 15 cm (6 in) Connectors: BNC (f) to Alligator Clips	8120-1292	A
Cable Assembly	Length: ≥91 cm (36 in) Connectors: Banana Plug to Alligator Clips	HP 11102A	A
Cable, Test	Length: ≥91 cm (36 in) Connectors: SMB (f) to BNC (m) *(2 required)*	85680-60093	A,T
Cable	Type N Length: 183 cm (72 in)	HP 11500A	P,A,T
Cable	Type N Length: 62 cm (24 in)	HP 11500B/C	P,A,T
Cable	Type N Length: 152 cm (60 in)	HP 11500D	P,A,T

a. P = Performance verification test, A = Adjustment, T = Troubleshooting

Table 1-4 Recommended Accessories

Equipment	Critical Specifications for Accessory Substitution	Recommended Model	Use [a]
Adapter	APC 3.5 (f) to APC 3.5 (f)	5061-5311	P,A,T
Adapter	Type N (f) to APC 3.5 (m)	1250-1750	P,A,T
Adapter	BNC (m) to BNC (m)	1250-0216	P,A,T
Adapter	Type N (f) to BNC (f)	1250-1474	P,A,T
Adapter	BNC (f) to SMB (m)	1250-1237	A,T
Adapter	Type N (m) to N (m)	1250-1475	P,A,T
Adapter	BNC tee (m) (f) (f)	1250-0781	T
Adapter	Type N (m) to APC 3.5 (m)	1250-1743	P,A,T
Adapter	Type N (m) to APC 3.5 (f)	1250-1744	P,A,T
Adapter	Type N (f) to APC 3.5 (f)	1250-1745	P,A,T
Adapter	Type N (f) to BNC (m)	1250-1477	P,A,T
Adapter	Type N (m) to BNC (f) *(4 required)*	1250-1476	P,A,T
Adapter	Type N (m) to BNC (m) *(2 required)*	1250-1473	P,A,T
Adapter	Type N (f) to N (f)	1250-1472	P,A,T
Adapter	Type N (f) to SMA (f)	1250-1772	P,A,T
Adapter	SMA (f) to SMA (f)	1250-1158	P,A,T

Table 1-4 Recommended Accessories

Equipment	Critical Specifications for Accessory Substitution	Recommended Model	Use [a]
Adapter	SMA (m) to SMA (m)	1250-1159	P,A,T
Adapter	SMB (m) to SMB (m)	1250-0813	A,T
Adapter	SMC (m) to SMC (m)	1250-0827	A,T
Adapter	Type N tee (m) (f) (f)	1250-0559	P,T
Attenuator, 10 dB	Type N (m to f) Frequency: 300 MHz	HP 8491A Option 010	P,A,T
Attenuator, 20 dB	Attenuation: 20 dB Frequency dc to 12.4 GHz	HP 8491A Option 020	A
Attenuator, 1 dB Step	Attenuation Range: 0 to 12 dB Frequency Range: 50 MHz Connectors: BNC female	HP 355C	P,A
Attenuator, 10 dB Step	Attenuation Range: 0 to 30 dB Frequency Range: 50 MHz Connectors: BNC female	HP 355D	P,A
Digital Current Tracer	Sensitivity: 1 mA to 500 mA Frequency Response: Pulse trains to 10 MHz Minimum Pulse Width: 50 ns Pulse Rise Time: <200 ns	HP 547A	T
Directional Bridge	Frequency Range: 0.1 to 110 MHz Directivity: >40 dB Maximum VSWR: 1.1:1 Transmission Arm Loss: 6 dB (nominal) Coupling Arm Loss: 6 dB (nominal)	HP 8721A	P,T
Directional Coupler	Frequency Range: 1.7 GHz to 8 GHz Coupling: 16 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,T

Table 1-4 Recommended Accessories

Equipment	Critical Specifications for Accessory Substitution	Recommended Model	Use [a]
Logic Pulser	TTL voltage and current drive levels	HP 546A	T
Logic Clip	TTL voltage and current drive levels	HP 548A	T
Low-Pass Filter, 50 MHz	Cutoff Frequency: 50 MHz Rejection at 80 MHz: >50 dB	0955-0306	P,T
Low-Pass Filter, 300 MHz	Cutoff Frequency: 300 MHz Bandpass Insertion Loss: <0.9 dB at 300 MHz Stopband Insertion Loss: >40 dB at 435 MHz	0955-0455	P,A,T
Power Splitter	Frequency Range: 50 kHz to 22 GHz Insertion Loss: 6 dB (nominal) Output Tracking: <0.25 dB Equivalent Output SWR: <1.22:1	HP 11667B	P,A
Termination, 50 Ω	Impedance: 50 Ω (nominal)	HP 909A	P,T

a. P = Performance verification test, A = Adjustment, T = Troubleshooting

1. 10 MHz Reference Output Accuracy

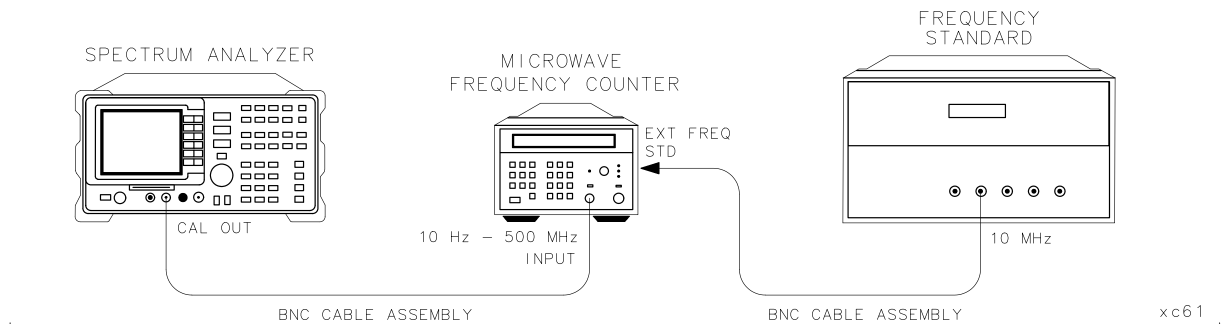
The settability is measured by changing the setting of the digital-to-analog converter (DAC) which controls the frequency of the timebase. The frequency difference per DAC step is calculated and compared to the specification.

The related adjustment for this performance verification test is the "10 MHz Frequency Reference Adjustment."

Equipment Required

Microwave frequency counter
Frequency standard
Cable, BNC, 122 cm (48 in) (2 required)

Figure 1-1 10 MHz Reference Test Setup



Procedure

The test results will be invalid if REF UNLK is displayed at any time during this test. REF UNLK will be displayed if the internal reference oscillator is unlocked from the 10 MHz reference. A REF UNLK might occur if there is a hardware failure or if the jumper between 10 MHz REF OUTPUT and EXT REF IN on the rear panel is removed.

1. Connect the equipment as shown in Figure 1-1.
2. Set the frequency counter controls as follows:

   SAMPLE RATE ....Midrange
   50 Ω/1 Ω SWITCH .... 50 Ω
   10 Hz-500 MHz/500 MHz-26.5 GHz SWITCH ...... 10 Hz-500 MHz
   FREQUENCY STANDARD (rear panel) ....EXTERNAL

3. Wait for the frequency counter reading to stabilize. Record the frequency counter reading in the 10 MHz Reference Accuracy

Worksheet as Counter Reading 1.

4. Set the spectrum analyzer by pressing the following keys:

   FREQUENCY, −37, **Hz**
   CAL, **More 1 of 4**, **More 2 of 4**, **VERIFY TIMEBASE**

5. Record the number in the active function block of the spectrum analyzer in the 10 MHz Reference Accuracy Worksheet as the Timebase DAC Setting.

6. Add one to the Timebase DAC Setting recorded in step 5, then enter this number using the DATA keys on the spectrum analyzer. For example, if the timebase DAC setting is 105, press the following keys:

   1,0,6, **Hz**

7. Wait for the frequency counter reading to stabilize. Record the frequency counter reading in the 10 MHz Reference Accuracy Worksheet as Counter Reading 2.

8. Subtract one from the Timebase DAC Setting recorded in step 5, then enter this number using the DATA keys on the spectrum analyzer. For example, if the timebase DAC setting is 105, press the following keys:

   1, 0, 4, **Hz**

9. Wait for the frequency counter reading to stabilize. Record the frequency counter reading in the 10 MHz Reference Accuracy Worksheet as Counter Reading 3.

10 MHz Reference Accuracy Worksheet

Description	Measurement
Counter Reading 1	______________ Hz
Timebase DAC Setting	______________
Counter Reading 2	______________ Hz
Counter Reading 3	______________ Hz

10. Calculate the frequency settability by performing the following steps:

   - Calculate the frequency difference between Counter Reading 2 and Counter Reading 1.
   - Calculate the frequency difference between Counter Reading 3 and Counter Reading 1.
   - Divide the difference with the greatest absolute value by two and record the value as TR Entry 1 of the performance verification test record. The settability should be less than ±150 Hz.
   - Press **PRESET** on the spectrum analyzer. The timebase DAC will be reset automatically to the value recorded in step 5.

2. Frequency Readout and Marker Count Accuracy

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

The related adjustment for this performance test is the "Sampler Match Adjustment."

Equipment Required

Synthesized sweeper
Adapter, Type N (f) to APC 3.5 (m)
Adapter, APC 3.5 (f) to APC 3.5 (f)
Cable, Type N, 183 cm (72 in)
Cable, BNC, 122 cm (48 in)

Procedure

This performance test consists of two parts:

Part 1: Frequency Readout Accuracy
Part 2: Marker Count Accuracy

Perform "Part 1: Frequency Readout Accuracy" before "Part 2: Marker Count Accuracy."

Part 1: Frequency Readout Accuracy

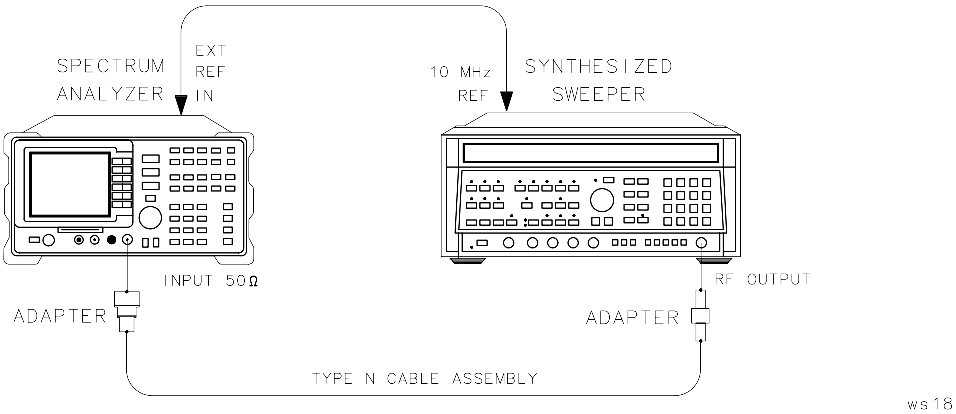
1. Connect the equipment as shown in Figure 1-2. Remember to connect the 10 MHz REF OUT of the synthesized sweeper to the EXT REF IN of the spectrum analyzer.
2. Perform the following steps to set up the equipment:
   - Press INSTRUMENT PRESET on the synthesized sweeper, then set the controls as follows:

     CW ....1.5 GHz
     POWER LEVEL ....–10 dBm

   - Press **PRESET** on the spectrum analyzer, then wait for the preset routine to finish. Set the spectrum analyzer by pressing the following keys:

     FREQUENCY, 1.5, **GHz**
     SPAN, 20, **MHz**

Figure 1-2 Frequency Readout Accuracy Test Setup



3. Press **PEAK SEARCH** on the spectrum analyzer to measure the frequency readout accuracy.
4. Record the MKR frequency reading in the performance verification test record as TR Entry indicated in Table 1-5. The reading should be within the limits shown in Table 1-5.
5. Change to the next spectrum analyzer span setting listed in Table 1-5.
6. Repeat steps 3 through 5 for each spectrum analyzer span setting listed in Table 1-5.

"Part 1: Frequency Readout Accuracy" is now complete. Continue with "Part 2: Marker Count Accuracy."

Table 1-5 Frequency Readout Accuracy

Spectrum Analyzer	MKR Reading		
Span (MHz)	**Min. (MHz)**	**TR Entry (Actual)**	**Max. (MHz)**
20	1.49918	**1**	1.50082
10	1.49958	**2**	1.50042
1	1.49996	**3**	1.500032

Part 2: Marker Count Accuracy

Perform "Part 1: Frequency Readout Accuracy" before performing this procedure.

1. Press **PRESET** on the spectrum analyzer, then wait for the preset routine to finish. Set the spectrum analyzer to measure the marker count accuracy by pressing the following keys:

   FREQUENCY, 1.5, **GHz**
   SPAN, 20, **MHz**
   BW, **RES BW AUTO MAN**, 300, **kHz**
   MKR FCTN, **MK COUNT ON OFF**, (ON)
   More 1 of 2
   CNT RES AUTO MAN, 100, **Hz**

2. Press **PEAK SEARCH**, then wait for a count be taken (it may take several seconds).

3. Record the CNTR frequency reading as TR Entry 5 of the performance verification test record. The reading should be within the limits of 1.4999989 GHz and 1.5000011 GHz.

4. Change the spectrum analyzer settings by pressing the following keys:

   SPAN, 1, **MHz**
   MKR FCTN, **MK COUNT ON OFF** (ON)
   More 1 of 2
   CNT RES AUTO MAN, 10, **Hz**

5. Press **PEAK SEARCH**, then wait for a count be taken (it may take several seconds).

6. Record the CNTR frequency reading as TR Entry 6 of the performance verification test record. The reading should be within the limits of 1.49999989 GHz and 1.50000011 GHz.

Performance test "2. Frequency Readout Accuracy and Marker Count Accuracy" is now complete.

3. Noise Sidebands

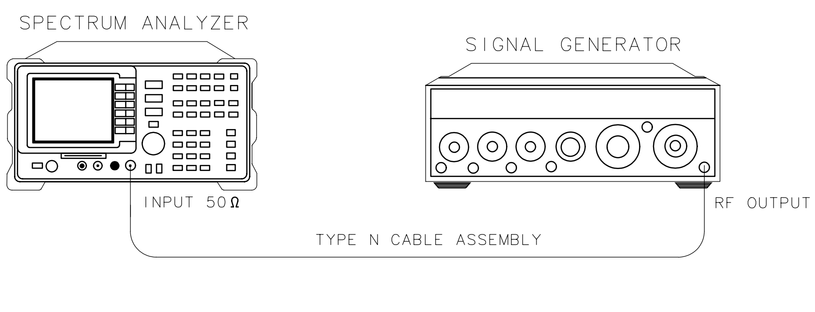
A 500 MHz CW signal is applied to the input of the spectrum analyzer. The marker functions are used to measure the amplitude of the carrier and the noise level 10 kHz, 20 kHz, and 30 kHz above and below the carrier. The difference between these two measurements is compared to specification after the result is normalized to 1 Hz.

There are no related adjustment procedures for this performance test.

Equipment Required

Signal generator
Cable, Type N, 183 cm (72 in)

Figure 1-3 **Noise Sidebands Test Setup**



Procedure

This performance test consists of three parts:

Part 1: Noise Sideband Suppression at 10 kHz
Part 2: Noise Sideband Suppression at 20 kHz
Part 3: Noise Sideband Suppression at 30 kHz

Perform part 1 before performing part 2 or part 3 of this procedure.

A worksheet is provided at the end of this procedure for calculating the noise sideband suppression.

Part 1: Noise Sideband Suppression at 10 kHz

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

   - Set the signal generator controls as follows:

     FREQUENCY ....500 MHz
     OUTPUT LEVEL ....0 dBm
     AM ....OFF
     FM ....OFF
     COUNTER ....INT
     RF ....ON

   - Connect the equipment as shown in Figure 1-3.
   - Press **PRESET** on the spectrum analyzer, then wait for the preset routine to finish. Set the spectrum analyzer by pressing the following keys:

     FREQUENCY, 500, **MHz**
     SPAN, 10, **MHz**

2. Press the following spectrum analyzer keys to measure the carrier amplitude.

   PEAK SEARCH
   MKR FCTN, **MK TRACK ON OFF** (ON)
   SPAN, 200, **kHz**
   BW, 1, **kHz**
   VID BW AUTO MAN, 30, **Hz**
   MKR FCTN, **MK TRACK ON OFF** (OFF)
   SGL SWP

   Wait for the completion of a sweep, then press **PEAK SEARCH**.

   Record the MKR amplitude reading in the Noise Sideband Worksheet as the Carrier Amplitude.

3. Press the following spectrum analyzer keys to measure the noise sideband level at +10 kHz:

   MARKER Δ, 10, **kHz**
   MKR, **MARKER NORMAL**

   Record the MKR amplitude reading in the Noise Sideband Worksheet as the Noise Sideband Level at +10 kHz.

4. Press the following spectrum analyzer keys to measure the noise sideband level at –10 kHz:

   PEAK SEARCH
   MARKER Δ, –10, **kHz**
   MKR, **MARKER NORMAL**

   Record the MKR amplitude reading in the Noise Sideband Worksheet as the Noise Sideband Level at –10 kHz.

5. Record the more positive value, either Noise Sideband Level at +10 kHz or Noise Sideband Level at –10 kHz from the Noise Sideband Worksheet as the Maximum Noise Sideband Level.
6. Subtract the Carrier Amplitude from the Maximum Noise Sideband Level at 10 kHz using the equation below.

   Noise Sideband Suppression = Maximum Noise Sideband Level – Carrier Amplitude

7. Record the Noise Sideband Suppression at 10 kHz in the performance verification test record as TR Entry 1. The suppression should be ≤–60 dBc.

Part 2: Noise Sideband Suppression at 20 kHz

1. Press the following spectrum analyzer keys to measure the noise sideband level at +20 kHz:

   MKR, **MARKER** Δ, 20, **kHz**
   MARKER NORMAL

   Record the MKR amplitude reading in the Noise Sideband Worksheet as the Noise Sideband Level at +20 kHz.

2. Press the following spectrum analyzer keys to measure the noise sideband level at –20 kHz:

   PEAK SEARCH
   MARKER Δ, –20, **kHz**
   MKR, **MARKER NORMAL**

   Record the MKR amplitude reading in the Noise Sideband Worksheet as the Noise Sideband Level at –20 kHz.

3. Record the more positive value, either Noise Sideband Level at +20 kHz or Noise Sideband Level at –20 kHz from the Noise Sideband Worksheet as the Maximum Noise Sideband Level.
4. Subtract the Carrier Amplitude from the Maximum Noise Sideband Level at 20 kHz using the equation below.

   Noise Sideband Suppression = Maximum Noise Sideband Level – Carrier Amplitude

5. Record the Noise Sideband Suppression at 20 kHz in the performance verification test record as TR Entry 2. The suppression should be ≤–70 dBc.

Part 3: Noise Sideband Suppression at 30 kHz

1. Press the following spectrum analyzer keys to measure the noise sideband level at +30 kHz:

   MKR, **MARKER** Δ, 30, **kHz**
   MARKER NORMAL

Record the MKR amplitude reading in the Noise Sideband Worksheet as the Noise Sideband Level at +30 kHz.

2. Press the following spectrum analyzer keys to measure the noise sideband level at –30 kHz:

   PEAK SEARCH
   MARKER Δ, –30, **kHz**
   MKR, **MARKER NORMAL**

   Record the MKR amplitude reading in the Noise Sideband Worksheet as the Noise Sideband Level at –30 kHz.

3. Record the more positive value, either Noise Sideband Level at +30 kHz or Noise Sideband Level at –30 kHz from the Noise Sideband Worksheet as the Maximum Noise Sideband Level.

4. Subtract the Carrier Amplitude from the Maximum Noise Sideband Level at 30 kHz using the equation below.

   Noise Sideband Suppression = Maximum Noise Sideband Level – Carrier Amplitude

5. Record the Noise Sideband Suppression at 30 kHz in the performance verification test record as TR Entry 3. The suppression should be ≤–75 dBc.

Noise Sideband Worksheet

Description	Measurement
Carrier Amplitude	______________ dBm
Noise Sideband Level at +10 kHz	______________ dBm
Noise Sideband Level at –10 kHz	______________ dBm
Maximum Noise Sideband Level at ±10 kHz	______________ dBm
Noise Sideband Level at +20 kHz	______________ dBm
Noise Sideband Level at –20 kHz	______________ dBm
Maximum Noise Sideband Level at ±20 kHz	______________ dBm
Noise Sideband Level at +30 kHz	______________ dBm
Noise Sideband Level at –30 kHz	______________ dBm
Maximum Noise Sideband Level at ±30 kHz	______________ dBm

Note that the resolution bandwidth is normalized to 1 Hz as follows:

1 Hz noise-power = (noise-power in dBc) – (10 x log[RBW])

For example, –60 dBc in a 1 kHz resolution bandwidth is normalized to –90 dBc/Hz.

4. System Related Sidebands

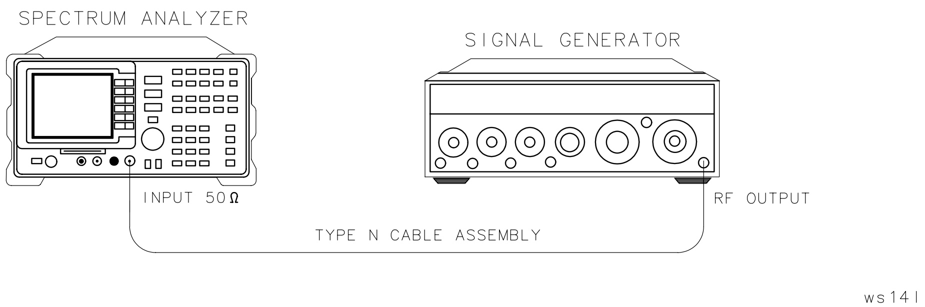
A 500 MHz CW signal is applied to the input of the spectrum analyzer. The marker functions are used to measure the amplitude of the carrier and the amplitude of any system related sidebands >30 kHz above and below the carrier. System related sidebands are any internally generated line related, power supply related or local oscillator related sidebands.

There are no related adjustment procedures for this performance test.

Equipment Required

Signal generator
Cable, Type N, 183 cm (72 in)

Figure 1-4 **System Related Sidebands Test Setup**



Procedure

1. Perform the following steps to set up the equipment:
   - Set the signal generator controls as follows:

     FREQUENCY ....500 MHz
     OUTPUT LEVEL ....0 dBm
     AM ....OFF
     FM ....OFF
     COUNTER ....INT
     RF ....ON

   - Connect the equipment as shown in Figure 1-4.
   - Press **PRESET** on the spectrum analyzer, then wait for the preset routine to finish. Set the spectrum analyzer by pressing the following keys:

     FREQUENCY, 500, **MHz**
     SPAN, 10, **MHz**

2. Set the spectrum analyzer to measure the system related sideband above the signal by performing the following steps:

   - Press the following keys:

     PEAK SEARCH
     MKR FCTN, **MK TRACK ON OFF** (ON)
     SPAN, 200, **kHz**
     BW, 1, **kHz**
     VID BW AUTO MAN, 30, **Hz**

     Allow the spectrum analyzer to stabilize for approximately 1 minute. Then press the following keys:

     MKR FCTN, **MK TRACK ON OFF** (OFF)
     FREQUENCY, **CF STEP AUTO MAN**, 130, **kHz**

   - Press **SGL SWP** and wait for the completion of the sweep. Press **PEAK SEARCH**, then **MARKER** Δ.
   - Press the following spectrum analyzer keys:

     FREQUENCY
     ⇑ (step-up key)

3. Measure the system related sideband above the signal by pressing **SGL SWP** on the spectrum analyzer. Wait for the completion of a new sweep, then press **PEAK SEARCH**.

4. Record the Marker-Δ Amplitude as TR Entry 1 of the performance verification test record.

   The system related sideband above the signal should be <–65 dB.

5. Set the spectrum analyzer to measure the system related sideband below the signal by pressing the following spectrum analyzer keys:

   ⇓ (step-down key)
   ⇓ (step-down key)

6. Measure the system related sideband below the signal by pressing **SGL SWP**. Wait for the completion of a new sweep, then press **PEAK SEARCH**.

   Record the Marker-Δ Amplitude as TR Entry 2 of the performance verification test record.

   The system related sideband below the signal should be <–65 dB.

5. Frequency Span Readout Accuracy

For testing each frequency span, two synthesized sources are used to provide two precisely-spaced signals. The spectrum analyzer marker functions are used to measure this frequency difference and the marker reading is compared to the specification.

There are no related adjustment procedures for this performance test.

Equipment Required

Synthesized sweeper
Synthesizer/level generator
Signal generator
Power splitter
Adapter, Type N (m) to Type N (m)
Adapter, Type N (f) to APC 3.5 (f)
Cable, Type N, 183 cm (72 in)
Cable, Type N, 152 cm (60 in) *or* Adapter, APC 3.5 (f) to Type N (f)

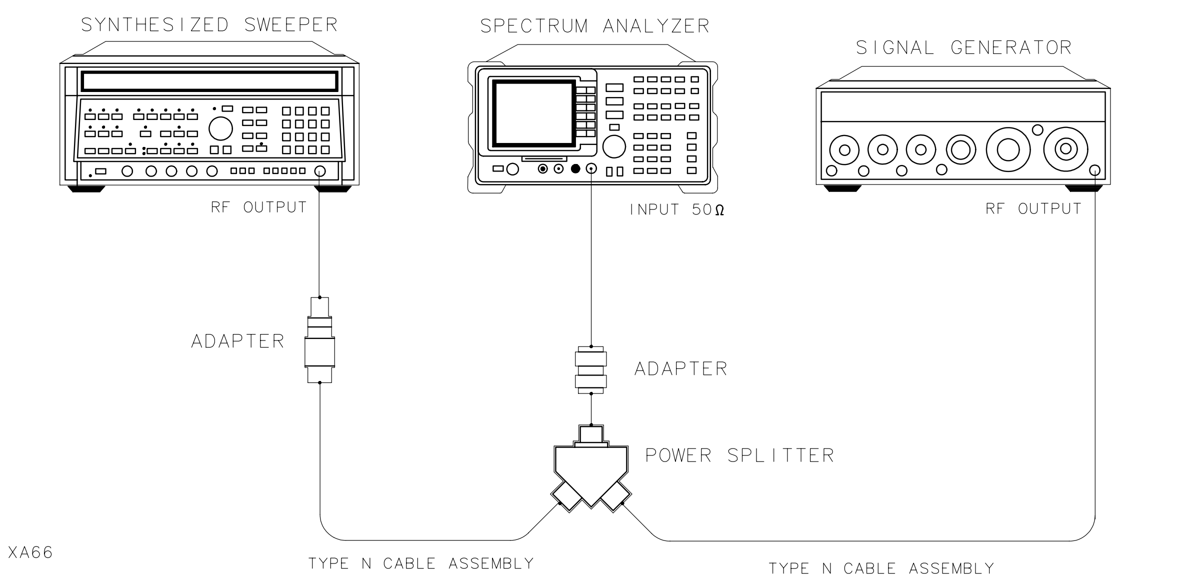
Procedure

This performance verification test consists of two parts:

Part 1: 1800 MHz Frequency Span Readout Accuracy
Part 2: 10.1 MHz to 10 kHz Frequency Span Readout Accuracy

Perform "Part 1: 1800 MHz Frequency Span Readout Accuracy" before "Part 2: 10.1 MHz to 10 kHz Frequency Span Readout Accuracy."

Figure 1-5 Frequency Span Readout Test Setup



Part 1: 1800 MHz Frequency Span Readout Accuracy

1. Connect the equipment as shown in Figure 1-5. Note that the power splitter is used as a combiner.
2. Press **PRESET** on the spectrum analyzer, then wait for the preset routine to finish. Set the spectrum analyzer by pressing the following keys:

   FREQUENCY, 900, **MHz**
   SPAN, 1800, **MHz**

3. Press INSTRUMENT PRESET on the synthesized sweeper and set the controls as follows:

   CW ....1700 MHz
   POWER LEVEL .... –5 dBm

4. On the signal generator, set the controls as follows:

   FREQUENCY (LOCKED MODE) ....200 MHz
   CW OUTPUT ....0 dBm

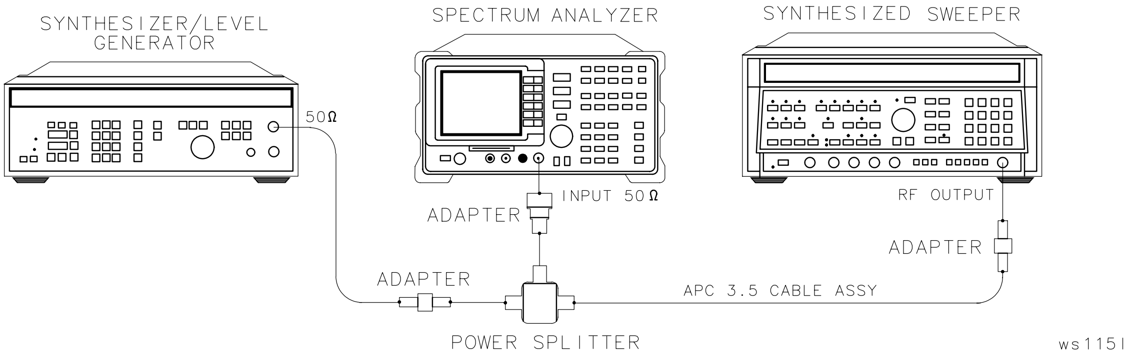
5. Adjust the spectrum analyzer center frequency, if necessary, to place the lower frequency on the second vertical graticule line (one division from the left-most graticule line).
6. On the spectrum analyzer, press **SGL SWP**. Wait for the completion of a new sweep, then press **PEAK SEARCH**, **MARKER** Δ, **NEXT PEAK**.

   The two markers should be on the signals near the second and tenth vertical graticule lines (the first graticule line is the left-most).

7. Press **MARKER** Δ, then continue pressing **NEXT PK RIGHT**. The marker Δ should be on the right-most signal.
8. Record the MKR Δ frequency reading as TR Entry 1 of the performance verification test record.

   The MKR reading should be within the 1446 MHz and 1554 MHz.

Figure 1-6 10.1 MHz to 10 kHz Frequency Span Readout Accuracy Test Setup



Part 2: 10.1 MHz to 10 kHz Frequency Span Readout Accuracy

Perform "Part 1: 1800 MHz Frequency Span Readout Accuracy" before performing this procedure.

1. Connect the equipment as shown in Figure 1-6. Note that the power splitter is used as a combiner.
2. Press **PRESET** on the spectrum analyzer, then wait for the preset routine to finish. Set the spectrum analyzer by pressing the following keys:

   FREQUENCY, 70, **MHz**
   SPAN, 10.1, **MHz**

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

   CW ....74 MHz
   POWER LEVEL ....–5 dBm

4. Set the synthesizer/level generator controls as follows:

   FREQUENCY ....66 MHz
   AMPLITUDE ....0 dBm

5. Adjust the spectrum analyzer center frequency to center the two signals on the display.
6. On the spectrum analyzer, press **SGL SWP**. Wait for the completion of a new sweep, then press the following keys:

   PEAK SEARCH, **MARKER** Δ, **NEXT PEAK**

   The two markers should be on the signals near the second and tenth vertical graticule lines (the first graticule line is the left-most).

7. Record the MKR-Δ frequency reading in the performance verification test record as TR Entry 2. The MKR-Δ frequency reading should be within the limits shown.
8. Press **MKR**, **MARKER 1 ON OFF** (OFF) on the spectrum analyzer.
9. Change to the next equipment settings listed in Table 1-6.
10. On the spectrum analyzer, press **SGL SWP**. Wait for the completion of a new sweep, then press the following keys:

    PEAK SEARCH, **MARKER** Δ, **NEXT PEAK**

11. Record the MKR-Δ frequency reading in the performance verification test record.
12. Repeat steps 8 through 11 for the remaining spectrum analyzer span settings listed in Table 1-6.

Performance verification test "Frequency Span Readout Accuracy" is now complete.

Table 1-6 Frequency Span Readout Accuracy

Spectrum Analyzer Span Setting	Synthesizer/ Level Generator Frequency	Synthesized Sweeper Frequency	MKR-Δ Reading		
	MHz	MHz	Min.	TR Entry	Max.
10.10 MHz	66.000	74.000	7.70 MHz	**2**	8.30 MHz
10.00 MHz	66.000	74.000	7.80 MHz	**3**	8.20 MHz
100.00 kHz	69.960	70.040	78.00 kHz	**4**	82.00 kHz
99.00 kHz	69.960	70.040	78.00 kHz	**5**	82.00 kHz
10.00 kHz	69.996	70.004	7.80 kHz	**6**	8.20 kHz

6. Residual FM

This test measures the inherent short-term instability of the spectrum analyzer LO system. With the analyzer in zero span, a stable signal is applied to the input and slope-detected on the linear portion of the IF bandwidth filter skirt. Any instability in the LO transfers to the IF signal in the mixing process. The test determines the slope of the IF filter in Hz/dB and then measures the signal amplitude variation caused by the residual FM. Multiplying these two values yields the residual FM in Hz. The narrow bandwidth options use a 300 Hz span. This span is not specified, however, it is tested in "Frequency Span Accuracy."

There are no related adjustment procedures for this performance test.

Equipment Required

Signal generator
Cable, Type N, 183 cm (72 in)

Procedure

This performance verification test consists of two parts:

Part 1: Determining the IF Filter Slope
Part 2: Measuring the Residual FM

Part 1: Determining the IF Filter Slope

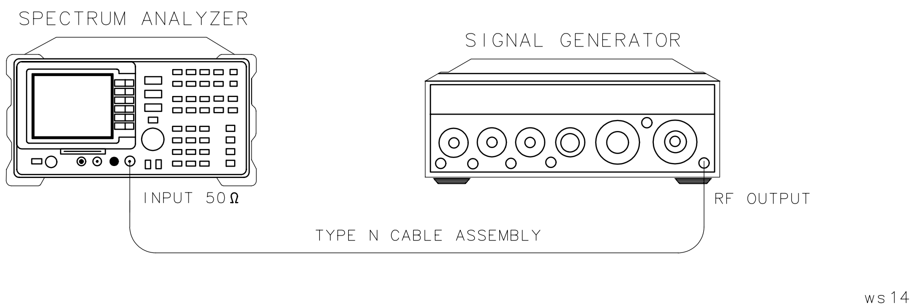
1. Connect the equipment as shown in Figure 1-7.
2. Set the signal generator controls as follows:

   FREQUENCY ....500 MHz
   CW OUTPUT ....–10 dBm

3. Press **PRESET** on the spectrum analyzer, then wait for the preset routine to finish. Set the spectrum analyzer by pressing the following keys:

   FREQUENCY, 500, **MHz**
   SPAN, 1, **MHz**
   AMPLITUDE, –9, **dBm**
   SCALE LOG LIN (LOG) 1, **dB**
   BW, 1, **kHz**

Figure 1-7 Residual FM Test Setup



4. On the spectrum analyzer, press the following keys:

   PEAK SEARCH
   MKR FCTN, **MK TRACK ON OFF** (ON)
   SPAN, 10, **kHz**

   Wait for the AUTO ZOOM message to disappear. Press the following spectrum analyzer keys:

   MKR →, **MARKER** →**REF LVL**
   MKR, **MARKER 1 ON OFF** (OFF)

5. On the spectrum analyzer, press the following keys:

   SGL SWP
   PEAK SEARCH, **MARKER** Δ

   If you have difficulty achieving the ±0.1 dB setting, then make the following spectrum analyzer settings:

   SPAN, 5, **kHz**
   BW, **VID BW AUTO MAN**, 30, **Hz**

6. Rotate the spectrum analyzer knob counterclockwise until the MKR-Δ amplitude reads –1 dB ±0.1 dB. Press **MARKER** Δ. Rotate the knob counterclockwise until the MKR-Δ amplitude reads –4 dB ±0.1 dB.

7. Divide the MKR-Δ frequency in hertz by the MKR-Δ amplitude in dB to obtain the slope of the resolution bandwidth filter. For example, if the MKR-Δ frequency is 1.08 kHz and the MKR-Δ amplitude is 3.92 dB, the slope would be equal to 275.5 Hz/dB. Record the result below:

   Slope ___________ Hz/ dB

Part 2: Measuring the Residual FM

8. On the spectrum analyzer, press **MKR**, **More 1 of 2**, **MARKER ALL OFF**, **PEAK SEARCH**, then **MARKER** Δ. Rotate the knob counterclockwise until the MKR-Δ amplitude reads –3 dB ±0.1 dB.

9. On the spectrum analyzer, press the following keys:

   MKR, **MARKER NORMAL**
   MKR →, **MARKER** → **CF**
   SGL SWP
   BW, **VID BW AUTO MAN**, 1, **kHz**
   SPAN, 0, **Hz**
   SWEEP, 100, **ms**

   Press **SGL SWP**.

NOTE The displayed trace should be about three divisions below the reference level. If it is not, press **TRIG**, **SWEEP CONT SGL** (CONT), **FREQUENCY**, and use the knob to place the displayed trace about three divisions below the reference level. Press **SGL SWP**.

10. On the spectrum analyzer, press **MKR** →, **More 1 of 2**, **MARKER** →**PK-PK**. Read the MKR-Δ amplitude, take its absolute value, and record the result as the Deviation.

    Deviation ___________ dB

11. Calculate the Residual FM by multiplying the Slope recorded in step 7 by the Deviation recorded in step 10.

    Record this value as TR Entry 1 of the performance verification test record. The residual FM should be less than 250 Hz.

The performance verification test, "Residual FM," is now complete.

7. Sweep Time Accuracy

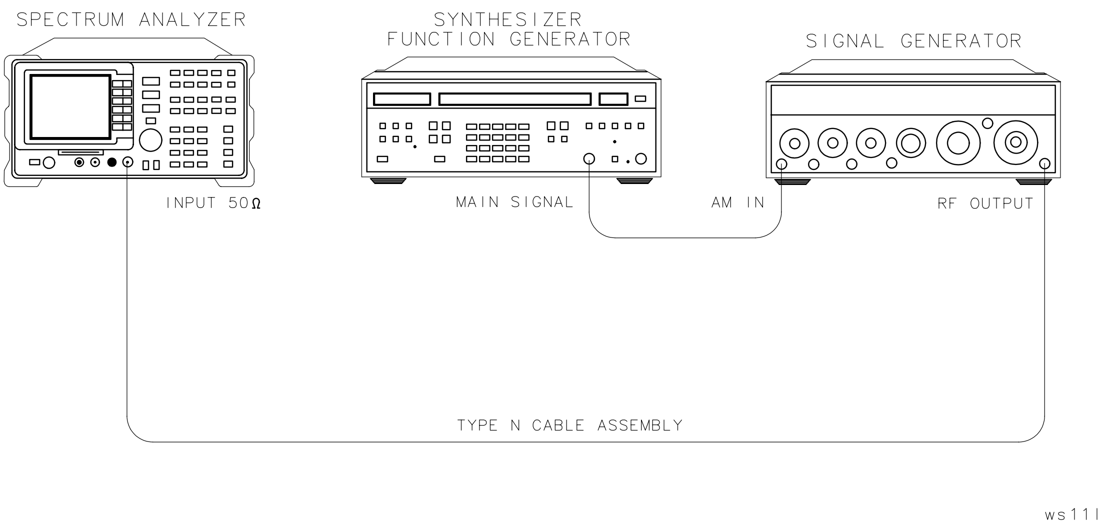
This test uses a synthesizer function generator to amplitude modulate a 500 MHz CW signal from another signal generator. The spectrum analyzer demodulates this signal in zero span to display the response in the time domain. The marker delta frequency function on the spectrum analyzer is used to read out the sweep time accuracy.

There are no related adjustment procedures for this performance test.

Equipment Required

Synthesizer/function generator
Signal generator
Cable, Type N, 152 cm (60 in)
Cable, BNC, 120 cm (48 in)

Figure 1-8 Sweep Time Accuracy Test Setup



Procedure

1. Set the signal generator to output a 500 MHz, –10 dBm, CW signal. Set the AM and FM controls to off.
2. Set the synthesizer/function generator to output a 500 Hz, +5 dBm triangle waveform signal.
3. Connect the equipment as shown in Figure 1-8.

4. Press **PRESET** on the spectrum analyzer, then wait for the preset routine to finish. Set the spectrum analyzer by pressing the following keys:

   FREQUENCY, 500, **MHz**
   SPAN, 10, **MHz**
   PEAK SEARCH
   MKR FCTN, **MK TRACK ON OFF** (ON)
   SPAN, 50, **kHz**

   Wait for the AUTO ZOOM routine to finish. Press **SPAN**, then **ZERO SPAN**.

   Press the following spectrum analyzer keys:

   BW, 3, **MHz**
   SWEEP, 20, **ms**
   AMPLITUDE, **SCALE LOG LIN** (LIN)

   Adjust signal amplitude for a midscreen display.

5. Set the signal generator AM switch to the AC position.
6. On the spectrum analyzer, press **TRIG** then **VIDEO**. Adjust the video trigger so that the spectrum analyzer is sweeping.
7. Press **SGL SWP**. After the completion of the sweep, press **PEAK SEARCH**. If necessary, press **NEXT PK LEFT** until the marker is on the left-most signal. This is the "marked signal."
8. Press **MARKER DELTA** and press **NEXT PK RIGHT** 8 times so the marker delta is on the eighth signal peak from the "marked signal."

   Record the marker Δ reading in the performance verification test record.

9. Repeat steps 7 and 8 for the remaining sweep time settings listed in Table 1-7.

Table 1-7 Sweep Time Accuracy

Spectrum Analyzer Sweep Time Setting	Synthesizer/Function Generator Frequency	Minimum Reading	TR Entry (MKR Δ)	Maximum Reading
20 ms	500.0 Hz	15.4 ms	1	16.6 ms
100 ms	100.0 Hz	77.0 ms	2	83.0 ms
1 s	10.0 Hz	770.0 ms	3	830.0 ms
10 s	1.0 Hz	7.7 s	4	8.3 s

8. Scale Fidelity

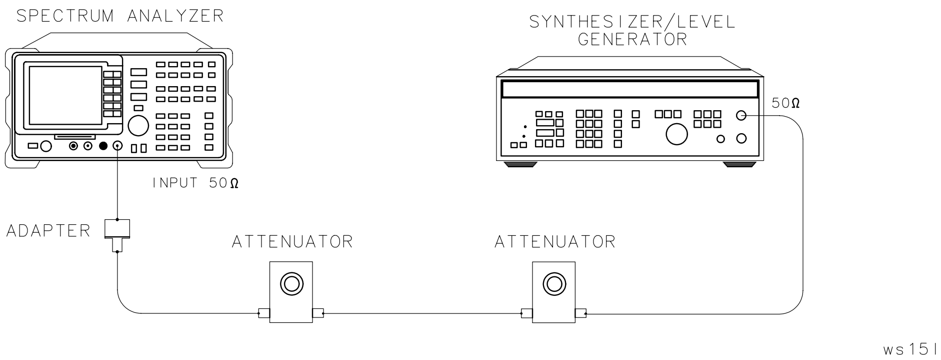
A 50 MHz CW signal is applied to the INPUT 50 Ω of the analyzer through two step attenuators. The attenuators increase the effective amplitude range of the source. The amplitude of the source is decreased in 10 dB steps and the analyzer marker functions are used to measure the amplitude difference between steps. The source's internal attenuator is used as the reference standard. The test is performed in both log and linear amplitude scales.

The related adjustment for this performance test is "Log and Linear Amplitude Adjustment."

Equipment Required

Synthesizer/level generator
Attenuator, 1 dB step
Attenuator, 10 dB step
Cable, BNC, 122 cm (48 in)
Cable, BNC, 20 cm (9 in)
Adapter, Type N (m) to BNC (f)
Adapter, BNC (m) to BNC (m)

Figure 1-9 Scale Fidelity Test Setup



Procedure

Log Scale

1. Set the synthesizer/level generator controls as follows:

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

2. Connect the equipment as shown in Figure 1-9. Set the 10 dB step attenuator to 10 dB attenuation and the 1 dB step attenuator to 0 dB attenuation.

3. Press **PRESET** on the spectrum analyzer, then wait for the preset routine to finish. Set the spectrum analyzer by pressing the following keys:

   FREQUENCY, 50, **MHz**
   SPAN, 10, **MHz**
   PEAK SEARCH
   MKR FCTN, **MK TRACK ON OFF** (ON)
   SPAN, 50, **kHz**

   Wait for the auto zoom routine to finish, then set the resolution bandwidth and the video bandwidth by pressing the following keys:

   BW
   RES BW AUTO MAN, 3, **kHz**
   VID BW AUTO MAN, 30, **Hz**

4. If necessary, adjust the 1 dB step attenuator attenuation until the MKR amplitude reads between 0 dBm and –1 dBm.

5. On the synthesizer/level generator, press AMPLITUDE and use the increment keys to adjust the amplitude until the spectrum analyzer MKR amplitude reads 0 dBm ±0.05 dB.

   It may be necessary to decrease the resolution of the amplitude increment of the synthesizer/level generator to 0.01 dB to obtain a MKR reading of 0 dBm ±0.05 dB.

6. On the spectrum analyzer, press **PEAK SEARCH**, then **MARKER** Δ.

7. Set the synthesizer/level generator AMPTD INCR to 4 dB.

8. On the synthesizer/level generator, press AMPLITUDE, then increment down to step the synthesizer/level generator to the next lowest nominal amplitude listed in Table 1-8.

9. Record the actual MKR Δ amplitude reading in the performance verification test record as indicated in Table 1-8. The MKR amplitude should be within the limits shown.

10. Repeat steps 8 through 9 for the remaining synthesizer/level generator Nominal Amplitudes listed in Table 1-8.

11. For each actual MKR Δ reading recorded in Table 1-8, subtract the previous actual MKR Δ reading. Add 4 dB to the number and record the result as the incremental error in the performance verification test record as indicated in Table 1-8. The incremental error should not exceed 0.4 dB/4 dB.

Table 1-8 Cumulative and Incremental Error, Log Mode

Synthesizer/Level Generator Nominal Amplitude	dB from Ref Level (nominal)	TR Entry Cumulative Error (MKR Δ Reading)			TR Entry (Incremental Error)
		Min. (dB)	Actual (dB)	Max. (dB)	TR Entry
+10 dBm	0	0 (Ref)	0 (Ref)	0 (Ref)	0 (Ref)
+6 dBm	−4	−4.34	**1**	−3.66	**18**
+2 dBm	−8	−8.38	**2**	−7.62	**19**
−2 dBm	−12	−12.42	**3**	−11.58	**20**
−6 dBm	−16	−16.46	**4**	−15.54	**21**
−10 dBm	−20	−20.50	**5**	−19.50	**22**
−14 dBm	−24	−24.54	**6**	−23.46	**23**
−18 dBm	−28	−28.58	**7**	−27.42	**24**
−22 dBm	−32	−32.62	**8**	−31.38	**25**
−26 dBm	−36	−36.66	**9**	−35.34	**26**
−30 dBm	−40	−40.70	**10**	−39.30	**27**
−34 dBm	−44	−44.74	**11**	−43.26	**28**
−38 dBm	−48	−48.78	**12**	−47.22	**29**
−42 dBm	−52	−52.82	**13**	−51.18	**30**
−46 dBm	−56	−56.86	**14**	−55.14	**31**
−50 dBm	−60	−60.90	**15**	−59.10	**32**
−54 dBm	−64	−64.94	**16**	−63.06	N/A
−58 dBm	−68	−68.98	**17**	−67.02	N/A

Linear Scale

12. Set the synthesizer/level generator controls as follows:

    AMPLITUDE ....+10 dBm
    AMPTD INCR ....0.05 dB

13. Set the 1 dB step attenuator to 0 dB attenuation.

14. Press **PRESET** on the spectrum analyzer, then wait for the preset routine to finish. Set the spectrum analyzer by pressing the following keys:

    AMPLITUDE, **SCALE LOG LIN** (LIN)
    FREQUENCY, 50, **MHz**
    SPAN, 10, **MHz**
    PEAK SEARCH
    MKR FCTN, **MK TRACK ON OFF** (ON)
    SPAN, 50, **kHz**

    Wait for the auto zoom routine to finish, then set the resolution bandwidth and the video bandwidth by pressing the following keys:

    BW
    RES BW AUTO MAN, 3, **kHz**
    VID BW AUTO MAN, 30, **Hz**

15. If necessary, adjust the 1 dB step attenuator attenuation until the MKR reads approximately 223.6 mV. It may be necessary to decrease the resolution of the amplitude increment of the synthesizer/level generator to 0.01 dB to obtain a MKR reading of 223.6 mV ± 0.4 mV.

16. On the synthesizer/level generator, press AMPLITUDE, then use the increment keys to adjust the amplitude until the spectrum analyzer MKR amplitude reads 223.6 mV ±0.4 mV.

17. On the spectrum analyzer, press **PEAK SEARCH**, **MKR FCTN**, **MK TRACK ON OFF** (OFF).

18. Set the synthesizer/level generator amplitude increment to 3 dB.

19. On the synthesizer/level generator, press AMPLITUDE, then increment down to step the synthesizer/level generator to the next lowest Nominal Amplitude listed in Table 1-9.

20. Record the MKR amplitude reading in the performance verification test record as indicated in Table 1-9. The MKR amplitude should be within the limits shown.

21.Repeat steps 21 and 22 for the remaining synthesizer/level generator Nominal Amplitudes listed in Table 1-9.

22.Set the 10 dB step attenuator to 10 dB attenuation and the 1 dB step attenuator to 0 dB attenuation.

Table 1-9 Scale Fidelity, Linear Mode

Synthesizer/Level Generator Nominal Amplitude	% of Ref Level (nominal)	MKR Reading		
		Min. (mV)	TR Entry	Max. (mV)
+10 dBm	100	0 (Ref)	0 (Ref)	0 (Ref)
+7 dBm	70.7	151.59	33	165.01
+4 dBm	50	105.36	34	118.78
+1 dBm	35.48	72.63	35	86.05
−2 dBm	25	49.46	36	62.88

Log to Linear Switching

23.Set the synthesizer controls as follows:

FREQUENCY ....50 MHz
AMPLITUDE ....+6 dBm

24.On the spectrum analyzer, press **PRESET**, then wait for the preset routine to finish. Set the spectrum analyzer by pressing the following keys:

FREQUENCY, 50, **MHz**
SPAN, 10, **MHz**
BW, 300, **kHz**

25.On the spectrum analyzer, press the following keys:

PEAK SEARCH
MKR →, **MARKER** →**REF LVL**
PEAK SEARCH

26.Record the peak marker reading in Log mode below.

Log Mode Amplitude Reading _________ dBm

27.Press **AMPLITUDE**, **SCALE LOG LIN** (LIN) to change the scale to linear, then press **More 1 of 2**, **Amptd Units**, and **dBm** to set the amplitude units to dBm.

28.Press **PEAK SEARCH**, then record the peak marker amplitude reading in linear mode.

Linear Mode Amplitude Reading _________ dBm

29. Subtract the Linear Mode Amplitude Reading from the Log Mode Amplitude Reading, then record this value as the Log/Linear Error.

Log/Linear Error ________ dB

30. If the Log/Linear Error is less than 0 dB, record this value as TR Entry 37 in the performance verification test record. The absolute value of the reading should be less than 0.25 dB. If the Log/Linear Error is greater than 0 dB, continue with the next step.

31. On the spectrum analyzer, press the following keys:

MKR →, **MARKER** →**REF LVL**
PEAK SEARCH

32. Record the peak marker amplitude reading in linear mode.

Linear Mode Amplitude Reading ________ dBm

33. On the spectrum analyzer, press the following keys:

AMPLITUDE, **SCALE LOG LIN** (LOG)
PEAK SEARCH

34. Record the peak marker reading in Log mode below.

Log Mode Amplitude Reading ________ dBm

35. Subtract the Log Mode Amplitude Reading from the Linear Mode Amplitude Reading, then record this value as the Linear/Log Error.

Linear/Log Error ________ dB

36. Record the Linear/Log Error as TR Entry 37 in the performance verification test record. The absolute value of the reading should be less than 0.25 dB.

Performance test, "Scale Fidelity" is complete.

9. Reference Level Accuracy

A 50 MHz CW signal is applied to the INPUT 50 Ω of the spectrum analyzer through two step attenuators. The attenuators increase the effective amplitude range of the source. The amplitude of the source is decreased in 10 dB steps and the spectrum analyzer marker functions are used to measure the amplitude difference between steps. The source internal attenuator is used as the reference standard. The test is performed in both log and linear amplitude scales.

It is only necessary to test reference levels as low as –90 dBm (with 10 dB attenuation) since lower reference levels are a function of the spectrum analyzer microprocessor manipulating the trace data. There is no error associated with the trace data manipulation.

The related adjustment for this procedure is "A12 Cal Attenuator Error Correction."

Equipment Required

Synthesizer/level generator
Attenuator, 1 dB steps
Attenuator, 10 dB steps
Cable, BNC 122 cm (48 in) *(two required)*
Adapter, Type N (m) to BNC (f)
Adapter, BNC (m) to BNC (m)

Procedure

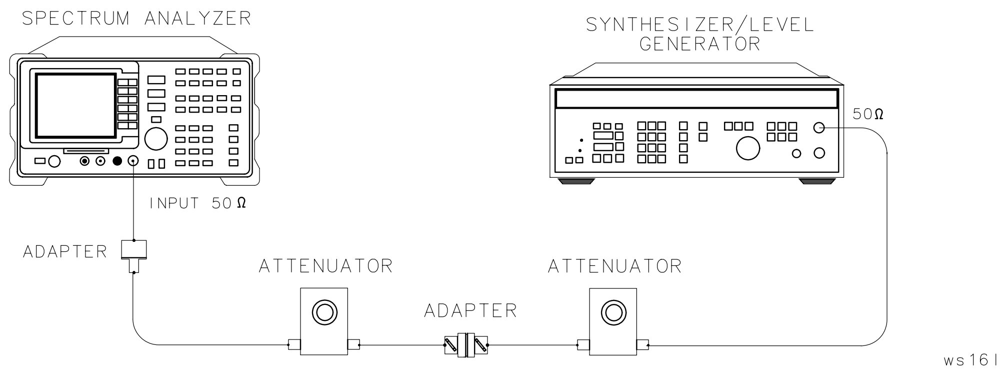
Log Scale

1. Set the synthesizer/level generator controls as follows:

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

2. Connect the equipment as shown in Figure 1-10. Set the 10 dB step attenuator to 10 dB attenuation and the 1 dB step attenuator to 0 dB attenuation.

Figure 1-10 Reference Level Accuracy Test Setup



3. Press **PRESET** on the spectrum analyzer, then wait for the preset routine to finish. Set the spectrum analyzer by pressing the following keys:

   FREQUENCY, 50, **MHz**
   SPAN, 10, **MHz**
   PEAK SEARCH
   MKR FCTN, **MK TRACK ON OFF** (ON)
   SPAN, 50, **kHz**
   AMPLITUDE, –20, **dBm**, **SCALE LOG LIN** (LOG), 1, **dB**
   BW, 3, **kHz**, **VID BW AUTO MAN**, 30, **Hz**

4. Set the 1 dB step attenuator to place the signal peak one to two dB (one to two divisions) below the reference level.

5. On the spectrum analyzer, press the following keys:

   SGL SWP
   PEAK SEARCH, **MARKER** Δ

6. Set the synthesizer/level generator amplitude and spectrum analyzer reference level according to Table 1-10. At each setting, press **SGL SWP** on the spectrum analyzer.

7. Record the MKR Δ amplitude reading in the performance verification test record as indicated in Table 1-10. The MKR Δ reading should be within the limits shown.

Table 1-10 Reference Level Accuracy, Log Mode

Synthesizer/Level Generator Amplitude	Spectrum Analyzer Reference Level	MKR Δ Reading (dB)		
(dBm)	(dBm)	Min.	TR Entry	Max.
−10	−20	0 (Ref)	0 (Ref)	0 (Ref)
0	−10	−0.4	**1**	+0.4
+10	0	−0.5	**2**	+0.5
−20	−30	−0.4	**3**	+0.4
−30	−40	−0.5	**4**	+0.5
−40	−50	−0.8	**5**	+0.8
−50	−60	−1.0	**6**	+1.0
−60	−70	−1.1	**7**	+1.1
−70	−80	−1.2	**8**	+1.2
−80	−90	−1.3	**9**	+1.3

Linear Scale

8. Set the synthesizer/level generator amplitude to −10 dBm.
9. Set the 1 dB step attenuator to 0 dB attenuation.
10. Set the spectrum analyzer controls as follows:

    AMPLITUDE, −20, **dBm**
    SCALE LOG LIN (LIN)
    AMPLITUDE, **More 1 of 2**, **Amptd Units**, **dBm**
    SWEEP, **SWEEP CONT SGL** (CONT)
    MKR, **More 1 of 2**, **MARKER ALL OFF**

11. Set the 1 dB step attenuator to place the signal peak one to two divisions below the reference level.
12. On the spectrum analyzer, press the following keys:

    SGL SWP
    PEAK SEARCH, **MARKER Δ**

13. Set the synthesizer/level generator amplitude and spectrum analyzer reference level according to Table 1-11. At each setting, press **SGL SWP** on the spectrum analyzer.
14. Record the MKR Δ amplitude reading in Table 1-11. The MKR Δ reading should be within the limits shown.

Table 1-11 Reference Level Accuracy, Linear Mode

Synthesizer/Level Generator Amplitude	Spectrum Analyzer Reference Level	MKR Δ Reading (dB)		
(dBm)	(dBm)	Min.	TR Entry	Max.
−10	−20	0 (Ref)	0 (Ref)	0 (Ref)
0	−10	−0.4	**10**	+0.4
+10	0	−0.5	**11**	+0.5
−20	−30	−0.4	**12**	+0.4
−30	−40	−0.5	**13**	+0.5
−40	−50	−0.8	**14**	+0.8
−50	−60	−1.0	**15**	+1.0
−60	−70	−1.1	**16**	+1.1
−70	−80	−1.2	**17**	+1.2
−80	−90	−1.3	**18**	+1.3

Performance verification test "Reference Level Accuracy" is now complete.

10. Absolute Amplitude Calibration and Resolution Bandwidth Switching Uncertainties

To measure the absolute amplitude calibration uncertainty the input signal is measured after the self-cal routine is finished.

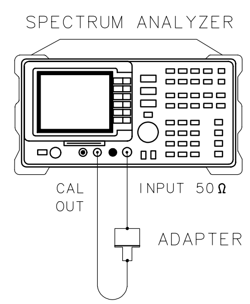
To measure the resolution bandwidth switching uncertainty an amplitude reference is taken with the resolution bandwidth set to 3 kHz using the marker-delta function. The resolution bandwidth is changed to settings between 3 MHz and 1 kHz and the amplitude variation is measured at each setting and compared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

The related adjustment procedure for this performance test is "Crystal and LC Bandwidth Adjustment."

Equipment Required

Cable, BNC, 23 cm (9 in)
Adapter, Type N (m) to BNC (f)

Figure 1-11 **Uncertainty Test Setup**



Absolute Amplitude Uncertainty

1. Connect the CAL OUT to the spectrum analyzer input using the BNC cable and adapter, as shown in Figure 1-11.

2. Press **PRESET** on the spectrum analyzer, then wait for the preset routine to finish. Set the spectrum analyzer controls by pressing the following keys:

   FREQUENCY, 300, **MHz**
   SPAN, 10, **MHz**
   PEAK SEARCH

MKR FCTN, **MK TRACK ON OFF** (ON)
SPAN, 50, **kHz**
BW, 3, **kHz**
VID BW AUTO MAN, 300, **Hz**
AMPLITUDE, **SCALE LOG LIN** (LIN)
More 1 of 3, **Amptd Units**, then **dBm**
AMPLITUDE, –20, **dBm**

3. Press **PEAK SEARCH**, then record the marker reading in TR Entry 1 of the performance verification test record.

   The marker reading should be within –20.15 and –19.85 dB.

Resolution Bandwidth Switching Uncertainty

4. Press **PRESET** on the spectrum analyzer, then wait for the preset routine to finish. Set the spectrum analyzer controls by pressing the following keys:

   FREQUENCY, 300, **MHz**
   SPAN, 10, **MHz**
   PEAK SEARCH
   MKR FCTN, **MK TRACK ON OFF** (ON)
   SPAN, 50, **kHz**
   AMPLITUDE, –20, **dBm**
   SCALE LOG LIN (LOG), 1, **dB**
   BW, 3, **kHz**
   VID BW AUTO MAN, 1, **kHz**

5. Press **AMPLITUDE** and use the knob to adjust the reference level until the signal appears one division below the reference level, then press the following keys:

   PEAK SEARCH, **MARKER ∆**
   MKR FCTN, **MK TRACK ON OFF** (ON)

6. Set the spectrum analyzer resolution bandwidth and span according to Table 1-12.

7. Press **PEAK SEARCH**, then record the MKR ∆ TRK amplitude reading in the performance verification test record as indicated in Table 1-12.

   The amplitude reading should be within the limits shown.

8. Repeat steps 6 and 7 for each of the remaining resolution bandwidth

and span settings listed in Table 1-12.

Table 1-12 Resolution Bandwidth Switching Uncertainty

Spectrum Analyzer		MKR Δ TRK Amplitude Reading		
RES BW Setting	**SPAN Setting**	**Min. (dB)**	**TR Entry**	**Max. (dB)**
3 kHz	50 kHz	0 (Ref)	0 (Ref)	0 (Ref)
1 kHz	50 kHz	–0.5	**2**	+0.5
9 kHz	50 kHz	–0.4	**3**	+0.4
10 kHz	50 kHz	–0.4	**4**	+0.4
30 kHz	500 kHz	–0.4	**5**	+0.4
100 kHz	500 kHz	–0.4	**6**	+0.4
120 kHz	500 kHz	–0.4	**7**	+0.4
300 kHz	5 MHz	–0.4	**8**	+0.4
1 MHz	10 MHz	–0.4	**9**	+0.4
3 MHz	10 MHz	–0.4	**10**	+0.4

Performance test "Resolution Bandwidth Switching Uncertainty" is now complete.

11. Resolution Bandwidth Accuracy

The output of a synthesizer/level generator is connected to the input of the spectrum analyzer. Measurements are performed in zero span to reduce the measurement uncertainty.

The frequency of the synthesizer/level generator is set to the center of the bandwidth-filter response. The synthesizer output is then reduced in amplitude by either 3 dB or 6 dB to determine the reference point. A marker reference is set and the synthesizer output is increased to its previous level.

The frequency of the synthesizer is reduced then recorded when the resulting marker amplitude matches the previously set marker reference. The synthesizer frequency is increased so that it is tuned on the opposite point on the skirt of the filter response. The frequency is once again recorded and the difference between the two frequencies is compared to the specification.

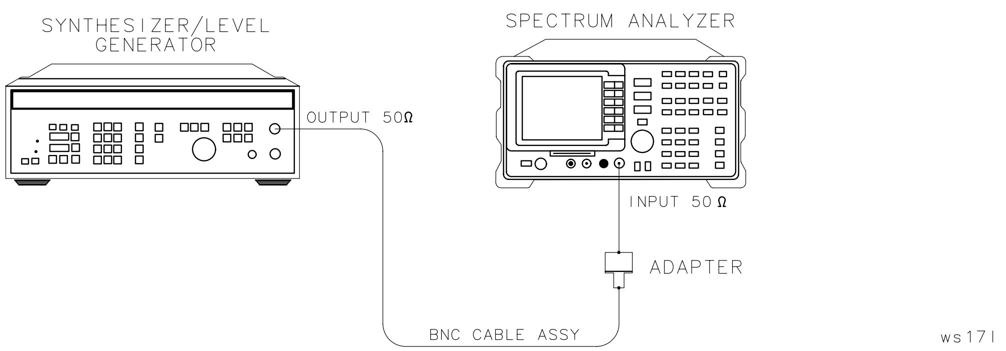
The related adjustments for this performance test are:

CAL AMPTD and CAL FREQ Self-Cal Routines
Crystal and LC Filter Adjustments

Equipment Required

Synthesizer/level generator
Cable, BNC, 122 cm (48 in)
Adapter, Type N (m) to BNC (f)

Figure 1-12 Resolution Bandwidth Accuracy Test Setup



Procedure

1. Connect the equipment as shown in Figure 1-12.

3 dB Bandwidths

2. Set the synthesizer/level generator controls as follows:

   AMPLITUDE ....0 dBm
   AMPTD INCR ....3 dB
   FREQUENCY ....50 MHz

3. Press **PRESET** on the spectrum analyzer, then wait for the preset routine to finish. Set the spectrum analyzer by pressing the following keys:

   FREQUENCY, 50, **MHz**
   SPAN, **ZERO SPAN**
   BW, 3, **MHz**
   VID BW AUTO MAN, 30, **Hz**
   AMPLITUDE, **SCALE LOG LIN** (LOG), 1, **dB**

4. On the synthesizer/level generator set MANUAL TUNE ON/OFF to ON.

5. On the spectrum analyzer press **MKR**.

6. Adjust the frequency of the synthesizer/level generator for a maximum marker reading.

   It will be necessary to adjust the MANUAL TUNE DIGIT resolution on the synthesizer/level generator for the best compromise between tuning speed and resolution.

   Adjust the synthesizer/level generator amplitude to place the peak of the signal at or below the top graticule.

7. On the synthesizer/level generator, press AMPLITUDE and INCR ⇓ (step-down key).

8. Press **MARKER** ∆ on the spectrum analyzer.

9. On the synthesizer/level generator, press INCR ⇑ (step-up key).

10. On the synthesizer/level generator, press FREQUENCY. Lower the frequency of the synthesizer/level generator by adjusting the knob until the marker delta amplitude is 0.0 ± 0.05 dB.

11. Record the synthesizer/level generator frequency readout in column 1 of Table 1-13.

12. Using the synthesizer/level generator knob, raise the frequency so that the marker-delta amplitude is maximum. Continue increasing the frequency until the marker reads 0.0 ± 0.05 dB.

13. Record the synthesizer/level generator frequency readout in column 2 of Table 1-13.

14. Adjust the synthesizer/level generator frequency for maximum amplitude.

15.Repeat steps 5 through 14 for each of the RES BW settings listed in Table 1-13.

16.Subtract the Synthesizer Lower Frequency from the Synthesizer Upper Frequency. Record the difference as the Resolution Bandwidth Accuracy, in the performance verification test record as indicated in Table 1-13.

RES BW Accuracy = Upper Frequency – Lower Frequency

Table 1-13 3 dB Resolution Bandwidth Accuracy

Spectrum Analyzer RES BW	Column 1 Synthesizer Lower Frequency	Column 2 Synthesizer Upper Frequency	TR Entry (Resolution Bandwidth Accuracy)
3 MHz	______________	______________	1
1 MHz	______________	______________	2
300 kHz	______________	______________	3
100 kHz	______________	______________	4
30 kHz	______________	______________	5
10 kHz	______________	______________	6
3 kHz	______________	______________	7
1 kHz	______________	______________	8

6 dB EMI Bandwidths

17.Set the synthesizer/level generator AMPTD INCR to 6 dB.

18.On the spectrum analyzer, press the following keys:

BW, **EMI BW MENU**, **9 kHz EMI BW**
MKR, **MARKER NORMAL**

19.On the synthesizer/level generator, press FREQUENCY. Adjust the frequency for a maximum marker reading.

20.On the synthesizer/level generator, press AMPLITUDE and INCR ⇓ (step-down key).

21.Press **MARKER DELTA** on the spectrum analyzer.

22.On the synthesizer/level generator, press INCR ⇑ (step-up key).

23.On the synthesizer/level generator, press FREQUENCY. Lower the frequency of the synthesizer/level generator by adjusting the knob until the marker-delta amplitude is 0.0 ± 0.05 dB.

24. Record the synthesizer/level generator frequency readout in column 1 of Table 1-14.

25. Using the synthesizer/level generator knob, increase the frequency so that the marker-delta amplitude is maximum. Continue increasing the frequency until the marker reads 0.0 ± 0.05 dB.

26. Record the synthesizer/level generator frequency readout in column 2 of Table 1-14.

27. Adjust the synthesizer/level generator frequency for maximum marker amplitude.

28. Repeat steps 18 through 26 for the **120 kHz EMI RES BW**.

29. Subtract the Synthesizer Lower Frequency from the Synthesizer Upper Frequency. Record the difference as the Resolution Bandwidth Accuracy, in the performance verification test record as indicated in Table 1-14.

RES BW Accuracy = Upper Frequency – Lower Frequency

Table 1-14 EMI Resolution Bandwidth Accuracy

Spectrum Analyzer RES BW	Column 1 Synthesizer Lower Frequency	Column 2 Synthesizer Upper Frequency	TR Entry (Resolution Bandwidth Accuracy)
9 kHz	________________	________________	**9**
120 kHz	________________	________________	**10**

Performance test "Resolution Bandwidth Accuracy" is now complete.

12. Calibrator Amplitude Accuracy

This test measures the accuracy of the spectrum analyzer CAL OUT signal. The first part of the test characterizes the insertion loss of a Low-Pass Filter (LPF) and 10 dB Attenuator. The harmonics of the CAL OUT signal are suppressed with the LPF before the amplitude accuracy is measured using a power meter.

Calibrator Frequency is not included in this procedure because it is a function of the Frequency Reference (CAL OUT Frequency = 300 MHz ± [300 MHz × Frequency Reference]). Perform the 10 MHz Frequency Reference Output Accuracy test (Test 1 for standard or Test 2 for an Option 004) to verify the CAL OUT frequency.

The related adjustment for this performance test is the "Calibrator Amplitude Adjustment."

Equipment Required

Synthesized sweeper
Measuring receiver *(used as a power meter)*
Power meter
Power sensor, low power with a 50 MHz reference attenuator
Power sensor, 100 kHz to 1800 MHz
Power splitter
10 dB attenuator, Type N (m to f), dc-12.4 GHz
Filter, low pass (300 MHz)
Cable, Type N, 152 cm (60 in)
Adapter, APC 3.5 (f) to Type N (f)
Adapter, Type N (f) to BNC (m) *(two required)*
Adapter, Type N (m) to BNC (f)

Procedure

This performance test consists of two parts:

Part 1: LPF, Attenuator and Adapter Insertion Loss Characterization
Part 2: Calibrator Amplitude Accuracy

Perform "Part 1: LPF, Attenuator and Adapter Insertion Loss Characterization" before "Part 2: Calibrator Amplitude Accuracy."

A worksheet is provided at the end of this procedure for calculating the corrected insertion loss and the calibrator amplitude accuracy.

Part 1: LPF, Attenuator and Adapter Insertion Loss Characterization

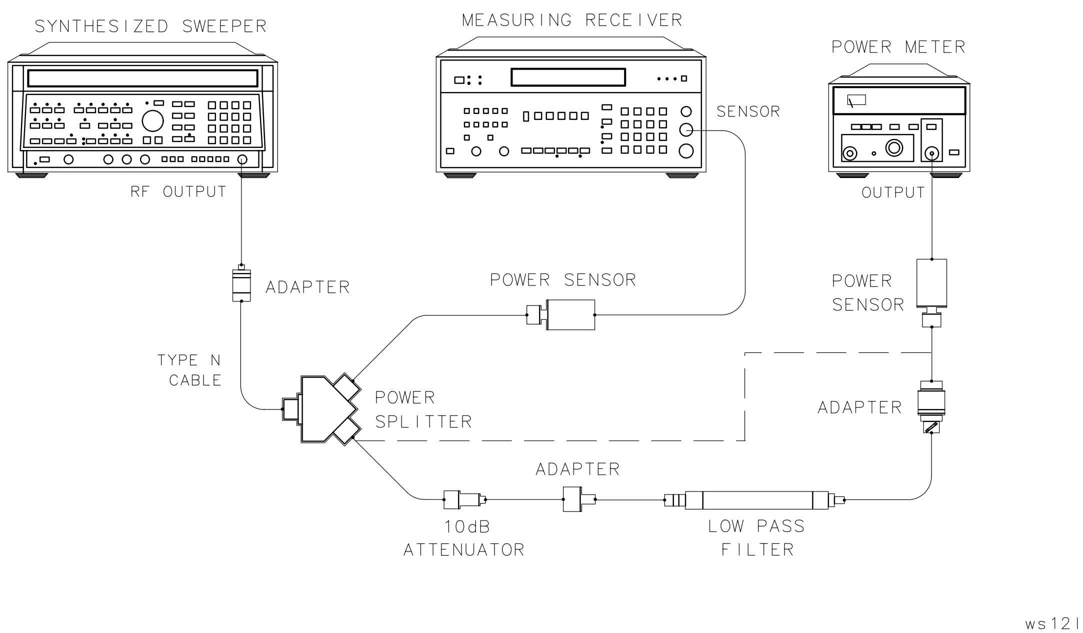
1. Zero and calibrate the measuring receiver and 100 kHz to 1800 MHz power sensor in LOG mode as described in the measuring receiver operation manual.

CAUTION Do not attempt to calibrate the low-power power sensor without the reference attenuator or damage to the low-power power sensor will occur.

2. Zero and calibrate the power meter and low-power power sensor, as described in the power meter operation manual.
3. Press INSTRUMENT PRESET on the synthesized sweeper, then set the controls as follows:

CW ....300 MHz
POWER LEVEL ....–15 dBm

Figure 1-13 LPF Characterization



4. Connect the equipment as shown in Figure 1-13. Connect the low-power power sensor directly to the power splitter (bypass the LPF, attenuator, and adapters). Wait for the power sensor to settle before proceeding with the next step.

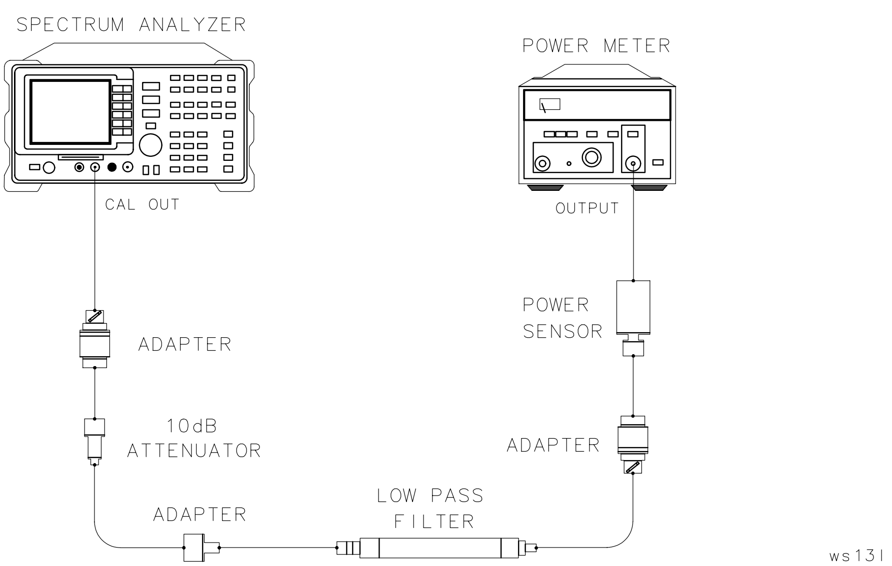
5. On the measuring receiver, press RATIO mode. The power indication should be 0 dB.
6. On the power meter, press the dB REF mode key. The power indication should be 0 dB.
7. Connect the LPF, attenuator and adapters as shown in Figure 1-13.
8. Record the measuring receiver reading in dB in the worksheet as the Mismatch Error. This is the relative error due to mismatch.
9. Record the power meter reading in dB in the worksheet as the Uncorrected Insertion Loss. This is the relative uncorrected insertion loss of the LPF, attenuator and adapters.
10. Subtract the Mismatch Error (step 8) from the Uncorrected Insertion Loss (step 9). This is the corrected insertion loss. Record this value in the worksheet as the Corrected Insertion Loss.

    Example: If the Mismatch Error is +0.3 dB and the Uncorrected Insertion Loss is –10.2 dB, subtract the mismatch error from the insertion loss to yield a corrected reading of –10.5 dB.

Part 2: Calibrator Amplitude Accuracy

Perform "Part 1: LPF, Attenuator and Adapter Insertion Loss Characterization" before performing this procedure.

Figure 1-14 Calibrator Amplitude Accuracy Test Setup



1. Connect the equipment as shown in Figure 1-14. The spectrum analyzer should be positioned so that the setup of the adapters, LPF and attenuator do not bind. It may be necessary to support the center of gravity of the devices.
2. On the power meter, press the dBm mode key. Record the power meter reading in dBm in the worksheet as the Power Meter Reading.
3. Subtract the Corrected Insertion Loss (step 10) from the Power Meter Reading (step 9).

   CAL OUT Power = Power Meter Reading – Corrected Insertion Loss

   Example: If the Corrected Insertion Loss is –10.0 dB, and the measuring receiver reading is –30 dB, then (–30 dB) – (–10.0 dB) = –20 dB
4. Record this value as TR Entry 1 of the performance verification test record as the CAL OUT power. The CAL OUT should be –20 dBm ±0.4 dB.

Calibrator Amplitude Accuracy Worksheet

Description	Measurement
Mismatch Error	______________ dB
Uncorrected Insertion Loss	______________ dB
Corrected Insertion Loss	______________ dB
Power Meter Reading	______________ dBm

13. Frequency Response

The RF INPUT coupling is first set to the dc coupled mode. The output of the synthesized sweeper is fed through a power splitter to a power sensor and the spectrum analyzer. The synthesized sweeper's power level is adjusted at 300 MHz to place the displayed signal at the analyzer center horizontal graticule line. The measuring receiver, used as a power meter, is placed in RATIO mode. At each new sweeper frequency and analyzer center frequency setting, 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 300 MHz (CAL OUT frequency).

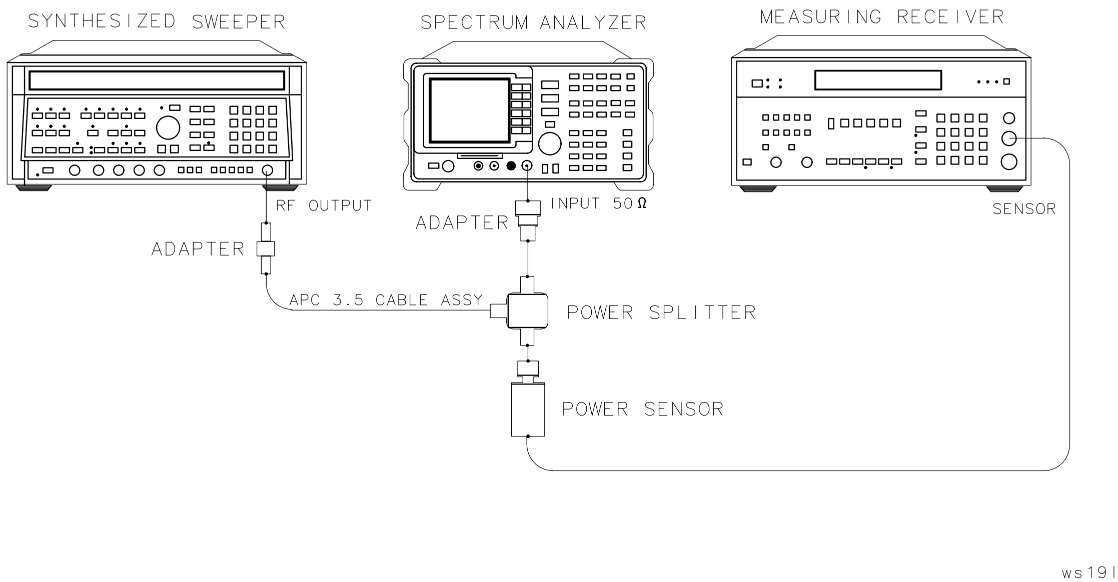
The related adjustment for this performance verification test is:

Frequency Response Adjustment

Equipment Required

Synthesized sweeper
Measuring receiver *(used as a power meter)*
Synthesizer/level generator
Power sensor, 50 MHz to 2.9 GHz
Power splitter
Termination, 50 Ω
Adapter, Type N (m) to APC 3.5 (m)
Adapter, Type N (f) to APC 3.5 (m)
Adapter, 3.5 mm (f) to 3.5mm (f)
Cable, BNC, 122 cm (48 in)
Cable, APC 3.5, 91 cm (36 in)

Figure 1-15 Frequency Response Test Setup, ≥50 MHz



Procedure

1. Zero and calibrate the measuring receiver and 50 MHz to 2.9 GHz power sensor in log mode as described in the measuring receiver operation manual.
2. Connect the equipment as shown in Figure 1-15.
3. Press INSTRUMENT PRESET on the synthesized sweeper, then set the controls as follows:

   CW ....300 MHz
   FREQ STEP ....100 MHz
   POWER LEVEL .... –8 dBm

4. On the spectrum analyzer, press **PRESET**. Wait for the preset to finish, then set the spectrum analyzer controls by pressing the following keys:

   FREQUENCY, 300, **MHz**
   CF STEP AUTO MAN, 100, **MHz**
   SPAN, 5, **MHz**
   AMPLITUDE, –10, **dBm**
   SCALE LOG LIN (LOG), 1, **dB**
   AMPLITUDE, **More 1 of 3**, **More 2 of 3**, **COUPLE AC DC** (DC)
   BW, 1, **MHz**
   VID BW AUTO MAN, 10, **kHz**

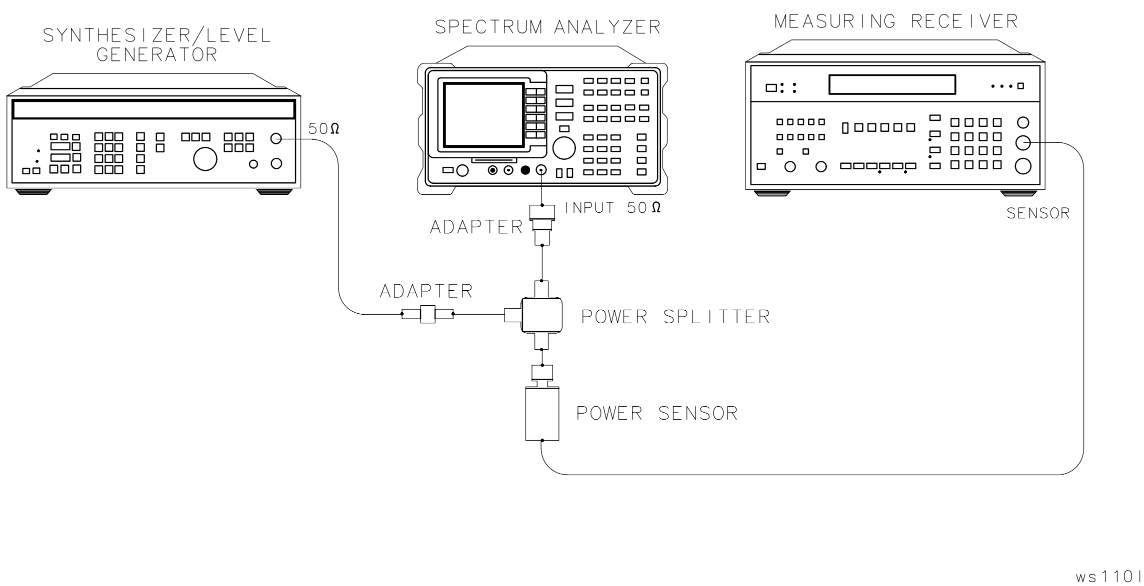
5. On the spectrum analyzer, press **PEAK SEARCH**, **SIGNAL TRACK** (ON).
6. Adjust the synthesized sweeper power level for a MKR-TRK amplitude reading of –14 dBm ±0.1 dB.
7. Set the power sensor cal factor for the measuring receiver, then press RATIO.
8. Set the synthesized sweeper CW to 50 MHz.
9. Press **FREQUENCY**, 50, **MHz** on the spectrum analyzer.
10. Adjust the synthesized sweeper power level for a spectrum analyzer MKR-TRK amplitude reading of –14 dBm ±0.1 dB.
11. Set the power sensor cal factor for the measuring receiver, then record the power ratio displayed on the measuring receiver below. Record the negative of the power ratio in Table 1-15.

Measuring Receiver Reading at 50 MHz_________ dB

12. Set the synthesized sweeper CW to 100 MHz.
13. Press **FREQUENCY**, 100 **MHz** on the spectrum analyzer.
14. Adjust the synthesized sweeper power level for a spectrum analyzer MKR-TRK amplitude reading of –14 dBm ±0.1 dB.
15. Set the power sensor cal factor for the measuring receiver, then record the negative of the power ratio displayed on the measuring receiver in Table 1-15 as the Measuring Receiver Reading at 100 MHz.
16. On the synthesized sweeper, press CW, ⇑ (step up).
17. On the spectrum analyzer, press **FREQUENCY**, ⇑ (step up) to step through the remaining frequencies listed in Table 1-15.

    At each new frequency repeat steps 14 through 16, entering the power sensor's Cal Factor into the measuring receiver as indicated in Table 1-15.

Figure 1-16 Frequency Response Test Setup, <50 MHz



18. Connect the equipment as shown in Figure 1-16, with the power sensor connected to power splitter.

19. Set the synthesizer/level generator controls as follows:

    FREQUENCY ....50 MHz
    AMPLITUDE .... –8 dBm
    AMPTD INCR ....0.05 dB

20. On the spectrum analyzer, press **MKR**, **MARKERS OFF**, then set the controls by pressing the following keys:

    FREQUENCY, 50, **MHz**
    SPAN, 100, **kHz**
    BW, 10, **kHz**

21. Enter the power sensor's 50 MHz Cal Factor into the measuring receiver.

22. Adjust the synthesizer/level generator amplitude until the measuring receiver display reads the same value as recorded in step 11. Record the synthesizer/level generator amplitude here and in Table 1-16.

    Synthesizer/Level Generator Amplitude Setting (50 MHz) ________ dBm

23. Replace the power sensor with the 50 Ω termination.

24. Press the following spectrum analyzer keys:

    PEAK SEARCH
    MKR FCTN, **MK TRACK ON OFF** (ON)
    MKR, **MARKER** Δ

25. Set the spectrum analyzer center frequency and the synthesizer/level generator frequency to the frequencies listed in Table 1-16. At each frequency, adjust the synthesizer/level generator amplitude for a MKR Δ-TRK amplitude reading of 0.00 ±0.05 dB. Record the synthesizer/level generator amplitude setting in Table 1-16 as the Synthesizer/Level Generator Amplitude.

26. For each of the frequencies in Table 1-16, subtract the Synthesizer/Level Generator Amplitude Reading (column 2) from the Synthesizer/Level Generator Amplitude Setting (50 MHz) recorded in step 20. Record the result as the Response Relative to 50 MHz (column 3) of Table 1-16.

27. Add to each of the Response Relative to 50 MHz entries in Table 1-16 the Measuring Receiver Reading for 50 MHz listed in Table 1-15. Record the results as the Response Relative to 300 MHz (column 4) in Table 1-16.

28. Record the test results in the performance verification test record by performing the following steps:

    a. Enter the most positive number from Table 1-16, column 4:

       _________ dB

    b. Enter the most positive number from Table 1-15, column 2:

       _________ dB

    c. Enter the more positive of numbers from (a) and (b) as TR Entry 1 of the performance verification test record. (Absolute referenced to 300 MHz.)

    d. Enter the most negative number from Table 1-16, column 4:

       _________ dB

    e. Enter the most negative number from Table 1-15, column 2:

       _________ dB

    f. Enter the more negative of numbers from (d) and (e) as TR Entry 2 of the performance verification test record.

    g. Subtract (f) from (c), then enter this value as TR Entry 3 of the performance verification test record. (Relative flatness.)

Table 1-15 Frequency Response, ≥50 MHz

Column 1 Frequency (MHz)	Column 2 Measuring Receiver Reading (dB)	Column 3 CAL FACTOR Frequency (GHz)	Column 1 Frequency (MHz)	Column 2 Measuring Receiver Reading (dB)	Column 3 CAL FACTOR Frequency (GHz)
50	________	0.05	1500	________	2.0
100	________	0.05	1600	________	2.0
200	________	0.05	1700	________	2.0
300	________	0.05	1800	________	2.0
400	________	0.05	1900	________	2.0
500	________	0.05	2000	________	2.0
600	________	0.05	2100	________	2.0
700	________	0.05	2200	________	2.0
800	________	0.05	2300	________	2.0
900	________	0.05	2400	________	2.0
1000	________	0.05	2500	________	3.0
1100	________	2.0	2600	________	3.0
1200	________	2.0	2700	________	3.0
1300	________	2.0	2800	________	3.0
1400	________	2.0	2900	________	3.0

Table 1-16 Frequency Response, <50 MHz

Column 1 Spectrum Analyzer Synthesizer/Level Generator Frequency	Column 2 Synthesizer Level Generator Amplitude (dBm)	Column 3 Response Relative to 50 MHz	Column 4 Response Relative to 300 MHz
50 MHz	________	0 (Reference)	________
20 MHz	________	________	________
10 MHz	________	________	________
5 MHz	________	________	________
1 MHz	________	________	________
200 kHz	________	________	________
50 kHz	________	________	________

14. Other Input Related Spurious Responses

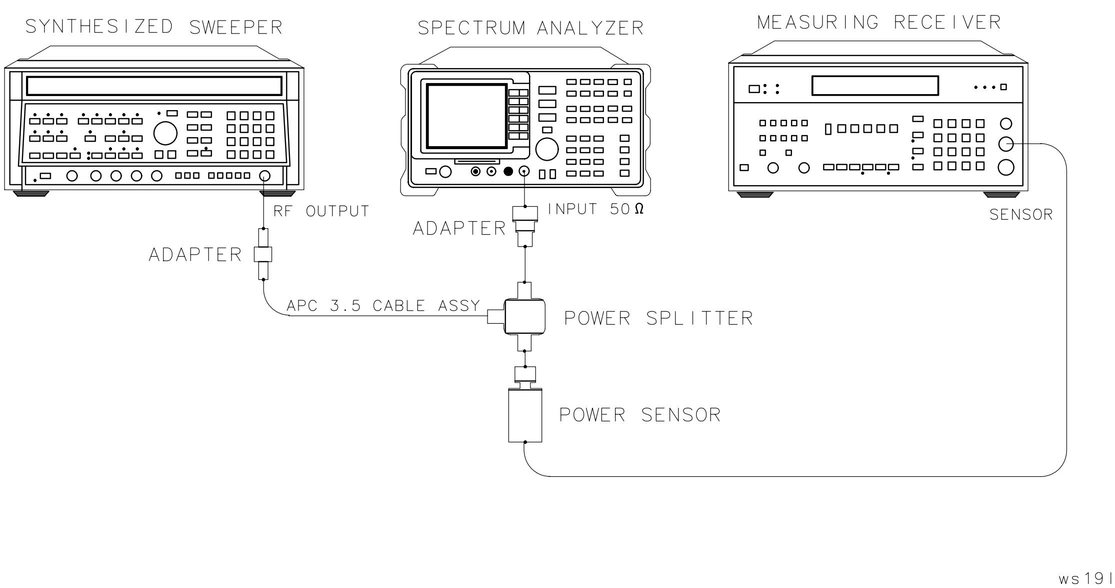
A synthesized source and the spectrum analyzer are set to the same frequency and the amplitude of the source is set to –20 dBm. A marker amplitude reference is set on the analyzer. The source is then tuned to several different frequencies which should generate image, multiple, and out-of-band responses. At each source frequency, the source amplitude is set to –20 dBm and the amplitude of the response, if any, is measured using the analyzer marker function. The marker amplitude difference is then compared to the specification.

There are no related adjustment procedures for this performance verification test.

Equipment Required

Synthesized sweeper
Measuring receiver *(used as a power meter)*
Power sensor, 50 MHz to 2.9 GHz
Power splitter
Adapter, Type N (m) to APC 3.5 (m)
Adapter, APC 3.5 (f) to APC 3.5 (f)
Cable, APC 3.5 male connectors, 91 cm (36 in)

Figure 1-17 Other Input Related Spurious Responses Test Setup



Procedure

1. Zero and calibrate the measuring receiver and 50 MHz to 2.9 GHz power sensor in log mode (power reads out in dBm). Enter the power sensor 2 GHz Cal Factor into the measuring receiver.
2. Press INSTRUMENT PRESET on the synthesized sweeper, then set the controls as follows:

   CW ....2000 MHz
   POWER LEVEL ....–4 dBm

3. Connect the equipment as shown in Figure 1-17.
4. On the spectrum analyzer, press **PRESET** and wait for the preset to finish. Set the spectrum analyzer by pressing the following keys:

   FREQUENCY, 2.0, **GHz**
   SPAN, 1, **MHz**
   AMPLITUDE, −10, **dBm**
   ATTEN AUTO MAN, 0, **dB**

5. Adjust the synthesized sweeper power level for a –20 dBm ±0.1 dB reading on the measuring receiver.
6. On the spectrum analyzer, press the following keys:

   PEAK SEARCH
   MKR FCTN, **MK TRACK ON OFF** (ON)
   SPAN ,200, **kHz**

   Wait for the `AUTO ZOOM` message to disappear. Press the following analyzer keys:

   PEAK SEARCH, **MKR →**, **MARKER →REF LVL**
   PEAK SEARCH, **MARKER Δ**
   AMPLITUDE, ⇓ (step-down key)
   SGL SWP

7. For each of the frequencies listed in Table 1-17 for a center frequency of 2.0 GHz, do the following:

   a. Set the synthesized sweeper to the listed CW frequency.
   b. Enter the appropriate power sensor Cal Factor into the measuring receiver.
   c. Set the synthesized sweeper power level for a –20 dBm reading on the measuring receiver.
   d. Press **SGL SWP** and wait for completion of a new sweep.
   e. On the spectrum analyzer, press **PEAK SEARCH** and record the MKR Δ amplitude reading in Table 1-17 as the actual MKR Δ Amplitude.
      The actual MKR Δ Amplitude should be less than the maximum MKR Δ Amplitude listed in the table.

Note that the maximum MKR Δ Amplitude is 10 dB more positive than the specification. This is due to the 10 dB change in reference level made in step 6.

8. Record the maximum actual MKR Δ Amplitude from Table 1-17 as TR Entry 1 of the performance verification test record.

Table 1-17 Other Input Related Spurious Worksheet

Spectrum Analyzer Center Frequency	Synthesized Sweeper CW Frequency	MKR Δ Amplitude	
GHz	MHz	Actual (dBc)	Max (dBc)
2.0	2042.8[a]	________	−55
2.0	2642.8[a]	________	−55
2.0	9842.8[b]	________	−55
2.0	7921.4[b]	________	−55
2.0	1820.8[c]	________	−55
2.0	278.5[c]	________	−55

a. Image Response
b. Out-of-Band Response
c. Multiple Response

15. Spurious Response

This test is performed in two parts. The first part measures second harmonic distortion; the second part measures third order intermodulation distortion.

To test second harmonic distortion, a 50 MHz low-pass filter is used to filter the source output, ensuring that harmonics read by the analyzer are internally generated and not coming from the source. The distortion products are measured using the analyzer marker functions.

For third order intermodulation distortion, two signals are combined in a directional coupler (for isolation) and are applied to the analyzer input. The power level of the two signals is 8 dB higher than specified, so the distortion products should be suppressed by 16 dB less than specified. In this manner, the equivalent Third Order Intercept (TOI) is measured.

With two –30 dBm signals at the input mixer and the distortion products suppressed by 70 dBc, the equivalent TOI is +5 dBm (–30 dBm + 70 dBc/2). However, if two –22 dBm signals are present at the input mixer and the distortion products are suppressed by 54 dBc, the equivalent TOI is also +5 dBm (–22 dBm + 54 dBc/2).

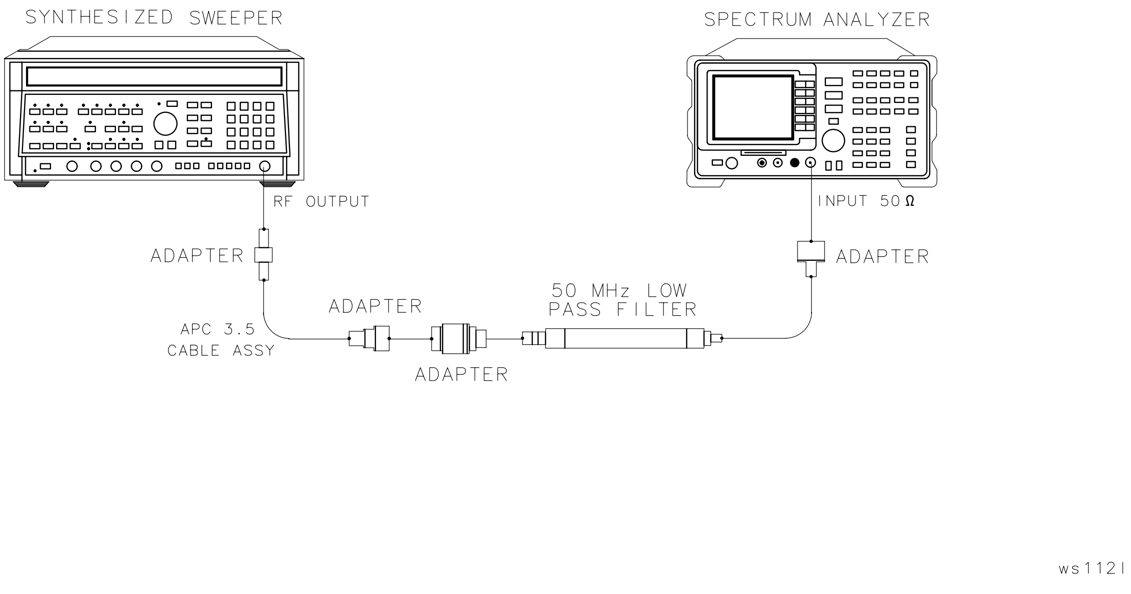
Performing the test with a higher power level maintains the measurement integrity while reducing both test time and the dependency upon the source's noise sideband performance.

There are no related adjustment procedures for this performance verification test.

Equipment Required

Synthesized sweeper *(two required)*
Measuring receiver *(used as a power meter)*
Power sensor, 50 MHz to 2.9 GHz
Power splitter
Low-pass filter, 50 MHz
Directional coupler
Cable, APC 3.5 Cable 91 cm (36 in)
Cable, BNC 120 cm (48 in)
Adapter, Type N (m) to APC 3.5 (m)
Adapter, APC 3.5 (f) to APC 3.5 (f) *(two required)*
Adapter, Type N (f) to APC 3.5 (f)
Adapter, Type N (m) to BNC (f) *(two required)*
Adapter, Type N (m) to APC 3.5 (f)
Adapter, Type N (f) to BNC (m)

Figure 1-18 Second Harmonic Distortion Test Setup



Procedure

Second Harmonic Distortion

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

   CW ....30 MHz
   POWER LEVEL ....–30 dBm

2. Connect the equipment as shown in Figure 1-18.

3. Press **PRESET** on the spectrum analyzer, then wait for the preset to finish. Set the spectrum analyzer by pressing the following keys:

   FREQUENCY, 30, **MHz**
   SPAN, 1, **MHz**
   AMPLITUDE, –30, **dBm**
   BW, 30, **kHz**

4. Adjust the synthesized sweeper power level to place the peak of the signal at the reference level (–30 dBm).

5. Set the spectrum analyzer by pressing the following keys:

   BW, 1, **kHz**
   VID BW AUTO MAN, 100, **Hz**

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

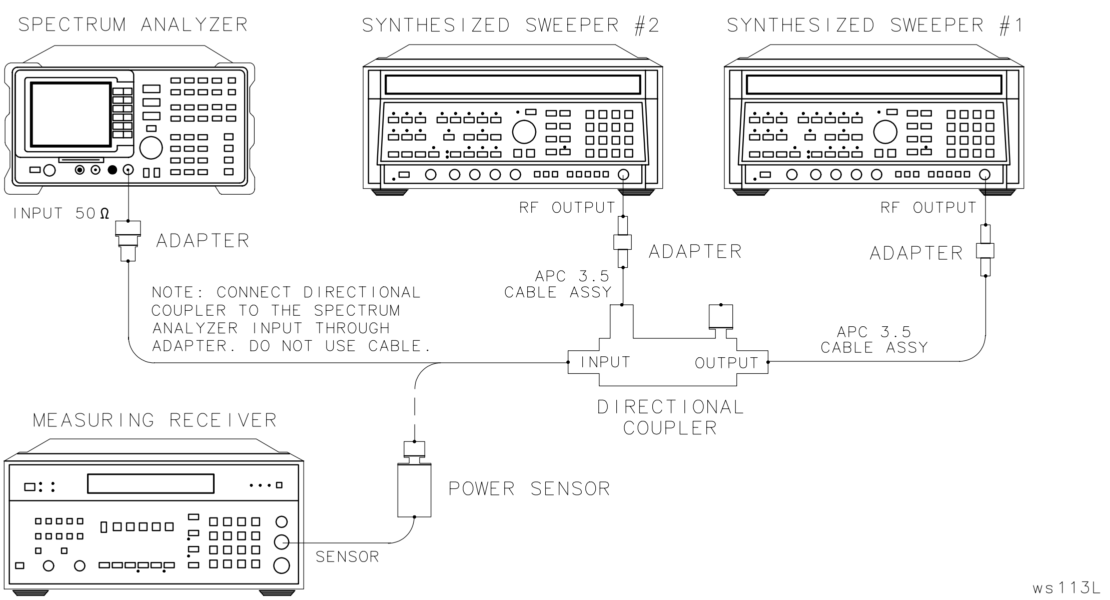
   PEAK SEARCH
   MKR →, MKR →CF STEP
   MKR, MARKER Δ
   FREQUENCY

7. Press the ⇑ (step up) key on the spectrum analyzer to step to the second harmonic (at 60 MHz). Set the reference level to –50 dBm. Wait for a full sweep to finish, then press **PEAK SEARCH**.

8. Record the MKR Δ Amplitude reading as TR Entry 1 of the performance verification test record.

   Note that the maximum MKR Δ Amplitude Reading is 20 dB higher than the specification. This is a result of changing the reference level from –30 dBm to –50 dBm.

Figure 1-19 Third-Order Intermodulation Distortion Test Setup



Third Order Intermodulation Distortion

9. Zero and calibrate the measuring receiver and 50 MHz to 2.9 GHz power sensor combination in log mode (RF power readout in dBm). Enter the power sensor 3 GHz Cal Factor into the measuring receiver.

10. Connect the equipment as shown in Figure 1-19 with the input of

the directional coupler connected to the power sensor.

11.Press INSTRUMENT PRESET on each synthesized sweeper. Set each of the synthesized sweeper controls as follows:

POWER LEVEL ....–15 dBm
CW (synthesized sweeper #1) ....2.800 GHz
CW (synthesized sweeper #2) ....2.80005 GHz
RF ....OFF

12.On the spectrum analyzer, press **PRESET** and wait until the preset routine is finished. Press the following spectrum analyzer keys:

FREQUENCY, 2.8, **GHz**
SPAN, 1, **MHz**
AMPLITUDE, –10, **dBm**
PEAK SEARCH, **More 1 of 2**, **PEAK EXCURSN**, 3, **dB**
DISPLAY, **More 1 of 2**, **THRESHLD ON OFF** (ON), –90, **dBm**

13.On synthesized sweeper #1, set RF on. Adjust the power level until the measuring receiver reads –12 dBm ±0.05 dB.

14.Disconnect the power sensor from the directional coupler. Connect the directional coupler directly to the spectrum analyzer INPUT 50 Ω using an adapter (do not use a cable).

15.On the spectrum analyzer, press the following keys:

PEAK SEARCH
MKR FCTN, **MK TRACK ON OFF** (ON)
SPAN, 200, **kHz**

Wait for the `AUTO ZOOM` message to disappear, then press the following spectrum analyzer keys:

MKR FCTN, **MK TRACK ON OFF** (OFF)
FREQUENCY, ⇑ (step-up key)
PEAK SEARCH
MKR →, **MARKER →REF LVL**

16.On synthesized sweeper #2, set RF on. Adjust the power level until the two signals are displayed at the same amplitude.

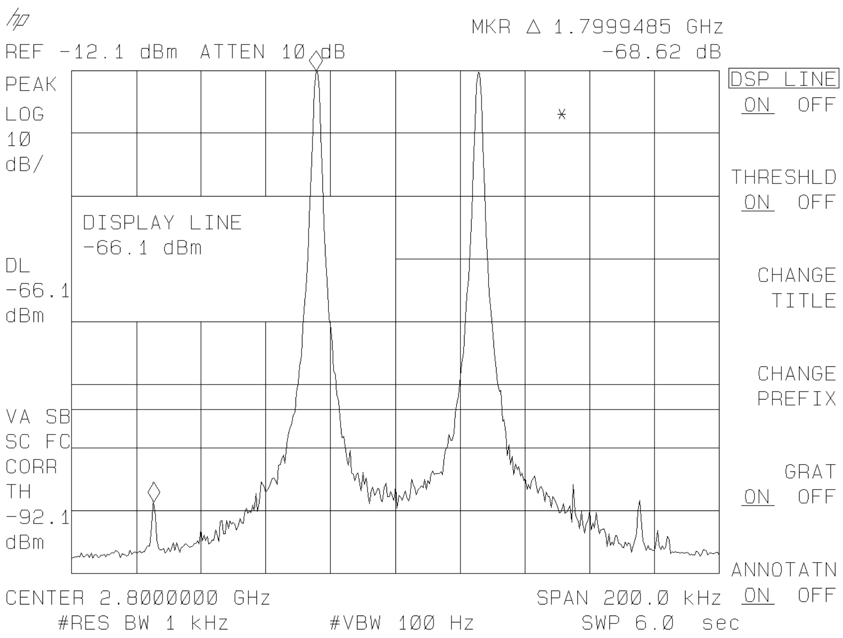
17.If necessary, adjust the spectrum analyzer Center Frequency until the two signals are centered on the display. Press the following spectrum analyzer keys:

BW 1 **kHz**
VID BW AUTO MAN, 100, **Hz**
PEAK SEARCH, **MARKER Δ**
DISPLAY, **DSP LINE ON OFF** (ON)

Set the display line to a value 54 dB below the current reference level setting.

18. The third-order intermodulation distortion products should appear 50 kHz below the lower frequency signal and 50 kHz above the higher frequency signal. Their amplitude should be less than the display line. See Figure 1-20.

Figure 1-20 Third Order Intermodulation Distortion



19. If the distortion products can be seen, proceed as follows:

a. On the spectrum analyzer, press **MKR** →, **More 1of 2**, **PEAK MENU**.
b. Repeatedly press **PEAK SEARCH** until the active marker is on the desired distortion product.
c. Record the MKR Δ amplitude reading as TR Entry 2 of the performance verification test record. The MKR Δ reading should be less than the specified limit.

20. If the distortion products cannot be seen, proceed as follows:

a. On each synthesized sweeper, increase the power level by 5 dB. Distortion products should now be visible at this higher power level.
b. On the spectrum analyzer, press **MKR** → and **PEAK MENU**.
c. Repeatedly press **PEAK SEARCH** until the active marker is on one of the distortion products.
d. On each synthesized sweeper, reduce the power level by 5 dB and wait for completion of a new sweep.
e. Record the MKR Δ amplitude reading as TR Entry 2 of the performance verification test record. The MKR Δ reading should be less than the specified limit.

16. Gain Compression

This performance verification test measures gain compression. Two signals, separated by 3 MHz, are used. First, the test places a –30 dBm signal at the input of the spectrum analyzer (the spectrum analyzer reference level is also set to –30 dBm). Then, a 0 dBm signal is applied to the spectrum analyzer, overdriving its input. The decrease in the first signal's amplitude (gain compression) caused by the second signal is the measured gain compression.

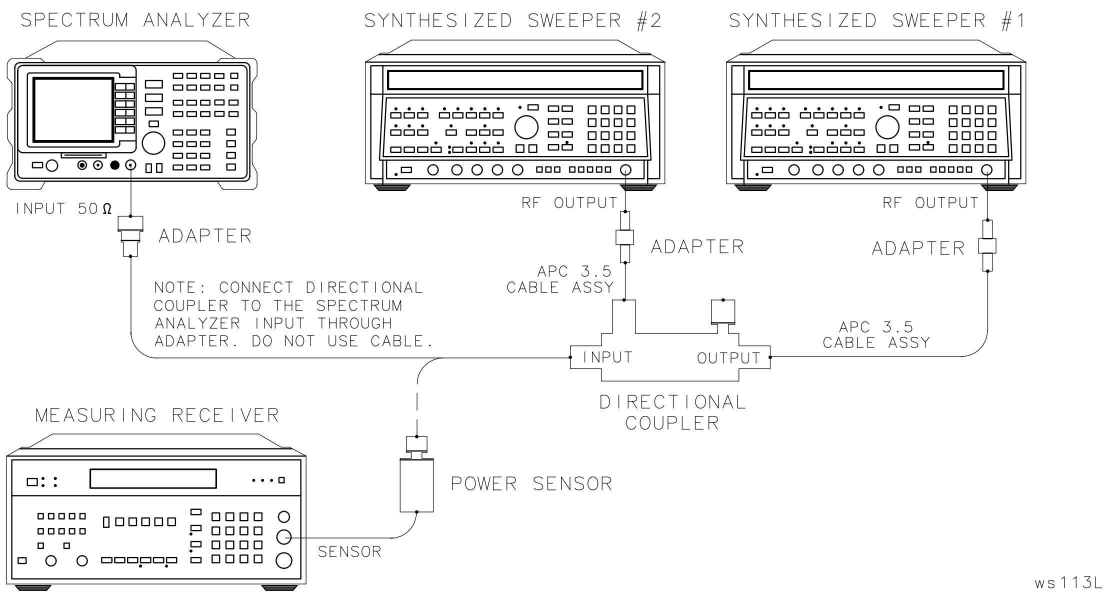
For spectrum analyzers equipped with Option 130 the signals are separated by 10 kHz, then the first signal is kept 10 dB below the reference level.

There are no related adjustment procedures for this performance test.

Equipment Required

Synthesized sweeper *(two required)*
Measuring receiver *(used as a power meter)*
Power sensor, 50 MHz to 2.9 GHz
Directional coupler
Cable, APC 3.5, 91 cm (36 in) *(two required)*
Adapter, Type N (m) to APC 3.5 (m)
Adapter, APC 3.5 (f) to APC 3.5 (f) *(two required)*

Figure 1-21 Gain Compression Test Setup



Procedure

Gain Compression, <2.9 GHz

1. Zero and calibrate the measuring receiver and 50 MHz to 2.9 GHz power sensor combination in log mode (power reads out in dBm) as described in the measuring receiver operation manual. Enter the power sensor 2 GHz Cal Factor into the measuring receiver.
2. Connect the equipment as shown in Figure 1-21, with the output of the directional coupler connected to the power sensor.
3. Press INSTRUMENT PRESET on both synthesized sweepers.
4. Set synthesized sweeper #1 controls as follows:

   CW ....2.003 GHz
   POWER LEVEL ....0 dBm

5. Set synthesized sweeper #2 controls as follows:

   CW ....2.0 GHz
   AMPLITUDE ....–14 dBm

6. On the spectrum analyzer, press **PRESET**, then wait for the preset routine to finish. Press the spectrum analyzer keys as follows:

   FREQUENCY, 2.0, **GHz**
   SPAN, 20, **MHz**
   AMPLITUDE, **REF LVL**, 30, –**dBm**
   SCALE LOG LIN (LOG), 1, **dB**
   BW, **RES BW AUTO MAN**, 300, **kHz**

7. On synthesized sweeper #1, adjust the power level for a 0 dBm reading on the measuring receiver. Set RF to off.

   The power level applied to the spectrum analyzer input is 10 dB greater than the specification to account for the 10 dB attenuation setting. A power level of 0 dBm at the spectrum analyzer input yields –10 dBm at the input mixer.

8. Disconnect the power sensor from the directional coupler and connect the directional coupler to the INPUT 50 Ω connector of the spectrum analyzer using an adapter. Do not use a cable.
9. On the spectrum analyzer, press the following keys:

   PEAK SEARCH
   MKR FCTN, **MK TRACK ON OFF** (ON)
   SPAN, 10, **MHz**

   Wait for the `AUTO ZOOM` routine to finish.

10. On synthesized sweeper #2, adjust the power level to place the signal 1 dB below the spectrum analyzer reference level.

11. On the spectrum analyzer, press **PEAK SEARCH**, then **MARKER Δ**.

12. On synthesized sweeper #1, set RF to ON.

13. On the spectrum analyzer, press **PEAK SEARCH**, then **NEXT PEAK**.

    The active marker should be on the lower amplitude signal and 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 spectrum analyzer knob.

14. Read the MKR Δ amplitude and record in the performance verification test record as TR Entry 1. The absolute value of this amplitude should be less than 0.5 dB.

17. Displayed Average Noise Level

This performance test measures the displayed average noise level within the frequency range specified. The spectrum analyzer input is terminated in 50 Ω.

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

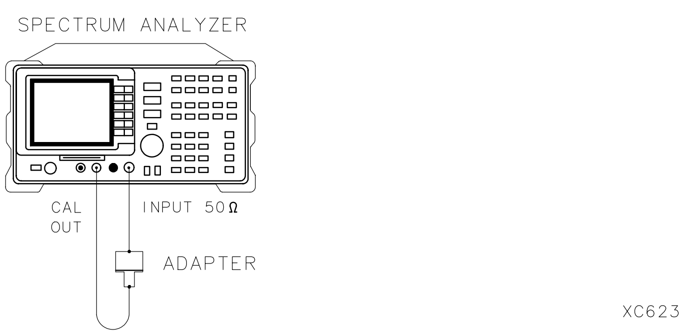
To reduce measurement uncertainty due to input attenuator switching and resolution bandwidth switching, a reference level offset is added. The CAL OUT signal is used as the amplitude reference for determining the amount of offset required. The offset is removed at the end of the test by pressing **PRESET**.

The related adjustment for this procedure is "Frequency Response Adjustment."

Equipment Required

Termination, 50 Ω
Cable, BNC, 23 cm (9 in)
Adapter, Type N (m) to BNC (f)

Figure 1-22 Displayed Average Noise Level Test Setup



Procedure

1. Connect a cable from the CAL OUT to the INPUT 50 Ω of the spectrum analyzer as shown in Figure 1-22.

2. Press **PRESET** on the spectrum analyzer, then wait for the preset routine to finish. Set the spectrum analyzer by pressing the following keys:

   FREQUENCY, 300, **MHz**
   SPAN, 10, **MHz**
   AMPLITUDE, –20, **dBm**
   ATTEN AUTO MAN, 0, **dB**

3. Press the following spectrum analyzer keys:

   PEAK SEARCH
   MKR FCTN, **MK TRACK ON OFF** (ON)
   SPAN, 100, **kHz**

   Wait for the `AUTO ZOOM` message to disappear, then press the following keys:

   BW, 1, **kHz**, **VID BW AUTO MAN**, 30, **Hz**
   MKR FCTN, **MK TRACK ON OFF** (OFF)

4. Press **SGL SWP**, then wait for the completion of a new sweep. Press the following spectrum analyzer keys:

   PEAK SEARCH
   AMPLITUDE, **More 1 of 3**, **REF LVL OFFSET**

   Subtract the MKR amplitude reading from –20 dBm and enter the result as the REF LVL OFFSET. For example, if the marker reads –20.21 dBm, enter +0.21 dB (–20 dBm – (–20.21 dBm) = +0.21 dB).

   REF LVL OFFSET ________ dB

5. Disconnect the cable from the INPUT 50 Ω connector of the spectrum analyzer. Connect the 50 Ω termination to the spectrum analyzer INPUT 50 Ω connector.

400 kHz

6. Press the following spectrum analyzer keys:

   FREQUENCY, 400, **kHz**
   SPAN, 50, **kHz**
   AMPLITUDE, –90, **dBm**
   TRIG, **SWEEP CONT SGL** (CONT)

7. Press the following spectrum analyzer keys:

   BW, 1, **kHz**
   TRACE, **More 1 of 3**, **DETECTOR PK SP NG** (SP)
   SGL SWP

   Wait for the completion of a new sweep.

8. Press the following spectrum analyzer keys:

   DISPLAY, **DSP LINE ON OFF** (ON)

   Adjust the display line so that it is centered on the average trace noise, ignoring any residual responses (refer to the Residual Responses verification test for any suspect residuals).

9. Record the display line amplitude setting as TR Entry 1 of the performance test record as the noise level at 400 kHz. The average noise level should be less than the specified limit.

4 MHz

10. Press the following spectrum analyzer keys:

    FREQUENCY, 4, **MHz**
    SGL SWP

    Wait for the completion of a new sweep.

11. Press the following spectrum analyzer keys:

    DISPLAY, **DSP LINE ON OFF** (ON)

    Adjust the display line so that it is centered on the average trace noise, ignoring any residual responses (refer to the Residual Responses verification test for any suspect residuals).

12. Record the display line amplitude setting as TR Entry 2 of the performance test record as the noise level at 4 MHz. The average noise level should be less than the specified limit.

5 MHz to 2.9 GHz

13. Press the following spectrum analyzer keys:

    FREQUENCY, **START FREQ**, 5, **MHz**
    STOP FREQ, 2.9, **GHz**
    BW, 1, **MHz**
    VID BW AUTO MAN, 10, **kHz**
    TRIG, **SWEEP CONT SGL** (CONT)

14. Press **FREQUENCY** and adjust the start frequency setting, if necessary, to place the LO feedthrough just off-screen to the left.

15. Press the following spectrum analyzer keys:

    SGL SWP
    TRACE, **CLEAR WRITE A**
    More 1 of 3, **VID AVG ON OFF** (ON), 10, **Hz**

    Wait until `AVG 10` is displayed to the left of the graticule (the spectrum analyzer will take ten sweeps, then stop).

16. Press **PEAK SEARCH** and record the MKR frequency as the Measurement Frequency in Table 1-18 for 5 MHz to 2.9 GHz.

17. Press the following spectrum analyzer keys:

    TRACE, **More 1 of 3**
    VID AVG ON OFF (OFF)
    DETECTOR PK SP NG (SP)
    AUTO COUPLE, **RES BW AUTO MAN** (AUTO)
    VID BW AUTO MAN (AUTO)
    SPAN, 50, **kHz**
    FREQUENCY

18. Set the center frequency to the Measurement Frequency recorded in Table 1-18 for 5 MHz to 2.9 GHz.

19. Press the following spectrum analyzer keys:

    BW, 1, **kHz**
    VID BW AUTO MAN, 30, **Hz**
    SGL SWP.

    Wait for the sweep to finish.

20. Press the following spectrum analyzer keys:

    DISPLAY, **DSP LINE ON OFF** (ON)

    Adjust the display line so that it is centered on the average trace noise, ignoring any residual responses (refer to the Residual Responses verification test for any suspect residuals).

21.Record the display line amplitude setting as TR Entry 3 of the performance test record. The average noise level should be less than the specified limit.

Table 1-18 Displayed Average Noise Level Worksheet

Frequency Range	Measurement Frequency	TR Entry (Displayed Average Noise Level)
400 kHz	400 kHz	**1**
4 MHz	4 MHz	**2**
5 MHz to 2.9 GHz	______________	**3**

18. Residual Responses

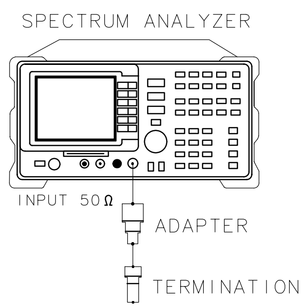
The spectrum analyzer input is terminated and the spectrum analyzer is swept from 150 kHz to 5 MHz. Then the spectrum analyzer is swept in 10 MHz spans throughout the 5 MHz to 2.9 GHz range. Any responses above the specification are noted.

There are no related adjustment procedures for this performance test.

Equipment Required

Termination, 50 Ω
Adapter, Type N (m) to APC 3.5 (f)

Figure 1-23 Residual Response Test Setup



ws114l

Procedure

150 kHz to 5 MHz

1. Connect the termination to the spectrum analyzer input as shown in Figure 1-23.

2. Press **PRESET** on the spectrum analyzer, then wait for the preset routine to finish. Press the following spectrum analyzer keys:

   PEAK SEARCH
   MKR FCTN, **MK TRACK ON OFF** (ON)
   SPAN, 6, **MHz**

   Wait for the AUTO ZOOM message to disappear, then press **MKR FCTN**, **MK TRACK ON OFF** (OFF).

3. Press **FREQUENCY**, then adjust the center frequency until the LO feedthrough peak is on the left-most vertical graticule line. Set the spectrum analyzer by pressing the following keys:

   PEAK SEARCH, **MARKER** Δ, 150, **kHz**
   MKR, **MARKER NORMAL**
   AMPLITUDE, **REF LVL**, –60, **dBm**
   ATTEN AUTO MAN, 0, **dB**
   BW, **RES BW AUTO MAN**, 3, **kHz**
   VID BW AUTO MAN, 1, **kHz**
   DISPLAY, **DSP LINE ON OFF** (ON), –90, **dBm**

4. Press **SGL SWP** and wait for a new sweep to finish. Look for any residual responses at or above the display line, to the right of the marker.

   If a residual is suspected, press **SGL SWP** again. A residual response will persist on successive sweeps, but a noise peak will not. Note the frequency and amplitude of any residual responses above the display line and to the right of the marker in Table 1-19.

5 MHz to 2.9 GHz

5. Press **PRESET** on the spectrum analyzer, then wait for the preset routine to finish. Press the following keys:

   FREQUENCY, 10, **MHz**
   FREQUENCY, **CF STEP SIZE AUTO MAN**, 9.8, **MHz**
   SPAN, 10, **MHz**
   AMPLITUDE, **REF LVL**, –60, **dBm**
   ATTEN AUTO MAN, 0, **dBm**
   BW, **RES BW AUTO MAN**, 10, **kHz**
   VID BW AUTO MAN, 3, **kHz**
   DISPLAY, **DSP LINE ON OFF**, –90, **dBm**

6. Press **SGL SWP** and wait for a new sweep to finish. Look for any residual responses at or above the display line.

   If a residual is suspected, press **SGL SWP** again. A residual response will persist on successive sweeps, but a noise peak will not. Note the frequency and amplitude of any residual responses above the display line in Table 1-19.

7. Press **FREQUENCY**, ⇑ (step-up key), to step to the next frequency and repeat step 6.

8. Repeat step 7 until the range from 5 MHz to 2.9 GHz has been checked. (This requires 295 additional frequency steps.)

9. Record the highest residual from Table 1-19 as TR Entry 1 in the performance verification test record. If no residuals are found, then record "N/A" in the performance verification test record.

Table 1-19 Residual Responses above Display Line Worksheet

Frequency (MHz)	Amplitude (dBm)
______________	______________
______________	______________
______________	______________
______________	______________
______________	______________
______________	______________

Performance Verification Test Record

Table 1-20 HP 8594L Performance Verification Test Record

Hewlett-Packard Company

Address: ______________________________

____

____

Report No. ____________________

Date ____________________

(e.g. 10 SEP 1989)

Model HP 8594L

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
Frequency Counter	________	________	________
Frequency Standard	________	________	________
Low Pass Filter, 50 MHz	________	________	________
Low Pass Filter, 300 MHz	________	________	________
Measuring Receiver	________	________	________
Microwave Frequency Counter	________	________	________
Power Meter	________	________	________
Power Sensor	________	________	________
Power Sensor	________	________	________
Power Splitter	________	________	________
Signal Generator	________	________	________
Synthesized Sweeper	________	________	________
Synthesizer/Function Generator	________	________	________
Synthesizer/Level Generator	________	________	________
Termination, 50 Ω	________	________	________

Notes/Comments:

____

____

____

Table 1-21 HP 8594L Performance Verification Test Record (page 2 of 6)

Hewlett-Packard Company Model HP 8594L Serial No. ______		**Report No. ______ Date ______**		
Test Description	**Min.**	**Results Measured (TR Entry**	**Max.**	**Measurement Uncertainty**
1. 10 MHz Reference Output Accuracy				
		Frequency Error		
Settability	−150 Hz	**(1)**______	+150 Hz	$\pm 4.2 \times 10^{-9}$
2. Frequency Readout and Marker Count Accuracy				
Frequency Readout Accuracy		Frequency (MHz)		
Frequency = 1.5 GHz				
SPAN				
20 MHz	1.49918	**(1)**______	1.50082	±1.0 Hz
10 MHz	1.49958	**(2)** ______	1.50042	±1.0 Hz
1 MHz	1.4999680	**(3)**______	1.500032	±1.0 Hz
Frequency = 1.5 GHz				
SPAN				
(CNT RES = 100 Hz) 20MHz	1.4999989	**(4)**______	1.5000011	±1.0 Hz
(CNT RES = 10 Hz) 1 MHz	1.49999989	**(5)**______	1.50000011	±1.0 Hz
3. Noise Sidebands				
Suppression at 10 kHz		**(1)**______	−60 dBc	±1.0 dB
Suppression at 20 kHz		**(2)**______	−70 dBc	±1.0 dB
Suppression at 30 kHz		**(3)**______	−75 dBc	±1.0 dB
4. System Related Sidebands				
Sideband Above Signal		**(1)**______	−65 dBc	±1.0 dB
Sideband Below Signal		**(2)**______	−65 dBc	±1.0 dB
5. Frequency Span Readout Accuracy				
SPAN		MKR Δ Reading		
1800 MHz	1446.00 MHz	**(1)** ______	1554.00 MHz	±6.37 MHz
10.10 MHz	7.70 MHz	**(2)**______	8.30 MHz	±35.4 kHz
10.00 MHz	7.80 MHz	**(3)**______	8.20 MHz	±35.4 kHz
100.00 kHz	78.00 kHz	**(4)**______	82.00 kHz	±354 Hz
99.00 kHz	78.00 kHz	**(5)**______	82.00 kHz	±354 Hz
10.00 kHz	7.80 kHz	**(6)**______	8.20 kHz	±3.54 Hz

Table 1-21 HP 8594L Performance Verification Test Record (page 2 of 6)

Hewlett-Packard Company Model HP 8594L Serial No. ______		Report No. ______ Date ______		
Test Description	**Min.**	**Results Measured (TR Entry**	**Max.**	**Measurement Uncertainty**
6. Residual FM		**(1)**______	250 Hz	±45.8 Hz
7. Sweep Time Accuracy				
SWEEP TIME		MKR Δ Reading		
20 ms	15.4 ms	**(1)** ______	16.6 ms	±0.057 ms
100 ms	77.0 ms	**(2)**______	83.0 ms	±0.283 ms
1 s	770.0 ms	**(3)**______	830.0 ms	±2.83 ms
10 s	7.7 s	**(4)**______	8.3 s	±23.8 ms
8. Scale Fidelity				
Log Mode		Cumulative Error		
dB from Ref Level				
0	0 (Ref)	0 (Ref)	0 (Ref)	
–4	–4.34 dB	**(1)** ______	+3.66 dB	±0.06 dB
–8	–8.38 dB	**(2)** ______	–7.62 dB	±0.06 dB
–12	–12.42 dB	**(3)**______	–11.58 dB	±0.06 dB
–16	–16.46 dB	**(4)** ______	–15.54 dB	±0.06 dB
–20	–20.50 dB	**(5)** ______	–19.50 dB	±0.06 dB
–24	–24.54 dB	**(6)** ______	–23.46 dB	±0.06 dB
–28	–28.58 dB	**(7)** ______	–27.42 dB	±0.06 dB
–32	–32.62 dB	**(8)**______	–31.38 dB	±0.06 dB
–36	–36.66 dB	**(9)** ______	–35.34 dB	±0.06 dB
–40	–40.70 dB	**(10)** ______	–39.30 dB	±0.06 dB
–44	–44.74 dB	**(11)**______	–43.26 dB	±0.06 dB
–48	–48.78 dB	**(12)** ______	–47.22 dB	±0.06 dB
–52	–52.82 dB	**(13)** ______	–51.18 dB	±0.06 dB
–56	–56.86 dB	**(14)** ______	–55.14 dB	±0.06 dB
–60	–60.90 dB	**(15)** ______	–59.10 dB	±0.11 dB
–64	–64.94 dB	**(16)** ______	–63.06 dB	±0.11 dB
–68	–68.98 dB	**(17)**______	–67.02 dB	±0.11 dB

Table 1-21 HP 8594L Performance Verification Test Record (page 2 of 6)

Hewlett-Packard Company Model HP 8594L Serial No. ______________		Report No. ______________ Date ______________		
Test Description	**Min.**	**Results Measured (TR Entry**	**Max.**	**Measurement Uncertainty**
8. Scale Fidelity (continued)				
Log Mode		Incremental Error		
dB from Ref Level				
0	0 (Ref)	0 (Ref)	0 (Ref)	
−4	−0.4 dB	**(18)**____________	+0.4 dB	±0.06 dB
−8	−0.4 dB	**(19)**____________	+0.4 dB	±0.06 dB
−12	−0.4 dB	**(20)** ____________	+0.4 dB	±0.06 dB
−16	−0.4 dB	**(21)**____________	+0.4 dB	±0.06 dB
−20	−0.4 dB	**(22)**____________	+0.4 dB	±0.06 dB
−24	−0.4 dB	**(23)** ____________	+0.4 dB	±0.06 dB
−28	−0.4 dB	**(24)** ____________	+0.4 dB	±0.06 dB
−32	−0.4 dB	**(25)**____________	+0.4 dB	±0.06 dB
−36	−0.4 dB	**(26)**____________	+0.4 dB	±0.06 dB
−40	−0.4 dB	**(27)**____________	+0.4 dB	±0.06 dB
−44	−0.4 dB	**(28)**____________	+0.4 dB	±0.06 dB
−48	−0.4 dB	**(29)**____________	+0.4 dB	±0.06 dB
−52	−0.4 dB	**(30)**____________	+0.4 dB	±0.06 dB
−56	−0.4 dB	**(31)** ____________	+0.4 dB	±0.06 dB
−60	−0.4 dB	**(32)**____________	+0.4 dB	±0.11 dB
Linear Mode				
% of Ref Level				
100.00	0 (Ref)	0 (Ref)	0 (Ref)	
70.70	151.59 mV	**(33)**____________	165.01 mV	±1.84 mV
50.00	105.36 mV	**(34)**____________	118.78 mV	±1.84 mV
35.48	72.63 mV	**(35)** ____________	86.05 mV	±1.84 mV
25.00	49.46 mV	**(36)**____________	82.88 mV	±1.84 mV
Log-to-Linear Switching				
	−0.25 dB	**(37)**____________	+0.25 dB	±0.05 dB

Table 1-21 HP 8594L Performance Verification Test Record (page 2 of 6)

Hewlett-Packard Company Model **HP 8594L** **Serial No. ______________**		**Report No. ______________** **Date ______________**		
Test Description	**Min.**	**Results Measured (TR Entry**	**Max.**	**Measurement Uncertainty**
9. Reference Level Accuracy				
Log Mode				
Reference Level (dBm)				
−20	0 (Ref)	0 (Ref)	0 (Ref)	
−10	−0.40 dB	**(1)** ______________	+0.40 dB	±0.06 dB
0	−0.50 dB	**(2)** ______________	+0.50 dB	±0.06 dB
−30	−0.40 dB	**(3)**______________	+0.40 dB	±0.06 dB
−40	−0.50 dB	**(4)**______________	+0.50 dB	±0.08 dB
−50	−0.80 dB	**(5)**______________	+0.80 dB	±0.08 dB
−60	−1.00 dB	**(6)**______________	+1.00 dB	±0.12 dB
−70	−1.10 dB	**(7)** ______________	+1.10 dB	±0.12 dB
−80	−1.20 dB	**(8)**______________	+1.20 dB	±0.12 dB
−90	−1.30 dB	**(9)**______________	+1.30 dB	±0.12 dB
Linear Mode				
Reference Level (dBm)				
−20	0 (Ref)	0 (Ref)	0 (Ref)	
−10	−0.40 dB	**(10)**______________	+0.40 dB	±0.06 dB
0	−0.50 dB	**(11)**______________	+0.50 dB	±0.06 dB
−30	−0.40 dB	**(12)**______________	+0.40 dB	±0.06 dB
−40	−0.50 dB	**(13)**______________	+0.50 dB	±0.08 dB
−50	−0.80 dB	**(14)**______________	+0.80 dB	±0.08 dB
−60	−1.00 dB	**(15)**______________	+1.00 dB	±0.12 dB
−70	−1.10 dB	**(16)**______________	+1.10 dB	±0.12 dB
−80	−1.20 dB	**(17)** ______________	+1.20 dB	±0.12 dB
−90	−1.30 dB	**(18)**______________	+1.30 dB	±0.12 dB

Table 1-21 HP 8594L Performance Verification Test Record (page 2 of 6)

Hewlett-Packard Company Model **HP 8594L** **Serial No.** ______		**Report No.** ______ **Date** ______		
Test Description	**Min.**	**Results Measured (TR Entry**	**Max.**	**Measurement Uncertainty**
10. Absolute Amplitude Calibration and Resolution Bandwidth Switching Uncertainties				
Absolute Amplitude Uncertainty	–20.15 dB	**(1)** ______	–19.85 dB	N/A
Resolution Bandwidth Switching Uncertainty				
Resolution Bandwidth				
3 kHz	0 (Ref)	0 (Ref)	0 (Ref)	
1 kHz	–0.5 dB	**(2)**______	+0.5 dB	+0.07/–0.08 dB
9 kHz	–0.4 dB	**(3)**______	+0.4 dB	+0.07/–0.08 dB
10 kHz	–0.4 dB	**(4)**______	+0.4 dB	+0.07/–0.08 dB
30 kHz	–0.4 dB	**(5)**______	+0.4 dB	+0.07/–0.08 dB
100 kHz	–0.4 dB	**(6)**______	+0.4 dB	+0.07/–0.08 dB
120 kHz	–0.4 dB	**(7)**______	+0.4 dB	+0.07/–0.08 dB
300 kHz	–0.4 dB	**(8)**______	+0.4 dB	+0.07/–0.08 dB
1 MHz	–0.4 dB	**(9)**______	+0.4 dB	+0.07/–0.08 dB
3 MHz	–0.4 dB	**(10)**______	+0.4 dB	+0.07/–0.08 dB
11. Resolution Bandwidth Accuracy				
3 dB Resolution Bandwidth				
3 MHz	2.4 MHz	**(1)** ______	3.6 MHz	±138 kHz
1 MHz	0.8 MHz	**(2)**______	1.2 MHz	±46 kHz
300 kHz	240 kHz	**(3)**______	360 kHz	±13.8 kHz
100 kHz	80 kHz	**(4)**______	120 kHz	±4.6 kHz
30 kHz	24 kHz	**(5)**______	36 kHz	±1.38 kHz
10 kHz	8 kHz	**(6)**______	12 kHz	±460 Hz
3 kHz	2.4 kHz	**(7)**______	3.6 kHz	±138 Hz
1 kHz	0.8 kHz	**(8)**______	1.2 kHz	±46 Hz
6 dB EMI Bandwidth				
9 kHz	7.2 kHz	**(9)**______	10.8 kHz	±333 Hz
120 kHz	96 kHz	**(10)** ______	144 kHz	±4.44 kHz

Table 1-21 HP 8594L Performance Verification Test Record (page 2 of 6)

Hewlett-Packard Company Model HP 8594L Serial No. ____		**Report No. ____ Date ____**		
Test Description	**Min.**	**Results Measured (TR Entry**	**Max.**	**Measurement Uncertainty**
12. Calibrator Amplitude Accuracy				
	−20.4 dBm	**(1)**____	−19.6 dBm	±0.2 dB
13. Frequency Response				
Max Positive Response		**(1)** ____	+1.5 dB	+0.32/−0.33 dB
Max Negative Response	−1.5 dB	**(2)**____		+0.32/−0.33 dB
Peak-to-Peak Response		**(3)**____	2.0 dB	+0.32/−0.33 dB
14. Other Input Related Spurious Responses				
50 kHz to 2.9 GHz		**(1)**____	−55 dBc	+1.12/−1.21 dB
15. Spurious Responses				
Second Harmonic Distortion		**(1)**____	−50 dBc	=1.12/−1.21 dB
Third Order Intermodulation Distortion				
Frequency				
2.8 GHz		**(2)** ____	−54 dBc	+2.07/−2.42 dB
16. Gain Compression				
<2.9 GHz		**(1)**____	0.5 dB	+0.21/−0.22 dB
17. Displayed Average Noise				
Frequency				
400 kHz		**(1)** ____	−107 dBm	+1.15/−1.25 dB
4 MHz		**(2)** ____	−107 dBm	+1.15/−1.25 dB
5 MHz to 2.9 GHz		**(3)**____	−112 dBm	+1.15/−1.25 dB
18. Residual Responses				
150 kHz to 2.9 GHz		**(1)**____	−90 dBm	+1.09/−1.15 dB

2 Specifications and Characteristics

This chapter contains specifications and characteristics for the HP 8594L Spectrum Analyzer.

The specifications and characteristics in this chapter are listed separately. The specifications are described first and are followed by the characteristics.

General	General specifications.
Frequency	Frequency-related specifications and characteristics.
Amplitude	Amplitude-related specifications and characteristics.
Physical	Input, output and physical characteristics.

The distinction between specifications and characteristics is described as follows.

- Specifications describe warranted performance over the temperature range 0 °C to +55 °C* (unless otherwise noted). The spectrum analyzer will meet its specifications under the following conditions:
  - ❑ The instrument is within the one year calibration cycle.
  - ❑ 2 hours of storage at a constant temperature within the operating temperature range.
  - ❑ 30 minutes after the spectrum analyzer is turned on.
  - ❑ After the CAL frequency, and CAL amplitude routines have been run.
- Characteristics provide useful, but nonwarranted information about the functions and performance of the spectrum analyzer. Characteristics are specifically identified.
- Typical Performance, where listed, is not warranted, but indicates performance that most units will exhibit.
- Nominal Value indicates the expected, but not warranted, value of the parameter.

* 0 °C to +50 °C with Option 015 or Option 016 operating/carrying case.

General Specifications

All specifications apply over 0 °C to +55 °C unless equipped with Option 015 or 016. The analyzer will meet its specifications after 2 hours of storage at a constant temperature, within the operating temperature range, 30 minutes after the analyzer is turned on and after CAL FREQ and CAL AMPTD have been run.

Temperature Range	
Operating	0 °C to +55 °C*
Storage	–40 °C to +75 °C
* 0 °C to +50 °C with Option 015 or Option 016 operating and carrying case.	

EMI Compatibility	Conducted and radiated emission is in compliance with CISPR Pub. 11/1990 Group 1 Class A.

Audible Noise	<37.5 dBA pressure and <5.0 Bels power (ISODP7779)

Power Requirements	
ON (LINE 1)	90 to 132 V rms, 47 to 440 Hz
	195 to 250 V rms, 47 to 66 Hz
	Power consumption <500 VA; <180 W
Standby (LINE 0)	Power consumption <7 W

Environmental Specifications	Type tested to the environmental specifications of Mil-T-28800 class 5

Frequency Specifications

Frequency Range	
dc Coupled	9 kHz to 2.9 GHz
ac Coupled	100 kHz to 2.9 GHz

Frequency Reference	
Aging	$\pm 2 \times 10^{-6}$/year
Settability	$\pm 0.5 \times 10^{-6}$
Temperature Stability	$\pm 5 \times 10^{-6}$

Frequency Readout Accuracy	
(Start, Stop, Center, Marker)	±(frequency readout × frequency reference error* + span accuracy + 1% of span + 20% of RBW + 100 Hz)‡

* frequency reference error = (aging rate × period of time since adjustment + initial achievable accuracy + temperature stability). See "Frequency Characteristics."

‡ See "Drift" under "Stability" in Frequency Characteristics.

Marker Count Accuracy †	
Frequency Span ≤ 10 MHz	±(marker frequency ×frequency reference error* + counter resolution + 100 Hz)
Frequency Span >10 MHz	±(marker frequency × frequency reference error* + counter resolution + 1 kHz)
Counter Resolution	
Frequency Span ≤ 10 MHz	Selectable from 10 Hz to 100 kHz
Frequency Span > 10 MHz	Selectable from 100 Hz to 100 kHz

* frequency reference error = (aging rate × period of time since adjustment + initial achievable accuracy and temperature stability). See "Frequency Characteristics."

† Marker level to displayed noise level > 25 dB, RBW/Span ≥ 0.01. Span ≤ 300 MHz. Reduce SPAN annotation is displayed when RBW/Span < 0.01.

Frequency Span	
Range	0 Hz (zero span), 10 kHz to 2.9 GHz
Resolution	Four digits or 20 Hz, whichever is greater.
Accuracy	
Span ≤10 MHz	±2% of span
Span >10 MHz	±3% of span

Frequency Sweep Time	
Range	20 ms to 100 s
Accuracy	
20 ms to 100 s	±3%
Sweep Trigger	Free Run, Single, Line, Video, External

Resolution Bandwidth	
Range	1 kHz to 3 MHz, 8 selectable resolution (3 dB) bandwidths in 1-3-10 sequence. 9 kHz and 120 kHz (6 dB) EMI bandwidths.
Accuracy	
3 dB bandwidths	±20%

Stability	
Noise Sidebands	(1 kHz RBW, 30 Hz VBW and sample detector)
>10 kHz offset from CW signal	≤–90 dBc/Hz
>20 kHz offset from CW signal	≤–100 dBc/Hz
>30 kHz offset from CW signal	≤–105 dBc/Hz
Residual FM	
1 kHz RBW, 1 kHz VBW	≤250 Hz pk-pk in 100 ms
System-Related Sidebands	
>30 kHz offset from CW signal	≤–65 dBc

Calibrator Output Frequency	300 MHz ±(freq. ref. error* × 300 MHz)
* frequency reference error = (aging rate × period of time since adjustment + initial achievable accuracy + temperature stability). See "Frequency Characteristics."	

Amplitude Specifications

Amplitude Range	–112 dBm to +30 dBm

Maximum Safe Input Level	
Average Continuous Power	+30 dBm (1 W, 7.1 V rms), input attenuation ≥10 dB.
Peak Pulse Power	+50 dBm (100 W) for <10 µs pulse width and <1% duty cycle, input attenuation ≥30 dB.
dc	0 V (dc coupled)
	50 V (ac coupled)

Gain Compression	
>10 MHz	≤0.5 dB (total power at input mixer* –10 dBm)
* Mixer Power Level (dBm) = Input Power (dBm) – Input Attenuation (dB).	

Displayed Average Noise Level	(Input terminated, 0 dB attenuation, 30 Hz VBW, sample detector)
	1 kHz RBW
400 kHz to <5 MHz	≤–107 dBm
5 MHz to 2.9 GHz	≤–112 dBm

Spurious Responses	
Second Harmonic Distortion	
>10 MHz	<–70 dBc for –40 dBm tone at input mixer.*
Third Order Intermodulation Distortion	
>10 MHz	<–70 dBc for two –30 dBm tones at input mixer* and >50 kHz separation.
Other Input Related Spurious	<–65 dBc at ≥30 kHz offset, for –20 dBm tone at input mixer ≤2.9 GHz.
* Mixer Power Level (dBm) = Input Power (dBm) – Input Attenuation (dB).	

Residual Responses	(Input terminated and 0 dB attenuation)
150 kHz to 2.9 GHz	<–90 dBm

Display Range	
Log Scale	0 to –70 dB from reference level is calibrated; 0.1, 0.2, 0.5 dB/division and 1 to 20 dB/division in 1 dB steps; eight divisions displayed.
Linear Scale	eight divisions
Scale Units	dBm, dBmV, dBµV, mV, mW, nV, nW, pW, µV, µW, V, and W

Marker Readout Resolution	0.05 dB for log scale 0.05% of reference level for linear scale

Reference Level	
Range	
Log Scale	Minimum amplitude to maximum amplitude**
Linear Scale	–99 dBm to maximum amplitude**
Resolution	
Log Scale	±0.01 dB
Linear Scale	±0.12% of reference level
Accuracy	(referenced to –20 dBm reference level, 10 dB input attenuation, at a single frequency, in a fixed RBW)
0 dBm to –59.9 dBm	±(0.3 dB + 0.01 × dB from –20 dBm)
–60 dBm and below	
1 kHz to 3 MHz RBW	±(0.6 dB + 0.01 × dB from –20 dBm)

** See "Amplitude Range."

Frequency Response (dc coupled)	(10 dB input attenuation)	
	Absolute §	**Relative Flatness** †
9 kHz to 2.9 GHz	±1.5 dB	±1.0 dB

† Referenced to midpoint between highest and lowest frequency response deviations.

§ Referenced to 300 MHz CAL OUT.

Calibrator Output	
Amplitude	–20 dBm ±0.4 dB

Absolute Amplitude Calibration Uncertainty ‡‡	±0.15 dB

‡‡ Uncertainty in the measured absolute amplitude of the CAL OUT signal at the reference settings after CAL FREQ and CAL AMPTD self-calibration. Absolute amplitude reference settings are: Reference Level –20 dBm; Input Attenuation 10 dB; Center Frequency 300 MHz; Res BW 3 kHz; Video BW 300 Hz; Scale Linear; Span 50 kHz; Sweep Time Coupled, Top Graticule (reference level), Corrections ON, DC Coupled.

Input Attenuator	
Range	0 to 70 dB, in 10 dB steps

Resolution Bandwidth Switching Uncertainty	(At reference level, referenced to 3 kHz RBW)
3 kHz to 3 MHz RBW	±0.4 dB
1 kHz RBW	±0.5 dB

Linear to Log Switching	±0.25 dB at reference level

Display Scale Fidelity	
Log Maximum Cumulative	
0 to –70 dB from Reference Level	
3 kHz to 3 MHz RBW	± (0.3 dB + 0.01 × dB from reference level)
RBW ≤ 1 kHz	± (0.4 dB + 0.01 × dB from reference level)
Log Incremental Accuracy	
0 to –60 dB from Reference Level	±0.4 dB/4 dB
Linear Accuracy	±3% of reference level

Frequency Characteristics

These are not specifications. Characteristics provide useful but nonwarranted information about instrument performance.

Frequency Reference	
Initial Achievable Accuracy	$\pm 0.5 \times 10^{-6}$
Aging	$\pm 1.0 \times 10^{-7}$/day

Stability	
Drift* (after warmup at stabilized temperature)	
Frequency Span ≤10 MHz, Free Run	<2 kHz/minute of sweep time
* Because the analyzer is locked at the center frequency before each sweep, drift occurs only during the time of one sweep. For Line, Video or External trigger, additional drift occurs while waiting for the appropriate trigger signal.	

Resolution Bandwidth (–3 dB)	
Range	1 kHz to 3 MHz, selectable in 1, 3 and 10 increments, and 5 MHz. Resolution bandwidths may be selected manually, or coupled to frequency span.
Shape	Synchronously tuned four poles. Approximately Gaussian shape.
60 dB/3 dB Bandwidth Ratio	
Resolution Bandwidth	
100 kHz to 3 MHz	15:1
30 kHz	16:1
3 kHz to 10 kHz	15:1
1 kHz	16:1

Video Bandwidth (–3 dB)	
Range	30 Hz to 1 MHz, selectable in 1, 3, 10 increments, accuracy ±30% and 3 MHz. Video bandwidths may be selected manually, or coupled to resolution bandwidth and frequency span.
Shape	Post detection, single pole low-pass filter used to average displayed noise.

FFT Bandwidth Factors	**FLATTOP**	**HANNING**	**UNIFORM**
Noise Equivalent Bandwidth†	3.63×	1.5×	1×
3 dB Bandwidth†	3.60×	1.48×	1×
Sidelobe Height	<–90 dB	–32 dB	–13 dB
Amplitude Uncertainty	0.10 dB	1.42 dB	3.92 dB
Shape Factor (60 dB BW/3 dB BW)	2.6	9.1	>300
† Multiply entry by one-divided-by-sweep time.			

Amplitude Characteristics

These are not specifications. Characteristics provide useful but nonwarranted information about instrument performance.

Log Scale Switching Uncertainty	Negligible error

Input Attenuation Uncertainty*	
Attenuator Setting	
0 dB	±0.2 dB
10 dB	Reference
20 dB	±0.4 dB
30 dB	±0.5 dB
40 dB	±0.7 dB
50 dB	±0.8 dB
60 dB	±1.0 dB
70 dB	±1.0 dB

* Referenced to 10 dB input attenuator setting. See the "Amplitude Specifications" table under “Frequency Response (dc coupled)” on page 102

ac Coupled Insertion Loss‡	
100 kHz to 300 kHz	0.7 dB
300 kHz to 1 MHz	0.7 dB
1 MHz to 100 MHz	0.05 dB
100 MHz to 2.9 GHz	0.05 dB + $(0.06 \times F)^{\dagger}$ dB

† F = frequency in GHz.

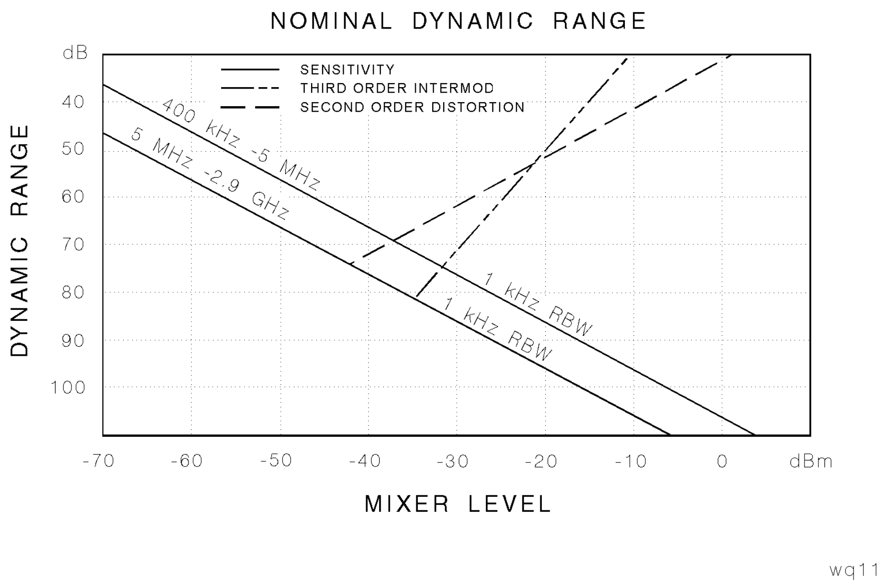
‡ Referenced to dc coupled mode.

Input Attenuator 10 dB Step Uncertainty	(Attenuator setting 10 to 70 dB) ±0.8 dB/10 dB

Input Attenuator Repeatability	±0.05 dB

RF Input SWR		
10 dB attenuation	**dc Coupled**	**ac Coupled**
300 MHz	1.15:1	1.4:1
10 dB to 70 dB attenuation		
100 kHz to 300 kHz	1.3:1	2.3:1
300 kHz to 1 MHz	1.3:1	1.4:1
1 MHz to 2.9 GHz	1.3:1	1.3:1

DYNAMIC RANGE



Immunity Testing	
Radiated Immunity	When tested at 3 V/m according to IEC 801-3/1984 the displayed average noise level will be within specifications over the full immunity test frequency range of 27 to 500 MHz except that at immunity test frequencies of 278.6 MHz ± selected resolution bandwidth and 321.4 MHz ± selected resolution bandwidth the displayed average noise level may be up to –45 dBm. When the analyzer tuned frequency is identical to the immunity test signal frequency there may be signals of up to –70 dBm displayed on the screen.
Electrostatic Discharge	When an air discharge of up to 8 kV according to IEC 801-2/1991 occurs to the shells of the BNC connectors on the rear panel of the instrument spikes may be seen on the CRT display. Discharges to center pins of any of the connectors may cause damage to the associated circuitry.

Physical Characteristics

Front-Panel Inputs and Outputs

INPUT 50Ω	
Connector	Type N female
Impedance	50 Ω nominal

PROBE POWER‡	
Voltage/Current	+15 Vdc, ±7% at 150 mA max.
	–12.6 Vdc ±10% at 150 mA max.
‡ Total current drawn from the +15 Vdc on the PROBE POWER and the AUX INTERFACE cannot exceed 150 mA. Total current drawn from the –12.5 Vdc on the PROBE POWER and the –15 Vdc on the AUX INTERFACE cannot exceed 150 mA.	

Rear-Panel Inputs and Outputs

10 MHz REF OUTPUT	
Connector	BNC female
Impedance	50 Ω nominal
Output Amplitude	>0 dBm

EXT REF IN	
Connector	BNC female Note: Analyzer noise sideband and spurious response performance may be affected by the quality of the external reference used.
Input Amplitude Range	–2 to +10 dBm
Frequency	10 MHz

AUX IF OUTPUT	
Frequency	21.4 MHz
Amplitude Range	–10 to –60 dBm
Impedance	50 Ω nominal

AUX VIDEO OUTPUT	
Connector	BNC female
Amplitude Range	0 to 1 V (uncorrected)

EXT KEYBOARD *(Option 041 or 043)*	Interface compatible with HP part number C1405B using adapter C1405-60015 and most IBM/AT non-auto switching keyboards.

EXT TRIG INPUT	
Connector	BNC female
Trigger Level	Positive edge initiates sweep in EXT TRIG mode (TTL).

HI-SWEEP IN/OUT	
Connector	BNC female
Output	High = sweep, Low = retrace (TTL)
Input	Open collector, low stops sweep.

MONITOR OUTPUT *(Spectrum Analyzer Display)*	
Connector	BNC female
Format	
SYNC NRM	Internal Monitor
SYNC NTSC	NTSC Compatible
	15.75 kHz horizontal rate
	60 Hz vertical rate
SYNC PAL	PAL Compatible
	15.625 kHz horizontal rate
	50 Hz vertical rate

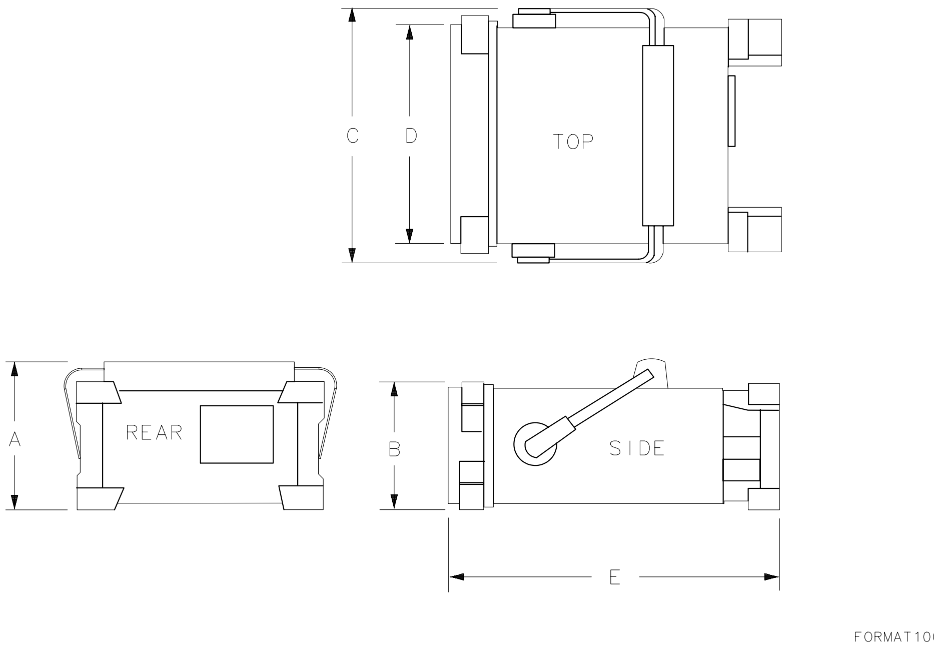
REMOTE INTERFACE	
HP-IB and Parallel *(Option 041)*	HP 10833A, B, C or D and 25 pin subminiature D-shell, female for parallel
HP-IB Codes	SH1, AH1, T6, SR1, RL1, PP0, DC1, C1, C2, C3 and C28
RS-232 and Parallel *(Option 043)*	9 pin subminiature D-shell, male for RS-232 and 25 pin subminiature D-shell, female for parallel

SWEEP OUTPUT	
Connector	BNC female
Amplitude	0 to +10 V ramp

AUX INTERFACE				
Connector Type: 9 Pin Subminiature "D" Connector Pinout				
Pin #	Function	Current	"Logic" Mode	"Serial Bit" Mode
1	Control A	—	TTL Output Hi/Lo	TTL Output Hi/Lo
2	Control B	—	TTL Output Hi/Lo	TTL Output Hi/Lo
3	Control C	—	TTL Output Hi/Lo	Strobe
4	Control D	—	TTL Output Hi/Lo	Serial Data
5	Control I	—	TTL Input Hi/Lo	TTL Input Hi/Lo
6	Gnd	—	Gnd	Gnd
7†	–15 Vdc ±7%	150 mA	—	—
8*	+5 Vdc ±5%	150 mA	—	—
9†	+15 Vdc ±5%	150 mA	—	—
* Exceeding the +5 V current limits may result in loss of factory correction constants. † Total current drawn from the +15 Vdc on the PROBE POWER and the AUX INTERFACE cannot exceed 150 mA. Total current drawn from the –12.6 Vdc on the PROBE POWER and the –15 Vdc on the AUX INTERFACE cannot exceed 150 mA.				

WEIGHT	
Net	
HP 8594L	16.4 kg (36 lb)
Shipping	
HP 8594L	19.1 kg (42 lb)

DIMENSIONS
A = 8 in (200 mm)
B = 7.25 in (184 mm)
C = 14.69 in (373 mm)
D = 13.25 in (337 mm)
E = 18.12 in (460.5 mm)



Regulatory Information

The information on the following pages apply to the HP 8594L spectrum analyzer products.

IEC Compliance

This instrument has been designed and tested in accordance with IEC Publication 348, Safety Requirements for Electronic Measuring Apparatus, and has been supplied in a safe condition. The instruction documentation contains information and warnings which must be followed by the user to ensure safe operation and to maintain the instrument in a safe condition.

Instrument Markings

The CE mark is a registered trademark of the European Community. (If accompanied by a year, it is when the design was proven.)

The CSA mark is a registered trademark of the Canadian Standards Association.

ISM1-A — This is a symbol of an Industrial Scientific and Medical Group 1 Class A product.

Notice for Germany: Noise Declaration

LpA < 70 dB
am Arbeitsplatz (operator position)
normaler Betrieb (normal position)
nach DIN 45635 T. 19 (per ISO 7779)

Declaration of Conformity

DECLARATION OF CONFORMITY

According to ISO/IEC Guide 22 and EN 45014

Manufacturer's Name:

Hewlett-Packard Co. | Hewlett-Packard Ltd.

Manufacturer's Address:

Microwave Instruments Division
1400 Fountaingrove Parkway
Santa Rosa, CA 95403-1799
USA

Queensferry Microwave Division
South Queensferry
West Lothian
EH30 9TG
United Kingdom

Declares that the product:

Product Name:	Spectrum Analyzer
Model Number:	HP 8594L
Product Options:	This declaration covers all options of the above product

Conforms to the following Product specifications:

Safety: IEC 61010-1:1990 / EN 61010-1:1993
CAN/CSA-C22.2 No. 1010.1-92

EMC: CISPR 11:1990/EN 55011:1991 Group 1, Class A
IEC 801-2:1984/EN 50082-1:1992 4 kV CD, 8 kV AD
IEC 801-3:1984/EN 50082-1:1992 3 V/m, 27-500 MHz
IEC 801-4:1988/EN 50082-1:1992 0.5 kV sig. lines, 1 kV power lines

Supplementary Information:
The product herewith complies with the requirements of the Low Voltage Directive 73/23/EEC and the EMC Directive 89/336/EEC and carries the CE-marking accordingly.

Greg Pfeiffer/Quality Engineering Manager
Santa Rosa, 20 May 1998

R M Evans/Quality Manager
South Queensferry, 29 May 1998

European Contact: Your local Hewlett-Packard Sales and Service Office or Hewlett-Packard GmbH Department HQ-TRE, Herreneberger Strasse 130, D71034 Boblingen, Germany (FAX +49-7031-14-3143

3 If You Have a Problem

Your spectrum analyzer is built to provide dependable service. It is unlikely that you will experience a problem. However, Hewlett-Packard's worldwide sales and service organization is ready to provide the support you need.

Calling HP Sales and Service Offices

Sales and service offices are located 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 3-1. In any correspondence or telephone conversations, refer to the spectrum analyzer by its model number and full serial number. With this information, the HP representative can quickly determine whether your unit is still within its warranty period.

Before calling Hewlett-Packard

Before calling Hewlett-Packard or returning the spectrum analyzer for service, please make the checks listed in "Check the Basics".

If you still have a problem, please read the warranty printed at the front of this guide. If your spectrum analyzer is covered by a separate maintenance agreement, please be familiar with its terms.

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

If you want to service the spectrum analyzer yourself after warranty expiration, contact your HP Sales and Service Office to obtain the most current test and maintenance information.

Check the Basics

In general, a problem can be caused by a hardware failure, a software error, or a user error. 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 time spent waiting for instrument repair.

- ❏ Check that the spectrum analyzer is plugged into the proper ac power source.
- ❏ Check that the line socket has power.
- ❏ Check that the rear-panel voltage selector switch is set correctly.
- ❏ Check that the line fuse is good.
- ❏ Check that the spectrum analyzer is turned on.
- ❏ Check that the light above **LINE** is on, indicating that the power supply is on.
- ❏ Check that the other equipment, cables, and connectors are connected properly and operating correctly.
- ❏ Check the equipment settings in the procedure that was being used when the problem occurred.
- ❏ Check that the test being performed and the expected results are within the specifications and capabilities of the spectrum analyzer. Refer to Chapter 2 of this guide.
- ❏ Check the spectrum analyzer display for error messages. Refer to the *HP 8590 E-Series and L-Series Spectrum Analyzers User's Guide*.
- ❏ Check operation by performing the verification procedures in Chapter 1 of this guide. Record all results in the performance test record.
- ❏ Check for problems similar to those described in the *HP 8590 E-Series and L-Series Spectrum Analyzers User's Guide*.

Table 3-1 Hewlett-Packard Sales and Service Offices

UNITED STATES		
Instrument Support Center Hewlett-Packard Company (800) 403-0801		
EUROPEAN FIELD OPERATIONS		
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 Hewlett-Packard Strasse 61352 Bad Homburg v.d.H Germany (49 6172) 16-0
Great Britain Hewlett-Packard Ltd. Eskdale Road, Winnersh Triangle Wokingham, Berkshire RG41 5DZ England (44 118) 9696622		
INTERCON FIELD OPERATIONS		
Headquarters Hewlett-Packard Company 3495 Deer Creek Rd. Palo Alto, CA 94304-1316 USA (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 Hewlett-Packard Japan, Ltd. 9-1 Takakura-Cho, Hachioji Tokyo 192, Japan (81 426) 60-2111	Singapore Hewlett-Packard Singapore (Pte.) Ltd. 150 Beach Road #29-00 Gateway West Singapore 0718 (65) 291-9088	Taiwan Hewlett-Packard Taiwan 8th Floor, H-P Building 337 Fu Hsing North Road Taipei, Taiwan (886 2) 712-0404
China China Hewlett-Packard Co. 38 Bei San Huan X1 Road Shuang Yu Shu Hai Dian District Beijing, China (86 1) 256-6888		

Returning the Spectrum Analyzer for Service

Use the information in this section if it is necessary to return the spectrum analyzer to Hewlett-Packard.

Package the spectrum analyzer for shipment

Use the following steps to package the spectrum analyzer for shipment to Hewlett-Packard for service:

1. Fill in a service tag (available in the *HP 8590 E-Series and L-Series Spectrum Analyzers User's Guide*.) and attach it to the instrument. Please be as specific as possible about the nature of the problem. Send a copy of any or all of the following information:
   - Any error messages that appeared on the spectrum analyzer display.
   - A completed Performance Test record located in Chapter 1 of this guide.
   - Any other specific data on the performance of the spectrum analyzer.

CAUTION Spectrum analyzer damage can result from using packaging materials other than those specified. Never use styrene pellets in any shape as packaging materials. They do not adequately cushion the instrument or prevent it from shifting in the carton.

Styrene pellets cause equipment damage by generating static electricity and by lodging in the spectrum analyzer fan.

2. Use the original packaging materials or a strong shipping container that is made of double-walled, corrugated cardboard with 159 kg (350 lb) bursting strength. The carton must be both large enough and strong enough to accommodate the spectrum analyzer and allow at least 3 to 4 inches on all sides of the spectrum analyzer for packing material.
3. If you have a front-panel cover, install it on the instrument; if not, protect the front panel with cardboard.
4. Surround the instrument with at least 3 to 4 inches of packing material, or enough to prevent the instrument from moving in the carton. If packing foam is not available, 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 Air Cap to reduce static electricity. Wrap the instrument several times in the material to both protect the instrument and prevent it from moving in the carton.

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