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## 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 8590L Spectrum Analyzer

HEWLETT PACKARD

HP Part No. 08590-90269
Printed in USA November 1995

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

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## Assistance

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

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

## Safety Symbols

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

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

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

## General Safety Considerations

Warning — **This is a Safety Class I 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 protective earth contact. Any interruption of the protective conductor, inside or outside the instrument, is likely to make the instrument 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 its 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 8590 Series Spectrum Analyzer Documentation Description

The following guides are shipped with your spectrum analyzer:

***HP 8592L 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 Analyzer 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 E-Series and L-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 E-Series and L-Series Spectrum Analyzer, and HP 8591 C Cable TV Analyzer Assembly-Level Repair Service Guide***

- Describes adjustment and assembly level repair of the analyzer.

***HP 8590 E-Series and L-Series Spectrum Analyzer, and HP 8591 C Cable TV Analyzer, Component-Level Information***

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

## How to Order Guides

Each of the guides listed above 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 spectrum analyzer and want to get ready for use for the first time, do the following:

- Read Chapters 1 and 2 of the ***HP 8590 E-Series and L.-Series Spectrum Analyzer User's Guide***.
- Perform the initial self-calibration routines described in Chapter 2 of the ***HP 8590 E-Series and L-Series Spectrum 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 Chapter 1 of this guide.

After completing the performance verification, use the ***HP 8590 E-Series and L-Series Spectrum Analyzer*** User's ***Guide*** to learn how to use the spectrum analyzer and to find more detailed information about the spectrum analyzer, its applications, and key descriptions.

## This guide uses the following conventions:

| | |
|---|---|
| Front-Panel Key | A boxed, uppercase name in this typeface represents a key physically located on the instrument. |
| Sof tkey | A boxed 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. |

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

# Contents

## 3. If You Have a Problem

# Figures

# Tables

1

# Calibrating

This chapter contains performance 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 tests. See Table l-l for a complete listing of the performance tests.

## Operation Verification

Operation verification consists of a subset of the performance tests. See Table l-l. 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 tests included in this chapter. Select the spectrum analyzer option being calibrated and perform the tests marked in the option column. Note that some of the tests are used for both calibration and operation verification (marked with [•]).

**Table 1-1. Performance Verification Tests**

| Performance Test Name | Calibration for Instrument Option: | | | |
|---|---|---|---|---|
| | Std[1] | 001 | 010 | 011 |
| 1. 10 MHz Reference Output Accuracy | • | • | • | • |
| 2. Frequency Readout and Marker Count Accuracy | [•] | [•] | [•] | [•] |
| 3. Noise Sidebands | [•] | [•] | [•] | [•] |
| 4. System Related Sidebands | • | • | • | • |
| 5. Frequency Span Readout Accuracy | • | • | • | • |
| 6. Residual FM | • | • | • | • |
| 7. Sweep Time Accuracy | • | • | • | • |
| 8. Scale Fidelity | [•] | [•] | [•] | [•] |
| 9. Reference Level Accuracy | [•] | [•] | [•] | [•] |
| 3. Absolute Amplitude Calibration and Resolution Bandwidth Switching Uncertainties | [•] | [•] | [•] | [•] |
| 1. Resolution Bandwidth Accuracy | • | • | • | • |
| 2. Calibrator Amplitude Accuracy | [•] | [•] | [•] | [•] |
| 3. Frequency Response | [•] | [•] | [•] | [•] |
| 4. Other Input Related Spurious Responses | • | • | • | • |
| 5. Spurious Response* | [•] | [•] | [•] | [•] |
| 3. Gain Compression | • | • | • | • |
| 7. Displayed Average Noise Level | [•] | [•] | [•] | [•] |
| 3. Residual Responses | • | • | • | • |
| ). Absolute Amplitude, Vernier, and Power Sweep Accuracy | | | • | • |
| ). Tracking Generator Level Flatness | | | • | • |
| l. Harmonic Spurious Outputs | | | • | • |
| 2. Non-Harmonic Spurious Outputs | | | • | • |
| 3. Tracking Generator Feedthrough | | | • | • |

Use this column for **all** other options not listed in this table.

2 "Part 2: Third Order Intermodulation Distortion, 50 MHz" is not required for operation verification.

## Safety

Familiarize yourself with the safety symbols marked on the pulse generator, and read the general safety instructions and the symbol definitions given in the front of this manual before you begin verifying performance of the pulse generator.

## 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 Analyzer 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 Analyzer 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 Test Record described in "Recording the Test Results."

### Test equipment you will need

Tables 1-2 through 1-4 lists the recommended test equipment for the performance tests. The tables also lists recommended equipment for the spectrum analyzer adjustment procedures which are located in the ***HP 8590 E-Series and L-Series Spectrum Analyze?; and HP 8591C*** Cable ***TV Analyzer 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 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 test record. We recommend that you make a copy of the performance 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 . 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.

**Table 1-2. Recommended Test Equipment**

| Equipment | Critical Specifications for Equipment Substitution | Recommended Model | Use[1] |
|---|---|---|---|
| Digital Voltmeter | Input Resistance: $\geq 10$ megohms<br>Accuracy: $\pm 10$ mV on 100 V range | HP 3456A | P,A,T |
| DVM Test Leads | For use with HP 3456A | HP 34118 | A,T |
| Frequency Standard | Frequency: 10 MHz<br>Timebase Accy (Aging): < 1 x $10^{-9}$ /day | HP 5061B | P,A |
| Measuring Receiver | Compatible with Power Sensors<br>dB Relative Mode<br>Resolution: 0.01 dB<br>Reference Accuracy: ± 1.2 % | HP 8902A | P,A,T |
| Microwave Frequency Counter | Frequency Range: 9 MHz to 7 GHz<br>Timebase Accy (Aging): <5 x $10^{-10}$/day | HP 5343A | P,A,T |
| Oscilloscope | Bandwidth: dc to 100 MHz<br>Vertical Scale Factor of 5 V/Div | 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: 100 kHz to 1800 MHz<br>Maximum SWR: 1.60 (100 kHz to 300 kHz)<br>1.20 (300 kHz to 1 MHz)<br>1.1 (1 MHz to 2.0 GHz)<br>1.30 (2.0 to 2.9 GHz) | HP 8482A | P,A,T |
| Power Sensor[2] | Frequency Range: 1 MHz to 2 GHz<br>Maximum SWR: 1.18 (600 kHz to 2.0 GHz) 75 Ω | HP 8483A | P,A,T |
| Power Sensor, Low-Power | Frequency Range: 300 MHz<br>Amplitude Range: -20 dBm to -70 dBm<br>Maximum SWR: 1.1 (300 MHz) | HP 8484A | P,A,T |

1 P = Performance Test, A = Adjustment, T = Troubleshooting

2 Option 001 and Option 011 Only

## Table 1-2. Recommended Test Equipment (continued)

| Equipment | Critical Specifications for Equipment Substitution | Recommended Model | Use[1] |
|---|---|---|---|
| Signal Generator | Frequency Range: 1 MHz to 1000 MHz<br>Amplitude Range: -35 to + 16 dBm<br>SSB Noise: <- 120 dBc/Hz at 20 kHz offset | HP 8640B, Option 002 | P,A,T |
| Spectrum Analyzer, Microwave | Frequency Range: 100 kHz to 7 GHz<br>Relative Amplitude Accuracy:<br>100 kHz to 1.8 GHz: <±1.8 dB<br>Frequency Accuracy: <±10 kHz @ 7 GHz | HP 8566A/B | P,A,T |
| Synthesized Sweeper | Frequency Range: 10 MHz to 1.8 GHz<br>Frequency Accuracy (CW): ± 0.02%<br>Leveling Modes: Internal and External<br>Modulation Modes: AM<br>Power Level Range: -35 to + 16 dBm | HP 8340A/B | P,A,T |
| synthesizer/Function Generator | Frequency Range: 0.1 Hz to 500 Hz<br>Frequency Accuracy: ±0.02%<br>Waveform: Triangle | HP 3325B | P,T |
| synthesizer/Level Generator | Frequency Range: 1 kHz to 80 MHz<br>Amplitude Range: + 12 to -85 dBm<br>Flatness: ±0.15 dB<br>Attenuator Accuracy: ±0.09 dB | HP 3335A | P,A,T |

1 P = Performance Test, A = Adjustment, T = Troubleshooting

## Table 1-3. Recommended Accessories

| Equipment | Critical Specifications for Accessory Substitution | Recommended Model | Use[1] |
|---|---|---|---|
| Active Probe | 5 Hz to 500 MHz<br>300 kHz to 3 GHz | HP 41800A<br>HP 85024A | T |
| Adapter | APC 3.5 (f) to APC 3.5 (f) | 5061-5311 | P,A,T |
| Adapter | BNC (f) to dual banana plug | 1251-1277 | P,A,T |
| Adapter | BNC (m) to BNC (m) | 1250-0216 | P,A,T |
| Adapter[2] | BNC (m) to BNC (m), 75 Ω | 1250-1288 | P,A,T |
| Adapter | BNC (f) to SMB (m) | 1250-1237 | A,T |
| Adapter | BNC tee (m) (f) (f) | 1250-0781 | T |
| Adapter | Type N (f) to APC 3.5 (f) | 1250-1745 | P,A,T |
| Adapter | Type N (f) to APC 3.5 (m) | 1250-1750 | P,A,T |
| Adapter | Type N (m) to APC 3.5 (m) | 1250-1743 | P,A,T |
| Adapter | Type N (f) to BNC (f) | 1250-1474 | P,A,T |
| Adapter | Type N (f) to BNC (m) | 1250-1477 | P,A,T |
| Adapter[2] | Type N (f) to BNC (m), 75 Ω | 1250-1534 | 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 (m) to N (m) | 1250-1475 | P,A,T |
| Adapter | Type N (f) to N (f), 75 Ω | 1250-1529 | P,A,T |
| Adapter[2] | Type N (f), 75 Ω, to Type N (m), 50 Ω | 1250-0597 | P,A,T |
| Adapter | SMB (f) to SMB (f) | 1250-0692 | A,T |
| Adapter | SMB (m) to SMB (m) | 1250-0813 | A,T |
| Adapter,[2]<br>Minimum Loss | 50 to 75 Ω, matching<br>Frequency Range: dc to 2 GHz<br>Insertion Loss: 5.7 dB | HP 11852B | P,A,T |

1 P = Performance Test, A = Adjustment, T = Troubleshooting

2 Option 001 and Option 011 Only

## Table 1-3. Recommended Accessories (continued)

| Equipment | Critical Specifications for Accessory Substitution | Recommended Model | Use[1] |
|---|---|---|---|
| Attenuator. 10 dB | Type N (m to f)<br>Frequency: 300 MHz | HP 8491A<br>Option 010 | P,A,T |
| Attenuator, 1 dB Step | Attenuation Range: 0 to 12 dB<br>Frequency Range: 50 MHz<br>Connectors: BNC female | HP 355C | P,A |
| Attenuator, 10 dB Step | Attenuation Range: 0 to 30 dB<br>Frequency Range: 50 MHz<br>Connectors: BNC female | HP 355D | P,A |
| Digital Current Tracer | Sensitivity: 1 mA to 500 mA<br>Frequency Response: Pulse trains to 10 MHz<br>Minimum Pulse Width: 50 ns<br>Pulse Rise Time: <200 ns | HP 547A | T |
| Directional Bridge | Frequency Range: 0.1 to 110 MHz<br>Directivity: >40 dB<br>Maximum VSWR: 1.1:1<br>Transmission Arm Loss: 6 dB (nominal)<br>Coupling Arm Loss: 6 dB (nominal) | HP 8721A | P,T |
| 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<br>Rejection at 80 MHz: >50 dB | 0955-0306 | P,T |
| Low-Pass Filter, 300 MHz | Cutoff Frequency: 300 MHz<br>Bandpass Insertion Loss: <0.9 dB at 300 MHz<br>Stopband Insertion Loss: >40 dB at 435 MHz | 0955-0455 | P,A,T |
| Power Splitter | Frequency Range: 50 kHz to 1.8 GHz<br>Insertion Loss: 6 dB (nominal)<br>Output Tracking: <0.25 dB<br>Equivalent Output SWR: < 1.22: 1 | HP 11667A | P,A |
| Termination, 50 Ω | Impedance: 50 Ω (nominal)<br>*(2 required for Option 010)* | HP 908A | P,T |
| Termination, 75 Ω[2] | Impedance: 75 Ω (nominal)<br>*(2 required for option 011)* | HP 909E<br>Option 201 | P,T |

1 P = Performance Test, A = Adjustment, T = Troubleshooting

2 Option 001 and Option 011 Only

## Table 1-4. Recommended Cables

| Equipment | Critical Specifications for Cable Substitution | Recommended Model | Use[1] |
|---|---|---|---|
| Cable | Type N, 183 cm (72 in) | HP 11500A | P,A,T |
| Cable | Type N, 152 cm (60 in) | HP 11500D | P,A,T |
| Cable | Frequency Range: dc to 1 GHz<br>Length: ≥91 cm (36 in)<br>Connectors: BNC (m) both ends<br>(4 required) | HP 10503A | P,A,T |
| Cable | Frequency Range: dc to 310 MHz<br>Length: 20 cm (9 in)<br>Connectors: BNC (m) both ends | HP 10502A | P,A,T |
| Cable[2] | BNC, 75 Ω, 30 cm (12 in) | 5062-6452 | P,A,T |
| Cable[2] | BNC, 75 Ω, 120 cm (48 in) | 15525-80010 | P,A,T |
| Cable, Test | Length: ≥91 cm (36 in)<br>Connectors: SMB (f) to BNC (m)<br>*(2 required)* | 85680-60093 | A,T |

1 P = Performance Test, A = Adjustment, T = Troubleshooting

2 Option 001 and Option 011 Only

# 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 test is the "10 MHz Frequency Reference Adjustment."

## Equipment Required

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

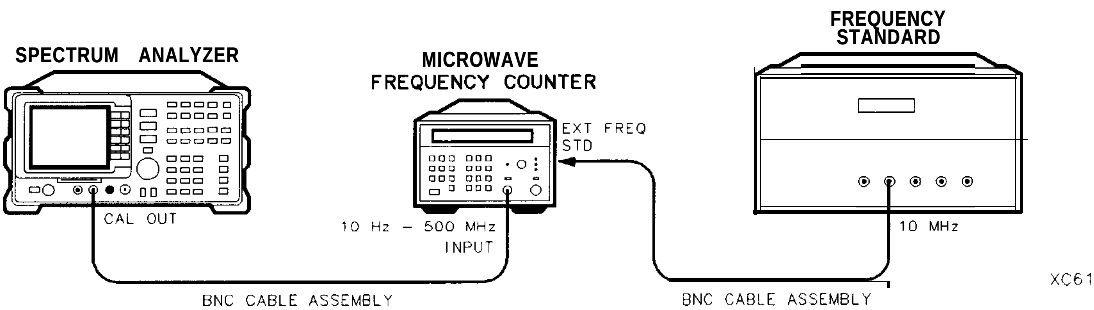



**Figure 1-1. 10 MHz Reference Test Setup**

## 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 to 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:

   SAMPLERATE .................................................. Midrange
   50 Ω/1 MΩ 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 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 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 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)

## Additional Equipment for Option 001

Adapter, minimum loss
Adapter, Type N (f) to BNC (m), 75 Ω

**Caution** Use only 75 Ω cables, connectors, or adapters on the 75 Ω input of an Option 001 or damage to the input connector will occur.

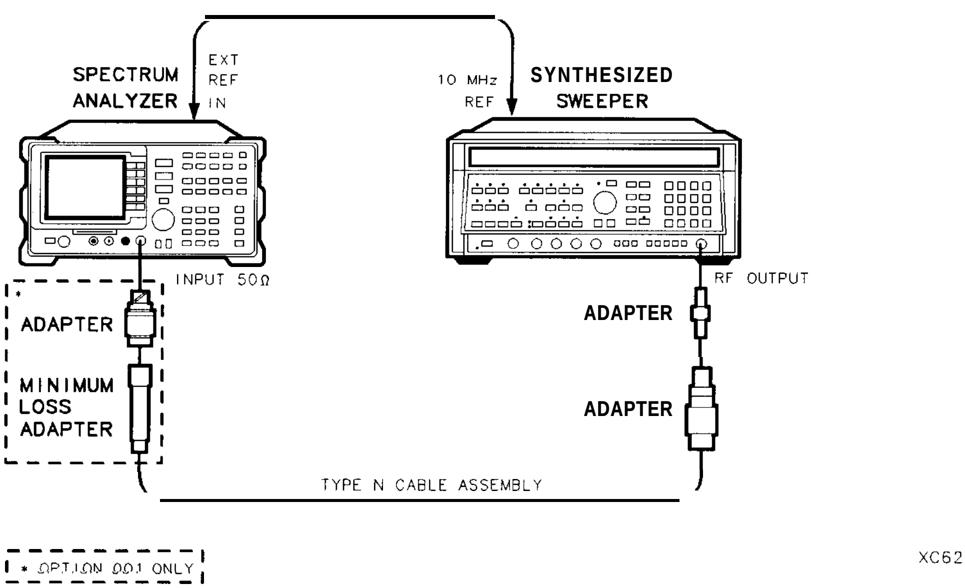



**Figure 1-2. Frequency Readout Accuracy Test Setup**

**2. Frequency Readout and Marker Count Accuracy**

## 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)

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

**Table 1-5. Frequency Readout Accuracy**

| Spectrum Analyzer Span (MHz) | MKR Reading | | |
|---|---|---|---|
| | Min. (MHz) | TR Entry (Actual) | Max. (MHz) |
| 20 | 1.49918 | 1 | 1.50082 |
| 10 | 1.49958 | 2 | 1.50042 |
| 1 | 1.499968 | 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 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 test record. The reading should be within the limits of 1.49999989 GHz and 1.50000011 GHz.

# 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)

## Additional Equipment for 75 Ω Input

Adapter, minimum loss
Adapter, Type N (f) to BNC (m), 75 Ω

**Caution** Use only 75 Ω cables, connectors, or adapters on instruments with 75 Ω inputs, or damage to the input connector will occur.

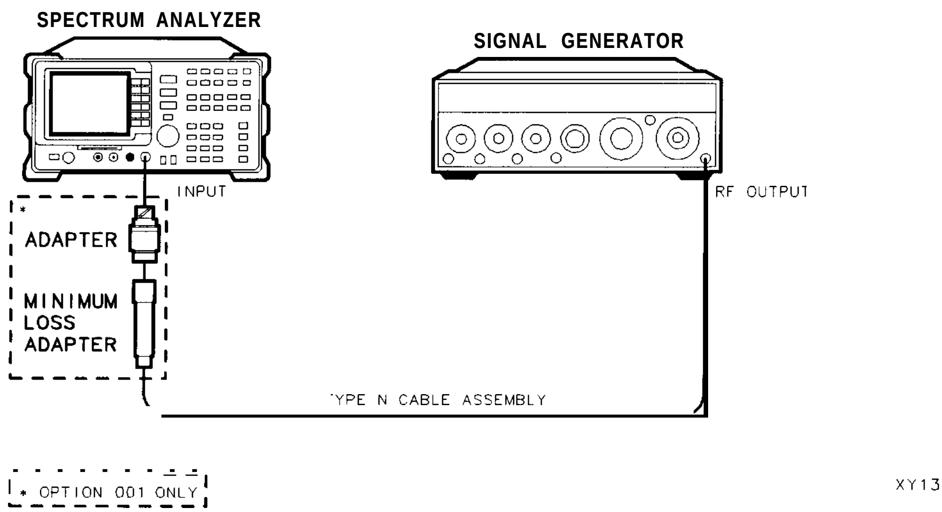



**Figure 1-3. Noise Sidebands Test Setup**

## 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 MAM 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 A 10 (kHz)
   (MKR) MARKER NORMAL

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

**3. Noise Sidebands**

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 $\leq -60$ 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 A** 20 (kHz)
   **MARKER MORMAL**

   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 A** −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 $\leq -70$ 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 $\leq -75$ dBc.

**Noise Sideband Worksheet**

| Description | Measurement |
|---|---|
| Carrier Amplitude | ______dBm *or* dBmV |
| Noise Sideband Level at + 10 kHz | ______dBm *or* dBmv |
| Noise Sideband Level at – 10 kHz | ______dBm *or* dBmv |
| Maximum Noise Sideband Level at ±10 kHz | ______dBm *or* dBmv |
| Noise Sideband Level at + 20 kHz | ______dBm *or* dBmv |
| Noise Sideband Level at -20 kHz | ______dBm *or* dBmv |
| Maximum Noise Sideband Level at ±20 kHz | ______dBm *or* dBmv |
| Noise Sideband Level at + 30 kHz | ______dBm *or* dBmv |
| Noise Sideband Level at -30 kHz | ______dBm *or* dBmv |
| Maximum Noise Sideband Level at ±30 kHz | ______dBm or dBmv |

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

***1 Hz noise-power = (noise-power in dBc) – (10 × 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)

### Additional Equipment for 75 Ω Input

Adapter, minimum loss
Adapter, Type N (f) to BNC (m), 75 Ω

**Caution** Use only 75 Ω cables, connectors, or adapters on instruments with 75 Ω inputs, or damage to the input connector will occur.

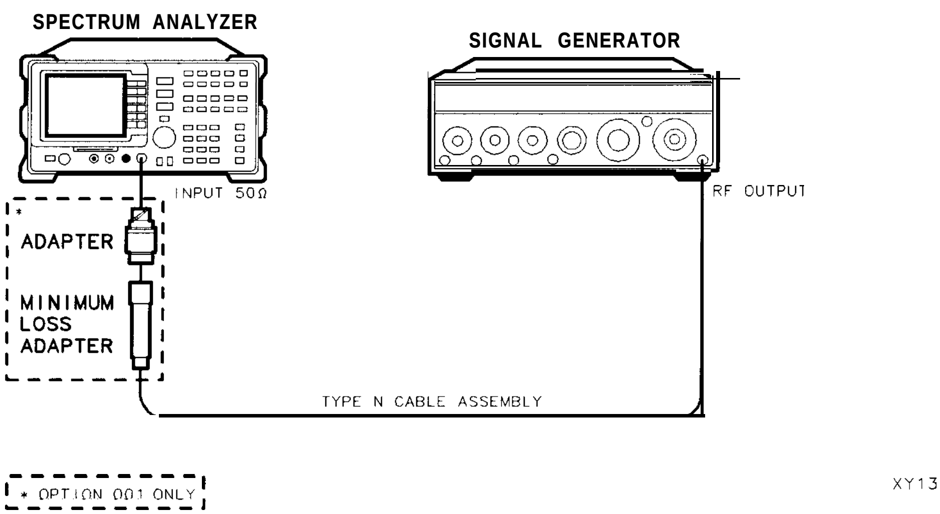



**Figure 1-4. System Related Sidebands Test Setup**

## 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-A 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-A 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)

## Additional Equipment for 75 Ω Input

Adapter, minimum loss
Adapter, Type N (f) to BNC (m), 75 Ω

## Procedure

This performance 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."

## 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.
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. Frequency Span Readout Accuracy

**Caution** Use only 75 Ω cables, connectors, or adapters on instruments with 75 Ω inputs, or damage to the input connector will occur.

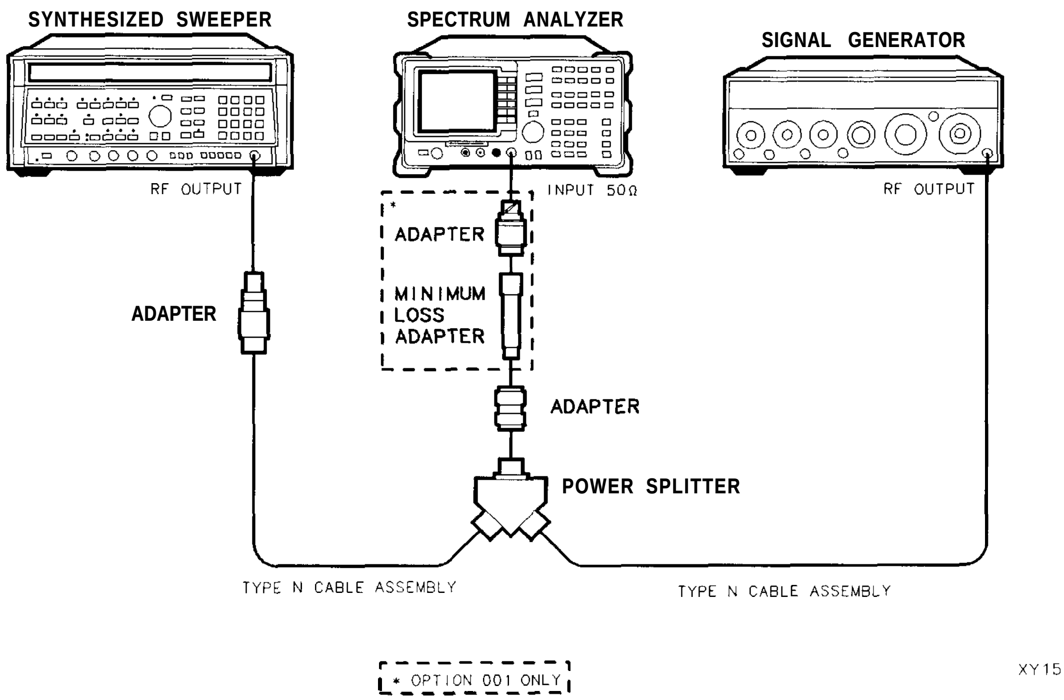



**Figure 1-5. 1800 MHz Frequency Span Readout Accuracy Test Setup**

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 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. Press MARKER A , then continue pressing NEXT PK RIGHT until the marker A is on the right-most signal (1700 MHz).
8. Record the MKR A frequency reading as TR Entry 1 of the performance verification test record.

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

**Caution** Use only 75 Ω cables, connectors, or adapters on instruments with 75 Ω inputs, or damage to the input connector will occur.

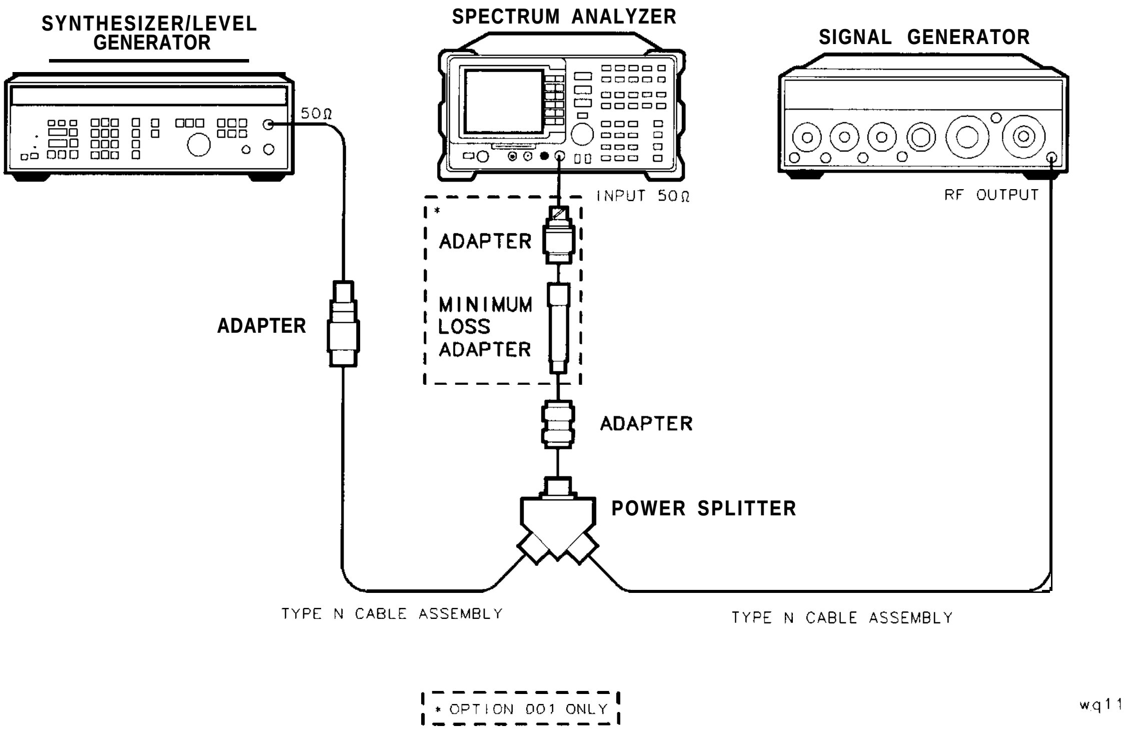



**Figure 1-6. 10.1 MHz to 10 kHz Frequency Span Readout Accuracy Test Setup**

## 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. An additional step to measure the frequency span accuracy at 1 kHz is included for spectrum analyzers equipped with Option 130.

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 test record as TR Entry 2. The MKR-Δ frequency reading should be within the limits shown.
8. Press (MKR), More 1 of 2, then MARKER ALL 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 test record.
12. Repeat steps 8 through 11 for the remaining spectrum analyzer span settings listed in Table 1-6.

## Table 1-6. Frequency Span Readout Accuracy

| Spectrum Analyzer Span Setting | Synthesizer/Level Generator Frequency | Synthesized Sweeper Frequency | MKR-A 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 | 82.06 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)

### Additional Equipment for 75 Ω Input

Adapter, minimum loss
Adapter, Type N (f) to BNC (m), 75 Ω

**Caution** Use only 75 Ω cables, connectors, or adapters on instruments with 75 Ω inputs, or damage to the input connector will occur.

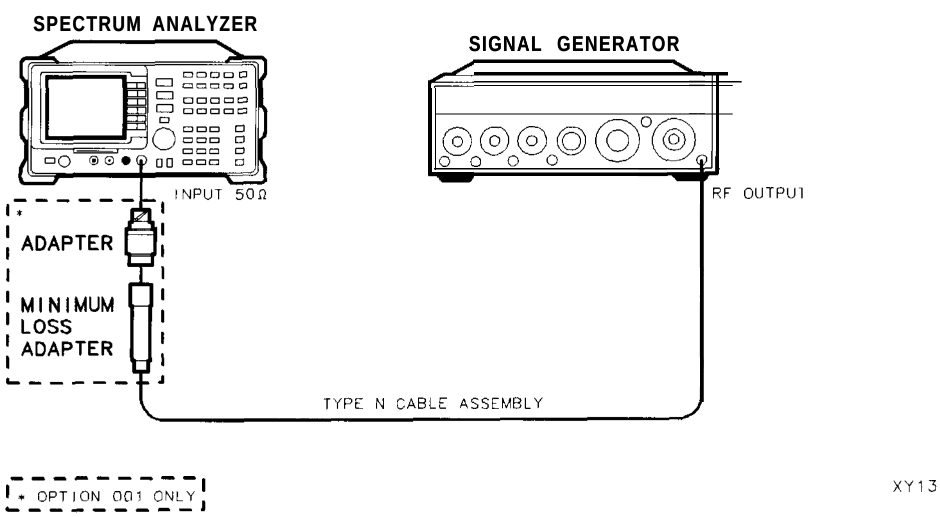



**Figure 1-7. Residual FM Test Setup**

### Procedure

This performance 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
   CW OUTPUT (75 Ω *input only)* . . . . . . . . . . . . . . . . . . . . . . . . . . -4 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) 50 (MHz)
   (SPAN) 1 (MHz)

   ***75 Ω input*** Only: Press (AMPLITUDE), More 1 of 2, Amptd Units , then dBm .

   (AMPLITUDE) −9 (dBm)
   SCALE LOG LIN (LOG) 1 (dB)
   (BW) 1 (kHz)

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 fO.l 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-A amplitude reads – 1 dB ±0.1 dB. Press MARKER A . Rotate the knob counterclockwise until the MKR-A amplitude reads -4 dB fO.l dB.
7. Divide the MKR-A frequency in hertz by the MKR-A amplitude in dB to obtain the slope of the resolution bandwidth filter. For example, if the MKR-A frequency is 1.08 kHz and the MKR-A 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 A . Rotate the knob counterclockwise until the MKR-A amplitude reads -3 dB fO.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-A 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.

# 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)

## Additional Equipment for Option 001

Adapter, minimum loss
Adapter, Type N (f) to BNC (m), 75 Ω

**Caution** Use only 75 Ω cables, connectors, or adapters on the 75 Ω input of an Option 001 or damage to the input connector will occur.

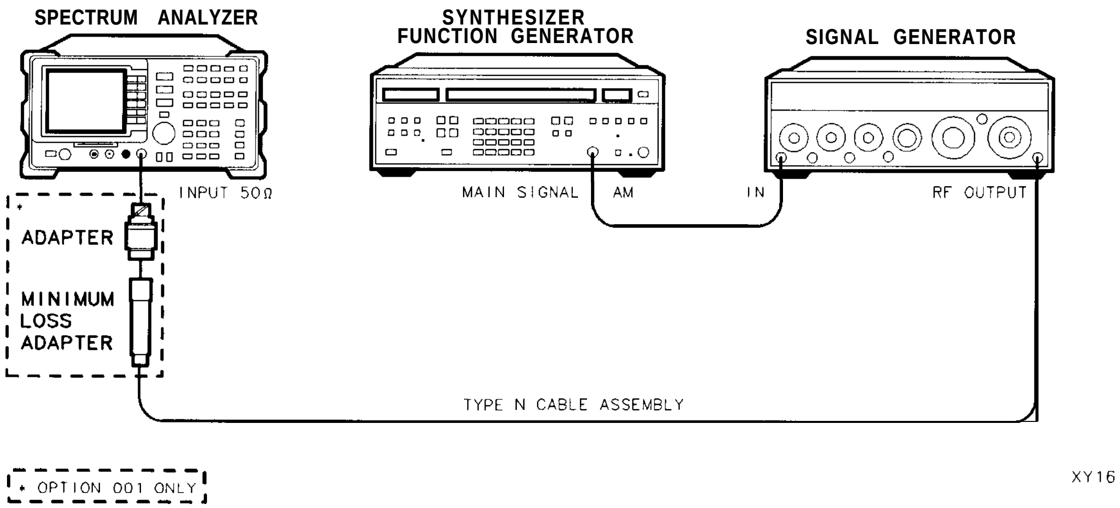



**Figure 1-8. Sweep Time Accuracy Test Setup**

## Procedure

1. Set the signal generator to output a 500 MHz, -10 dBm, CW signal. Set the AM and FM controls to OFF.

   ***Option 001 only:*** Set the output to -4 dBm.

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 and wait for the preset to finish. Set the controls as follows:

   (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 then press the following spectrum analyzer keys:

   (SPAN) ZERO SPAN
   (BW) 3 (MHz)
   (SWEEP TIME) 20 (ms)
   (AMPLITUDE) SCALE LOG LIN (LIN)

   Adjust signal amplitude for a mid-screen display.

5. Set the signal generator AM switch to the AC position.
6. On the spectrum analyzer, press the following keys:

   (TRIG) 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 A , MARKER A, then NEXT PK RIGHT until the marker A is on the eighth signal peak. Record the marker A reading in the performance test record as indicated in Table 1-7.
9. Repeat steps 6 through 8 for the remaining sweep time settings listed in Table 1-7.

**Table 1-7. Sweep Time Accuracy**

| Spectrum Analyzer Sweep Time Setting | Synthesizer/Level Generator Frequency | Minimum Reading | TR Entry (MKR A) | Maximum Reading |
|---|---|---|---|---|
| 20 ms | 500 Hz | 15.4 ms | 1 | 16.6 ms |
| 100 ms | 100 Hz | 77.0 ms | 2 | 83.0 ms |
| 1 s | 10 Hz | 770.0 ms | 3 | 830.0 ms |
| 10 s | 1 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, Type BNC (m) to BNC (m)

## Additional Equipment for Option 001

Adapter, minimum loss
Adapter, Type N (f) to BNC (m), 75 Ω

**Caution** Use only 75 Ω cables, connectors, or adapters on the 75 Ω input of an Option 001 or damage to the input connector will occur.

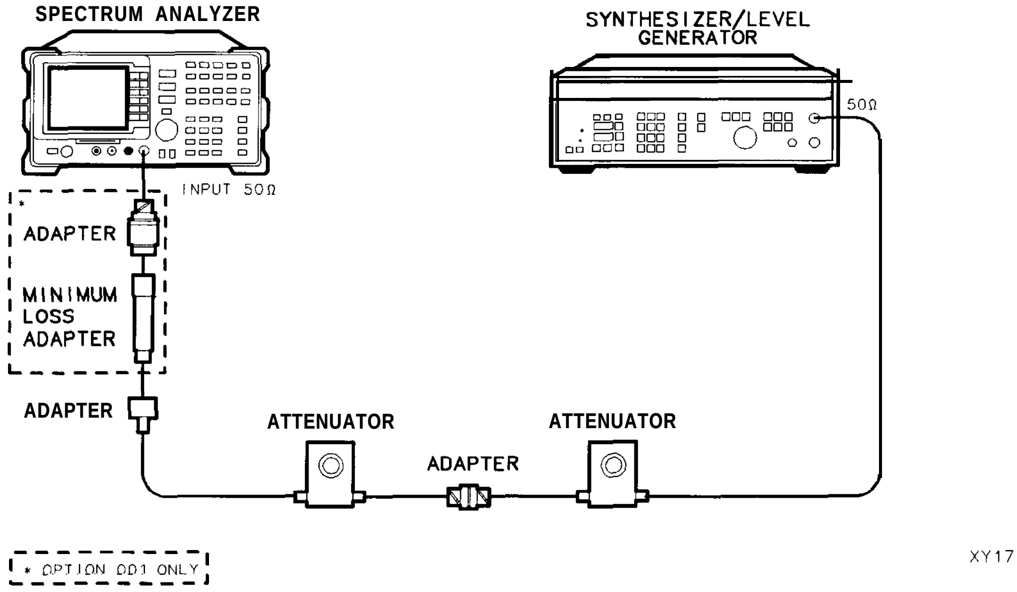



**Figure 1-9. Scale Fidelity Test Setup**

**8. Scale Fidelity**

## Procedure

### Log Scale

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

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

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.

   *Option 001 only:* Set the attenuation of the 10 dB step attenuator to 0 dB. Connect the minimum loss pad to the INPUT 75 Ω using adapters.

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)

   *Option 001 only:* Press (AMPLITUDE), More 1 of 2, Amptd Units, then dBm.

   (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 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 A reading recorded in Table 1-8, subtract the previous Actual MKR A reading. Add 4 dB to the number and record the result as the incremental error in the performance 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 A 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)

    ***Option 001 only:*** Press More 1 of 2 , INPUT Z 50 Ω 75 Ω (50 62).

    (FREQUENCY) 5C (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), then 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 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.

**Table 1-9. Scale Fidelity, Linear Mode**

| Synthesizer/Level Generator Nominal Amplitude | % of Ref Level (nominal) | MKR Reading | | |
|---|---|---|---|---|
| | | Min. (mV) | TR Entry | Max. (mV) |
| +1O 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 | 82.88 |

## Log to Linear Switching

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

**8. Scale Fidelity**

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 ad the Linear/Log Error.

Linear/Log Error__________ dB

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

# 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's 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)

## Additional Equipment for Option 001

Adapter, minimum loss
Adapter, Type N (f) to BNC (m) 75 Ω

| | |
|---|---|
| Caution | Use only 75 Ω cables, connectors, or adapters on the 75 Ω input of an Option 001 or damage to the input connector will occur. |

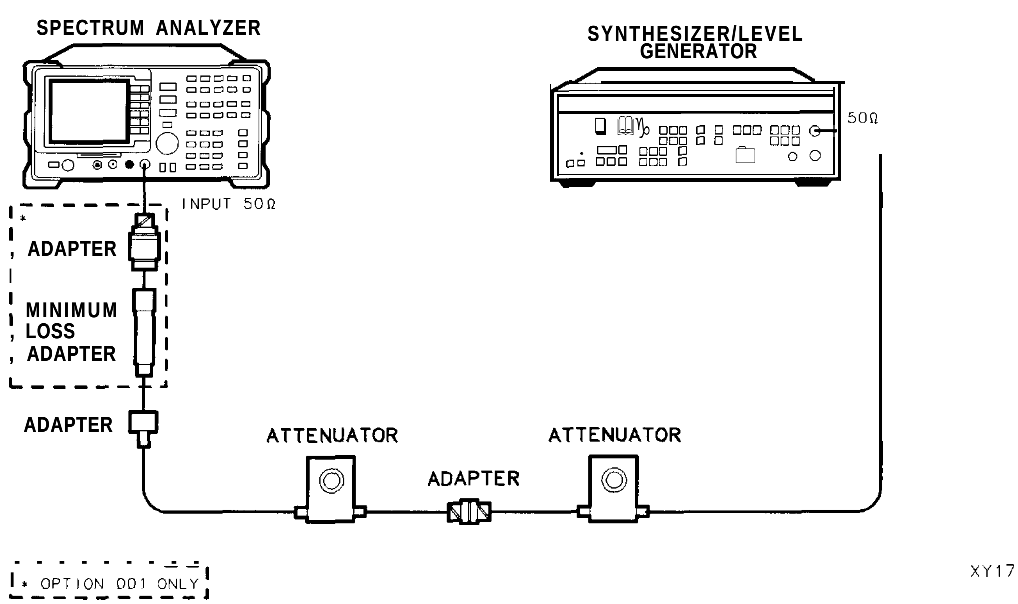



**Figure 1-10. Reference Level Accuracy Test Setup**

**9. Reference Level Accuracy**

## Procedure

## Log Scale

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

   FREQUENCY .......................................................... 50 MHz
   AMPLITUDE ........................................................ −10 dBm
   AMPTDINCR ........................................................ 10 dB
   OUTPUT ........................................................... 5061

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.

   ***Option 001 only:*** Connect the minimum loss adapter to the RF input 75 Ω, using adapters, and set the 10 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)

   ***Option 001 only:*** Press [AMPLITUDE], More 1 of 2, Amptd Units, then dBm .

   [AMPLITUDE] -20 (dBm) SCALE LOG LIM (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 A amplitude reading in the performance test record as indicated in Table 1-10. The MKR A reading should be within the limits shown.

**Table 1-10. Reference Level Accuracy, Log Mode**

| Synthesizer/Level Generator Amplitude (dBm) | Spectrum Analyzer Reference Level (dBm) | MKR A Reading (dB) | | |
|---|---|---|---|---|
| | | 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
    (MKR FCTN) MK TRACK ON OFF (OFF)

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 A amplitude reading in Table 1-11. The MKR A reading should be within the limits shown.

## 9. Reference Level Accuracy

**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 |

# 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)

## Additional Equipment for Option 001

Cable, BNC, 75 Ω, 30 cm (12 in)

**Caution** Use only 75 Ω cables, connectors, or adapters on the 75 Ω input of an Option 001 or damage to the input connector will occur.

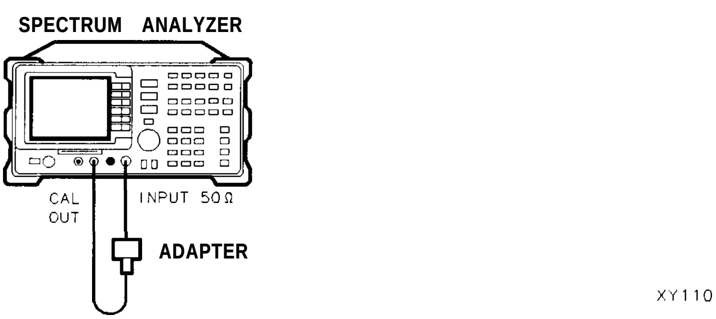



**Figure 1-11. Uncertainty Test Setup**

## Procedure

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

   *Option 001 only:* Use the 75 Ω cable and omit the adapter.

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)

   *Option 001 only:* Press (AMPLITUDE), More 1 of 2, Amptd Units, then dBm.

   (AMPLITUDE) -20 (dBm)
   SCALE LOG LIN (LOG) 1 (dB)

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

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

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)

   *Option 001 only:* Press (AMPLITUDE), More 1 of 2 , Amptd Units , then dBm.

   (SPAN) 50 (kHz)
   (AMPLITUDE) -20 (dBm)
   SCALE LOG LIM (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 a

   (MKR FCTN) MK TRACK ON OFF (OFF)

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

7. Press (PEAK SEARCH), then record the MKR A TRK amplitude reading in the performance test record as indicated in Table 1-12.

   The amplitude reading should be within the limits shown.

8. Repeat steps 6 through 7 for each of the remaining resolution bandwidth and span settings listed in Table 1-12.

## 10. Absolute Amplitude Calibration and Resolution Bandwidth Switching Uncertainties

**Table 1-12. Resolution Bandwidth Switching Uncertainty**

| Spectrum Analyzer | | MKR A 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 |

## 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)

### Additional Equipment for 75 Ω Input

Cable, BNC (75 Ω), 122 cm (48 in)

**Caution** Use only 75 Ω cables, connectors, or adapters on instruments with 75 Ω inputs, or damage to the input connector will occur.

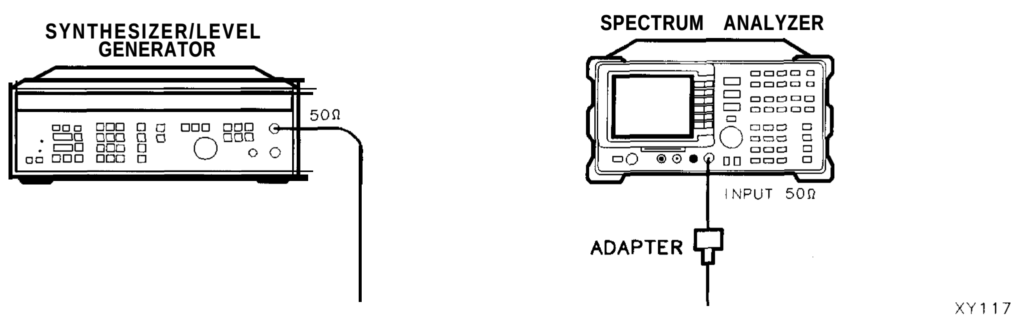



**Figure 1-12. Resolution Bandwidth Accuracy Test Setup**

## Procedure

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

   ***75 Ω input:*** Connect the 75 Ω cable to the OUTPUT 75Ω connector of the synthesizer/level generator.

## 3 dB Bandwidths

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

   ***75 Ω input:*** Set the 50 Ω/75 Ω switch to 75 Ω

   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 Δ) 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 | | | |

## 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 |

## 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 x Frequency Reference]). Perform the 10 MHz Reference Output Accuracy test (Test 1) 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)
APC 3.5 (f) to Type N (f)
Adapter, Type N (f) to BNC (m) ***(two required)***
Adapter, Type N (m) to BNC (f)

### Additional Equipment for 75 Ω Input

Adapter, minimum loss
Adapter, mechanical, 75 Ω to 50 Ω
Adapter, Type N (f) 75 Ω to BNC (m) 75 Ω

### 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

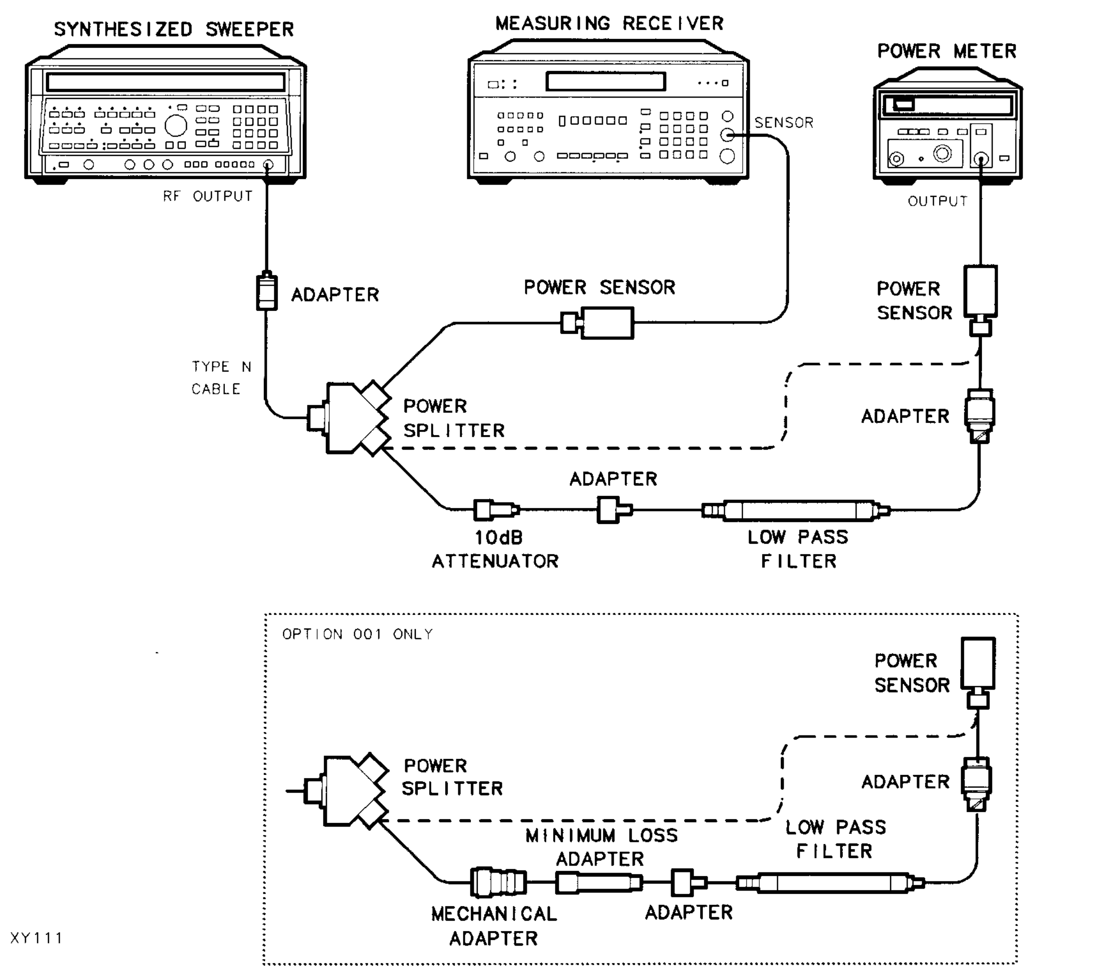



**Figure 1-13. LPF Characterization**

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.

**Caution** Use only 75 Ω cables, connectors, or adapters on instruments with 75 Ω inputs, or damage to the input connector will occur.

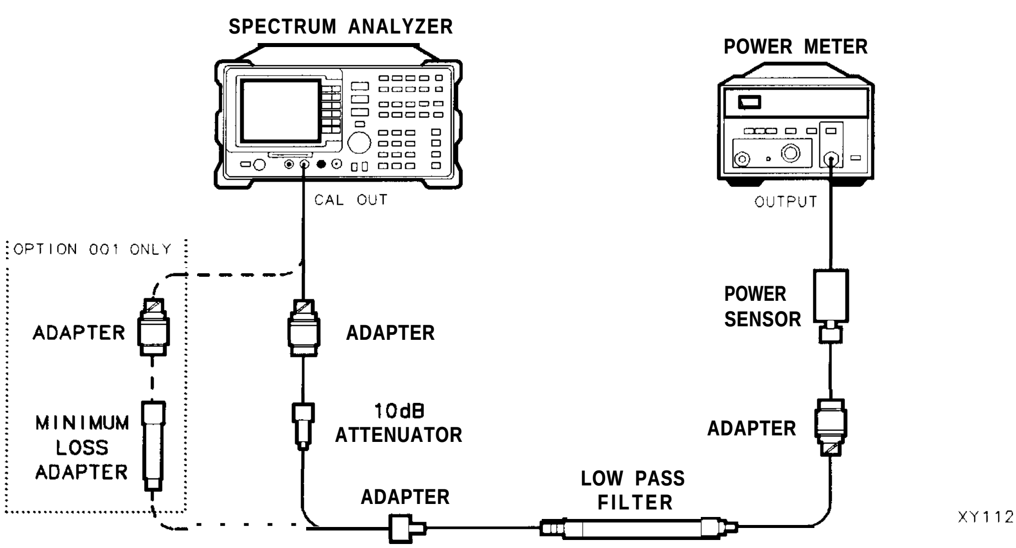



**Figure 1-14. Calibrator Amplitude Accuracy Test Setup**

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.

   ***75 Ω input:*** The CAL OUT power measured on 75 Ω instruments will be the same as 50 Ω instruments. To convert from dBm to dBmV use the following equation, then record this value as TR Entry 2 of the performance verification test record.

   dBmV = dBm + 48.75 dB

   Example: -20 + 48.75 = 28.75 dBmV

**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 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 spectrum analyzer center horizontal graticule line. The measuring receiver, used as a power meter, is placed in RATIO mode. At each new sweeper frequency and spectrum 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).

Testing the flatness of Option 001, INPUT 75 Ω, is accomplished by first characterizing the system flatness.

The related adjustment for this procedure is the "Frequency Response Error Correction."

### Equipment Required

Synthesized sweeper
Measuring receiver (used as a power meter)
Synthesizer/level generator
Power sensor
Power splitter
Adapter, Type N (f) to APC 3.5 (f)
Adapter, Type N (m) to Type N (m)
Cable, BNC, 122 cm (48 in)
Cable, Type N, 183 cm (72 in)

### Additional Equipment for Option 001

Power meter
Power sensor
Adapter, Type N (f) 75 Ω to Type N (m) 50 Ω
Adapter, Type N (m) to BNC (m), 75 Ω
Cable, BNC, 120 cm (48 in) 75 Ω

## System Characterization Procedure for Option 001

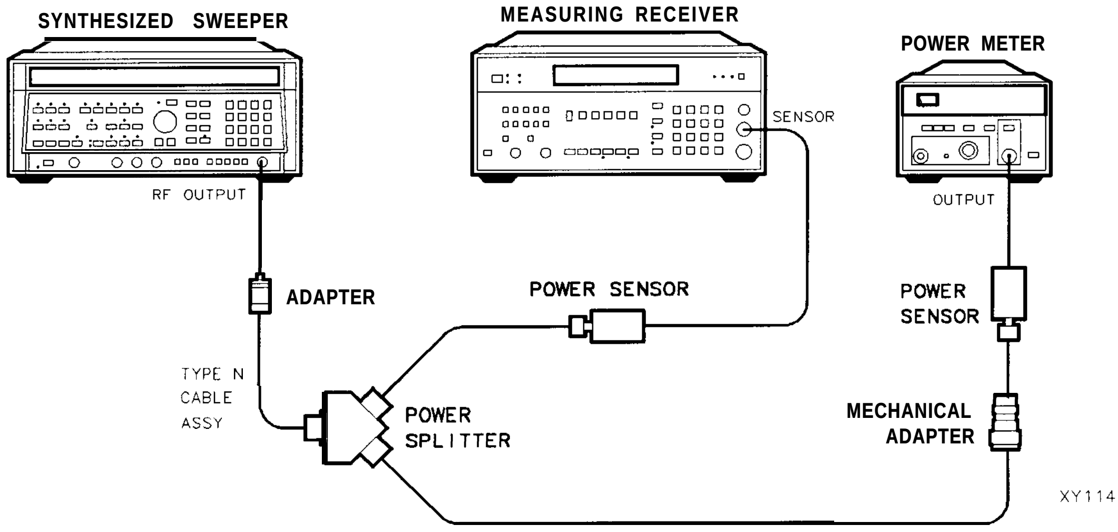



**Figure 1-15. System Characterization Test Setup *(Option 001)***

1. Zero and calibrate the measuring receiver and the power sensor as described in the measuring receiver operation manual.
2. Zero and calibrate the power meter and the 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 . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 50 MHz
   FREQSTEP . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 50 MHz
   POWER LEVEL . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 5 dBm

4. Connect the equipment as shown in Figure 1-15.
5. Adjust the synthesized sweeper power level for a 0 dBm reading on the measuring receiver.
6. Record the power meter reading in Column 4 of Table 1-15, taking into account the Cal Factors of both the power sensors.
7. On the synthesized sweeper, press (CW), and (⇑) (step-up key), to step through the remaining frequencies listed in Table 1-15. At each new frequency repeat steps 5 and 6, entering each power sensor's Cal Factor into the respective power meter.

## 13. Frequency Response

**Caution** Use only 75 Ω cables, connectors, or adapters on the 75 Ω input of an Option 001 or damage to the input connector will occur.

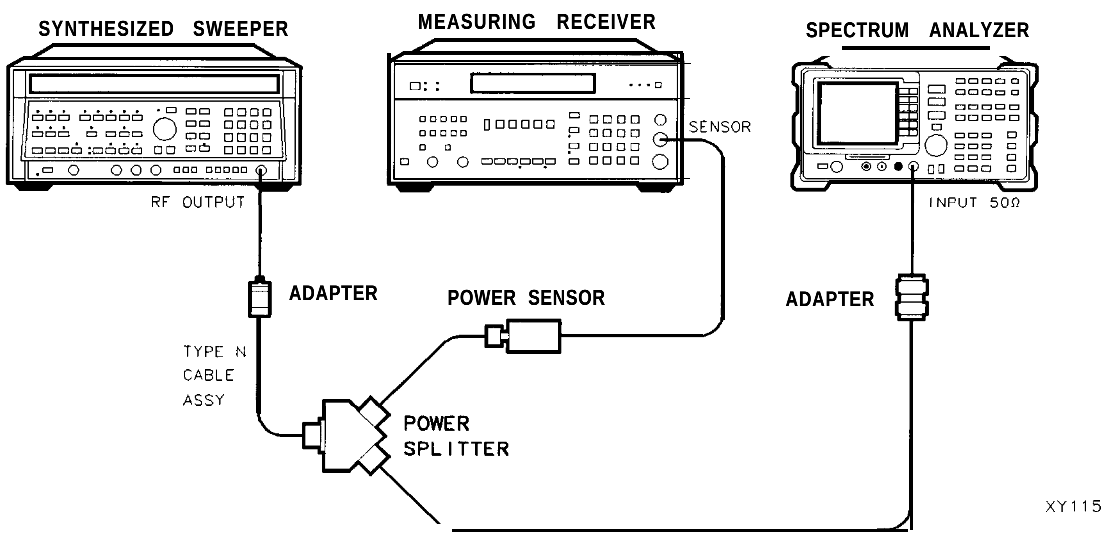



**Figure 1-16. Frequency Response Test Setup, ≥50 MHz**

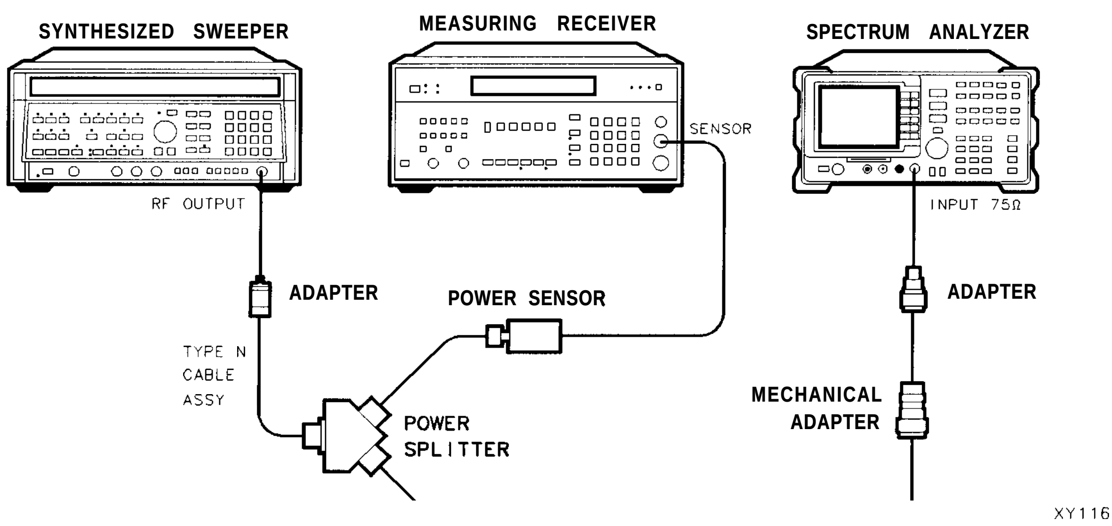



**Figure 1-17. Frequency Response Test Setup, ≥50 MHz, for Option 001**

## Procedure

1. Zero and calibrate the measuring receiver and the power sensor in log mode as described in the measuring receiver operation manual.
2. Connect the equipment as shown in Figure 1-16.

   ***Option 001 only:*** Refer to Figure 1-17.

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

   CW .......................................................... 300 MHz
   FREQSTEP .................................................... 50 MHz
   POWERLEVEL .................................................. -8 dBm

4. On the spectrum analyzer, press (PRESET) and wait for the preset to finish. Set the spectrum analyzer controls as follows:

   (FREQUENCY) 300 (MHz)
   CF STEP AUTO MAN 50 (MHz)
   [SPAN] 10 (MHz)

   *(Option 001 only:* Press (AMPLITUDE), More 1 of 2, Amptd Units , then dBm .

   (AMPLITUDE) 10 (−dBm)
   SCALE LOG LIN (LOG) 1 (dB)
   (BW) 1 (MHz)
   VID BW AUTO MAN 3 (kHz)

5. On the spectrum analyzer, press (PEAK SEARCH), (MKR FCTN), then MK TRACK ON OFF (ON).
6. Adjust the synthesized sweeper power level for a MKR-TRK amplitude reading of -14 dBm ±0.05 dB.
7. Set the sensor Cal Factor on the measuring receiver and then press (RATIO).
8. Set the synthesized sweeper CW to 50 MHz.
9. Set the spectrum analyzer center frequency to 50 MHz by pressing (FREQUENCY) 50 (MHz).
10. Adjust the synthesized sweeper power level for a spectrum analyzer MKR-TRK amplitude reading of -14 dBm ±0.05 dB.
11. Set the sensor Cal Factor on the measuring receiver and record the negative of the power ratio here and in Table 1-15.

    Negative of Measuring Receiver Reading at 50 MHz ________ dB

12. Set the synthesized sweeper CW to 100 MHz.
13. Set the spectrum analyzer center frequency to 100 MHz by pressing [FREQUENCY] 100 (MHz).
14. Adjust the synthesized sweeper power level for a spectrum analyzer MKR-TRK amplitude reading of -14 dBm ±0.05 dB.
15. Set the sensor Cal Factor on the measuring receiver and record the negative of the power ratio displayed on the measuring receiver in Table 1-15 as the Error Relative to 300 MHz.
16. On the synthesized sweeper, press (CW), and (⇑) (step-up key), and on the spectrum analyzer, press (FREQUENCY), and (⇑) (step-up key), 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.

## Frequency Response, (≤ 50 MHz)

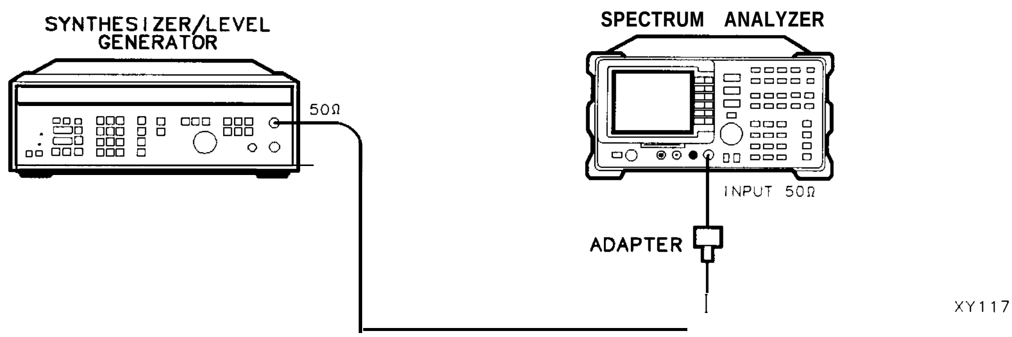



**Figure 1-18. Frequency Response Test Setup (<50 MHz)**

17. Using a cable, connect the synthesizer/level generator directly to the INPUT 50 Ω. Refer to Figure 1-18.

    ***Option 001 only:*** Using a 75 Ω cable, connect the synthesizer/level generator from the 75 Ω OUTPUT to the INPUT 75 Ω and set the 50-75 Ω switch to the 75 Ω position.

    Set the synthesizer/level generator controls as follows:

    FREQUENCY .................................................... 50 MHz
    AMPLITUDE .................................................... −15 dBm
    AMPTD INCR .................................................... 0.05 dB

18. On the spectrum analyzer press the following keys:

    (SPAN) 10 (MHz)
    (FREQUENCY) 50 (MHz)
    (PEAK SEARCH)
    (MKR FCTN) MK TRACK ON OFF (ON)
    (SPAN) 100 (kHz)

    Wait for AUTO ZOOM to finish, then press the following spectrum analyzer keys:

    (BW) 3 (kHz)
    VID BW AUTO MAN 1 (kHz)

19. Adjust the synthesizer/level generator Amplitude until the MKR-TRK reads -14 dBm. This corresponds to the amplitude at 50 MHz recorded in step 11. Record the synthesizer/level generator amplitude below.

    Amplitude Setting (50 MHz) ________ dBm

20. On the spectrum analyzer, press MARKER Δ , (MKR FCTN), then MK TRACK ON OFF (ON).
21. Set the synthesizer/level generator frequency to 20 MHz.
22. On the spectrum analyzer, press the following keys:

    (FREQUENCY)
    CF STEP AUTO MAN 30 (MHz)
    (FREQUENCY)
    (⇩) (step-down key)

23. Adjust the synthesizer/level generator amplitude for a MKR A-TRK amplitude reading of 0.00 ±0.05 dB. Record this amplitude setting in Table 1-16 in Column 2 at 20 MHz.
24. Repeat steps 21 through 23 for each of the frequencies listed in Table 1-16. Change the spectrum analyzer's center frequency step size to the relative frequency change for each new frequency (for example, use 10 MHz CF STEP size when changing from 20 MHz to 10 MHz).

    ***Option 001 only:*** Do not test below 1 MHz.

    When measuring the 50 kHz center-frequency flatness and below, there will be two signals on screen, the LO feedthrough and the signal from the synthesizer/level generator. Ensure that the marker is on the signal from the synthesizer/level generator (to the right of the LO feed through).
25. 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 19. Record the result as the Response Relative to 50 MHz (column 3) in Table 1-16.
26. Add to each of the Response Relative to 50 MHz entries in Table 1-16 the measuring receiver Reading at 50 MHz recorded in step 11. Record the results as the Response Relative to 300 MHz (column 4) in Table 1-16.
27. ***Option 001 only:*** Starting with the error at 50 MHz, subtract Column 4 (System Error) to Column 2 (Error Relative to 300 MHz) and record the result in Column 5 (Corrected Error Relative to 300 MHz).

## Test Results

Perform the following steps to verify the frequency response of the spectrum analyzer.

1. Enter the most positive number from Table 1-16, column 4: ________ dB
2. Enter the most positive number from Table 1-15, column 2: ________ dB
   ***(Option 001 only:*** Use column 5.)
3. Record the more positive of numbers from steps 1 and 2 in TR Entry 1 of the performance test record.
4. Enter the most negative number from Table 1-16, column 4: ________ dB
5. Enter the most negative number from Table 1-15, column 2: ________ dB
   ***(Option 001 only:*** Use column 5.)
6. Record the more negative of numbers from steps 4 and 5 in TR Entry 2 of the performance test record.
7. Subtract the results of step 6 from the results of step 3. Record this value in TR Entry 3 of the performance test record.

   The result should be less than 2.0 dB.

   The absolute values in steps 3 and 6 should be less than 1.5 dB.

## 13. Frequency Response

**Table 1-15. Frequency Response Errors Worksheet**

| Column 1<br>Frequency (MHz) | Column 2<br>Error Relative to 300 MHz (dB) | Column 3<br>Sensor CAL FACTOR Frequency (GHz) | Column 4<br>System Error (dB) | Column 5 (Option 001)<br>Corrected Errol Relative to 300 MHz (dB) |
|---|---|---|---|---|
| 50 | | 0.03 | | |
| 100 | | 0.1 | | |
| 150 | | 0.1 | | |
| 200 | | 0.3 | | |
| 250 | | 0.3 | | |
| 300 (Ref) | | 0.3 | | |
| 350 | | 0.3 | | |
| 400 | | 0.3 | | |
| 450 | | 0.3 | | |
| 500 | | 0.3 | | |
| 550 | | 1.0 | | |
| 600 | | 1.0 | | |
| 650 | | 1.0 | | |
| 700 | | 1.0 | | |
| 750 | | 1.0 | | |
| 800 | | 1.0 | | |
| 850 | | 1.0 | | |
| 900 | | 1.0 | | |
| 950 | | 1.0 | | |
| 1000 | | 1.0 | | |
| 1050 | | 1.0 | | |
| 1100 | | 1.0 | | |
| 1150 | | 1.0 | | |
| 1200 | | 1.0 | | |
| 1250 | | 1.0 | | |
| 1300 | | 1.0 | | |
| 1350 | | 1.0 | | |

## Table 1-15. Frequency Response Errors Worksheet (continued)

| Column 1<br>Frequency (MHz) | Column 2<br>Error Relative to 300 MHz (dB) | Column 3<br>Sensor CAL FACTOR Frequency (GHz) | Column 4<br>System Error (dB) | Column 5<br>(*Option 001*)<br>Corrected Error Relative to 300 MHz (dB) |
|---|---|---|---|---|
| 1400 | | 1.0 | | |
| 1450 | | 1.0 | | |
| 1500 | | 1.0 | | |
| 1550 | | 2.0 | | |
| 1600 | | 2.0 | | |
| 1650 | | 2.0 | | |
| 1700 | | 2.0 | | |
| 1750 | | 2.0 | | |
| 1800 | | 2.0 | | |

## Table 1-16. Frequency Response (<50 MHz) Worksheet

| Column 1<br>Frequency | Column 2<br>Synthesizer/Level Generator Amplitude (dBm) | Column 3<br>Response Relative to 50 MHz | Column 4<br>Response Relative to 300 MHz |
|---|---|---|---|
| 50 MHz | | 0 (Reference) | |
| 20 MHz | | | |
| 10 MHz | | | |
| 5 MHz | | | |
| 1 MHz | | | |
| 200 kHz | | | |
| 50 kHz | | | |
| 9 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 -10 dBm. A marker-amplitude reference is set on the analyzer. The source is then tuned to several different frequencies which should generate image responses. At each source frequency, the source amplitude is set to -10 dBm and the amplitude of the response, if any, is measured using the spectrum analyzer marker function. The marker-amplitude difference is then compared to the specification.

There are no related adjustment procedures for this performance test.

### Equipment Required

Synthesized sweeper
Measuring receiver (used as a power meter)
Power sensor
Adapter, Type N (f) to APC 3.5 (f)
Adapter, Type N (f) to Type N (f)
Cable, Type N, 183 cm (72 in)

### Additional Equipment for Option 001

Power sensor
Adapter, minimum loss
Adapter, Type N (f) to BNC (m), 75 Ω
Adapter, Type N (f) to Type N (f)

**Caution** Use only 75 Ω cables, connectors, or adapters on the 75 Ω input of an Option 001 or damage to the input connector will occur.

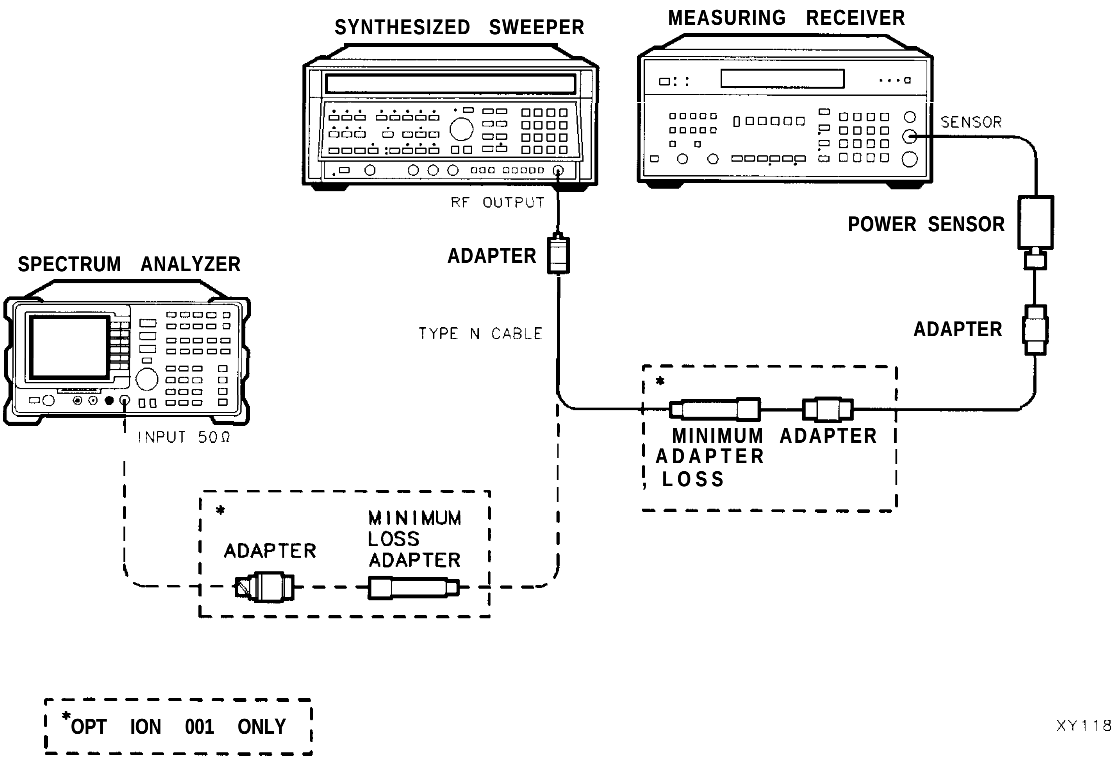



**Figure 1-19. Other Input Related Spurious Test Setup**

## Procedure

1. Zero and calibrate the measuring receiver and the power sensor in log mode so that power is read out in dBm. Enter the power sensor's 542.8 MHz Cal Factor into the measuring receiver.

   ***Option 001 only:*** Use 75 Ω power sensor,

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

   CW . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 542.8 MHz
   POWER LEVEL . . . . . . . . . . . . . . . . . . . . . . . . -10 dBm
   ***Option 001 only:*** POWER LEVEL . . . . . . . . . . . . . . . -14.3 dBm

3. Connect the equipment as shown in Figure 1-19. Connect the output of the synthesizer to the power sensor using adapters.

   *Option 001 only:* Use the minimum loss adapter and 75 Ω adapter to connect to the 75 Ω power sensor.

4. Adjust the synthesized sweeper power level for a -10 dBm ±0.1 dB reading on the measuring receiver.

5. On the synthesized sweeper, press SAVE 1.

6. Enter the power sensor's Cal Factor for 1142.8 MHz into the measuring receiver.

7. Set the CW frequency on the synthesized sweeper to 1142.8 MHz.

8. Adjust the synthesized sweeper power level for a – 10 dBm ±0.1 dB reading on the measuring receiver.
9. On the synthesized sweeper, press SAVE 2.
10. Enter the power sensor's Cal Factor for 500 MHz into the measuring receiver.
11. Set the CW frequency on the synthesized sweeper to 500 MHz.
12. Adjust the synthesized sweeper power level for a – 10 dBm ±0.1 dB reading on the measuring receiver.
13. Connect the synthesized sweeper to the RF INPUT of the spectrum analyzer using the appropriate cable and adapters.

    ***Option 001 only:*** Use the minimum loss adapter and 75 Ω adapter as shown in Figure 1-19.
14. On the spectrum analyzer, press (PRESET) and wait for the preset to finish then set the controls as follows:

    (FREQUENCY) 500 (MHz)
    (SPAN) 10 (MHz)
    (AMPLITUDE) 0 (–dBm)

    *Option **001** only:* Press (AMPLITUDE), More 1 of 2, Amptd Units, then dBm.
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. Press the following spectrum analyzer keys:

    (PEAK SEARCH)
    (MKR ->) **MARKER ->** REF LVL
    (MKR FCTN) MK TRACK ON OFF (OFF)
    (PEAK SEARCH) MARKER Δ
    (AMPLITUDE) (⇩) (step-down)
    (SGL SWP)
16. For each of the frequencies listed in Table 1-17, do the following:
    a. Set the synthesized sweeper to the listed CW frequency by pressing RECALL 1 for a CW frequency of 542.8 MHz or RECALL 2 for a CW frequency of 1148.8 MHz.
    b. Press (SGL SWP) and wait for the completion of a new sweep.
    c. On the spectrum analyzer, press (PEAK SEARCH) and record the marker-delta amplitude reading in Table 1-17 as the Actual MKR ΔAmplitude.

       The Actual MKR A Amplitude should be less than the Maximum MKR A Amplitude listed in the table below.

    The Maximum MKR A Amplitude is 10 dB more positive than the specification. This is due to the 10 dB change in reference level made in step 15.

**Table 1-17. Image Responses Worksheet**

| Synthesized Sweeper CW Frequency | Actual MKR Δ Amplitude (dBc) | Maximum MKR Δ Amplitude (dBc) |
|---|---|---|
| 542.8 MHz | ________ | −55 |
| 1142.8 MHz | ________ | −55 |

17. Record the Maximum MKR A Amplitude from Table 1-17 as TR Entry 1 in the performance test record.

## 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.

‘lb test second harmonic distortion, a 50 MHz low-pass filter is used to filter the source output, ensuring that harmonics read by the spectrum analyzer are internally generated and not coming from the source. To measure the distortion products, the power at the mixer is set 25 dB higher than specified. New test limits have been developed based on this higher power.

With -45 dBm at the input mixer and the distortion products suppressed by 70 dBc, the equivalent Second Order Intercept (SOI) is +25 dBm (-45 dBm + 70 dBc). Therefore, with -20 dBm at the mixer, and the distortion products suppressed by 45 dBc, the equivalent SOI is also +25 dBm (-20 dBm + 45 dBc).

For third order intermodulation distortion, two signals are combined in a directional bridge (for isolation) and are applied to the spectrum 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 test.

### Equipment Required

Synthesizer/level generator
Synthesized sweeper
Measuring receiver ***(used as a power meter)***
Power sensor, 100 kHz to 1800 MHz
50 MHz low pass filter
Directional bridge
Cable, BNC, 120 cm (48 in) ***(two required)***
Adapter, Type N (f) to APC 3.5 (f)
Adapter, Type N (f) to BNC (m)
Adapter, Type N (m) to BNC (f)
Adapter, Type N (m) to BNC (m)

### Additional Equipment for 75 Ω Input

Power sensor, 75 Ω
Adapter, mechanical, 75 Ω to 50 Ω
Adapter, minimum loss
Adapter, Type N (f) to BNC (m), 75 Ω
Adapter, BNC (m) to BNC (m)

Caution Use only 75 Ω cables, connectors, or adapters on instruments with 75 Ω inputs, or damage to the input connector will occur.

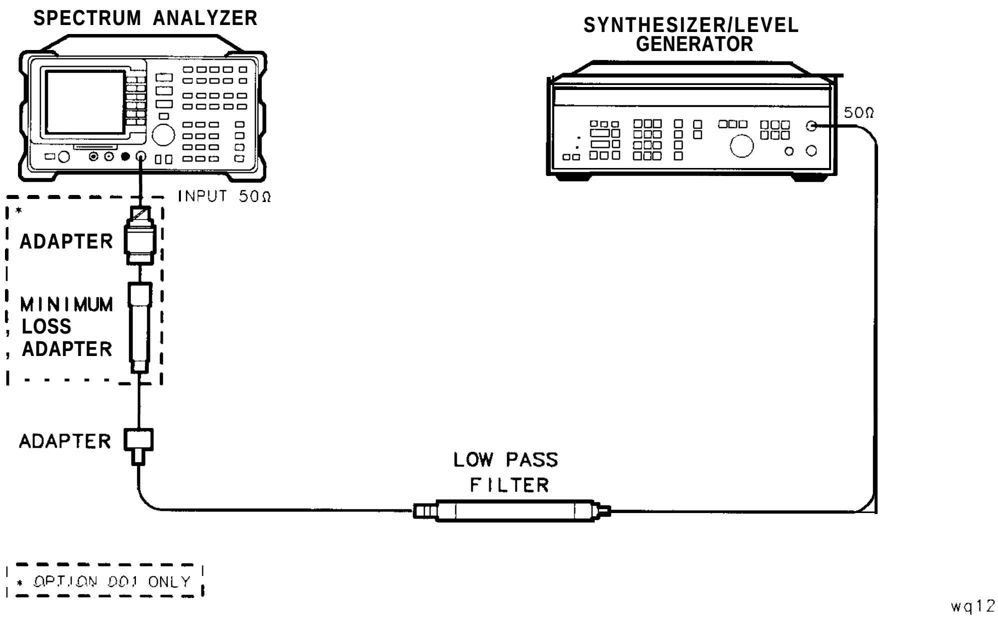



**Figure 1-20. Second Harmonic Distortion Test Setup, 30 MHz**

## Procedure

This performance test consists of two parts:

Part 1: Second Harmonic Distortion, 30 MHz
Part 2: Third Order Intermodulation Distortion, 50 MHz

Perform "Part 1: Second Harmonic Distortion, 30 MHz" before "Part 2: Third Order Intermodulation Distortion, 50 MHz."

Note Part 2: Third Order Intermodulation Distortion, 50 MHz test is not required when performing the operation verification.

## 15. Spurious Response

### Part 1: Second Harmonic Distortion, 30 MHz

1. Set the synthesizer level generator controls as follows:

   FREQUENCY . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 30 MHz
   AMPLITUDE . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . -10 dBm
   AMPLITUDE ***(75 Ω input*** only:) . . . . . . . . . . . . . . . . . . . . . . . . . -4.3 dBm

2. Connect the equipment as shown in Figure 1-20.

   ***75 Ω input only:*** Connect the minimum loss adapter between the LPF and INPUT 75 Ω.

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) 30 (MHz)
   (SPAN) 10 (MHz)

   75 Ω ***input only:*** Press (AMPLITUDE), More 1 of 2, Amptd Units , then dBm .

   (AMPLITUDE) -10 (dBm)
   (PEAK SEARCH)
   (MKR FCTN) MK TRACK ON OFF (ON)
   (SPAN) 1 (MHz)

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

   (MKR FCTN) MK TRACK ON OFF (OFF)
   (BW) 30 (kHz)

5. Adjust the synthesizer level generator amplitude to place the peak of the signal at the reference level (-10 dBm).

6. Set the spectrum analyzer control as follows:

   (BW) 1 (kHz)
   VID BW AUTO MAN 100 (Hz)

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

   (PEAK SEARCH)
   (MKR →) MKR →CF STEP
   (MKR) MARKER Δ
   (FREQUENCY).

8. Press the (⇧), (step-up key) on the spectrum analyzer to step to the second harmonic (at 60 MHz). Press (PEAK SEARCH). Record the MKR Δ Amplitude reading in the performance verification test record as TR Entry 1.

## Part 2: Third Order Intermodulation Distortion, 50 MHz

Perform this procedure for calibrating the spectrum analyzer. It is not necessary to perform this procedure for operation verification.

**Caution** Use only 75 Ω cables, connectors, or adapters on the 75 Ω input of an Option 001 or damage to the input connector will occur.

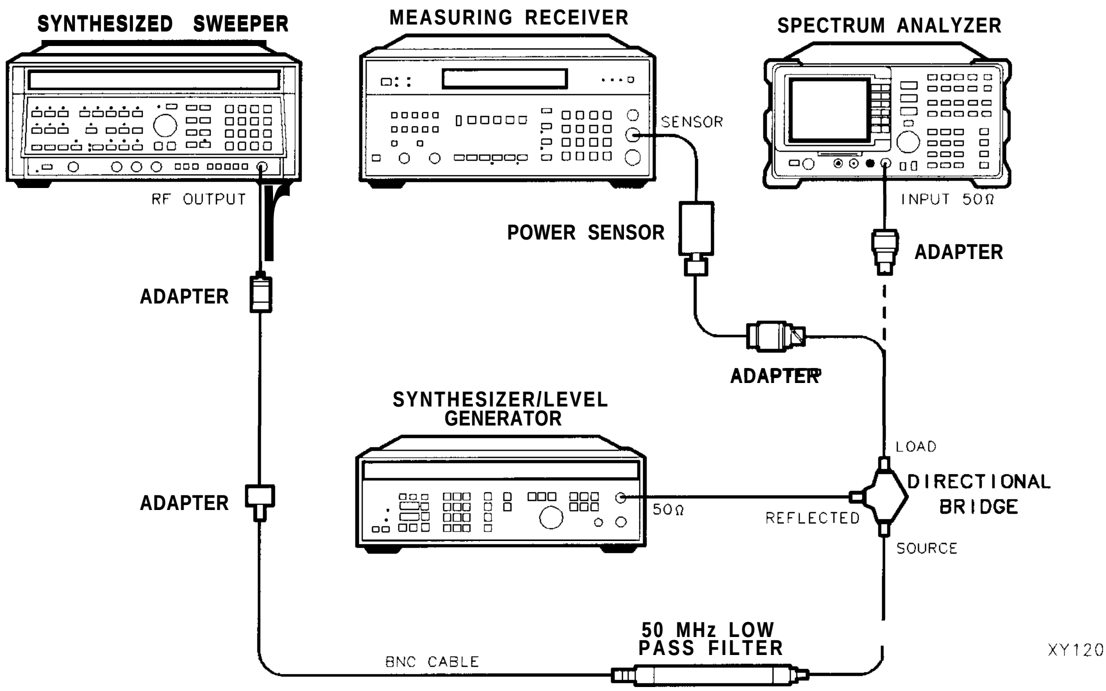



**Figure 1-21. Third Order Intermodulation Distortion Test Setup**

1. Zero and calibrate the measuring receiver and the power sensor in log mode so the power reads out in dBm. Enter the power sensor's 50 MHz Cal Factor into the measuring receiver.

   ***Option 001 only:*** Calibrate the 75 Ω power sensor.

2. Connect the equipment as shown in Figure 1-21 with the output of the directional bridge connected to the power sensor.

   ***Option 001 only:*** The power measured at the output of the 50 Ω directional bridge by the 75 Ω power sensor, is the equivalent power "seen" by the 75 Ω spectrum analyzer. Use the 75 Ω power sensor with the Type N (f) to BNC (m) 75 Ω adapter and use a BNC (m) to BNC (m) 75 Ω adapter in place of the 50 Ω adapter.

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

   POWERLEVEL . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . -6 dBm
   CW . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 50 MHz
   RF . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . OFF

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

   FREQUENCY . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 50.050 MHz
   AMPLITUDE . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . −6 dBm
   50 Ω/75 Ω switch . . . . . . . . . . . . . . . . . . . . . . . . . 75 Ω (no RF output)

5. On the spectrum analyzer, press (PRESET) and wait until the preset is finished then set the controls as follows:

(FREQUENCY) 50 (MHz)
(SPAN) 10 (MHz)

***Option 001 only:*** Press (AMPLITUDE), More 1 of 2, Amptd Units, then dBm .

(AMPLITUDE) 10 (−dBm)
[PEAK SEARCH] Mare 1 of 2
PEAK EXCURSM 3 (dB)
(DISPLAY) More 1 of 2
THRESHLD ON OFF (ON) 90 (−dBm)

6. On the synthesized sweeper, set the RF to ON. Adjust the power level until the measuring receiver reads -12 dBm ±0.05 dB.

7. Disconnect the power sensor from the directional bridge. Connect the directional bridge directly to the spectrum analyzer RF INPUT using an adapter and *not* a cable.

***Option 001 only:*** Use a 75 Ω adapter, BNC (m) to BNC (m).

8. 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 OH OFF (OFF)
[PEAK SEARCH]
(MKR ->) MARKER ->REF LVL

9. On the synthesizer/level generator, set the 50 Ω/75 Ω switch to the 50 Ω position (RF ON). Adjust the Amplitude until the two signals are displayed at the same amplitude.

10. If necessary, adjust the spectrum analyzer center frequency until the two signals are centered on the display. Set the controls as follows:

(BW) 3 (kHz)
VID BW AUTO MAN 300 (Hz)

11. Press (PEAK SEARCH), (DISPLAY), then DSP LINE ON OFF (ON). Set the display line to a value 54 dB below the current reference level setting.

12. 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.

13. If the distortion products can be seen, proceed as follows:
    a. On the spectrum analyzer, press (SGL SWP), wait for completion of the sweep, then press (PEAK SEARCH) and MARKER Δ.
    b. Repeatedly press NEXT PEAK until the active marker is on the highest distortion product.
    c. Record the MKR Δ amplitude reading as TR Entry 2 in the performance test record. The MKR Δ reading should be less than -54 dBc.
14. If the distortion products cannot be seen, proceed as follows:
    a. On both the synthesized sweeper and the synthesizer/level generator, increase the power level by 5 dB. Distortion products should now be visible at this higher power level.
    b. On the spectrum analyzer, press (SGL SWP), (PEAK SEARCH), then MARKER Δ.
    c. Repeatedly press NEXT PEAK until the active marker is on the highest distortion products.
    d. On both the synthesized sweeper and the synthesizer/level generator, reduce the power level by 5 dB and wait for the completion of a new sweep.
    e. Record the MKR Δ amplitude reading as TR Entry 2 in the performance test record. The MKR Δ reading should be less than -54 dBc.

# 16. Gain Compression

Gain Compression is measured by applying two signals, separated by 3 MHz. 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.

There are no related adjustment procedures for this performance test.

## Equipment Required

Synthesized sweeper
Synthesizer/level generator
Measuring receiver (used as a power meter)
Power sensor
Directional bridge
Adapter, Type N (f) to BNC (m)
Adapter, Type N (m) to BNC (m)
Adapter, Type N (f) to APC 3.5 (f)
Adapter, Type N (m) to BNC (f)
Cable, BNC, 120 cm (48 in) (2 required)

## Additional Equipment for Option 001

Power sensor, 75 Ω
Adapter, Type N (f) to BNC (m), 75 Ω
Adapter, BNC (m) to BNC (m), 75 Ω

**Caution** Use only 75 Ω cables, connectors, or adapters on the 75 Ω input of an Option 001 or damage to the input connector will occur.

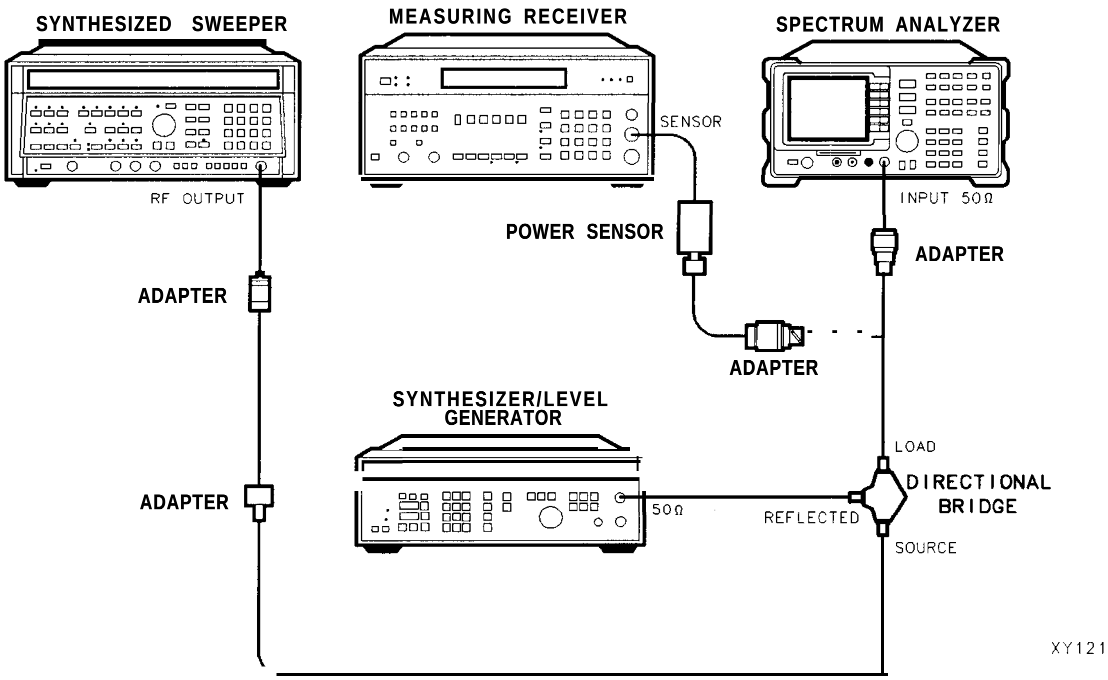



**Figure 1-22. Gain Compression Test Setup**

## Procedure

1. Zero and calibrate the measuring receiver and the power sensor in log mode so the power reads out in dBm. Enter the power sensor's 50 MHz Cal Factor into the measuring receiver.

   ***Option 001 only:*** Calibrate the 75 Ω power sensor.

2. Connect the equipment as shown in Figure 1-22, with the load (reflected) of the directional coupler connected to the power sensor.

   ***Option 001 only:*** The power measured at the output of the 50 Ω directional bridge by the 75 Ω power sensor, is the equivalent power "seen" by the 75 Ω spectrum analyzer. Use the 75 Ω power sensor with a Type N (f) to BNC (m) 75 Ω adapter and use a BNC (m) to BNC (m) 75 Ω adapter in place of the 50 Ω adapter.

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

   CW .......................................................... 53 MHz
   POWER LEVEL ................................................ 6 dBm

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

   CW .......................................................... 50 MHz
   AMPLITUDE .................................................. −14 dBm
   50 Ω/75 Ω SWITCH ...................................... 75 Ω (no RF output)

5. On the spectrum analyzer, press (PRESET) and wait for the preset to finish then set the controls as follows:

   (FREQUENCY) 5(MHz)
   (SPAN) 20 (MHz)

   ***Option 001:*** Press (AMPLITUDE), **More** 1 of 2, Amptd Units, then dBm .

   (AMPLITUDE) 20 (−dBm)
   SCALE LOG LIN (LOG) 1 (dB)
   (BW) 300 (kHz)

6. On the synthesized sweeper, adjust the power level for a 0 dBm reading on the measuring receiver. Set RF to OFF. On the synthesizer/level generator, set the 50 Ω/75 Ω switch to *50* Ω.

   Note that 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.

7. 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 and *not* a cable.

   ***Option 001 only:*** Use a 75 Ω adapter, BNC (m) to BNC (m).

8. 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 message to disappear.

9. On the synthesizer/level generator, adjust the Amplitude to place the signal 1 dB below the spectrum analyzer reference level.

10. On the spectrum analyzer, press (SGL SWP), (PEAK SEARCH), then MARKER Δ .

11. On the synthesized sweeper, set RF to ON.

12. On the spectrum analyzer, press (SGL SWP), (PEAK SEARCH), 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.

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

# 17. Displayed Average Noise Level

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

The LO feedthrough is used as a frequency reference for these measurements. 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 the "Frequency Response Adjustment."

## Equipment Required

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

## Additional Equipment for Option 001

Termination, 75 Ω Type N (m)
Adapter, 75 Ω, Type N (f) to BNC (m)
Cable, BNC, 75 Ω, 30 cm (12 in)

**Caution** Use only 75 Ω cables, connectors, or adapters on the 75 Ω input of an Option 001 or damage to the input connector will occur.

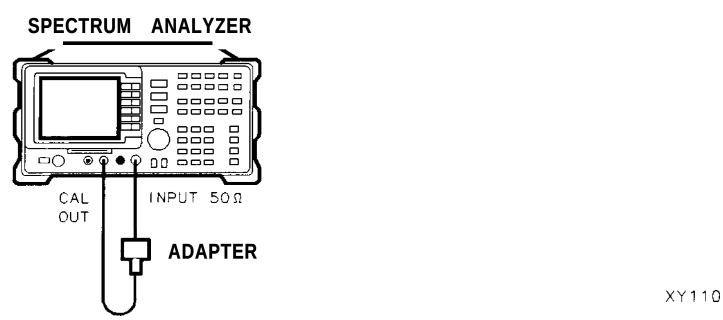



**Figure 1-23. Displayed Average Noise Level Test Setup**

### 17. Displayed Average Noise Level

## Procedure

1. Connect a cable from the CAL OUT to the INPUT 50 Ω of the spectrum analyzer as shown in Figure 1-23.

   *Option* ***001 only:*** Use a 75 Ω cable and omit the adapter.

   Press (PRESET) and wait for the preset to finish. Set the controls as follows:

   (FREQUENCY) 300 (MHz)
   (SPAN) 10 (MHz)
   (AMPLITUDE) 20 (−dBm)

   *Option* ***001 only:*** (AMPLITUDE) REF LVL 28.75 (+dBm)

   ATTEN AUTO MAN 0 (dB)

2. 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. Set the controls as follows:

   (BW)
   VID BW AUTO MAN 30 (Hz)
   (MKR FCTN) MK TRACK ON OFF (OFF)

3. Press (SGL SWP) and wait for completion of a new sweep, then 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). ***Example*** *for* ***Option*** 001: If the marker reads 26.4 dBmV, enter +2.35 dBmV (28.75 dBmV − 26.4 dBmV = 2.35 dBmV).

   REF LVL OFFSET ________ dB

   *Option* ***001:*** REF LVL OFFSET ________ dBmV

4. 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.

   ***Option*** 001 ***only:*** Use the 75 Ω termination.

## 400 kHz

If testing a spectrum analyzer equipped with Option 001, omit steps 5 through 9 and proceed to step 10.

5. Press the following spectrum analyzer keys:

   (AUTO COUPLE)
   VID BW AUTO MAN (AUTO)
   (FREQUENCY) 0 (Hz)
   (SPAN) 10 (MHz)
   (AMPLITUDE) 10 (−dBm)
   (TRIG) SWEEP CONT SGL

6. Press the following spectrum analyzer keys:

   (PEAK SEARCH)
   (MKR FCTN) MK TRACK ON OFF (ON)
   (SPAN) 800 (kHz)

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

   (MKR FCTN) MK TRACK ON OFF (OFF)
   (BW) 3 (kHz)
   (FREQUENCY)

7. Adjust the center frequency until the LO feedthrough peak is on the left-most graticule line. Set the controls as follows:

   (SPAN) 0 (Hz)
   (AMPLITUDE) 50 (−dBm)
   (BW) 1 (kHz)
   VID BW AUTO MAN 30 (Hz)
   (SWEEP) SWP TIME AUTO MAN 5 (sec)

   Press (TRACE), More 1 of 3 , DETECTOR SMP PK (SMP), then (SGL SWP).

   Wait for 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 as the noise level at 400 kHz. The average noise level should be less than the specified limit.

## 17. Displayed Average Noise Level

### 1 MHz

10. Press the following spectrum analyzer keys:

    [AUTO COUPLE]
    RES BW AUTO MAN (AUTO)
    VID BW AUTO MAN (AUTO)
    [FREQUENCY] 0 [Hz]
    [SPAN] 10 [MHz]
    [AMPLITUDE] 10 [−dBm]
    ***Option 001 only:*** [AMPLITUDE] REF LVL 35 [−dBm]
    [TRIG] SWEEP CONT SGL (CONT)

11. Press the following spectrum analyzer keys:

    [PEAK SEARCH]
    [MKR FCTN] MK TRACK ON OFF (ON)
    [MKR ->] MARKER ->REF LVL
    [SPAN] 2 [MHz]

    Wait for the AUTO ZOOM message to disappear. Press [MKR FCTN] then MK TRACK ON OFF (OFF).

12. Press [FREQUENCY] and adjust the center frequency until the LO feedthrough peak is on the left-most graticule line. Set the controls as follows:

    [SPAN] 50 [kHz]
    5[AMPLITUDE] 0 ____ [−dBm]
    ***Option 001 only:*** [AMPLITUDE] REF LVL 1.2 [−dBm]
    [BW]
    VID BW AUTO MAN 30 [Hz]

13. Press [SGL SWP]. Wait for the completion of a new sweep.

14. 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.

15. Record the display line amplitude setting as TR Entry 2 in the performance test record as the noise level at 1 MHz. The average noise level should be less than the specified limit.

## 1 MHz to 1.5 GHz

16. Press the following spectrum analyzer keys:

    (FREQUENCY)
    START FREQ 1 (MHz)
    STOP FREQ 1.5 (GHz)
    (BW) 1 (MHz)
    VID BW AUTO MAN 10 (kHz)
    [TRIG) SWEEP CONT SGL (CONT)

17. Adjust the spectrum analyzer start frequency setting, if necessary, to place the LO feedthrough just off-screen to the left.
18. Press the following spectrum analyzer keys:

    (SGL SWP)
    (TRACE) CLEAR WRITE A More 1 of 3
    VID AVE 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).

19. Press (PEAK SEARCH) and record the MKR frequency as the Measurement Frequency in Table 1-18 for 1 MHz to 1.5 GHz.
20. Press the following spectrum analyzer keys:

    (TRACE) More 1 of 3 VID AVG ON OFF (OFF)
    (AUTO COUPLE] RES BW AUTO MAN (AUTO)
    VID BW AUTO NAN (AUTO)
    (SPAN) 50 (kHz)
    (FREQUENCY) CENTER FREQ

    Set the center frequency to the measurement frequency recorded in Table 1-18 for 1 MHz to 1.5 GHz. Set the controls as follows:

    (BW) 1 (kHz)
    VID BW AUTO HAN 30 (Hz)

21. Press (SGL SWP).

    Wait for the sweep to finish. 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.

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

**17. Displayed Average Noise Level**

## 1.5 GHz to 1.8 GHz

23. Press the following spectrum analyzer keys:

(AUTO COUPLE)
RES BW AUTO MAN (AUTO)
VID BW AUTO MAN (AUTO)
(SPAN) 10 (MHz)
(AMPLITUDE) *0* ____ (−dBm)
***Option 001 only:*** (AMPLITUDE) REF LVL 1.2 (−dBm)
(TRIG) SWEEP CONT SGL (CONT)
(FREQUENCY)
START FREQ 1.5 (GHz)
STOP FAEQ 1.8 (GHz)

24. Repeat steps 18 through 21 above for frequencies from 1.5 GHz to 1.8 GHz.

    If the Displayed Average Noise at 1.8 GHz is at or out of specification, it is recommended that a known frequency source be used as a frequency marker. This ensures that testing is done at or below 1.8 GHz.

**Table 1-18. Displayed Average Noise Level**

| Frequency Range | Measurement Frequency | Displayed Average Noise Level (dBm or dBmV) TR Entrv | Specification |
|---|---|---|---|
| *400* kHz | *400* kHz | 1 | -115 dBm |
| 1 MHz | 1 MHz | *2* | -115 dBm (Option *001:* ≤-63 dBmV) |
| 1 MHz to 1.5 GHz | ____ | *3* | -115 dBm (Option *001:* ≤-63 dBmV) |
| *1.5* GHz to 1.8 GHz | ____ | *4* | -113 dBm (Option *001:* ≤−61 dBmV) |

25. Record the display line amplitude setting as TR Entry 4 in the performance test record. The average noise level should be less than the specified limit.

# 18. Residual Responses

The spectrum analyzer input is terminated and the spectrum analyzer is swept from 150 kHz above the LO to 1 MHz. Then the spectrum analyzer is swept in 50 MHz spans throughout the 1 MHz to 1.8 GHz range. Any responses above the specification are noted.

There are no related adjustment procedures for this performance test.

## Equipment Required

Termination, 50 Ω

## Additional Equipment for Option 001

Termination, 75 Ω Type N (m)
Adapter, 75 Ω Type N (f) to BNC (m)

**Caution** Use only 75 Ω cables, connectors, or adapters on the 75 Ω input of an Option 001 or damage to the input connector will occur.

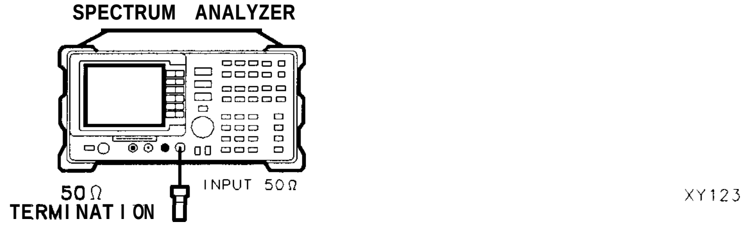



**Figure 1-24. Residual Response Test Setup**

## Procedure

### 150 kHz to 1 MHz

1. Connect the termination to the spectrum analyzer input as shown in Figure 1-24.

   *Option **001** only:* Use the 75 Ω termination with the adapter, skip steps 2 through 4, and proceed with step 5.

2. Press (PRESET) on the spectrum analyzer and wait for the preset to finish. Press the following spectrum analyzer keys:

   (PEAK SEARCH)
   (MKR FCTN) MK TRACK ON OFF (ON)
   (SPAN) 1 (MHz)

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

3. Adjust the center frequency until the LO feedthrough peak is on the left-most vertical graticule line. Press the following spectrum analyzer keys as follows:

   (PEAK SEARCH]
   (MKR)
   MARKER Δ 150 (kHz)
   MARKER NORMAL
   [AMPLITUDE) 60(-dBm)
   ATTEN AUTO MAN 0 (dB)
   (BW) 3 (kHz)
   VID BW AUTO HAN 1 (kHz)
   (DISPLAY)
   DSP LINE ON OFF 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. 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.

## 1 MHz to 1.8 GHz

5. Press (PRESET) on the spectrum analyzer and wait for the preset to finish. Set the controls as follows:

   (FREQUENCY) 25 (MHz)
   (SPAN) 50 (MHz)
   (AMPLITUDE) 60 (-dBm)
   ***Option 001 only:*** (AMPLITUDE) REF LVL 11.25 (-dBm)
   ATTEN AUTO MAN 0 (dB)

6. Press (FREQUENCY) and adjust the center frequency until the LO feedthrough (the "signal" near the left of the screen) is just off the left-most vertical graticule line. Set the controls as follows:

   CF STEP AUTO MAN 45 (MHz)
   (BW) 10 (kHz)
   VID BW AUTO MAN 3 (kHz)
   (DISPLAY)
   DSP LINE ON OFF 90 (-dBm)

   ***Option 001 only:*** Press (DISPLAY), DSP LINE ON OFF , then 38 (-dBm)

7. 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.

8. Press (FREQUENCY), (⇧) (step-up key), to step to the next frequency and repeat step 7.
9. Repeat steps 7 and 8 until the range from 1 MHz to 1.8 GHz has been checked. This requires 40 additional frequency steps. The test for this band requires about 6 minute to complete if no residuals are found.

   If there are any residuals at or near the frequency specification limits (1 MHz or 1.8 GHz), it is recommended that a known frequency source be used as a frequency marker. This will ensure that testing is done within the specification limits.
10. Record the highest residual from Table 1-19 as TR Entry 1 in the performance test record. If no residuals are found, then record N/A in the performance test record.

**Table 1-19. Residual Responses Above Display Line**

| Frequency (MHz) | Amplitude (dBm) |
|---|---|
| ______ | ______ |
| ______ | ______ |
| ______ | ______ |
| ______ | ______ |
| ______ | ______ |

## 19. Absolute Amplitude, Vernier, and Power Sweep Accuracy

This procedure is only for spectrum analyzers equipped with Option 010 or 011.

The tracking generator output is connected to the spectrum analyzer input and the tracking is adjusted at 300 MHz for a maximum signal level. A calibrated power sensor is then connected to the tracking generator output to measure the power level at 300 MHz.

The measuring receiver is then set for RATIO mode so that future power level readings are in dB relative to the power level at -10 dBm (Option 011: +38.8 dBmV). The output power level setting is decreased in 1 dB steps and the power level is measured at each step. The difference between ideal and actual power levels is calculated at each step.

Since a power sweep is accomplished by stepping through the vernier settings, the peak-to-peak variation of the vernier accuracy is equal to the power sweep accuracy.

The related adjustment for this procedure is the "Modulator Offset and Gain Adjustment."

### Equipment Required

Measuring receiver
Power sensor
Cable, Type N, 62 cm (24 in)

### Additional Equipment for Option 011

Power sensor
Cable, BNC, 75 Ω
Adapter, Type N (f) to BNC (m), 75 Ω
Adapter, mechanical, Type N, 50 Ω (m) to 75 Ω (f)

**Caution** Use only 75 Ω cables, connectors, or adapters on the 75 Ω input of an Option 011 or damage to the input connector will occur.

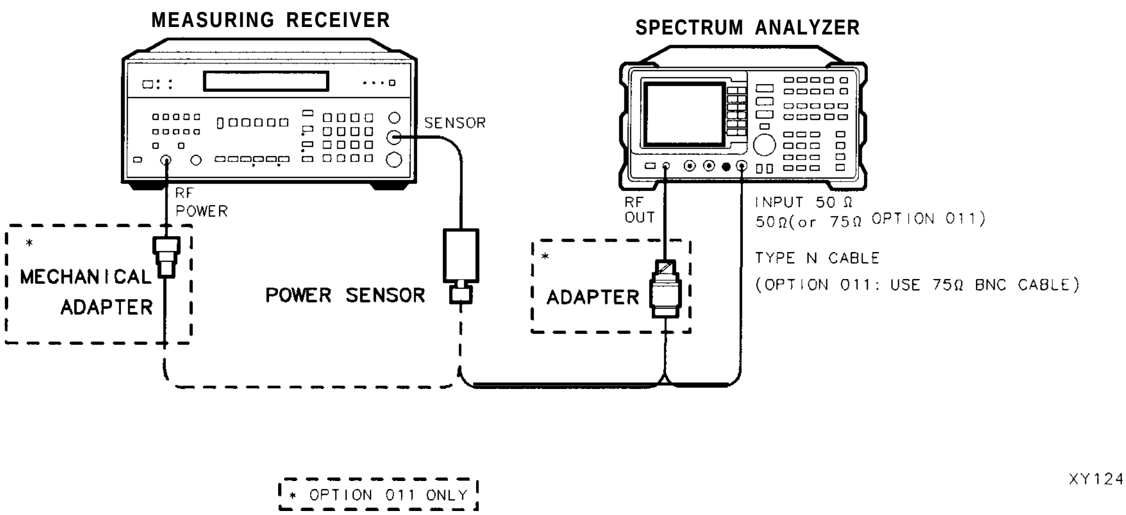



**Figure 1-25. Absolute Amplitude, Vernier, and Power Sweep Accuracy Test Setup**

## Procedure

1. Connect the Type N cable between the RF OUT 50 Ω and INPUT 50 Ω connectors on the spectrum analyzer. See Figure 1-25.

   ***Option 011 only:*** Connect the BNC cable between the RF OUT 75 Ω and INPUT 75 Ω connectors on the spectrum analyzer.

2. Press (PRESET) on the spectrum analyzer and set the controls as follows:

   (FREQUENCY) 300 (MHz)
   (SPAN) 0 (Hz)

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

   (MKR)

   (AUX CTRL) Track Gen

   SRC PWR ON OFF (ON) 5 (−dBm)

   ***Option 011 only:*** SRC PWR ON OFF (ON) 38 (+dBm)

4. On the spectrum analyzer, press TRACKING PEAK . Wait for the PEAKING message to disappear.

5. Zero and calibrate the measuring receiver/power sensor combination in log mode (power levels readout in dBm). Enter the power sensor's 300 MHz Cal Factor into the measuring receiver.

6. Disconnect the Type N cable from the RF OUT 50 Ω and connect the power sensor to the RF OUT 50 Ω as shown in Figure 1-25.

   ***Option 011 only:*** Disconnect the BNC cable from the RF OUT 75 Ω and connect the power sensor to the RF OUT 75 Ω using an adapter.

7. On the spectrum analyzer, press 10 (−dBm), (SGL SWP).

   ***Option 011 only:* 38.8** (+dBm) (+38.8 dBmV).

8. Subtract -10 dBm from the power level displayed on the measuring receiver and record the result in the performance test record as TR Entry 1.

9. Press RATIO on the measuring receiver. Power levels now readout in dB relative to the power level just measured at the -10 dBm output power level setting.

   ***Option 011 only:*** +38.8 dBmV output power level setting.

10. Set the SRC POWER to the settings indicated in Table 1-20. At each setting, record the power level displayed on the measuring receiver.

11. Calculate the Vernier Accuracy by subtracting the SRC POWER setting and 10 dB from the Measured Power Level for each SRC POWER setting in Table 1-20.

    Vernier Accuracy = Measured Power Level − SRC POWER + 10 dB

    ***Option 011 only:*** Calculate the Vernier Accuracy by subtracting the SRC POWER setting from the Measured Power Level, adding 38.8 dB to each SRC POWER setting in Table 1-20.

    Vernier Accuracy = Measured Power Level − SRC POWER − 38.8 dB.

12. Locate the most positive and most negative Absolute Vernier Accuracy values in Table 1-20 and record as TR Entries 2 and 3 in the performance test record.

13. Calculate the power sweep accuracy by subtracting the Negative Vernier Accuracy recorded in step 12 from the Positive Vernier Accuracy recorded in step 12. Record the result in the performance test record as TR Entry 4.

Power Sweep Accuracy = Positive Vernier Accuracy – Negative Vernier Accuracy

**Table 1-20. Vernier Accuracy Worksheet**

| SRC POWER Setting | | Measured Power Level | Vernier Accuracy | Measurement Uncertainty |
|---|---|---|---|---|
| Opt 011, dBmV | Opt 010, dBm | (dB) | (dB) | (dB) |
| +38.8 | -10 | 0 (Ref) | 0 (Ref) | 0 |
| +39.8 | -9 | | | ±0.033 |
| +40.8 | -8 | | | ±0.033 |
| +41.8 | -7 | | | ±0.033 |
| +42.8 | -6 | | | ±0.033 |
| +37.8 | -5 | | | ±0.033 |
| +36.8 | -4 | | | ±0.033 |
| +35.8 | -3 | | | ±0.033 |
| +34.8 | -2 | | | ±0.033 |
| +33.8 | -1 | | | ±0.033 |
| +32.8 | 0 | | | ±0.033 |
| +31.8 | -15 | | | ±0.033 |
| +30.8 | -14 | | | ±0.033 |
| +29.8 | -13 | | | ±0.033 |
| +28.8 | -12 | | | ±0.033 |
| +27.8 | -11 | | | ±0.033 |

# 20. Tracking Generator Level Flatness

This procedure is only for spectrum analyzers equipped with Option 010 or 011.

The tracking generator output is connected to the spectrum analyzer input and the tracking is adjusted at 300 MHz for a maximum signal level. A calibrated power sensor is then connected to the tracking generator output to measure the power level at 300 MHz. The measuring receiver is set for RATIO mode so that future power level readings are in dB relative to the power level at 300 MHz.

The tracking generator is stepped to several frequencies throughout its range. The output power difference relative to the power level at 300 MHz is measured at each frequency and recorded.

The related adjustment for this procedure is the "Modulator Offset and Gain Adjustment."

## Equipment Required

Measuring receiver
Power sensor
Cable, Type N, 62 cm (24 in)

## Additional Equipment for Option 011

Power sensor
Adapter, Type N (f) to BNC (m), 75 Ω
Adapter, mechanical, Type N, 50 Ω (m) to 75 Ω (f)
Cable, BNC, 75 Ω

**Caution** Use only 75 Ω cables, connectors, or adapters on the 75 Ω input of an Option 011 or damage to the input connector will occur.

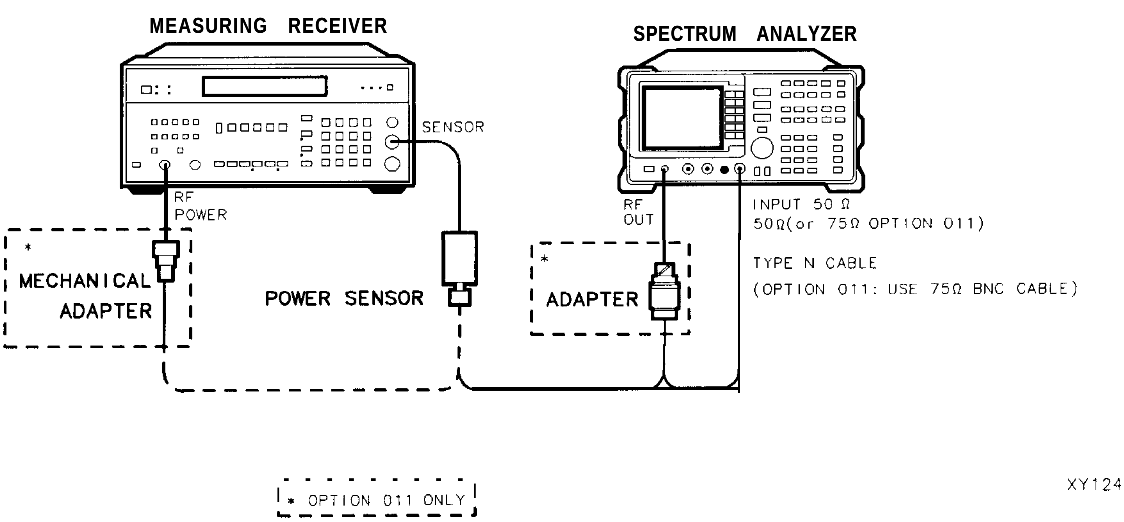



**Figure 1-26. Tracking Generator Level Flatness Test Setup**

## 20. Tracking Generator Level Flatness

### Procedure

1. Connect the Type N cable between the RF OUT 50 Ω and INPUT 50 Ω connectors on the spectrum analyzer. See Figure 1-26.

   *Option 011 only:* Connect the BNC cable between the RF OUT 75 Ω and INPUT 75 Ω connectors on the spectrum analyzer.

2. Press (PRESET) on the spectrum analyzer. Set the controls as follows:

   (FREQUENCY) 0 (Hz)
   (SPAN) 15 (MHz)

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. Press (FREQUENCY), FREQ OFFSET. Enter the negative of the MKR-TRK frequency displayed in the upper right-hand corner of the display. For example, if the MKR-TRK frequency is 132 kHz, enter -132 kHz.

   Set the spectrum analyzer controls as follows:

   (MKR FCTN) MK TRACK ON OFF (OFF)
   (SPAN) ZERO SPAN
   (BW) 1 (MHz)

4. Set the spectrum analyzer controls as follows:

   (FREQUENCY) 300 (MHz)
   CF STEP AUTO MAN 100 (MHz)
   (SPAN) 0 (Hz)

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

   (MKR)
   (AUX CTRL) Track Gen
   SRC PWR ON OFF 5 (−dBm)

   ***Option 011 only:*** SRC PWR ON OFF 38 (+dBm) (+ 38 dBmV).

6. On the spectrum analyzer, press TRACKING PEAK . Wait for the PEAKING message to disappear.

7. Zero and calibrate the measuring-receiver/power-sensor combination in log mode (power levels readout in dBm). Enter the power sensor's 300 MHz Cal Factor into the measuring receiver.

8. Disconnect the Type N cable from the RF OUT 50 Ω and connect the power sensor to the RF OUT 50 Ω.

   ***Option 011 only:*** Disconnect the BNC cable from the RF OUT 75 Ω and connect the power sensor to the RF OUT 75 Ω using an adapter.

9. On the spectrum analyzer, press (AUX CTRL), Track Gen , SRC PWR ON OFF , 10 (−dBm), then (SGL SWP).

   *Option 011 only:* SRC PWR ON OFF 38.8 (+dBm).

10. Press RATIO on the measuring receiver. The measuring receiver readout is now for power levels relative to the power level at 300 MHz.
11. Set the spectrum analyzer center frequency to 100 kHz then press (SGL SWP).

    ***Option 011 only:*** Set the spectrum analyzer center frequency to 1 MHz then press (SGL SWP).
12. Enter the appropriate power sensor Cal Factor into the measuring receiver as indicated in Table 1-21.
13. Record the power level displayed on the measuring receiver as the Level Flatness in Table 1-21.
14. Repeat steps 11 through 13 above to measure the flatness at each center frequency setting listed in Table 1-21. The (⇧) (step-up) key may be used to tune to center frequencies above 100 MHz.

    Spectrum analyzers equipped with Option 011 should be tested only at frequencies of 1 MHz to 1.8 GHz.
15. Locate the most positive Level Flatness reading in Table 1-21 for the indicated frequency ranges and record as the Maximum Flatness.

    Option 010:

    Maximum Flatness, 100 kHz ______________ dB (TR Entry 1)

    Maximum Flatness, 300 kHz to 5 MHz ______________ dB (TR Entry 2)

    Maximum Flatness, 10 MHz to 1800 MHz ______________ dB (TR Entry 3)

    Option 011:

    Maximum Flatness, 1 MHz to 1800 MHz ______________ dB (TR Entry 1)
16. Locate the most negative Level Flatness reading in Table 1-21 for the indicated frequency ranges as the Minimum Flatness.

    Option 010:

    Minimum Flatness, 100 kHz ______________ dB (TR Entry 4)

    Minimum Flatness, 300 kHz to 5 MHz ______________ dB (TR Entry 5)

    Minimum Flatness, 10 MHz to 1800 MHz ______________ dB (TR Entry 6)

    Option 011:

    Minimum Flatness, 1 MHz to 1800 MHz ______________ dB (TR Entry 2)
17. Press (PRESET) on the spectrum analyzer.

## 20. Tracking Generator Level Flatness

### Table 1-21. Level Flatness Relative to 300 MHz Worksheet

| Center Freq | Level Flatness (dB) | Cal Factor Freq (MHz) | Measurement Uncertainty (dB) | |
|---|---|---|---|---|
| | | | Option 010 | Option 011 |
| 100 kHz* | ______ | 0.1 | +0.42/−0.45 | N/A |
| 300 kHz* | ______ | 0.3 | +0.28/−0.28 | N/A |
| 500 kHz* | ______ | 0.3 | +0.28/−0.28 | N/A |
| 1 MHz | ______ | 1 | +0.28/−0.28 | +0.18/−0.39 |
| 2 MHz | ______ | 3 | +0.28/−0.28 | +0.18/−0.39 |
| 5 MHz | ______ | 3 | +0.28/−0.28 | +0.18/−0.39 |
| 10 MHz | ______ | 10 | +0.24/−0.24 | +0.18/−0.39 |
| 20 MHz | ______ | 30 | +0.24/−0.24 | +0.18/−0.39 |
| 50 MHz | ______ | 50 | +0.24/−0.24 | +0.18/−0.39 |
| 100 MHz | ______ | 100 | +0.24/−0.24 | +0.18/−0.39 |
| 200 MHz | ______ | 300 | +0.24/−0.24 | +0.18/−0.39 |
| 300 MHz | 0 (Ref) | 300 | 0 (Ref) | 0 (Ref) |
| 400 MHz | ______ | 300 | +0.24/−0.24 | +0.18/−0.39 |
| 500 MHz | ______ | 300 | +0.24/−0.24 | +0.18/−0.39 |
| 600 MHz | ______ | 300 | +0.24/−0.24 | +0.18/−0.39 |
| 700 MHz | ______ | 1000 | +0.24/−0.24 | +0.18/−0.39 |
| 800 MHz | ______ | 1000 | +0.24/−0.24 | +0.18/−0.39 |
| 900 MHz | ______ | 1000 | +0.24/−0.24 | +0.18/−0.39 |
| 000 MHz | ______ | 1000 | +0.24/−0.24 | +0.18/−0.39 |
| 100 MHz | ______ | 1000 | +0.24/−0.24 | +0.18/−0.39 |
| 200 MHz | ______ | 1000 | +0.24/−0.24 | +0.18/−0.39 |
| 300 MHz | ______ | 1000 | +0.24/−0.24 | +0.18/−0.39 |
| 400 MHz | ______ | 1000 | +0.24/−0.24 | +0.18/−0.39 |
| 500 MHz | ______ | 2000 | +0.24/−0.24 | +0.18/−0.39 |
| 600 MHz | ______ | 2000 | +0.24/−0.24 | +0.18/−0.39 |
| 700 MHz | ______ | 2000 | +0.24/−0.24 | +0.18/−0.39 |
| 800 MHz | ______ | 2000 | +0.24/−0.24 | +0.18/−0.39 |

These frequencies are tested on Option 010 spectrum analyzers only.

# 21. Harmonic Spurious Outputs

This procedure is only for spectrum analyzers equipped with Option 010 or 011.

The tracking generator output is connected to the spectrum analyzer input and the tracking is adjusted at 300 MHz for a maximum signal level. The tracking generator output is then connected to the input of an microwave spectrum analyzer. The tracking generator is tuned to several frequencies and the amplitude of the second and third harmonics relative to the fundamental are measured at each frequency.

There are no related adjustment procedures for this performance test.

## Equipment Required

Microwave spectrum analyzer
Adapter, Type N (m) to BNC (f)
Cable, Type N, 62 cm (24 in)
Cable, BNC, 23 cm (9 in)

## Additional Equipment for Option 011

Adapter, minimum loss
Adapter, Type N (f) to BNC (m), 75 Ω
Cable, BNC, 75 Ω

**Caution** Use only 75 Ω cables, connectors, or adapters on the 75 Ω input of an Option 011 or damage to the input connector will occur.

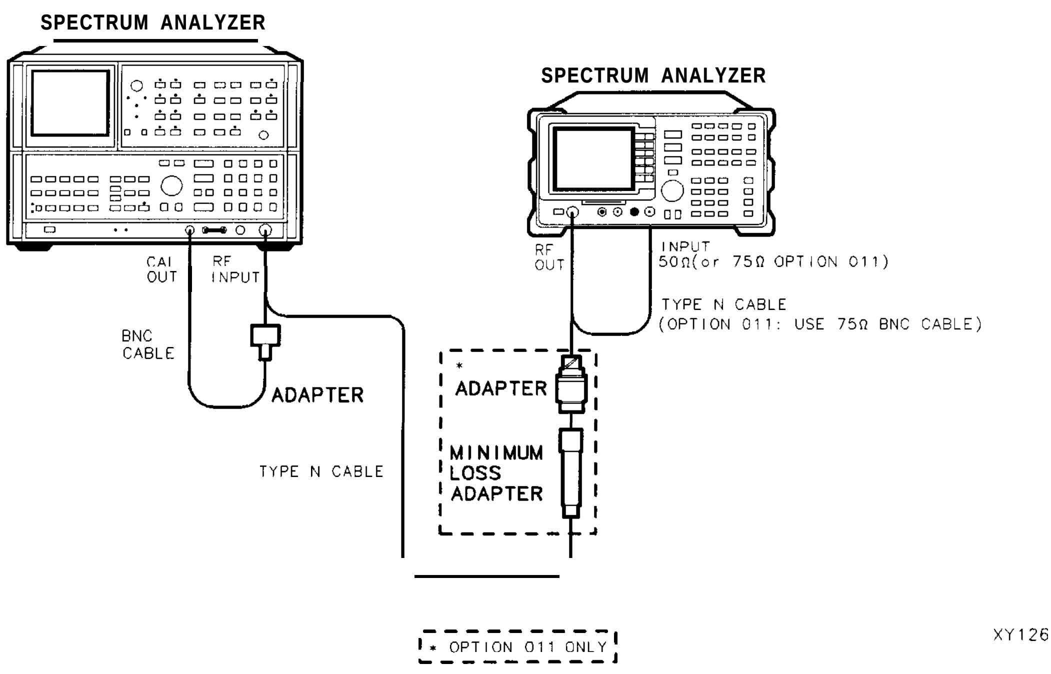



**Figure 1-27. Harmonic Spurious Outputs Test Setup**

### 21. Harmonic Spurious Outputs

## Procedure

1. Connect the Type N cable between the RF OUT 50 Ω and INPUT 50 Ω connectors on the spectrum analyzer. See Figure 1-27.

   *Option 011 only:* Connect the 75 Ω BNC cable between the RF OUT 75 Ω and INPUT 75 Ω connectors on the spectrum analyzer.

2. Press PRESET on the spectrum analyzer and set the controls as follows:

   (FREQUENCY) 300 (MHz)
   (SPAN) 0 (Hz)

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

   (MKR)
   (AUX CTRL) Track Gen
   SRC PWR ON OFF 5 (−dBm)

   *Option 011 only:* SRC PWR ON OFF 42 (+dBm) (+42 dBmV).

4. On the spectrum analyzer, press TRACKING PEAK . Wait for the **PEAKING** message to disappear.

5. On the spectrum analyzer, press 0 (+dBm), (FREQUENCY), 10 (MHz), then (SGL SWP).

   ***Option 011 only:* 42.8** (+dBm).

   It is only necessary to perform step 6 if more than 2 hours have elapsed since a front-panel calibration of the microwave spectrum analyzer has been performed. The microwave spectrum analyzer should be allowed to warm up for at least 30 minutes before proceeding.

6. Perform a front-panel calibration of the microwave spectrum analyzer as follows:

   a. Connect a BNC cable between CAL OUTPUT and RF INPUT.
   b. Press (2 − 22 GHz) (INSTR PRESET), (RECALL), 8. Adjust AMPTD CAL for a marker amplitude reading of -10 dBm.
   c. Press (RECALL), 9. Adjust (FREQ ZERO) for a maximum amplitude response.

7. Connect the Type N cable from the tracking generator output to the microwave spectrum analyzer RF INPUT. See Figure 1-27.

   *Option 011 only:* Use the minimum loss adapter and Type N (f) to BNC (m) adapter.

8. Set the microwave spectrum analyzer controls as follows:

   CENTERFREQUENCY . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 10 MHz
   SPAN . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 10 MHz
   REFERENCE LEVEL . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . +5 dBm
   RESBW . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 30 kHz
   LOG dB/DIV . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 10 dB

9. On the microwave spectrum analyzer, do the following:
   a. Press (PEAK SEARCH] and (SIGNAL TRACK) (ON). Wait for the signal to be displayed at center screen.
   b. Press (PEAK SEARCH], [MKR -> CF STEP], In], and (SIGNAL TRACK] (OFF).
   c. Press (CENTER FREQUENCY), (⇧) (step-up key) to tune to the second harmonic. Press (PEAK SEARCH). Record the marker amplitude reading in Table 1-22 as the 2nd Harmonic Level for the 10 MHz Tracking Generator Output Frequency.
   d. Perform this step only if the tracking generator output frequency is less than 600 MHz. Press (CENTER FREQUENCY), (⇧) (step-up) key to tune to the third harmonic. Press (PEAK SEARCH]. Record the marker amplitude reading in Table 1-22 as the 3rd Harmonic Level for the 10 MHz Tracking Generator Output Frequency.
   e. Press MARKER (OFF).
10. Repeat steps 8 and 9 above for the remaining Tracking Generator Output Frequencies listed in Table 1-22. Note that the spectrum analyzer CENTER FREQ is the same as the Tracking Generator Output Frequency.
11. Locate the most positive 2nd Harmonic Level in Table 1-22 and record as TR Entry 1 in the performance test record.
12. Locate the most positive 3rd Harmonic Level in Table 1-22 and record as TR Entry 2 in the performance test record.

**Table 1-22. Harmonic Spurious Responses Worksheet**

| Tracking Generator Frequency | 2nd Harmonic Level (dBc) | 3rd Harmonic Level (dBc) | Measurement Uncertainty (dB) |
|---|---|---|---|
| 10 MHz | | | +1.55/−1.80 |
| 100 MHz | | | +1.55/− 1.80 |
| 300 MHz | | | +1.55/−1.80 |
| 850 MHz | | N/A | +1.55/−1.80 |

## 22. Non-Harmonic Spurious Outputs

This procedure is only for spectrum analyzers equipped with Option 010 or 011.

The tracking generator output is connected to the spectrum analyzer input and the tracking is adjusted at 300 MHz for a maximum signal level. The tracking generator output is then connected to the input of a microwave spectrum analyzer. The tracking generator is set to several different output frequencies.

For each output frequency, several sweeps are taken on the microwave spectrum analyzer over different frequency spans and the highest displayed spurious response is measured in each span. Responses at the fundamental frequency of the tracking generator output or their harmonics are ignored. The amplitude of the highest spurious response is recorded.

There are no related adjustment procedures for this performance test.

### Equipment Required

Microwave spectrum analyzer
Adapter, Type N (m) to BNC (f)
Cable, Type N, 62 cm (24 in)
Cable, BNC, 23 cm (9 in)

### Additional Equipment for Option 011

Adapter, minimum loss
Adapter, Type N (f) to BNC (m), 75 Ω
Cable, BNC, 75 Ω

**Caution** Use only 75 Ω cables, connectors, or adapters on the 75 Ω input of an Option 011 or damage to the input connector will occur.

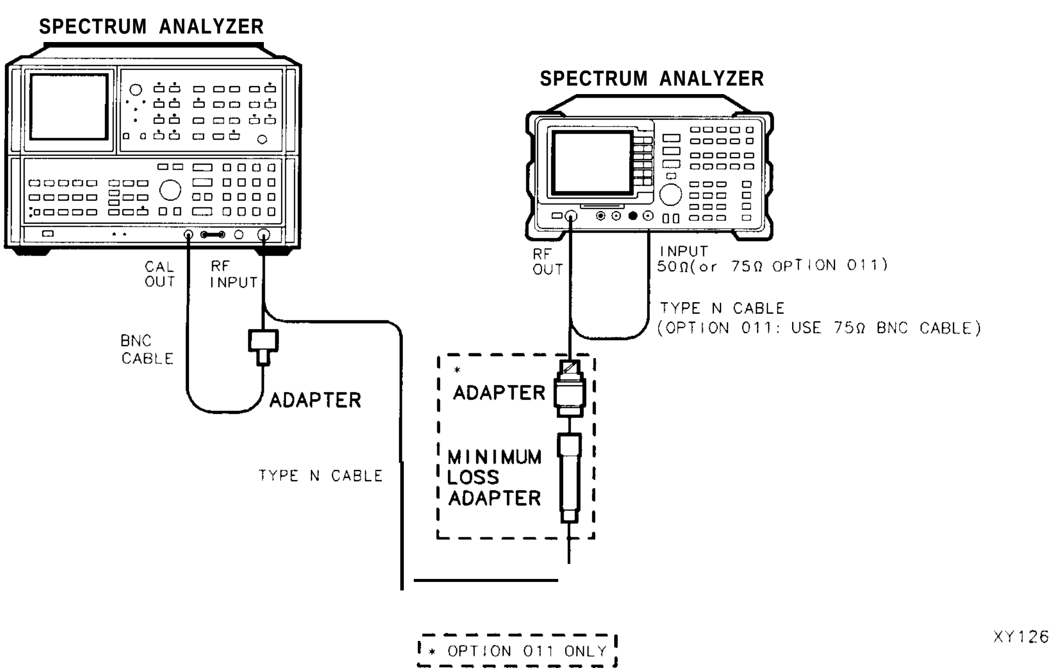



**Figure 1-28. Non-Harmonic Spurious Outputs Test Setup**

## Procedure

1. Connect the Type N cable between the RF OUT 50 Ω and INPUT 50 Ω connectors on the spectrum analyzer. See Figure 1-28.

   ***Option 011 only:*** Connect the 75 Ω BNC cable between the RF OUT 75 Ω and INPUT 75 Ω on the spectrum analyzer.

2. Press (PRESET) on the spectrum analyzer and set the controls as follows:

   (FREQUENCY) 300 (MHz)
   (SPAN) 0 (Hz)
   (BW) 30 (kHz)

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

   (MKR)
   (AUX CTRL) Track Gen
   SRC PWR ON OFF 5 (−dBm)

   ***Option 011 only:*** SRC PWR ON OFF 38 (+dBm) (+38 dBmV).

4. On the spectrum analyzer, press TRACKING PEAK . Wait for the PEAKING message to disappear.

5. On the spectrum analyzer, press 0 (+dBm) then (SGL SWP).

   ***Option 011 only: 42.8*** (+dBm).

   It is only necessary to perform step 6 if more than two hours have elapsed since a front-panel calibration of the microwave spectrum analyzer has been performed. The microwave spectrum analyzer should be allowed to warm up for at least 30 minutes before proceeding.

6. Perform a front-panel calibration on the microwave spectrum analyzer as follows:

   a. Connect a BNC cable between CAL OUTPUT and RF INPUT.
   b. Press (2 − 22 GHz) (INSTR PRESET), [RECALL], 8. Adjust AMPTD CAL for a marker amplitude reading of -10 dBm.
   c. Press (RECALL), 9. Adjust FREQ ZERO for a maximum amplitude response.

      Press (SHIFT), [FREQUENCY SPAN] to start the 30 second internal error correction routine.
   d. Press (SHIFT), [START FREQ] to use the error correction factors just calculated.

7. Connect the Type N cable from the tracking generator output to the microwave spectrum analyzer RF INPUT as shown in Figure 1-28.

   ***Option 011 only:*** Use the minimum loss adapter and Type N (f) to BNC (m) adapter.

8. Set the spectrum analyzer CENTER FREQ to the Fundamental Frequency listed in Table 1-23.

9. Set the microwave spectrum analyzer controls as follows:

   SPAN .......... 100 kHz
   REFERENCE LEVEL .......... +5 dBm
   ATTEN .......... 20 dB
   LOGdB/DIV .......... 10 dB

10. Set the microwave spectrum analyzer CENTER FREQUENCY to the Fundamental Frequency listed in Table 1-23.

11. On the microwave spectrum analyzer, press [PEAK SEARCH]. Press (MKR -> CF), (MKR -> REF LVL). Wait for another sweep to finish.
12. Record the microwave spectrum analyzer marker-amplitude reading in Table 1-23 as the Fundamental Amplitude.
13. Set the microwave spectrum analyzer (START FREQ), (STOP FREQ), and (RES BW) as indicated in the first row of Table 1-24.
14. Press (SINGLE] on the microwave spectrum analyzer and wait for the sweep to finish. Press (PEAK SEARCH].
15. Verify that the marked signal is not the fundamental or a harmonic of the fundamental as follows:
    a. Divide the marker frequency by the fundamental frequency (the spectrum analyzer CENTER FREQ setting). For example, if the marker frequency is 30.3 MHz and the fundamental frequency is 10 MHz, dividing 30.3 MHz by 10 MHz yields 3.03.
    b. Round the number calculated in step a the nearest whole number. In the example above, 3.03 should be rounded to 3.
    c. Multiply the fundamental frequency by the number calculated in step b. Following the example, multiplying 10 MHz by 3 yields 30 MHz.
    d. Calculate the difference between the marker frequency and the frequency calculated in step c above. Continuing the example, the difference would be 300 kHz.
    e. Due to span accuracy uncertainties in the microwave spectrum analyzer and center frequency uncertainties in the spectrum analyzer, the marker frequency might not equal the actual frequency. Given the marker frequency, check if the difference calculated in step d is within the appropriate tolerance:
       For marker frequencies <55 MHz, tolerance = ±750 kHz
       For marker frequencies >55 MHz, tolerance = ±10 MHz
    f. If the difference in step d is within the indicated tolerance, the signal in question is the fundamental signal (if the number in step b = 1) or a harmonic of the fundamental (if the number in step b >1). This response should be ignored.
16. Verify that the marked signal is a true response and not a random noise peak by pressing (SINGLE) to trigger a new sweep and press [PEAK SEARCH]. A true response will remain at the same frequency and amplitude on successive sweeps but a noise peak will not.
17. If the marked signal is either the fundamental or a harmonic of the fundamental (see step 15) or a noise peak (see step 16), move the marker to the next highest signal by pressing (SHIFT), (PEAK SEARCH]. Continue with step 19.
18. If the marked signal is not the fundamental or a harmonic of the fundamental (see step 15) and is a true response (see step 16), calculate the difference between the amplitude of marked signal and the Fundamental Amplitude as listed in Table 1-23.

    For example, if the Fundamental Amplitude for a fundamental frequency of 10 MHz is + 1.2 dBm and the marker amplitude is -40.8 dBm, the difference is -42 dBc.

    Record this difference as the Non-Harmonic Response Amplitude for the appropriate spectrum analyzer CENTER FREQ and microwave spectrum analyzer START and STOP FREQ settings in Table 1-24.

    Non-Harmonic Amplitude = Marker Amplitude – Fundamental Amplitude

19. If a true non-harmonic spurious response is not found, record "NOISE" as the Non-Harmonic Response Amplitude in Table 1-24 for the appropriate spectrum analyzer CENTER FREQ and microwave spectrum analyzer START and STOP FREQ settings.

20. Repeat steps 14 through 19 for the remaining microwave spectrum analyzer settings for [START FREQ], [STOP FREQ], and [RES BW] for the spectrum analyzer CENTER FREQ setting of 10 MHz.
21. Repeat steps 8 through 20 with the spectrum analyzer CENTER FREQ set to 900 MHz.
22. Repeat steps 8 through 20 with the spectrum analyzer CENTER FREQ set to 1.8 GHz.
23. Locate in Table 1-24 the most-positive Non-Harmonic Response Amplitude. Record this amplitude as TR Entry 1 in the performance test record.

**Table 1-23. Fundamental Response Amplitudes Worksheet**

| Fundamental Frequency | Fundamental Amplitude (dBm) |
|---|---|
| 10 MHz | ______ |
| 900 MHz | ______ |
| 1.8 GHz | ______ |

**Table 1-24. Non-Harmonic Responses Worksheet**

| Microwave Spectrum Analyzer Settings | | | Non-Harmonic Response Amplitude (dBc) | | | Measurement Uncertainty |
|---|---|---|---|---|---|---|
| start Freq (MHz) | stop Freq (MHz) | Res BW | @10 MHz Center Freq | @900 MHz Center Freq | @1.8 GHz Center Freq | (dB) |
| 0.1* | 5.0 | 10 kHz | | | | +1.55/−1.80 |
| 5.0 | 55 | 100 kHz | | | | +1.55/−1.80 |
| 55 | 1240 | 1 MHz | | | | +1.55/−1.80 |
| 1240 | 1800 | 1 MHz | | | | +1.55/−1.80 |

* Option 011: Set START FREQ to 1 MHz.

# 23. Tracking Generator Feedthrough

This procedure is only for spectrum analyzers equipped with Option 010 or 011.

The tracking generator output is connected to the spectrum analyzer input and the tracking is adjusted at 300 MHz for a maximum signal level. The tracking generator output is terminated and set for 0 dBm output power (maximum output power). The spectrum analyzer input is also terminated. The noise level of the spectrum analyzer is then measured at several frequencies.

There is no related adjustment procedure for this performance test.

## Equipment Required

Termination, 50 Ω (2 required)
Adapter, Type N (m) to BNC (f)
Cable, Type N, 62 cm (24 in)
Cable, 23 cm (9 in)

## Additional Equipment for Option 011

Termination, 75 Ω Type N (m) (2 required)
Adapter, Type N (f) to BNC (m), 75 Ω (2 required)
Cable, BNC, 75 Ω

**Caution** Use only 75 Ω cables, connectors, or adapters on the 75 Ω input of an Option 011 or damage to the input connector will occur.

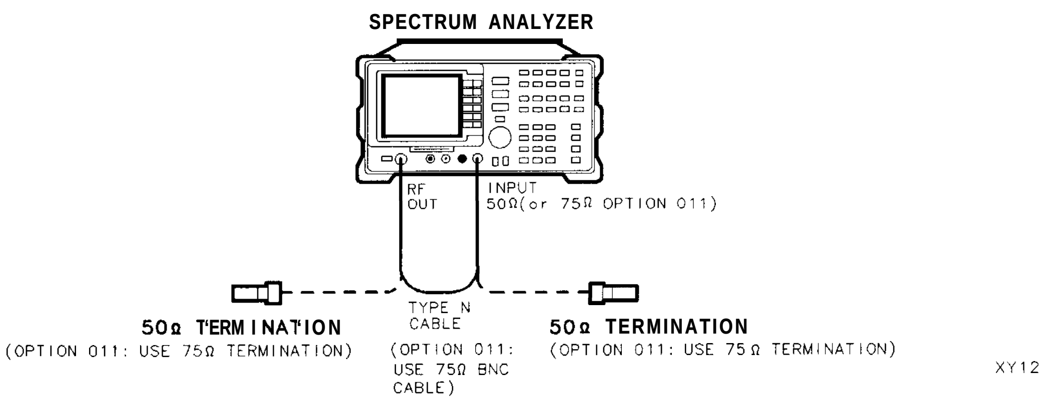



**Figure 1-29. Tracking Generator Feedthrough Test Setup**

## Procedure

1. Connect the Type N cable between the RF OUT 50 Ω and INPUT 50 Ω connectors on the spectrum analyzer. See Figure 1-29.

   *Option 011 only:* Connect the 75 Ω BNC cable between the RF OUT 75 Ω and INPUT 75 Ω connectors on the spectrum analyzer.

2. Press (PRESET) on the spectrum analyzer and set the controls as follows:

   (FREQUENCY) 30 (MHz)
   (SPAN) 1 (MHz)

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

   (MKR)
   (AUX CTRL) Track Gen
   SRC PWR ON OFF 5 (-dBm)

   ***Option 011 only:*** 42 + dBm (+ 42 dBmV).

4. On the spectrum analyzer, press TRACKING PEAK . Wait for the PEAKING message to disappear.

5. Connect the CAL OUTPUT to the INPUT 50 Ω.

   *Option 011 only:* Connect the CAL OUTPUT to the INPUT 75 Ω.

   Set the spectrum analyzer controls as follows:

   (AMPLITUDE) 20 (-dBm)
   ***Option 011 only:*** (AMPLITUDE) REF LVL 28.75 (+dBm)
   (SPAN) 10 (MHz)
   (AMPLITUDE)
   ATTEN AUTO MAN 0 (dB)

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

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

   Wait for the AUTO ZOOM message to disappear then set the controls as follows:

   (BW) VID BW AUTO MAN 30 (Hz)
   (MKR FCTN) MK TRACK ON OFF (OFF)

7. Press (SGL SWP) and wait for 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].

   Example for ***Option*** 011: If the marker reads 26.4 dBmV, enter +2.35 dB

   (28.75 dBmV – 26.4 dBmV = 2.35 dB).

   REF LVL OFFSET ________dB

8. Connect one 50 Ω termination to the spectrum analyzer INPUT 50 Ω and another to the tracking generator's RF OUT 50 Ω.

   ***Option 011 only:*** Connect one 75 Ω termination to the spectrum analyzer INPUT 75 Ω and another to the tracking generator's RF OUT 75 Ω.

9. Press (AUX CTRL), Track Gen , then SRC PWR ON OFF (OFF) on the spectrum analyzer.

10. Set the spectrum analyzer controls as follows:

    (FREQUENCY) 0 (Hz)
    (SPAN) 10 (MHz)
    (AMPLITUDE) 0 ____ (-dBm)
    ***Option 011 only:*** (AMPLITUDE) REF LVL 38.75 (+dBm)
    (BW)
    VID BW AUTO MAN (AUTO)
    (MKR) More 1 of 2
    MARKER ALL OFF
    (TRIG)
    SWEEP CONT SGL (CONT)

11. Press the following spectrum analyzer keys:

    (PEAK SEARCH)
    (MKR FCTN) MK TRACK ON OFF (ON)
    (MKR ->) MARKER ->REF LVL
    (SPAN) 2 (MHz)

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

12. Press (FREQUENCY) and adjust the center frequency until the LO feedthrough peak is on the left-most graticule line. Set the spectrum analyzer controls as follows:

    (SPAN) 50 (kHz)
    (AMPLITUDE) 50 (−dBm)
    ***Option 011 only:*** (AMPLITUDE) REF LVL 1.25 (−dBm)
    (BW)
    VID BW AUTO MAN 30 (Hz)

13. On the spectrum analyzer, press (AUX CTRL), Track Gen , SRC PWR ON OFF 0 (+dBm).

    ***Option 011 only:*** 42.8 (+dBm) (+42.8 dBmV).

14. Press (SGL SWP) and wait for completion of a new sweep. Press (DISPLAY) then DSP LINE ON OFF (ON).
15. Adjust the display line so that it is centered on the average trace noise, ignoring any residual responses. Record the display line amplitude setting in Table 1-25 as the noise level at 1 MHz.
16. Repeat steps 14 and 15 for the remaining Tracking Generator Output Frequencies (spectrum analyzer CENTER FREQ) listed in Table 1-25.
17. In Table 1-25, locate the most positive Noise Level Amplitude. Record this amplitude as TR Entry 1 in the performance test record.

**Table 1-25. TG Feedthrough Worksheet**

| Tracking Generator Output Frequency | Noise Level Amplitude (dBm or dBmV) | Measurement Uncertainty (dB) |
|---|---|---|
| 1 MHz | | +1.15/−1.24 |
| 20 MHz | | +1.15/−1.24 |
| 50 MHz | | +1.15/−1.24 |
| 100 MHz | | +1.15/−1.24 |
| 250 MHz | | +1.15/−1.24 |
| 400 MHz | | +1.15/−1.24 |
| 550 MHz | | +1.15/−1.24 |
| 700 MHz | | +1.15/−1.24 |
| 850 MHz | | +1.15/−1.24 |
| 1000 MHz | | +1.15/−1.24 |
| 1150 MHz | | +1.15/−1.24 |
| 1300 MHz | | +1.15/−1.24 |
| 1450 MHz | | +1.15/−1.24 |
| 1600 MHz | | +1.15/−1.24 |
| 1750 MHz | | +1.15/−1.24 |

# Performance Verification Test Record

**Table 1-26. Performance Verification Test Record**

Hewlett-Packard Company

Address: ______________________ Report No. ______________________

______________________

______________________ Date ______________________

______________________ (e.g. 10 SEP 1989)

Model HP 8590L

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** |
|---|---|---|---|
| Synthesized Sweeper | | | |
| Synthesizer/Function Generator | | | |
| Synthesizer/Level Generator | | | |
| AM/FM Signal Generator | | | |
| Measuring Receiver | | | |
| Power Meter | | | |
| RF Power Sensor | | | |
| High-Sensitivity Power Sensor | | | |
| Microwave Frequency Counter | | | |
| Universal Frequency Counter | | | |
| Frequency Standard | | | |
| Power Splitter | | | |
| Minimum Loss Adapter (Options 001 and 011 only) | | | |
| 50 MHz Low-Pass Filter | | | |
| 50 Ω Termination | | | |
| 75 Ω Termination (Options 001 and 011 only) | | | |
| Microwave Spectrum Analyzer (Options 010 and 011 only) | | | |

Notes/Comments:

## Table 1-26. Performance Verification Test Record (page 2 of 7)

| | |
|---|---|
| Hewlett-Packard Company<br>Model HP 8590L | Report No. ______________ |
| Serial No. ______________ | Date ______________ |

| Test Description | Results Measured Min | (TR Entry) | Max | Measurement Uncertainty |
|---|---|---|---|---|
| **1. 10 MHz Reference Accuracy** | | Frequency Error | | |
| Settability | -150 Hz | (1) ______ | + 150 Hz | ±4.2 x $10^{-9}$ |
| **2. Frequency Readout Accuracy and Marker Count Accuracy** | | | | |
| Frequency Readout Accuracy | | Frequency (MHz) | | |
| **SPAN** | | | | |
| 20 MHz | 1.49918 | (1) ______ | 1.50082 | ±2.5 Hz |
| 10 MHz | 1.49958 | (2) ______ | 1.50042 | ± 12.5 Hz |
| 1 MHz | 1.4999680 | (3) ______ | 1.500032 | ±25.0 Hz |
| Marker Count Accuracy | | | | |
| **SPAN** | | | | |
| (CNT RES = 10 Hz) 1 MHz | 1.49999989 | (4) ______ | 1.50000011 | ± 1 Hz |
| (CNT RES = 100 Hz) 20 MHz | 1.4999989 | (5) ______ | 1.5000011 | ± 1 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 Below Signal | | (1) ______ | -65 dBc | ± 1.0 dB |
| Sideband Above Signal | | (2) ______ | -65 dBc | ± 1.0 dB |
| **5. Frequency Span Readout Accuracy** | | | | |
| **SPAN** | | MKRA 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 | ±3.54 kHz |
| 100.00 kHz | 78.00 kHz | (4) ______ | 82.00 kHz | ±354 Hz |
| 99.00 kHz | 78.00 kHz | (5) ______ | 82.06 kHz | ±354 Hz |
| 10.00 kHz | 7.80 kHz | (6) ______ | 8.20 kHz | ±3.54 Hz |
| **6. Residual FM** | | (1) ______ | 250 Hz | ±45.8 Hz |

## Table 1-26. Performance Verification Test Record (page 3 of 7)

Hewlett-Packard Company
Model HP 8590L

Report No. ______

Serial No. ______

Date ______

| Test Description | Min | Results Measured (TR Entry) | Max | Measurement Uncertainty |
|---|---|---|---|---|
| 7. **Sweep Time Accuracy** | | | | |
| **SWEEP TIME** | | MKRΔ 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 1-26. Performance Verification Test Record (page 4 of 7)

Hewlett-Packard Company
Model HP 8590L

Report No. ____________

Serial No. ____________

Date ____________

| Test Description | Results Measured Mill | (TR Entry) | Max | Measurement Uncertainty |
|---|---|---|---|---|
| **8. Scale Fidelity (continued)** | | | | |
| **Log** Mode | | Incremental Error | | |
| **dB from Ref Level** | | | | |
| 0 | O(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 | fO.11 dB |
| Linear Mode | | | | |
| **% of Ref Level** | | | | |
| 100.00 | O(Ref) | O(Ref) | O(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 1-26. Performance Verification Test Record (page 5 of 7)

| | |
|---|---|
| Hewlett-Packard Company<br>Model HP 8590L | Report No. ________ |
| Serial No. ________ | Date ________ |

| Test Description | Min | Results Measured (TR Entry) | Max | Measurement Uncertainty |
|---|---|---|---|---|
| ). Reference Level Accuracy | | | | |
| Reference Level (dBm) | | M o Log e | | |
| -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 |
| Reference Level (dBm) | | M oLineard e | | |
| -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 |
| .O. Absolute Amplitude Calibration and Resolution Bandwidth Switching Uncertainties | | | | |
| Absolute Amplitude Uncertainty | -20.15 dB | (1) ________ | −19.85 dB | d 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 |

## Table 1-26. Performance Verification Test Record (page 6 of 7)

Hewlett-Packard Company
Model HP 8590L — Report No. ______________________

Serial No. ______________________ — Date ______________________

| Test Description | Min | Results Measured (TR Entry) | Max | Measurement Uncertainty |
|---|---|---|---|---|
| **1. 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 |
| **2. Calibrator Amplitude** | | | | |
| Output Power | -20.4 dBm | (1) ________ | – 19.6 dBm | ±0.2 dB |
| Output Power for Option *001* | + 28.35 dBmv | (2) ________ | + 29.15 dBmv | ±0.2 dB |
| **3. 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 |
| **4. Other Input Related Spurious Responses** | | | | |
| 542.8 MHz | | (1) ________ | -55 dBc | fl.O dB |
| 1142.8 MHz | | (2) ________ | -55 dBc | fl.O dB |
| **5. Spurious Responses** | | | | |
| Second Harmonic Distortion | | (1) ________ | -45 dBc | +1.86/–2.27 dB |
| Third Order Intermodulation Distortion | | (2) ________ | -54 dBc | +2.07/–2.42 dB |
| **6. Gain Compression** | | (1) ________ | 0.5 dB | + 0.21/–0.22 dB |
| **7. Displayed Average Noise** | | | | |
| **Frequency** | | | | |
| 400 kHz | | (1) ________ | -115 dBm | + 1.15/–1.25 dB |
| 1 MHz | | (2) ________ | -115 dBm | + 1.15/–1.25 dB |
| 1 MHz to 1.5 GHz | | (3) ________ | -115 dBm | + 1.15/–1.25 dB |
| 1.5 GHz to 1.8 GHz | | (4) ________ | -113 dBm | + 1.15/–1.25 dB |
| *Option 001 only:* **Frequency** | | | | |
| 1 MHz | | (2) ________ | -63 dBmV | + 1.15/–1.25 dB |
| 1 MHz to 1.5 GHz | | (3) ________ | -63 dBmV | + 1.15/–1.25 dB |
| 1.5 GHz to 1.8 GHz | | (4) ________ | -61 dBmV | + 1.15/–1.25 dB |

## Table 1-26. Performance Verification Test Record (page 7 of 7)

| | |
|---|---|
| Hewlett-Packard Company<br>Model HP 8590L | Report No. ______ |
| Serial No. ______ | Date ______ |

| Test Description | Results Measured |  |  | Measurement |
|---|---|---|---|---|
| | Min | (TR Entry) | Max | Uncertainty |
| **18. Residual Responses** | | | | |
| 150 kHz to 1.8 GHz | | (1) ______ | -90 dBm | +1.09/−1.15 dB |
| *Option 001 only:* | | | | |
| 1 MHz to 1.8 GHz | | (1) ______ | -38 dBmV | +1.09/−1.15 dB |
| **19. Absolute Amplitude, Vernier, and Power Sweep Accuracy** | | | | |
| *Option 010 or 011 only:* | | | | |
| Absolute Amplitude Accuracy | -1.0 dB | (1) ______ | +1.0 dB | +0.25/−0.26 dB |
| Positive Vernier Accuracy | | (2) ______ | +0.75 dB | ±0.033 dB |
| Negative Vernier Accuracy | -0.75 dB | (3) ______ | | ±0.033 dB |
| Power Sweep Accuracy | | (4) ______ | 1.5 dB | ±0.033 dB |
| **20. Tracking Generator Level Flatness** | | | | |
| *Option 010 only:* | | | | |
| Maximum Flatness | | | | |
| 100 kHz | | (1) ______ | +1.75 dB | +0.42/−0.45 dB |
| 300 kHz to 5 MHz | | (2) ______ | +1.75 dB | +0.28/−0.28 dB |
| 10 MHz to 1800 MHz | | (3) ______ | +1.75 dB | +0.24/−0.24 dB |
| Minimum Flatness | | | | |
| 100 kHz | -1.75 dB | (4) ______ | | +0.42/−0.45 dB |
| 300 kHz to 5 MHz | -1.75 dB | (5) ______ | | +0.28/−0.28 dB |
| 10 MHz to 1800 MHz | -1.75 dB | (6) ______ | | +0.24/−0.24 dB |
| *Option 011 only:* | | | | |
| Maximum Flatness | | | | |
| 1 MHz to 1800 MHz | | (1) ______ | +1.75 dB | +0.18/−0.39 dB |
| Minimum Flatness | | | | |
| 1 MHz to 1800 MHz | -1.75 dB | (2) ______ | | +0.18/−0.39 dB |
| **21. Harmonic Spurious Outputs** | | | | |
| *Option 010 or 011 only:* | | | | |
| 2nd Harmonic Level | | (1) ______ | -25 dBc | +1.55/−1.80 dB |
| 3rd Harmonic Level | | (2) ______ | -25 dBc | +1.55/−1.80 dB |
| **22. Non-Harmonic Spurious outputs** | | | | |
| *Option 010 or 011 only:* | | | | |
| Highest Non-Harmonic Response Amplitude | | (1) ______ | −30 dBc | +1.55/−1.80 dB |
| **23. Tracking Generator Feedthrough** | | | | |
| *Option 010 only:* | | (1) ______ | −106 dBm | +1.15/−1.24 dB |
| *Option 011 only:* | | (1) ______ | 57.24 dBmV | +1.15/−1.24 dB |

2

# Specifications and Characteristics

This chapter contains specifications and characteristics for the HP 8590D spectrum analyzer.

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

| | |
|---|---|
| **General** | General specifications and characteristics. |
| **Frequency** | Frequency-related specifications and characteristics. |
| **Amplitude** | Amplitude-related specifications and characteristics. |
| **Option** | Option-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 after 2 hours of storage at a constant temperature, within the operating temperature range, 30 minutes after the spectrum analyzer is turned on and 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.

## 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. 1111990 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** | |
| *50 Ω* | 9 kHz to 1.8 GHz |
| *75 Ω (Option 001)* | 1 MHz to 1.8 GHz |

| | |
|---|---|
| **Frequency Reference** | |
| Aging | ±2 x $10^{-6}$/year |
| Settability | ±0.5 x $10^{-6}$ |
| Temperature Stability | ±5 x $10^{-6}$ |

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

* frequency reference error = (aging rate x 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 x frequency reference error* + counter resolution + 100 Hz) |
| Frequency Span >10 MHz | ±(marker frequency x 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 x 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 1.8 GHz |
| *(Option 130)** | 0 Hz *(zero* span), 1 kHz to 1.8 GHz |
| Resolution | Four digits or 20 Hz, whichever is greater. |
| Accuracy | |
| Span ≤ 10 MHz | ±2% of span§ |
| Span > 10 MHz | ±3% of span |

* Not available in 8590L.
§*(Option 130)* For spans < 10 kHz, add an additional 10 Hz resolution error.

## Frequency Specifications

| | |
|---|---|
| **Frequency Sweep Time** | |
| Range | |
| | *20* ms to 100 s |
| *(Option 101)**** | 20 μs to 100 s for span = 0 Hz |
| Accuracy | |
| *20* ms to 100 s | ±3% |
| *20* μs to <20 ms *(Option 1 01)**** | ±2% |
| Sweep Trigger | Free Run, Single, Line, Video, External |

*** Not available in 8590L 8592L.

| | |
|---|---|
| **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. |
| *(Option 130)**** | Adds 30, 100 and 300 Hz (3 dB) bandwidths and 200 Hz (6 dB) EMI bandwidth. |
| Accuracy | |
| 3 dB bandwidths | ±20% |

*** Not available in 8590L 8592L.

| | |
|---|---|
| **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 |
| 30 Hz RBW, 30 Hz VBW *(Option 130)**** | ≤30 Hz pk-pk in 300 ms |
| System-Related Sidebands | |
| >30 kHz offset from CW signal | ≤*-65* dBc |

*** Not available in 8590L.

| | |
|---|---|
| **Calibrator Output Frequency** | 300 MHz ±(freq. ref. error* x 300 MHz) |

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

# Amplitude Specifications

| Amplitude Range | |
|---|---|
| 50 Ω | -115 dBm to +30 dBm |
| 50 Ω *(Option 130)**** | −130 dBm to +30 dBm |
| 75 Ω | -63 dBmV to +72 dBmV |
| 75 Ω *(Options 001 and 130)**** | -78 dBmV to +72 dBmV |
| *** Not available in 8590L. | |

| Maximum Safe Input Level | (Input attenuator ≥10 dB) | |
|---|---|---|
| | 50 Ω | 75 Ω *(Option 001)* |
| Average Continuous Power | +30 dBm (1 W) | +72 dBmV (0.2 W) |
| Peak Pulse Power | +30 dBm (1 W) | +72 dBmV (0.2 W) |
| | 25 Vdc | 100 Vdc |

| Gain Compression‡ | |
|---|---|
| > 10 MHz | ≤0.5 dB (total power at input mixer* = -10 dBm) |

* Mixer Power Level (dBm) = Input Power (dBm) − Input Attenuation (dB).
‡ (Option 130) If RBW ≤ 300 Hz, this applies only if signal separation ≥ 4 kHz and signal amplitudes ≤ Reference Level + 10 dB. Not available in 8590L 8592L.

| Displayed Average Noise Level | (Input terminated, 0 dB attenuation, 30 Hz VBW, sample detector) | |
|---|---|---|
| 1 kHz RBW | 50 Ω | 75 Ω *(Option 001)* |
| 400 kHz to 1 MHz | ≤−115 dBm | N/A |
| 1 MHz to 1.5 GHz | ≤-115 dBm | ≤−63 dBmV |
| 1.5 GHz to 1.8 GHz | ≤−113 dBm | ≤−61 dBmV |
| 30 Hz RBW *(Option 130)**** | | |
| 400 kHz to 1 MHz | ≤−130 dBm | N/A |
| 1 MHz to 1.5 GHz | ≤-130 dBm | ≤-78 dBmV |
| 1.5 GHz to 1.8 GHz | ≤−128 dBm | ≤−76 dBmV |
| *** Not available in 8590L. | | |

| Spurious Responses | |
|---|---|
| Second Harmonic Distortion | |
| 5 MHz to 1.8 GHz | <-70 dBc for -45 dBm tone at input mixer.* |
| Third Order Intermodulation Distortion | |
| 5 MHz to 1.8 GHz | <−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 ≤1.8 GHz. |

* Mixer Power Level (dBm) = Input Power (dBm) − Input Attenuation (dB). (For analyzers with Input 75 Ω, add another 5.7 dB to the Input Attenuator.)

## Amplitude Specifications

| Residual Responses | (Input terminated and 0 dB attenuation) | |
|---|---|---|
| | **50 Ω** | **75 n** (Option *001)* |
| 150 kHz to 1 MHz | <-90 dBm | N/A |
| 1 MHz to 1.8 GHz | <-90 dBm | <-38 dBmV |

| **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<br>0.05% of reference level for linear scale |
|---|---|
| Fast Sweep Times for Zero Span | |
| *20 μs* to *20* ms *(Option 101 or 301)**** | |
| Frequency ≤ 1 GHz | 0.7% of reference level for linear scale |
| Frequency > 1 GHz | 1.0% of reference level for linear scale |
| *** Not available in 8590L 8592L. | |

| **Reference Level** | |
|---|---|
| Range | |
| Log Scale | Minimum amplitude to maximum amplitude * * |
| Linear Scale | -99 dBm to maximum amplitude * * |
| Resolution | |
| Log Scale | 50.01 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 + .01 x dB from -20 dBm) |
| -60 dBm and below | |
| 1 kHz to 3 MHz RBW | ±(0.6 dB + .01 x dB from -20 dBm) |
| 30 Hz to 300 Hz RBW *(Option 130)**** | ±(0.7 dB + .01 x dB from -20 dBm) |

* See "Amplitude Range."
** Not available in 8590L 8592L.

| **Frequency Response** | (10 dB input attenuation) | |
|---|---|---|
| | **Absolutes** | **Relative Flatness**† |
| 9 kHz to 1.8 GHz | ±1.5 dB | fl.O dB |

† Referenced to midpoint between highest and lowest frequency response deviations.
§ Referenced to 300 MHz CAL OUT.

| **Calibrator Output Amplitude** | |
|---|---|
| *50 n* | -20 dBm ±0.4 dB |
| *75* n *(Option 001)* | + *28.75* dB mV ±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.

| Input Attenuator | |
|---|---|
| Range | 0 to 60 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 |
| 30 Hz to 300 Hz *(Option 130)**** | ±0.6 dB |

*** Not available in 8590L 8592L.

| 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 x dB from reference level) |
| RBW ≤ 1 kHz | ± (0.4 dB + 0.01 x 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 |

# Option Specifications

## Tracking Generator Specifications (Option 010 or 011)

All specifications apply over 0 °C to + 55 °C *. The spectrum-analyzer/tracking-generator combination will meet its specifications after 2 hours of storage at a constant temperature within the operating temperature range, 30 minutes after the spectrum-analyzer/tracking-generator is turned on and after CAL FREQ, CAL AMPTD, CAL TRK GEN, and TRACKING PEAK have been run.

| | |
|---|---|
| **Warm-Up** | 30 minutes |

| | |
|---|---|
| **Output Frequency** | |
| Range | |
| *50 Ω (Option 010)* | 100 kHz to 1.8 GHz |
| 75 Ω *(Option 011)* | 1 MHz to 1.8 GHz |

| | |
|---|---|
| **Output Power Level** | |
| Range | |
| *50 Ω (Option 010)* | 0 to −15 dBm |
| *75 Ω (Option 011)* | +42.8 to + 27.8 dBmV |
| Resolution | 0.1 dB |
| Absolute Accuracy | ±1.5 dB (at 300 MHz and -10 dBm source power)<br>*(Option 011: use +38.8 dBmV instead of -10 dBm)* |
| Vernier | |
| Range | 15 dB |
| Accuracy | ±1.0 dB (referenced to − 10 dBm source power)<br>*(Option 011: referenced to +38.8 dBmV instead of -10 dBm)* |

| | |
|---|---|
| **Output Power Sweep** | |
| Range | |
| 50 Ω *(Option* **010)** | − 15 dBm to 0 dBm |
| 75 Ω (Option *011)* | +27.8 to + 42.8 dBmV |
| Resolution | 0.1 dB |
| Accuracy (zero span) | <2 dB peak-to-peak |

| | |
|---|---|
| **Output Flatness** | |
| (referenced to 300 MHz) | ±1.75 dB |

| | |
|---|---|
| **Spurious Outputs** | |
| 50 Ω (Option *010)* | (0 dBm output, 100 kHz to 1.8 GHz) |
| 75 Ω *(Option 011)* | (+42.8 dBmV output, 1 MHz to 1.8 GHz) |
| Harmonic Spurs | <-25 dBc |
| Nonharmonic Spurs | <-30 dBc |

| | |
|---|---|
| **Dynamic Range** | |
| Tracking Generator Feedthrough | |
| *50 Ω (Option 010)* | <−106 dBm |
| *75 Ω (Option 011)* | <−57.24 dBmV |

## 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 | fl.O x $10^{-7}$/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. |
| *(Option 130)**** | Adds 30 Hz, 100 Hz, and 300 Hz bandwidths. |
| 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 |
| 40 dB/3 dB Bandwidth Ratio *(Option 130)* * * | |
| Resolution Bandwidth | |
| 30 Hz to 300 Hz | 10:1 |

* * * Not available in 8590L 8592L.

| | |
|---|---|
| **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. |
| (Option *130)**** | Adds 1, 3, and 10 Hz bandwidths. |
| Shape | Post detection, single pole low-pass filter used to average displayed noise. |
| (Option *130)**** | Bandwidths below 30 Hz are digital bandwidths with anti-aliasing filtering. |

*** Not available in 8590L 8592L.

| **FFT Bandwidth Factors** | **FLATTOP** | **HANNING** | **UNIFORM** |
|---|---|---|---|
| Noise Equivalent Bandwidth† | 3.63x | 1.5x | 1x |
| 3 dB Bandwidth† | 3.60x | 1.48x | 1x |
| 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.

| | |
|---|---|
| **Input Level** | > (-60 dBm + attenuator setting) |
| **Signal Level** | 0 to -30 dB below reference level |
| **FM Offset** | |
| Resolution | 400 Hz nominal |
| **FM Deviation** (FM GAIN) | |
| Resolution | 1 kHz nominal |
| Range | 10 kHz to 1 MHz |
| **Bandwidth** | FM deviation/:! |
| **FM Linearity** (for modulating frequency < bandwidth/100) | ≤ 1% of FM deviation + 290 Hz |

## Amplitude Characteristics

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

| | |
|---|---|
| **Log Scale Switching Uncertainty** | Negligible error |

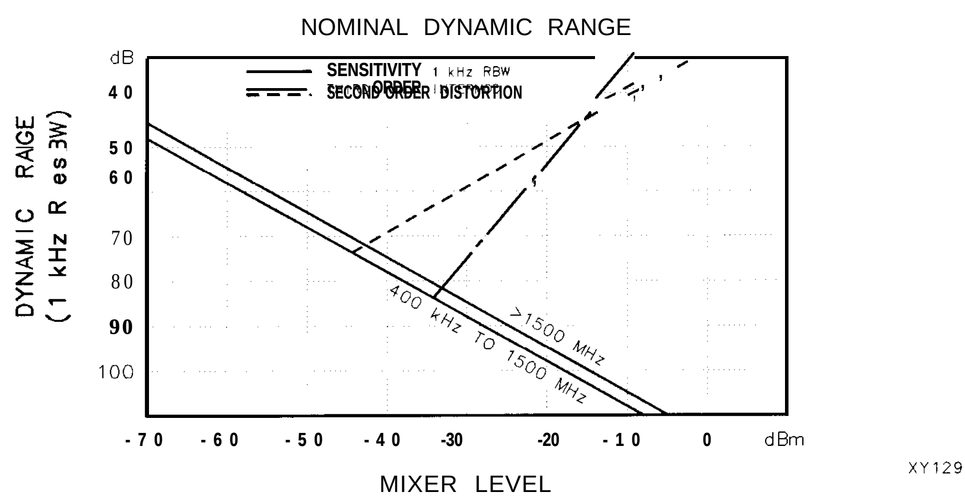
| | |
|---|---|
| **Input Attenuation Uncertainty*** | |
| Attenuator Setting | |
| 0 dB | ±0.5 dB |
| 10 dB | Reference |
| 20 dB | ±0.5 dB |
| 30 dB | ±0.6 dB |
| 40 dB | ±0.8 dB |
| 50 dB | fl.O dB |
| 60 dB | ±1.2 dB |

* Referenced to 10 dB input attenuator setting from 9 kHz to 1.8 GHz. See the "Specifications" table under "Freauencv Resoonse."

| | |
|---|---|
| **Input Attenuator Repeatability** | |
| 300 MHz | ±0.03 dB |
| 1.8 GHz | ±1.0 dB |

| | |
|---|---|
| **RF Input SWR** | (Attenuator setting 10 to 60 dB) |
| | 1.35:1 |

**DYNAMIC RANGE**




**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. |

# Option Characteristics

## Tracking Generator Characteristics (Option 010 or 011)

| | |
|---|---|
| **Output Tracking** | |
| Drift (usable in 10 kHz bandwidth after 30-minute warmup) | 1 kHz/5 minutes |

| | |
|---|---|
| **Spurious Outputs** (>1.8 GHz to 4.0 GHz) | |
| *50 Ω (Option 010)* | |
| 0 dBm output | |
| *75 Ω (Option 011)* | |
| + 42.8 dBmV, output | |
| Harmonic | <-20 dBc |
| Nonharmonic | < -40 dBc |
| 2121.4 MHz Feedthrough | |
| *(Option 010)* | <-45 dBm |
| *(Option 011)* | < + 3.8 dBmV |

| | |
|---|---|
| **RF Power-Off Residuals** | |
| 100 kHz to 1.8 GHz *(Option 010)* | <−65 dBm |
| 1 MHz to 1.8 GHz *(Option 011)* | <−16.2 dBmV |

| | |
|---|---|
| **Dynamic Range** (difference between maximum power out and tracking generator feedthrough) | |
| 100 kHz to 1.8 GHz *(Option 010)* | >106 dB |
| 1 MHz to 1.8 GHz (Option *011)* | >100 dB |

# Physical Characteristics

## Front-Panel Inputs and Outputs

| | |
|---|---|
| INPUT **50Ω** | |
| Connector | Type N female |
| Impedance | 50 Ω nominal |
| **INPUT 75Ω *(Option 001)*** | |
| Connector | BNC female |
| Impedance | 75 Ω nominal |

| | |
|---|---|
| **RF OUT** *(Option 010, 011)* | |
| Connector | |
| *(Option 010)* | Type N female |
| *(Option 011)* | 75 Ω BNC female |
| Impedance | |
| *(Option 010)* | 50 Ω nominal |
| *(Option 011)* | 75 Ω nominal |
| Maximum Safe Reverse Level | |
| (Option *010)* | + 20 dBm (0.1 W), 25 Vdc |
| *(Option 011)* | + 69 dBmV (0.1 W), 100 Vdc |

| | |
|---|---|
| PROBE POWERS | |
| Voltage/Current | + 15 Vdc, ±7% at 150 mA max.<br>-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<br>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 |

## Physical Characteristics

| | |
|---|---|
| **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 ALC** INPUT *(Option 010 or 011)* | |
| Impedance | 1 MΩ |
| Polarity | Positive or negative |
| Range | -66 dBV to + 6 dBV |
| Connector | BNC |

| | |
|---|---|
| **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<br>15.75 kHz horizontal rate<br>60 Hz vertical rate |
| SYNC PAL | PAL Compatible<br>15.625 kHz horizontal rate<br>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, PPO, DC1, Cl, 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.

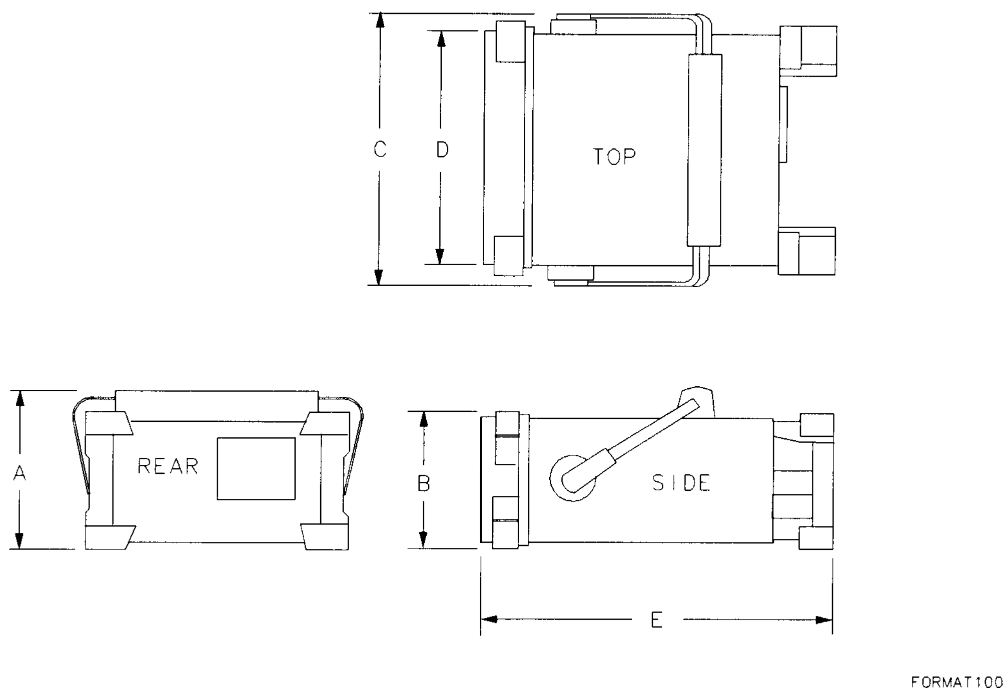
**WEIGHT**

| | |
|---|---|
| **Net** | |
| HP 8590L | 15.2 kg (33.5 lb) |
| **Shipping** | |
| HP 8590L | 16.8 kg (37 lb) |

## Physical Characteristics

**DIMENSIONS**

A = **8** in (200 mm)
B = **7.25** in (184 mm)
C = 14.69 in (373 mm)
D = 12.8 in (325 mm)
E = 18.12 in (460.5 mm)



# Regulatory Information

The information on the following pages apply to the HP 8590L and the HP 8592L spectrum analyzer products.

# Declaration of Conformity

**DECLARATION OF CONFORMITY**
**according to ISO/IEC Guide 22 and EN 45014**

| | |
|---|---|
| **Manufacturer's Name:** | Hewlett-Packard Co. |
| **Manufacturer's Address:** | 1212 Valleyhouse Drive<br>Rohnert Park, California 94928-4999<br>U.S.A. |
| **Manufacturer's Name:** | Hewlett-Packard Ltd. |
| **Manufacturer's Address:** | South Queesferry<br>West Lothian, EH30 9TG<br>Scotland, United Kingdom |

**Declares that the product:**

| | |
|---|---|
| Product Name: | Spectrum Analyzer |
| Model Numbers: | HP 8590L and HP 8592L |
| Product Options: | This declaration covers all options<br>of the above products. |

**Conforms to the following product specifications:**

| | |
|---|---|
| Safety: | IEC 348: 1978/HD 401: 1980<br>CAN/CSA-22.2 No. 231 Series M89 |
| EMC: | CISPR 11:1990 /EN 55011:1991, Group 1 Class A<br>IEC 801-2:1991 /EN 50082-1:1992, 4 kV CD, 8 kV AD<br>IEC 801-3: 1984 /EN 50082-1: 1992, 3V/m, 27-500 MHz<br>IEC 801-4:1988 /EN 50082-1:1992, 500 V signal, 1000 V AC |

**Supplementary Information:**

The product herewith complies with the requirements of the Low Voltage Directive 73/23/EEC and the EMC Directive 89/336/EEC.

| | | |
|---|---|---|
| Rohnert Park, California | Jan 28, 1994 | Dixon Browder |
| **Location** | **Date** | **Dixon Browder / Quality Manager** |
| South Queensferry, Scotland | Feb 4, 1994 | Peter Rigby |
| **Location** | **Date** | **Peter Rigby / Quality Manager** |

**European Contact:**
Your local Hewlett-Packard Sales and Service Office or Hewlett-Packard GmbH, Department ZQ/Standards Europe, Herrenberger Straße 130, D-7030 Böblingen (FAX: + 49-703 1- 143143)

## Notice for Germany: Noise Declaration

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

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.

•I 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.

•I 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 Analyzer 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-Sties and L-Series Spectrum Analyzer User's Guide.***

## Table 3-1. Hewlett-Packard Sales and Service Offices

### US FIELD OPERATIONS

**Headquarters**
Hewlett-Packard Co.
19320 Pruneridge Avenue
Cupertino, CA 95014
(800) 752-0900

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

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

**Colorado**
Hewlett-Packard Co.
24 Inverness Place, East
Englewood, CO 80112
(303) 649-5512

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

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

**New Jersey**
Hewlett-Packard Co.
150 Green Pond Rd.
Rockaway, NJ 07866
(201) 586-5400

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

### 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
(44 734) 696622

### INTERCON FIELD OPERATIONS

**Headquarters**
Hewlett-Packard Company
3495 Deer Creek Road
Palo Alto, California, USA
94304-1316
(415) 857-5027

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

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

**China**
China Hewlett-Packard Company
38 Bei San Huan Xl Road
Shuang Yu Shu
Hai Dian District
Beijing, China
(86 1) 256-6888

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

**Singapore**
Hewlett-Packard Singapore (Pte.) Ltd.
150 Beach Road
#29-00 Gateway West
Singapore 07 18
(65) 291-9088

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

## 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 Analyzer*** 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.

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**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.

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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.