Calibration Guide

8590L Spectrum Analyzer

Agilent Technologies

Manufacturing Part Number: 08590-90315
Supersedes: 08590-90269

Printed in USA

April 2001

Certification

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

Regulatory Information

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

Warranty

This Agilent Technologies instrument product is warranted against defects in material and workmanship for a period of three years from date of shipment. During the warranty period, Agilent Technologies will, at its option, either repair or replace products which prove to be defective.

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

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

Limitation of Warranty

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

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

Exclusive Remedies

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

Assistance

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

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

8590 Series Spectrum Analyzer Documentation Description

Manuals Shipped with your 8590L Spectrum Analyzer:

8590L Spectrum Analyzer Calibration Guide

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

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.

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 GPIB 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:

8590 E-Series and L-Series Spectrum Analyzer, and 8591C Cable TV Analyzer Assembly-Level Repair Service Guide

- Describes adjustment and assembly level repair of the analyzer.

8590 E-Series and L-Series Spectrum Analyzer, and 8591C 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 can be ordered individually. To order, contact your local Agilent Technologies Sales and Service Office.

How to Use This Guide

Where to Start

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

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

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

This guide uses the following conventions:

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

Contents

1 Calibrating

This chapter identifies the performance test procedures which test the electrical performance of the analyzer. Allow the analyzer to warm up in accordance with the temperature stability specifications before performing the tests in this chapter.

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

Calibrating

Calibration

Calibration verifies that the analyzer performance is within all specifications. It is time consuming and requires extensive test equipment. Calibration consists of *all* the performance tests. For a complete listing of the performance tests, see the performance verification tests table for your specific analyzer.

Calibration Cycle

The performance tests in Chapter 2 , “Performance Verification Tests,” should be used to check the analyzer against its specifications once every year. Specifications are listed in this calibration guide.

The 300 MHz frequency of the CAL OUT signal must be checked at the same time and adjusted if necessary. Refer to the “10 MHz Frequency Reference Adjustment” procedure in the assembly-level repair service guide.

When A 3335A Source Is Not Available

The 3335A Synthesizer Level Generator signal source has become obsolete because parts used in the manufacture of this instrument are no longer available from suppliers. To meet the need of our customers, this calibration guide has been revised to add new performance verification tests that do not use the 3335A Synthesizer Level Generator. This revision includes the addition of signal sources required to replace the 3335A, changes to the test equipment setup illustrations, and changes in the steps required to execute the procedures.

Since all of our customers will not need to replace their 3335A Synthesizer Level Generators immediately, the original performance tests which use the 3335A signal generator have been retained. The revisions have been incorporated in this calibration guide as Chapter 2a , “Performance Verification Tests: If 3335A Source Not Available,” and Chapter 3a , “Performance Test Records: If 3335A Source Not Available.”

Operation Verification

Operation verification only tests the most critical specifications. These tests are recommended for incoming inspection, troubleshooting, or after repair. Operation verification requires less time and equipment than the calibration. See the performance verification tests table for your analyzer.

Performance Verification Test Tables

The following table lists the performance tests in Chapter 2 and Chapter 2a. Select the analyzer option being calibrated and perform the tests marked in the option column.

A dot indicates that the test is required for calibration. A diamond indicates that the test is required for both calibration and operation verification. Note that some of the tests are used for both calibration and operation verification.

Table 1-1 8590L Performance Verification Tests

	Performance Test Name	Calibration for Instrument Option:			
		Std [a]	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[b]	•	•	•	•
5a.	Frequency Span Readout Accuracy[c]	•	•	•	•
6.	Residual FM	•	•	•	•
7.	Sweep Time Accuracy	•	•	•	•
8.	Scale Fidelity[b]	◊	◊	◊	◊
8a.	Scale Fidelity[c]	◊	◊	◊	◊
9.	Reference Level Accuracy[b]	◊	◊	◊	◊
9a.	Reference Level Accuracy[c]	◊	◊	◊	◊
10.	Absolute Amplitude Calibration and Resolution Bandwidth Switching Uncertainties	◊	◊	◊	◊
11.	Resolution Bandwidth Accuracy[b]	•	•	•	•
11a.	Resolution Bandwidth Accuracy[c]	•	•	•	•
12.	Calibrator Amplitude Accuracy	◊	◊	◊	◊
13.	Frequency Response[b]	◊	◊	◊	◊
13a.	Frequency Response[c]	◊	◊	◊	◊
14.	Other Input Related Spurious Responses	•	•	•	•
15.	Spurious Response[b, d]	◊	◊	◊	◊
15a.	Spurious Response[c, d]	◊	◊	◊	◊
16.	Gain Compression[b]	•	•	•	•
16a.	Gain Compression[c]	•	•	•	•
17.	Displayed Average Noise Level	◊	◊	◊	◊
18.	Residual Responses	•	•	•	•

Calibrating

Table 1-1 8590L Performance Verification Tests (Continued)

Performance Test Name		Calibration for Instrument Option:			
		Std [a]	001	010	011
19.	Absolute Amplitude, Vernier, and Power Sweep Accuracy			•	•
20.	Tracking Generator Level Flatness			•	•
21.	Harmonic Spurious Outputs			•	•
22.	Non-Harmonic Spurious Outputs			•	•
23.	Tracking Generator Feedthrough			•	•

a. Use this column for all other options *not* listed in this table.
b. If a 3335A source is not available, use the alternative performance test with the same number found in Chapter 2a , "Performance Verification Tests: If 3335A Source Not Available."
c. If a 3335A source is not available, substitute this performance test for the one with the same number found in Chapter 2 , "Performance Verification Tests."
d. "Part 2: Third Order Intermodulation Distortion, 50 MHz" is not required for operation verification.

Safety

Familiarize yourself with the safety symbols marked on the analyzer, and read the general safety instructions and the symbol definitions given in Chapter 6 , "Safety and Regulatory Information," *before* you begin verifying performance of the spectrum analyzer.

Before You Start

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

- Switch the analyzer on and let it warm up in accordance with the temperature stability specification.
- Read "Making a Measurement" in your analyzer user's guide.
- After the analyzer has warmed up as specified, perform the self-calibration procedure documented in "Improving Accuracy With Self-Calibration Routines" in the *8590 E-Series and L-Series Spectrum Analyzer User's Guide*. The performance of the analyzer is only specified after the analyzer calibration routines have been run and if the analyzer is autocoupled.
- Read the rest of this section before you start any of the tests, and make a copy of the Performance Verification Test Record described below in "Recording the test results."

Test Equipment You Will Need

Table 1-2 through Table 1-5 list the recommended test equipment for the performance tests. The tables also list recommended equipment for the analyzer adjustment procedures which are located in the *8590 Series Analyzers Assembly-Level Repair Service Guide*. Any equipment that meets the critical specifications given in the table can be substituted for the recommended model.

If a 3335A Synthesizer/Level Generator is not available, see Table 1-2 through Table 1-4 for alternative recommended test equipment, accessories, and adapters.

Recording the Test Results

Performance verification test records, for each spectrum analyzer, are provided in Chapter 3 , “Performance Test Records,” and Chapter 3a , “Performance Test Records: If 3335A Source Not Available,” following the tests.

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

Frequency and Amplitude Self-Calibration

Perform the frequency and amplitude self-calibration routines at least once per day, or if the analyzer fails a verification test. To perform self-calibration, press **CAL** then **CAL FREQ & AMPTD**. The instrument must be up to operating temperature in order for this test to be valid. Press **CAL STORE** when the test is complete. If the analyzer continuously 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 1 for instructions on how to solve the problem.

Periodically Verifying Operation

The analyzer requires periodic verification of operation. Under most conditions of use, you should test the 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 [a]
Digital Voltmeter	Input Resistance: ≥10 MΩ Accuracy: ±10 mV on 100 V range	3456A	P,A,T
DVM Test Leads	For use with 3456A	34118B	A,T
Frequency Standard	Frequency: 10 MHz Timebase Accuracy (Aging): $<1 \times 10^{-9}$/day	5061B	P,A
Measuring Receiver	Compatible with Power Sensors dB Relative Mode Resolution: 0.01 dB Reference Accuracy: ±1.2%	8902A	P,A,T
Microwave Frequency Counter	Frequency Range: 9 MHz to 7 GHz Timebase Accuracy (Aging): $<5 \times 10^{-10}$/day	5343A	P,A,T
Oscilloscope	Bandwidth: dc to 100 MHz Vertical Scale Factor of 0.5 V to 5 V/Div	54501A	T
Power Meter	Power Range: Calibrated in dBm and dB relative to reference power –70 dBm to +44 dBm, sensor dependent	436A	P,A,T
Power Sensor	Frequency Range: 100 kHz to 1800 MHz Maximum SWR: 1.60 (100 kHz to 300 kHz) 1.20 (300 kHz to 1 MHz) 1.1 (1 MHz to 2.0 GHz) 1.30 (2.0 to 2.9 GHz)	8482A	P,A,T
Power Sensor	Frequency Range: 1 MHz to 2 GHz Maximum SWR: 1.18 (600 kHz to 2.0 GHz) 75 Ω	8483A	P,A,T
Power Sensor, Low Power	Frequency Range: 300 MHz Amplitude Range: –20 dBm to –70 dBm Maximum SWR: 1.1 (300 MHz)	8484A	P,A,T
Signal Generator	Frequency Range: 1 MHz to 1000 MHz Amplitude Range: –35 to +16 dBm SSB Noise: <–120 dBc/Hz at 20 kHz offset	8640B Option 002	P,A,T
Spectrum Analyzer, Microwave	Frequency Range: 100 kHz to 7 GHz Relative Amplitude Accuracy: 100 kHz to 1.8 GHz: <±1.8 dB Frequency Accuracy: <±10 kHz @ 7 GHz	8566A/B	P,A,T

Table 1-2 Recommended Test Equipment (Continued)

Equipment	Critical Specifications for Equipment Substitution	Recommended Model	Use [a]
Synthesized Sweeper	Frequency Range: 10 MHz to 22 GHz Frequency Accuracy (CW): ± 0.02% Leveling Modes: Internal and External Modulation Modes: AM Power Level Range: –35 to +16 dBm	8340A/B	P,A,T
Synthesizer/Function Generator	Frequency Range: 0.1 Hz to 500 Hz Frequency Accuracy: ±0.02% Waveform: Triangle	3325B	P,T
Synthesizer/Level Generator[b]	Frequency Range: 1 kHz to 80 MHz Amplitude Range: +12 to –85 dBm Flatness: ±0.15 dB Attenuator Accuracy: ±0.09 dB	3335A	P,A,T
When a 3335A source is not available:			
Synthesized Signal Generator	Frequency Range: 100 kHz to 2560 MHz	8663A	P

a. P = Performance Test, A = Adjustment, T = Troubleshooting
b. If a 3335A source is not available, substitute an 8663A signal generator.

Table 1-3 Recommended Accessories

Equipment	Critical Specifications for Accessory Substitution	Recommended Model	Use [a]
Active Probe	5 Hz to 500 MHz	41800A	T
Active Probe	300 kHz to 3 GHz	85024A	T
Attenuator, 10 dB	Type N (m to f) Frequency: 300 MHz	8491A Option 010	P,A,T
Attenuator, 1 dB Step	Attenuation Range: 0 to 12 dB Frequency Range: 50 MHz Connectors: BNC female	355C	P,A
Attenuator, 10 dB Step	Attenuation Range: 0 to 30 dB Frequency Range: 50 MHz Connectors: BNC female	355D	P,A
Digital Current Tracer	Sensitivity: 1 mA to 500 mA Frequency Response: Pulse trains to 10 MHz Minimum Pulse Width: 50 ns Pulse Rise Time: <200 ns	547A	T

Table 1-3 Recommended Accessories (Continued)

Equipment	Critical Specifications for Accessory Substitution	Recommended Model	Use [a]
Directional Bridge	Frequency Range: 0.1 to 110 MHz Directivity: >40 dB Maximum VSWR: 1.1:1 Transmission Arm Loss: 6 dB (nominal) Coupling Arm Loss: 6 dB (nominal)	8721A	P,T
Logic Pulser	TTL voltage and current drive levels	546A	T
Logic Clip	TTL voltage and current drive levels	548A	T
Low Pass Filter, 50 MHz	Cutoff Frequency: 50 MHz Rejection at 80 MHz: >50 dB	0955-0306	P,T
Low Pass Filter, 300 MHz	Cutoff Frequency: 300 MHz Bandpass Insertion Loss: <0.9 dB at 300 MHz Stopband Insertion Loss: >40 dB at 435 MHz	0955-0455	P,A,T
Power Splitter	Frequency Range: 50 kHz to 1.8 GHz Insertion Loss: 6 dB (nominal) Output Tracking: <0.25 dB Equivalent Output SWR: <1.22:1	11667A	P,A
Termination, 50 Ω	Impedance: 50 Ω (nominal) *(2 required for Option 010)*	908A	P,T
Termination, 75 Ω	Impedance: 75 Ω (nominal) *(2 required for option 011)*	909E Option 201	P,T
When a 3335A source is not available:			
Attenuator/Switch Driver	Compatible with 8494G and 8496G programmable step attenuators	11713A	P, A
Attenuator Interconnect Kit	Mechanically and electrically connects 8494A/G and 8496A/G	11716 Series	P, A

a. P = Performance Test, A = Adjustment, T = Troubleshooting

Table 1-4 Recommended Adapters

Equipment	Critical Specifications for Accessory Substitution	Recommended Model	Use[a]
Adapter	APC 3.5 (f) to APC 3.5 (f)	5061-5311	P,A,T
Adapter	BNC (f) to dual banana plug	1251-1277	P,A,T
Adapter	BNC (m) to BNC (m)	1250-0216	P,A,T
Adapter	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	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	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, Minimum Loss	50 to 75 Ω, matching Frequency Range: dc to 2 GHz Insertion Loss: 5.7 dB	11852B	P,A,T
When a 3335A source is not available:			
Adapter	BNC (f) to SMA (m)	1250-1200	P, A, T
Adapter	BNC tee (f, m, f)	1250-0781	P, A, T

a. P = Performance Test, A = Adjustment, T = Troubleshooting

Table 1-5 Recommended Cables

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

a. P = Performance Test, A = Adjustment, T = Troubleshooting
b. Option 001 and Option 011 only

2 Performance Verification Tests

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

If a 3335A source is not available, use the alternative performance test with the same number found in Chapter 2a.

Calibrated Attenuator Settings

Refer to Table 2-1 for each test in Chapter 2 which requires the use of a calibrated attenuator.

Table 2-1 11713A Calibrated Attenuator Settings

1 dB Step Atten (dB)	Attenuator X				10 dB Step Atten (dB)	Attenuator Y			
	1	2	3	4		5	6	7	8
0	0	0	0	0	0	0	0	0	0
1	1	0	0	0	10	1	0	0	0
2	0	1	0	0	20	0	1	0	0
3	1	1	0	0	30	1	1	0	0
4	0	0	1	0	40	0	0	1	0
5	1	0	1	0	50	1	0	1	0
6	0	1	1	0	60	0	1	1	0
7	1	1	1	0	70	1	1	1	0
8	0	0	1	1	80	0	0	1	1
9	1	0	1	1	90	1	0	1	1
10	0	1	1	1	100	0	1	1	1
11	1	1	1	1	110	1	1	1	1

1. 10 MHz Reference Output Accuracy

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

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

Equipment Required

Microwave frequency counter

Frequency standard

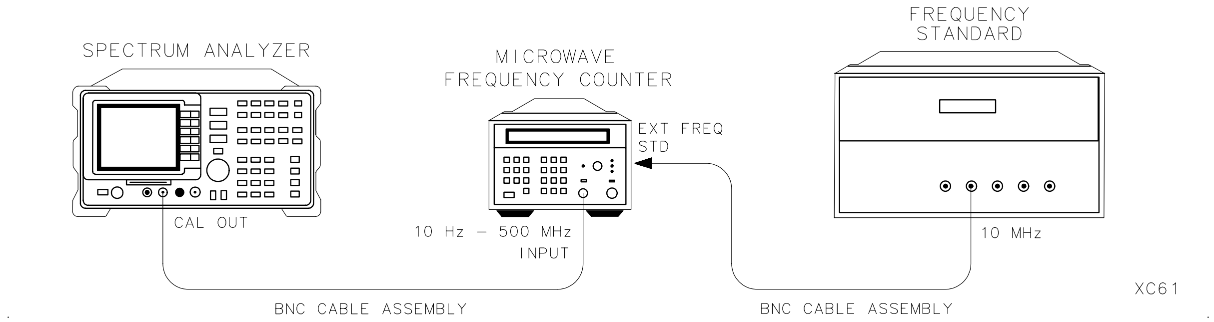
Cable, BNC, 122 cm (48 in) *(2 required)*

Procedure

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

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

Figure 2-1 10 MHz Reference Test Setup



2. Set the frequency counter controls as follows:

   SAMPLE RATE .... Midrange

   50 Ω/1 Ω SWITCH .... 50 Ω

   10 Hz-500 MHz/500 MHz-26.5 GHz
   SWITCH.. 10 Hz-500 MHz

   FREQUENCY STANDARD (Rear panel) ...EXTERNAL

3. Wait for the frequency counter reading to stabilize. Record the frequency counter reading in the 10 MHz Reference Accuracy Worksheet as Counter Reading 1.

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

   FREQUENCY, –37, **Hz**

   CAL, More 1 of 4, More 2 of 4, VERIFY TIMEBASE

5. Record the number in the active function block of the spectrum analyzer in Table 2-2 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 Table 2-2 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 Table 2-2 as Counter Reading 3.

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

    a. Calculate the frequency difference between Counter Reading 2 and Counter Reading 1.

    b. Calculate the frequency difference between Counter Reading 3 and Counter Reading 1.

    c. Divide the difference with the greatest absolute value by two and record the value as TR Entry 1 in the appropriate performance verification test record in Chapter 3. The settability should be less than ±150 Hz.

    d. Press **PRESET** on the spectrum analyzer. The timebase DAC will be reset automatically to the value recorded in step 5.

Performance verification test “10 MHz Reference Output Accuracy” is now complete.

Table 2-2 10 MHz Reference Accuracy Worksheet

Description	Measurement
Counter Reading 1	______________Hz
Timebase DAC Setting	______________Hz
Counter Reading 2	______________Hz
Counter Reading 3	______________Hz

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 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: Frequency Readout Accuracy

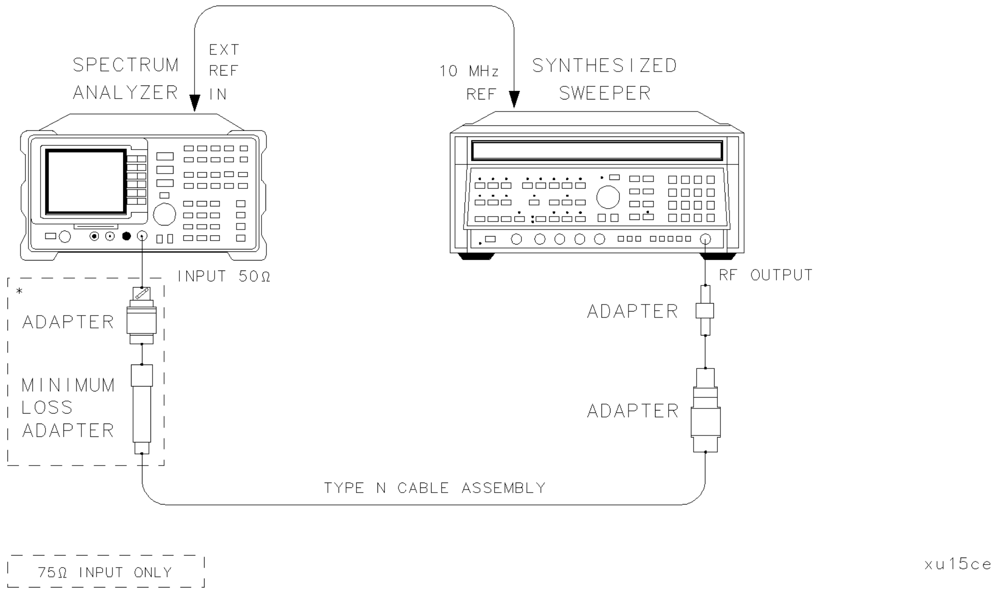
Part 2: Marker Count Accuracy

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 2-2. Remember to connect the 10 MHz REF OUT of the synthesized sweeper to the EXT REF IN of the spectrum analyzer.

Figure 2-2 Frequency Readout Accuracy Test Setup



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

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

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

      CW .... 1.5 GHz

      POWER LEVEL .... –10 dBm

   b. 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**

3. Press **PEAK SEARCH** on the spectrum analyzer to measure the frequency readout accuracy.

4. Record the MKR frequency reading in the performance verification test record. The reading should be within the limits shown in Table 2-3.

5. Change to the next spectrum analyzer span setting listed in Table 2-3.

6. Repeat steps 3 through 5 for each spectrum analyzer span setting listed in Table 2-3.

Part 2: Marker Count Accuracy

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

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

   FREQUENCY, 1.5, **GHz**

   SPAN, 20, **MHz**

   BW, RES BW AUTO MAN, 300, **kHz**

   MKR FCTN, **MK COUNT ON OFF** (ON)

   More 1 of 2

   CNT RES AUTO MAN, 100, **Hz**

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

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

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

   SPAN, 1, **MHz**

   MKR FCTN, MK COUNT ON OFF (ON)

   More 1 of 2

   CNT RES AUTO MAN, 10, **Hz**

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

6. Record the CNTR frequency reading as TR Entry 6 in the appropriate performance verification test record in Chapter 3. The reading should be within the limits of 1.49999989 GHz and 1.50000011 GHz.

Performance verification test “Frequency Readout and Marker Count Accuracy” is now complete.

Table 2-3 Frequency Readout Accuracy

Spectrum Analyzer	MKR Reading		
Span (MHz)	Min. (MHz)	TR Entry Actual	Max. (MHz)
20	1.49918	**(1)**________	1.50082
10	1.49958	**(2)**________	1.50042
1	1.499968	**(3)**________	1.500032

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 Option 026

Adapter, APC 3.5 (f) to Type N (f)

Additional Equipment for 75 Ω Input

Adapter, minimum loss

Adapter, Type N (f) to BNC (m), 75 Ω

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. Set the signal generator controls as follows:

   FREQUENCY .... 500 MHz

   OUTPUT LEVEL .... 0 dBm

   AM .... OFF

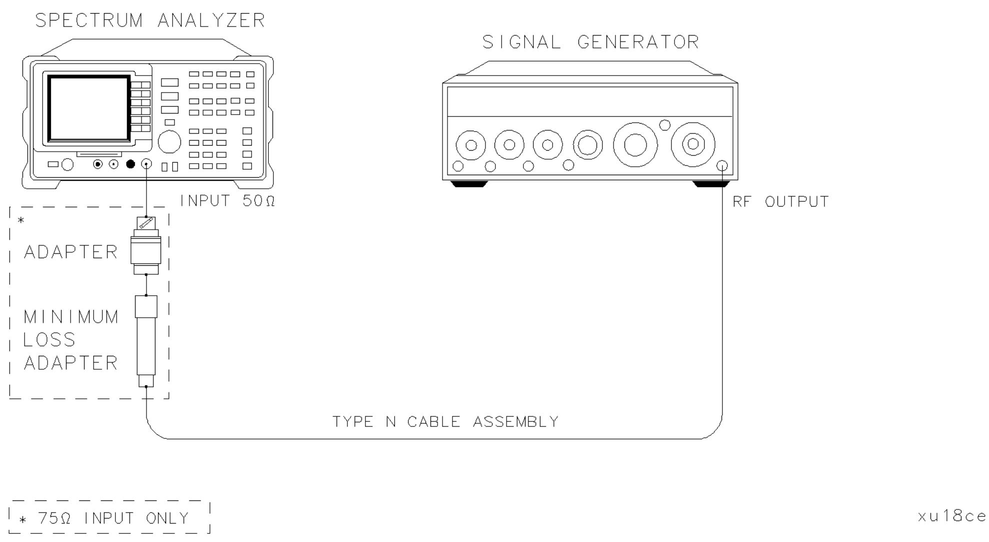
   FM .... OFF

   COUNTER .... INT

   RF .... ON

2. Connect the equipment as shown in Figure 2-3.

Figure 2-3 Noise Sidebands Test Setup



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

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**

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

   PEAK SEARCH

   MKR FCTN, **MK TRACK ON OFF** (ON)

   SPAN, 200, **kHz**

   BW, 1, **kHz**

   VID BW AUTO MAN, 30, **Hz**

   MKR FCTN, MK TRACK ON OFF (OFF)

   SGL SWP

5. Wait for the completion of a sweep, then press **PEAK SEARCH**.
6. Record the MKR amplitude reading in Table 2-3 as the Carrier Amplitude.
7. Press the following spectrum analyzer keys to measure the noise sideband level at +10 kHz:

   MARKER ∆, 10, **kHz**

   MKR, **MARKER NORMAL**

8. Record the MKR amplitude reading in Table 2-3 as the Noise Sideband Level at +10 kHz.
9. Press the following spectrum analyzer keys to measure the noise sideband level at –10 kHz:

   PEAK SEARCH

   MARKER ∆, –10, **kHz**

   MKR, MARKER NORMAL

10. Record the MKR amplitude reading in Table 2-3 as the Noise Sideband Level at –10 kHz.
11. Record the more positive value, either Noise Sideband Level at +10 kHz or Noise Sideband Level at –10 kHz from Table 2-3 as the Maximum Noise Sideband Level.
12. Calculate the Noise Sideband Suppression (NSS) by subtracting the Carrier Amplitude (Carrier AMP) from the Maximum Noise Sideband Level (NSL) at 10 kHz as follows:

    NSS = Maximum NSL – Carrier AMP

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

Part 1 of performance verification test "Noise Sidebands" is now complete. Proceed with Part 2 of performance verification test "Noise Sidebands."

Part 2: Noise Sideband Suppression at 20 kHz

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

   MKR, MARKER Δ, 20, **kHz**

   MARKER NORMAL

2. Record the MKR amplitude reading in Table 2-3 as the Noise Sideband Level at +20 kHz.
3. Press the following spectrum analyzer keys to measure the noise sideband level at –20 kHz:

   PEAK SEARCH

   MARKER Δ, –20, **kHz**

   MKR, MARKER NORMAL

4. Record the MKR amplitude reading in Table 2-3 as the Noise Sideband Level at –20 kHz.
5. Record the more positive value, either Noise Sideband Level at +20 kHz or Noise Sideband Level at –20 kHz from Table 2-3 as the Maximum Noise Sideband Level.
6. Subtract the Carrier Amplitude (Carrier AMP) from the Maximum Noise Sideband Level (NSL) at 20 kHz using the equation below.

   NSS = Maximum NSL – Carrier AMP

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

Part 2 of performance verification test "Noise Sidebands" is now complete. Proceed with Part 3 of performance verification test "Noise Sidebands."

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

2. Record the MKR amplitude reading in Table 2-3 as the Noise Sideband Level at +30 kHz.
3. Press the following spectrum analyzer keys to measure the noise sideband level at –30 kHz:

   PEAK SEARCH

   MARKER Δ, –30, **kHz**

   MKR, MARKER NORMAL

4. Record the MKR amplitude reading in Table 2-3 as the Noise Sideband Level at –30 kHz.
5. Record the more positive value, either Noise Sideband Level at +30 kHz or Noise Sideband Level at –30 kHz from Table 2-3 as the Maximum Noise Sideband Level.
6. Subtract the Carrier Amplitude (Carrier AMP) from the Maximum Noise Sideband Level (NSL) at 30 kHz using the equation below.

   NSL = Maximum NSL – Carrier AMP

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

NOTE The resolution bandwidth is normalized to 1 Hz as follows:

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

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

Performance verification test “Noise Sidebands” is now complete.

Table 2-4 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

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

Procedure

1. Set the signal generator controls as follows:

   FREQUENCY .... 500 MHz

   OUTPUT LEVEL .... 0 dBm

   AM .... OFF

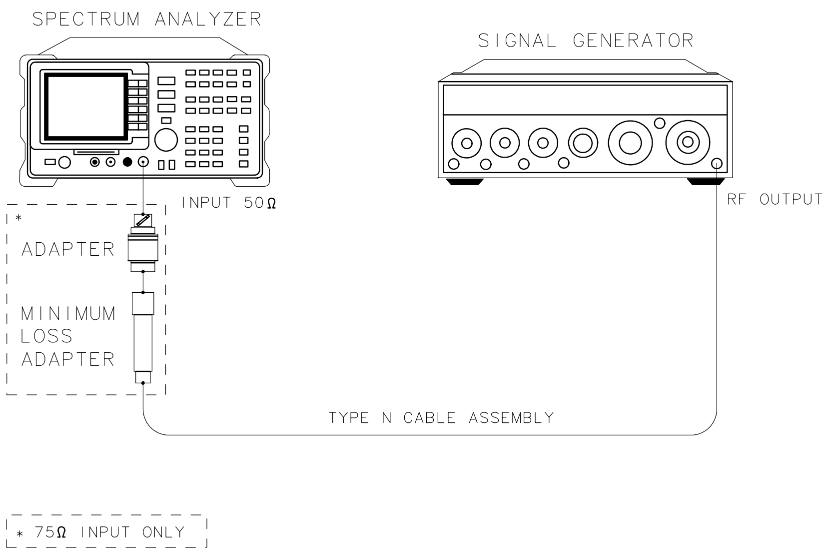
   FM .... OFF

   COUNTER .... INT

   RF .... ON

2. Connect the equipment as shown in Figure 2-4.

Figure 2-4 System Related Sidebands Test Setup



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

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**

4. Set the spectrum analyzer to measure the system related sideband above the signal as follows:

   PEAK SEARCH

   MKR FCTN, MK TRACK ON OFF (ON)

   SPAN, 200, **kHz**

   BW, 1, **kHz**

   VID BW AUTO MAN, 30, **Hz**

5. 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**

6. Press **SGL SWP** and wait for the completion of the sweep. Then press **PEAK SEARCH**, **MARKER** Δ.

7. On the spectrum analyzer, press **FREQUENCY**, ⇑ (step-up key).

8. 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**.

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

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

10. 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)

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

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

12. Record the Marker-Δ Amplitude as TR Entry 2 in the appropriate performance verification test record in Chapter 3.

Performance verification test “System Related Sidebands” is now complete.

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

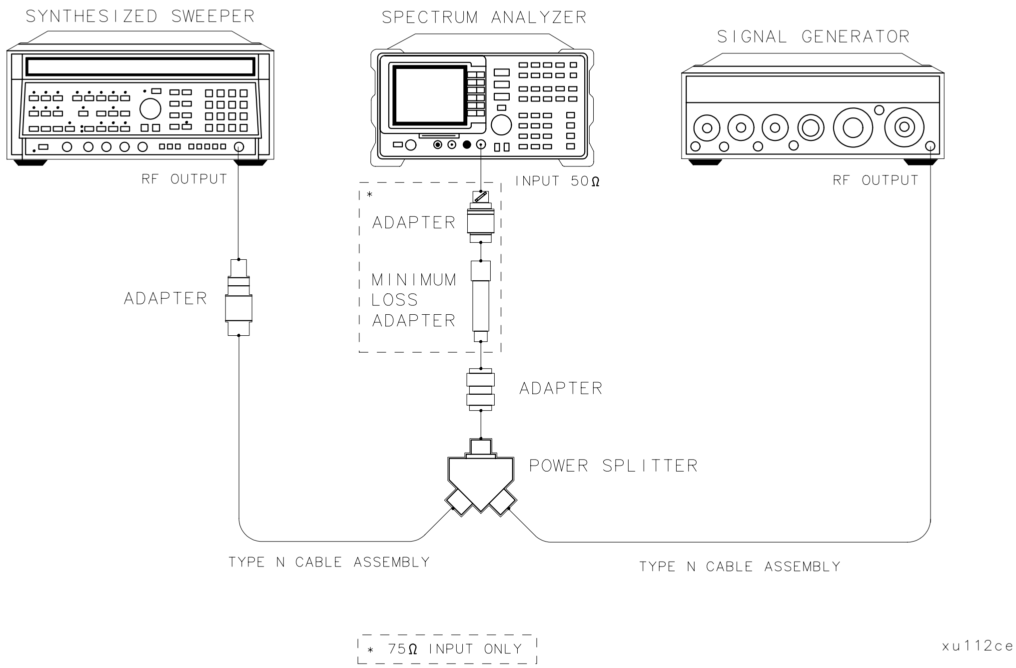
Part 2: 10.1 MHz to 10 kHz Frequency Span Readout Accuracy

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 2-5. Note that the power splitter is used as a combiner.

Figure 2-5 1800 MHz Frequency Span Readout Accuracy Test Setup



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

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. 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** Δ, then continue pressing **NEXT PK RIGHT** until the marker Δ is on the right-most signal (1700 MHz).

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

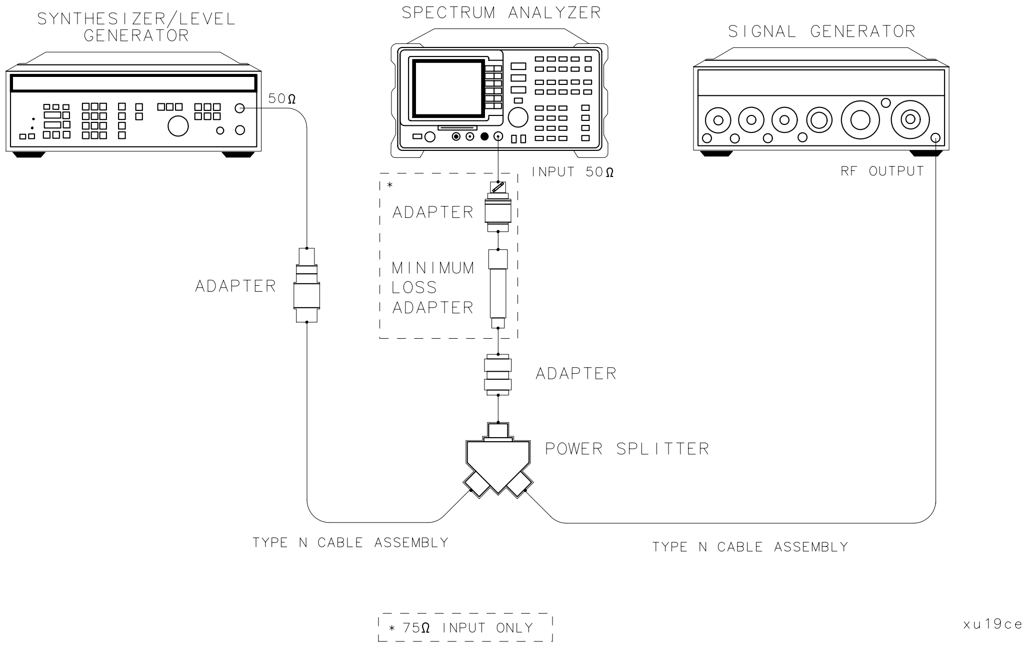
   The MKR reading should be within the 1446 MHz and 1554 MHz.

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

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

1. Connect the equipment as shown in Figure 2-6. Note that the power splitter is used as a combiner.

Figure 2-6 10.1 MHz to 10 kHz Frequency Span Readout Accuracy Test Setup



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

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 2-5.

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 settingslisted in Table 2-5.

Performance verification test “Frequency Span Readout Accuracy” is now complete.

Table 2-5 Frequency Span Readout Accuracy

Spectrum Analyzer Span Setting	Synthesizer/ Level Generator Frequency	Synthesized Sweeper Frequency	MKR-Δ Reading		
	MHz	MHz	Min.	TR Entry	Max.
10.10 MHz	66.000	74.000	7.70 MHz	**(2)**_________	8.30 MHz
10.00 MHz	66.000	74.000	7.80 MHz	**(3)**_________	8.20 MHz
100.00 kHz	69.960	70.040	78.00 kHz	**(4)**_________	82.00 kHz
99.00 kHz	69.960	70.040	78.00 kHz	**(5)**_________	82.06 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

Procedure

This performance test consists of two parts:

Part 1: Residual FM

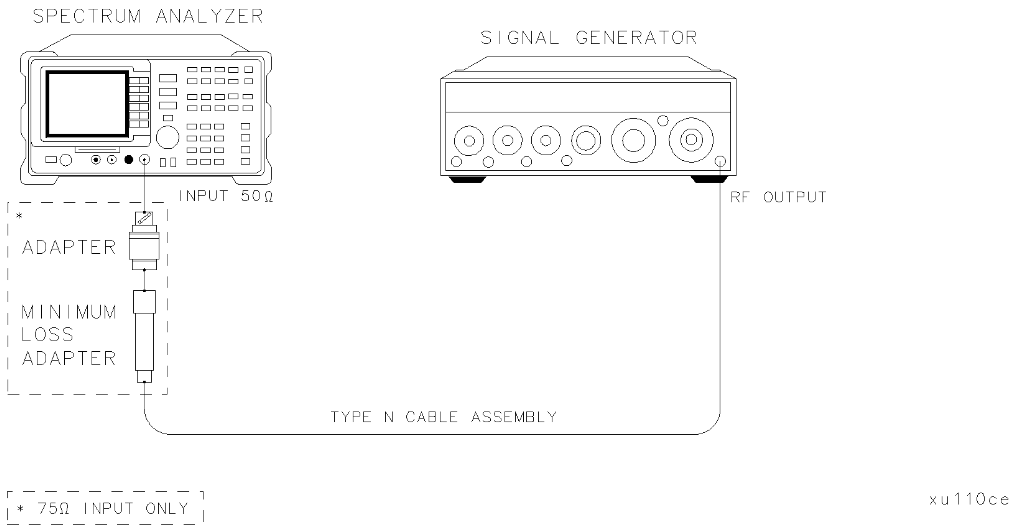
Part 2: Measuring the Residual FM Measurement

Part 1: Residual FM

Determining the IF Filter Slope

1. Connect the equipment as shown in Figure 2-7.

Figure 2-7 Residual FM Test Setup



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

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, 500, **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 ±0.1 dB setting, then make the following spectrum analyzer settings:

   SPAN, 5, **kHz**

   BW, VID BW AUTO MAN, 30, **Hz**

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

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

   _______________Slope Hz/ dB

Measuring the Residual FM

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

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

   MKR, MARKER NORMAL

   MKR →, **MARKER** →**CF**

   SGL SWP

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

   SPAN,0, **Hz**

   SWEEP, 100, **ms**

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

    ________________Deviation dB

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

    Record this value as TR Entry 1 in the appropriate performance verification test record in Chapter 3. The residual FM should be less than 250 Hz.

Performance verification test “Residual FM” is now complete.

7. Sweep Time Accuracy

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

There are no related adjustment procedures for this performance test.

Equipment Required

Synthesizer/function generator

Signal generator

Cable, Type N, 152 cm (60 in)

Cable, BNC, 120 cm (48 in)

Additional Equipment for 75 Ω Input

Adapter, minimum loss

Adapter, Type N (f) to BNC (m), 75 Ω

Procedure

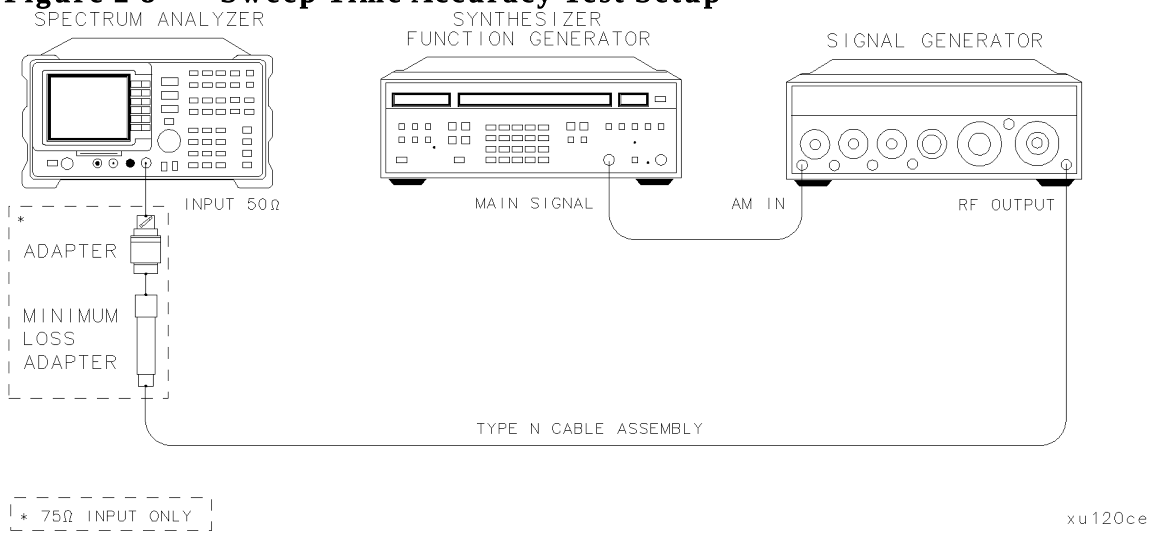
1. Set the signal generator to output a 500 MHz, –10 dBm, CW signal. Set the AM and FM controls to off.

   75 Ω input 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 2-8.

Figure 2-8 Sweep Time Accuracy Test Setup



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

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

   FREQUENCY, 500, **MHz**

   SPAN, 10, **MHz**

   PEAK SEARCH

   MKR, FCTN MK TRACK ON OFF (ON)

   SPAN, 50, **kHz**

5. Wait for the AUTO ZOOM routine to finish. Then press the following spectrum analyzer keys:

   SPAN

   ZERO SPAN

   BW, 3, **MHz**

   SWEEP, 20, **ms**

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

6. Adjust signal amplitude for a midscreen display.

7. Set the signal generator AM switch to the AC position.

8. On the spectrum analyzer, press **TRIG** then **VIDEO**. Adjust the video trigger so that the spectrum analyzer is sweeping.

9. 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.”

10. Press **MARKER DELTA** and press **NEXT PK RIGHT** 8 times so the marker delta is on the eighth signal peak from the “marked signal.” Record the marker Δ reading in Table 2-6.

11. Repeat steps 9 through 10 for the remaining sweep time settings listed in Table 2-6.

12. Record the marker Δ reading in the appropriate performance verification test record in Chapter 3.

Performance verification test “Sweep Time Accuracy” is now complete.

Table 2-6 Sweep Time Accuracy

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

8. Scale Fidelity

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

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

Equipment Required

Synthesizer/level generator

Attenuator, 1 dB step

Attenuator, 10 dB step

Cable, BNC, 122 cm (48 in)

Cable, BNC, 20 cm (9 in)

Adapter, Type N (m) to BNC (f)

Adapter, BNC (m) to BNC (m)

Additional Equipment for 75 Ω Input

Adapter, minimum loss

Adapter, Type N (f) to BNC (m), 75 Ω

Procedure

Log Scale

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

   FREQUENCY .... 50 MHz

   AMPLITUDE ....+10 dBm

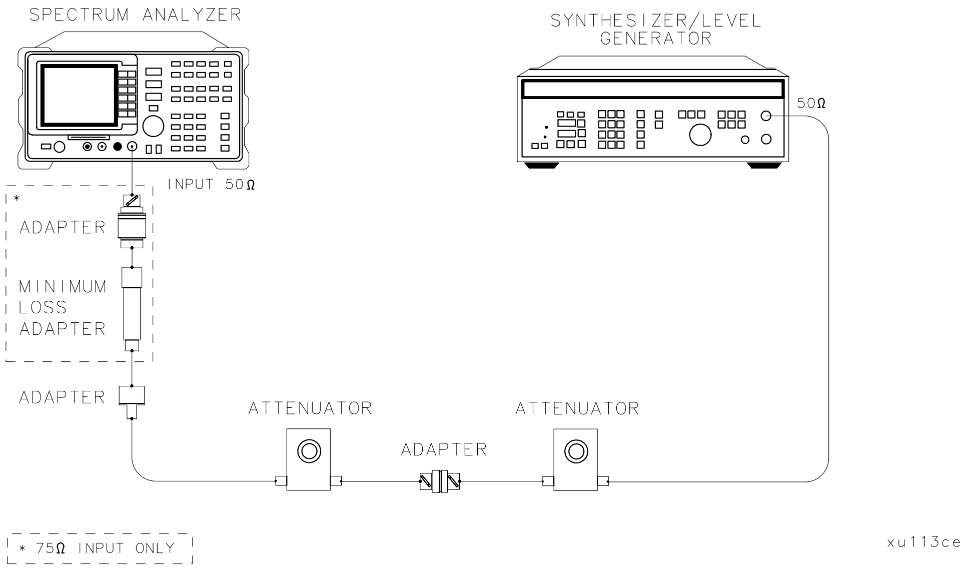
   AMPTD INCR .... 0.05 dB

   OUTPUT .... 50 Ω

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

   75 Ω input 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.

Figure 2-9 Scale Fidelity Test Setup



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

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**

   75 Ω input 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 2-7.
9. Record the Actual MKR Δ amplitude reading in the performance verification test record as indicated in Table 2-7. 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 2-7.

11. For each Actual MKR Δ reading recorded in Table 2-7, subtract the previous Actual MKR Δ reading. Add 4 dB to the number and record the result as the incremental error in the performance verification test record as indicated in Table 2-7. The incremental error should not exceed 0.4 dB/4 dB.

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)

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

    FREQUENCY, 50, **MHz**

    SPAN, 10, **MHz**

    PEAK SEARCH

    MKR FCTN, MK TRACK ON OFF (ON)

    SPAN, 50, **kHz**

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

    BW

    RES BW AUTO MAN, 3, **kHz**

    VID BW AUTO MAN, 30, **Hz**

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

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

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

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

19. On the synthesizer/level generator, press AMPLITUDE, then increment down to step the synthesizer/level generator to the next lowest Nominal Amplitude listed in Table 2-8.
20. Record the MKR amplitude reading in the performance verification test record as indicated in Table 2-8. The MKR amplitude should be within the limits shown.
21. Repeat steps 19 and 20 for the remaining synthesizer/level generator Nominal Amplitudes listed in Table 2-8.

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 as the Log/Linear Error.

    Log/Linear Error_______________dB

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

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

    MKR →, **MARKER** →**REF LVL**

    PEAK SEARCH

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

    Linear Mode Amplitude Reading_______________dBm

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

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

    PEAK SEARCH

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

    Log Mode Amplitude Reading_______________dBm

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

    Linear/Log Error_______________dB

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

    The performance verification test “Scale Fidelity” is now complete.

Table 2-7 Cumulative and Incremental Error, Log Mode

Synthesizer/ Level Generator Nominal Amplitude	dB from Ref Level (nominal)	TR Entry Cumulative Error (MKR Δ Reading)			TR Entry Incremental Error
		Min. (dB)	Actual (dB)	Max. (dB)	
+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

Table 2-8 Scale Fidelity, Linear Mode

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

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) **(2 required)**

Adapter, Type N (m) to BNC (f)

Adapter, BNC (m) to BNC (m)

Additional Equipment for 75 Ω Input

Adapter, minimum loss

Adapter, Type N (f) to BNC (m) 75 Ω

Procedure

Log Scale

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

   FREQUENCY .... 50 MHz

   AMPLITUDE .... −10 dBm

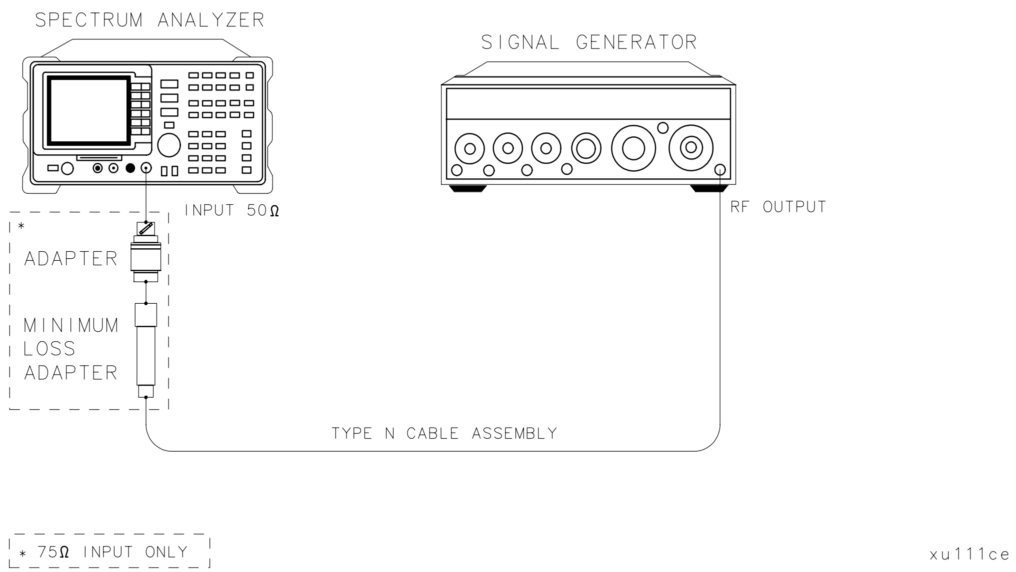
   AMPTD INCR .... 10 dB

   OUTPUT .... 50 Ω

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

   75 Ω input 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.

Figure 2-10 Reference Level Accuracy Test Setup



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

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**

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

   AMPLITUDE, –20, **dBm**, **SCALE LOG LIN** (LOG), 1, **dB**

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

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

   SGL SWP

   PEAK SEARCH, **MARKER** Δ

6. Set the synthesizer/level generator amplitude and spectrum analyzer reference level according to Table 2-9. At each setting, press **SGL SWP** on the spectrum analyzer.
7. Record the MKR Δ amplitude reading in the performance test record as indicated in Table 2-9. The MKR Δ reading should be within the limits shown.

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 ∆**

MKR FCTN, **MK TRACK ON OFF** (OFF)

13.Set the synthesizer/level generator amplitude and spectrum analyzer reference level according to Table 2-10. At each setting, press **SGL SWP** on the spectrum analyzer.

14.Record the MKR ∆ amplitude reading in Table 2-10. The MKR ∆ reading should be within the limits shown.

Performance verification test “Reference Level Accuracy” is now complete.

Table 2-9 Reference Level Accuracy, Log Mode

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

Table 2-10 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 75 Ω Input

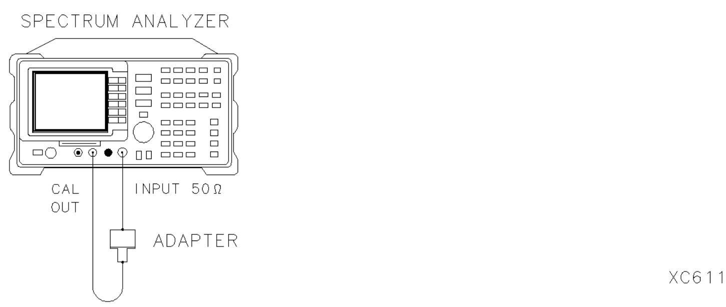
Cable, BNC, 75 Ω, 30 cm (12 in)

Procedure

1. Connect the CAL OUT to the spectrum analyzer input using the BNC cable and adapter, as shown in Figure 2-11.

   75 Ω input only: Use the 75 Ω cable and omit the adapter.

Figure 2-11 Uncertainty Test Setup



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

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**

   75 Ω input only: **AMPLITUDE**, **More 1 of 2**, **Amptd, Units**, **dBm**

   AMPLITUDE, SCALE LOG LIN (LIN)

   More 1 of 3, **Amptd Units**, then **dBm**

   AMPLITUDE, –20, **dBm**

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

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

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)

   75 Ω input only: **AMPLITUDE**, **More 1 of 2**, **Amptd Units**, **dBm**

   SPAN, 50, **kHz**

   AMPLITUDE, –20, **dBm**

   SCALE LOG LIN (LOG), 1, **dB**

   BW, 3, **kHz**

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

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

   PEAK SEARCH, MARKER Δ

   MKR FCTN, MK TRACK ON OFF (ON)

6. Set the spectrum analyzer resolution bandwidth and span according to Table 2-11.

7. Press **PEAK SEARCH**, then record the MKR Δ TRK amplitude reading as indicated in Table 2-11.

   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 2-11.

9. Record TR Entry 2 through TR Entry 10 in the appropriate performance verification test record in Chapter 3.

Performance verification test “Resolution Bandwidth Switching Uncertainty” is now complete.

Table 2-11 Resolution Bandwidth Switching Uncertainty

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

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” and “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

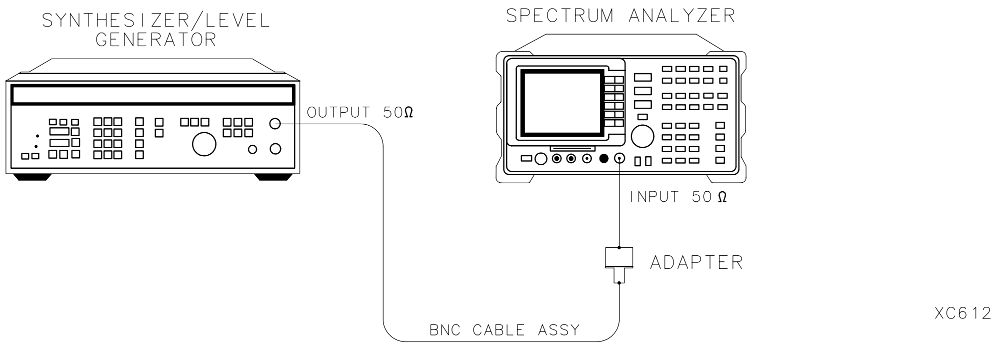
Cable, BNC (75 Ω), 122 cm (48 in)

Procedure

1. Connect the equipment as shown in Figure 2-12.

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

Figure 2-12 Resolution Bandwidth Accuracy Test Setup



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

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** ∆ 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 as the Synthesizer Lower Frequency in Table 2-12.

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 as the Synthesizer Upper Frequency in Table 2-12.

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 2-12.

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 2-12.

    RES BW Accuracy = Upper Frequency – Lower Frequency

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 as the Synthesizer Lower Frequency in Table 2-13.

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 as the Synthesizer Upper Frequency in Table 2-13.

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

28. Repeat step 18 through step 27 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 2-13.

    RES BW Accuracy = Upper Frequency – Lower Frequency

Performance test “Resolution Bandwidth Accuracy” is now complete.

Table 2-12 3 dB Resolution Bandwidth Accuracy

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

Table 2-13 EMI Resolution Bandwidth Accuracy

Spectrum Analyzer RES BW	Synthesizer Lower Frequency	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 × Frequency Reference]). Perform the 10 MHz Frequency Reference Output Accuracy test to verify the CAL OUT frequency.

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

Equipment Required

Synthesized sweeper

Measuring receiver *(used as a power meter)*

Power meter

Power sensor, low power with a 50 MHz reference attenuator

Power sensor, 100 kHz to 1800 MHz

Power splitter

10 dB attenuator, Type N (m to f), dc-12.4 GHz

Filter, low pass (300 MHz)

Cable, Type N, 152 cm (60 in)

Adapter, APC 3.5 (f) to Type N (f)

Adapter, Type N (f) to BNC (m) *(2 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.

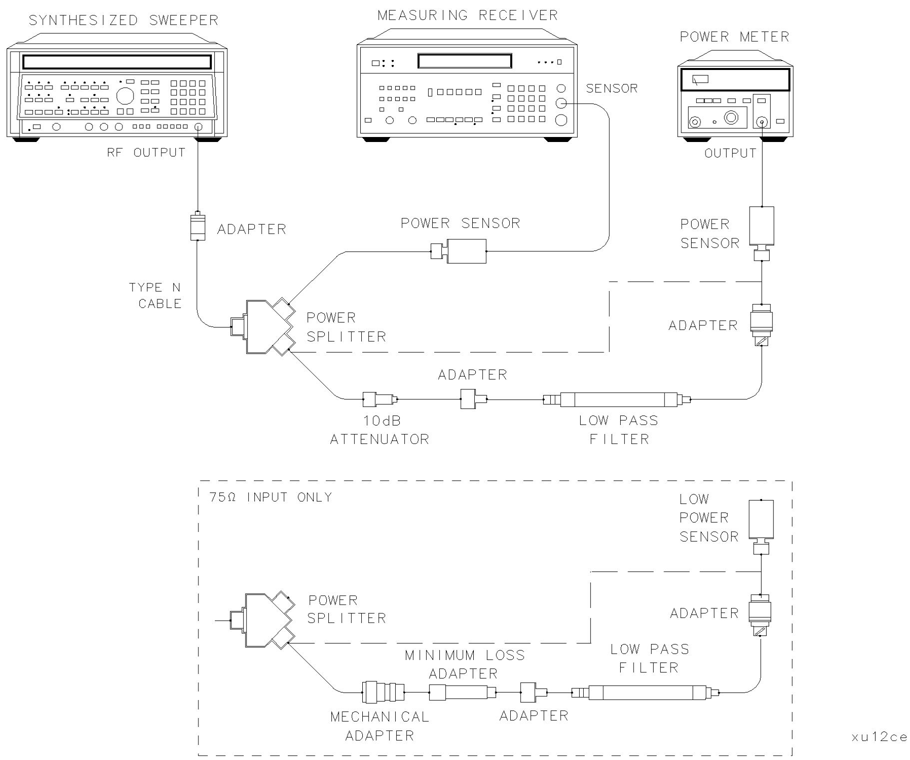
2. Zero and calibrate the power meter and low-power power sensor, as described in the power meter operation manual.
3. Press INSTRUMENT PRESET on the synthesized sweeper, then set the controls as follows:

   CW .... 300 MHz

   POWER LEVEL .... –15 dBm

4. Connect the equipment as shown in Figure 2-13. 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.

Figure 2-13 LPF Characterization



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 2-13.
8. Record the measuring receiver reading in dB in Table 2-14 as the Mismatch Error. This is the relative error due to mismatch.
9. Record the power meter reading in dB in Table 2-14 as the Uncorrected Insertion Loss. This is the relative uncorrected insertion loss of the LPF, attenuator and adapters.
10. Subtract the Mismatch Error, recorded in step 8, from the Uncorrected Insertion Loss, recorded in step 9. This is the corrected insertion loss. Record this value in the worksheet as the Corrected Insertion Loss.

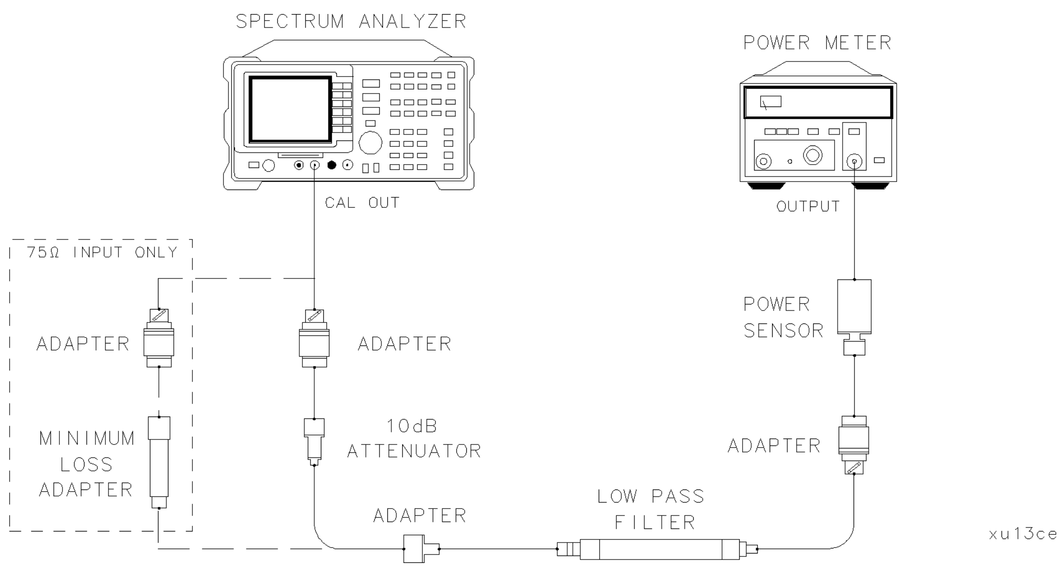
    For example, if the Mismatch Error is +0.3 dB and the Uncorrected Insertion Loss is –10.2 dB, subtract the mismatch error from the insertion loss to yield a corrected reading of –10.5 dB.

Part 2: Calibrator Amplitude Accuracy

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

1. Connect the equipment as shown in Figure 2-14. 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.

Figure 2-14 Calibrator Amplitude Accuracy Test Setup



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

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 (CIR), recorded in step 10, from the Power Meter Reading (PMR), recorded in step 9, to determine the CAL OUT Power.

   CAL OUT Power = PMR – CIL

   For example, if the Corrected Insertion Loss is –10.0 dB, and the Power Meter Reading is –30 dB, then the CAL OUT Power is:

   CAL OUT Power = (–30 dB) – (–10.0 dB) = –20 dB.

4. Record this value as TR Entry 1 in the performance verification test record as the CAL OUT power. The CAL OUT should be –20 dBm ±0.4 dB.

   75 Ω input only: 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 In The Appropriate Performance Verification Test Record In Chapter 3.

   Dbmv = Dbm + 48.75 Db

Performance verification test “Calibrator Amplitude Accuracy” is now complete.

Table 2-14 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 INPUT 75 Ω is accomplished by first performing a system flatness characterization.

The related adjustment for this performance test is “Frequency Response Error Correction.”

Equipment Required

Synthesized sweeper

Measuring receiver *(used as a power meter)*

Synthesizer/level generator

Power sensor, 100 kHz to 1800 MHz

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 75 Ω Input

Power meter

Power sensor, 1 MHz to 2 GHz

Cable, BNC, 120 cm (48 in) 75 Ω

Adapter, Type N (f) 75 Ω to Type N (m) 50 Ω

Adapter, Type N (m) to BNC (m), 75 Ω

System Characterization Procedure for 75 Ω Input

The following procedure is only for spectrum analyzers equipped with 75 Ω input. If your spectrum analyzer is *not* equipped with 75 Ω input, proceed with step 1 of "Frequency Response ≥50 MHz."

1. Zero and calibrate the measuring receiver and 100 kHz to 1800 MHz power sensor as described in the measuring receiver operation manual.
2. Zero and calibrate the power meter and 1 MHz to 2 GHz power sensor as described in the power meter operation manual.
3. Press INSTRUMENT PRESET on the synthesized sweeper, then set the controls as follows:

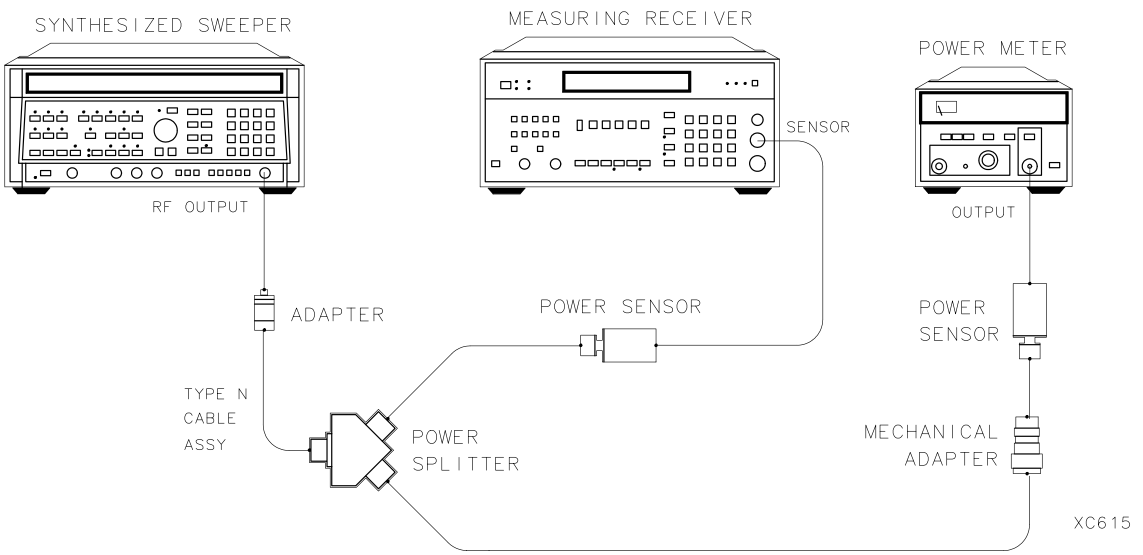
   CW .... 50 MHz

   FREQ STEP .... 50 MHz

   POWER LEVEL ....5 dBm

4. Connect the equipment as shown in Figure 2-15.

Figure 2-15 System Characterization Test Setup for 75 Ω Input



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

5. Adjust the synthesized sweeper power level for a 0 dBm reading on the measuring receiver.
6. Record the power meter reading as the System Error in Table 2-15, taking into account the Cal Factors of both the 100 kHz to 4.2 GHz power sensor and the 1 MHz to 2 GHz power sensor.

7. On the synthesized sweeper, press **CW**, and ⇑ (step-up key), to step through the remaining frequencies listed in Table 2-15.

   At each new frequency repeat steps 5 and 6, entering each power sensor's Cal Factor into the respective power meter.

   System characterization is now complete for spectrum analyzers equipped with 75 Ω Input. Continue with step 1 of “Frequency Response ≥50 MHz” below.

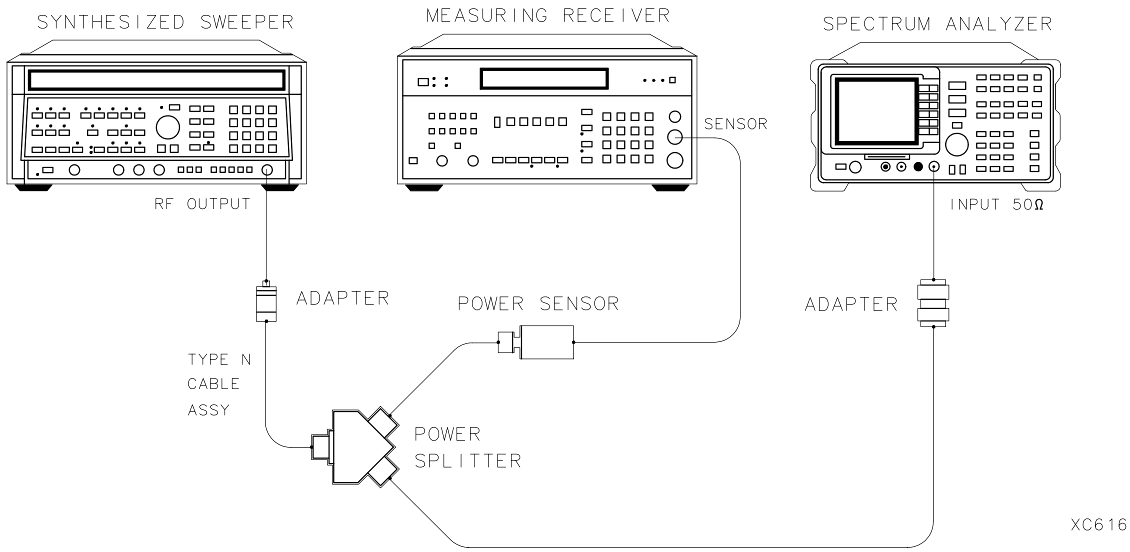
Frequency Response, ≥50 MHz

If your spectrum analyzer is equipped with 75 Ω input, perform “Procedure for System Characterization for 75 Ω Input” before proceeding with this procedure.

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.
2. Connect the equipment as shown in Figure 2-16.

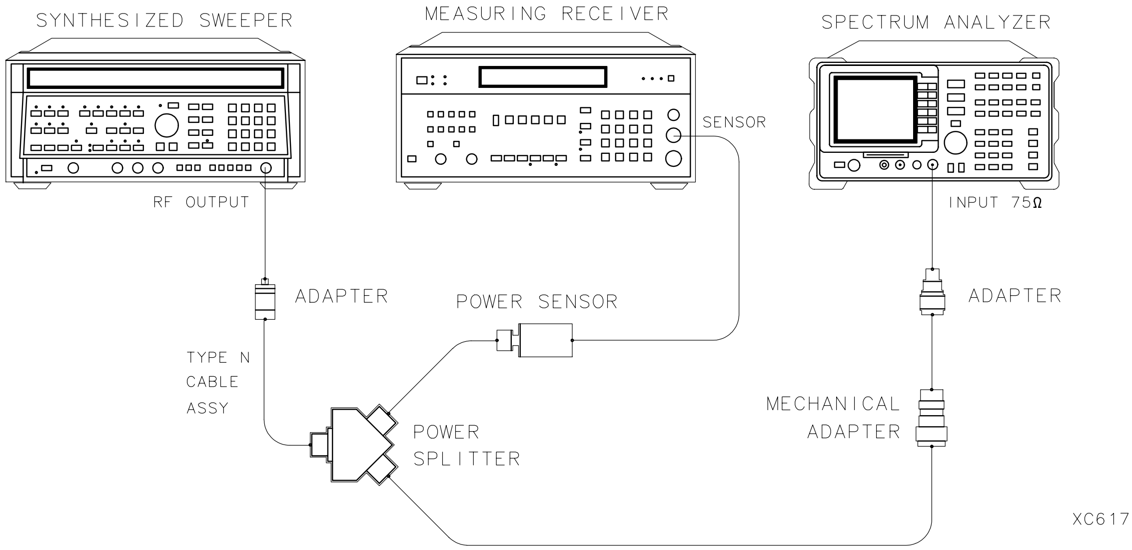
   75 Ω input only: Refer to Figure 2-17.

Figure 2-16 Frequency Response Test Setup, ≥50 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 2-17 Frequency Response Test Setup, ≥50 MHz, for 75 Ω Input



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

   CW .... 300 MHz

   FREQ STEP .... 50 MHz

   POWER LEVEL ....–8 dBm

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

   FREQUENCY, 300, **MHz**

   CF STEP AUTO MAN, 50, **MHz**

   SPAN, 5, **MHz**

   75 Ω input 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**

   PEAK SEARCH

   MKR FCTN, MK TRACK ON OFF (ON)

5. Adjust the synthesized sweeper power level for a MKR-TRK amplitude reading of –14 dBm ±0.05 dB.

6. Set the sensor Cal Factor on the measuring receiver, then press **RATIO**.
7. Set the synthesized sweeper CW to 50 MHz.
8. Press **FREQUENCY,** 50, **MHz** on the spectrum analyzer.
9. Adjust the synthesized sweeper power level for a spectrum analyzer MKR-TRK amplitude reading of –14 dBm ±0.05 dB.
10. Set the sensor Cal Factor on the measuring receiver, then record the negative of the power ratio displayed on the measuring receiver in Table 2-15 as the Error Relative to 300 MHz at 50 MHz.
11. Set the synthesized sweeper CW to 100 MHz.
12. Press **FREQUENCY,** 100, **MHz** on the spectrum analyzer.
13. Adjust the synthesized sweeper power level for a spectrum analyzer MKR-TRK amplitude reading of –14 dBm ±0.05 dB.
14. Set the sensor Cal Factor on the measuring receiver, then record the negative of the power ratio displayed on the measuring receiver in Table 2-15 as the Error Relative to 300 MHz at 100 MHz.
15. On the synthesized sweeper, press CW, and ⇑ (step-up key), then on the spectrum analyzer, press **FREQUENCY**, and ⇑ (step-up key).
16. Record the negative of the power ratio displayed on the measuring receiver in Table 2-15 as the Error Relative to 300 MHz.
17. Repeat steps 15 through 16 for each new frequency, entering the power sensor Cal Factor into the measuring receiver for each frequency setting as indicated in Table 2-15.

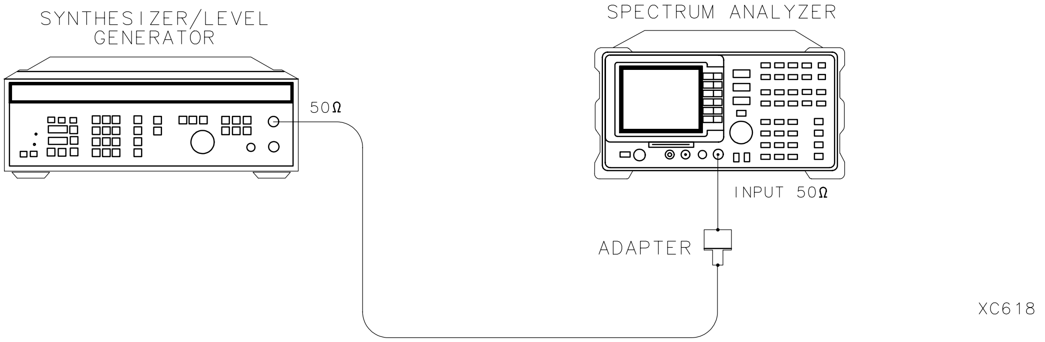
    75 Ω input only: Starting with the error at 50 MHz, subtract the System Error from the Error Relative to 300 MHz and record the result as the Corrected Error in Table 2-15.

Frequency Response, ≤50 MHz

18. Using a cable, connect the frequency synthesizer directly to the INPUT 50 Ω. Refer to Figure 2-18.

    75 Ω input only: Using a 75 Ω cable, connect the frequency synthesizer from the 75 Ω OUTPUT to the INPUT 75 Ω. Set the frequency synthesizer 50–75 Ω switch to the 75 Ω position.

Figure 2-18 Frequency Response Test Setup, <50 MHz



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

19. Set the frequency synthesizer controls as follows:

    FREQUENCY .... 50 MHz

    AMPLITUDE .... –15 dBm

    AMPTD INCR ....0.05 dB

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

    FREQUENCY, 50, **MHz**

    SPAN, 10, **MHz**

    BW, 3, **kHz, VID BW AUTO MAN,** 10, **kHz**

    PEAK SEARCH

    MKR FCTN, MK TRACK ON OFF (ON)

    SPAN, 100, **kHz**

    Wait for the AUTO ZOOM routine to finish.

21. Adjust the frequency synthesizer amplitude until the MKR-TRK reads –14 dBm. This corresponds to the amplitude at 50 MHz recorded in step 10. Record the frequency synthesizer amplitude in Table 2-16 as the Frequency Synthesizer Amplitude at 50 MHz.

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

23. Set the spectrum analyzer and the frequency synthesizer to the next frequency settings listed in Table 2-16.

24. At each frequency, adjust the frequency synthesizer amplitude for a MKR-Δ-TRK amplitude reading of 0.00 ±0.05 dB.

25. Record the frequency synthesizer amplitude setting in column 2 of Table 2-16 as the frequency synthesizer amplitude.

    75 Ω input only: Do not test below 1 MHz.

26. Repeat steps 23 through 25 for each frequency setting listed in Table 2-16.

27. For each of the frequencies in Table 2-16, subtract the Frequency Synthesizer Amplitude from the Frequency Synthesizer Amplitude at 50 MHz recorded in step 21. Record the result as the Response Relative to 50 MHz in Table 2-16.

28. Add to each of the Response Relative to 50 MHz entries in Table 2-16 the Error Relative to 300 MHz at 50 MHz recorded in step 10. Record the results as the Response Relative to 300 MHz in Table 2-16.

    75 Ω input only: Starting with the error at 50 MHz, subtract the System Error from the Error Relative to 300 MHz and record the result as the Corrected Error in Table 2-16.

Test Results

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

1. Enter the most positive Response Relative to 300 MHz from Table 2-16:

   _______________dB

2. Enter the most positive Error Relative to 300 MHz from Table 2-15:

   75 Ω input only: Enter the most positive Corrected Error from Table 2-15.

   _______________dB

3. Record the more positive of the numbers from steps 1 and 2 as TR Entry 1 in the appropriate performance verification test record in Chapter 3.

4. Enter the most negative Response Relative to 300 MHz from Table 2-16:

   _______________dB

5. Enter the most negative Error Relative to 300 MHz from Table 2-15:

   75 Ω input only: Enter the most negative Corrected Error from Table 2-15.

   ______________dB

6. Record the more negative of the numbers from steps 4 and 5 as TR Entry 2 in the appropriate performance verification test record in Chapter 3.

7. Subtract the result of step 6 from the result of step 3. Record this value as TR Entry 3 in the appropriate performance verification test record in Chapter 3.

   The result should be less than 2.0 dB.

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

Table 2-15 Frequency Response Errors Worksheet

Spectrum Analyzer Frequency (MHz)	Error Relative to 300 MHz (dB)	CAL FACTOR Frequency (GHz)	System Error (75 Ω input only) (dB)	Corrected Error (75 Ω input only) (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	________	________

Table 2-15 Frequency Response Errors Worksheet (Continued)

Spectrum Analyzer Frequency (MHz)	Error Relative to 300 MHz (dB)	CAL FACTOR Frequency (GHz)	System Error (75 Ω input only) (dB)	Corrected Error (75 Ω input only) (dB)
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	________	________
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 2-16 Frequency Response, ≤50 MHz Worksheet

Spectrum Analyzer Frequency	Frequency Synthesizer Amplitude (dBm)	Response Relative to 50 MHz	Response Relative to 300 MHz
50 MHz	________	0 (Ref)	________
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 –20 dBm. A marker-amplitude reference is set on the spectrum analyzer. The source is then tuned to several different frequencies where image responses could occur. At each source frequency, the source amplitude is set to –20 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, 100 kHz to 1800 MHz

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 75 Ω Input

Power sensor, 75 Ω

Adapter, minimum loss

Adapter, Type N (f) to BNC (m), 75 Ω

Adapter, Type N (f) to Type N (f), 75 Ω

Procedure

1. Zero and calibrate the measuring receiver and 100 kHz to 1800 MHz power sensor in log mode (power reads out in dBm), as described in the measuring receiver operation manual. Enter the power sensor's 542.8 MHz Cal Factor into the measuring receiver.

   75 Ω only: Use 75 Ω power sensor.

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

   CW .... 542.8 MHz

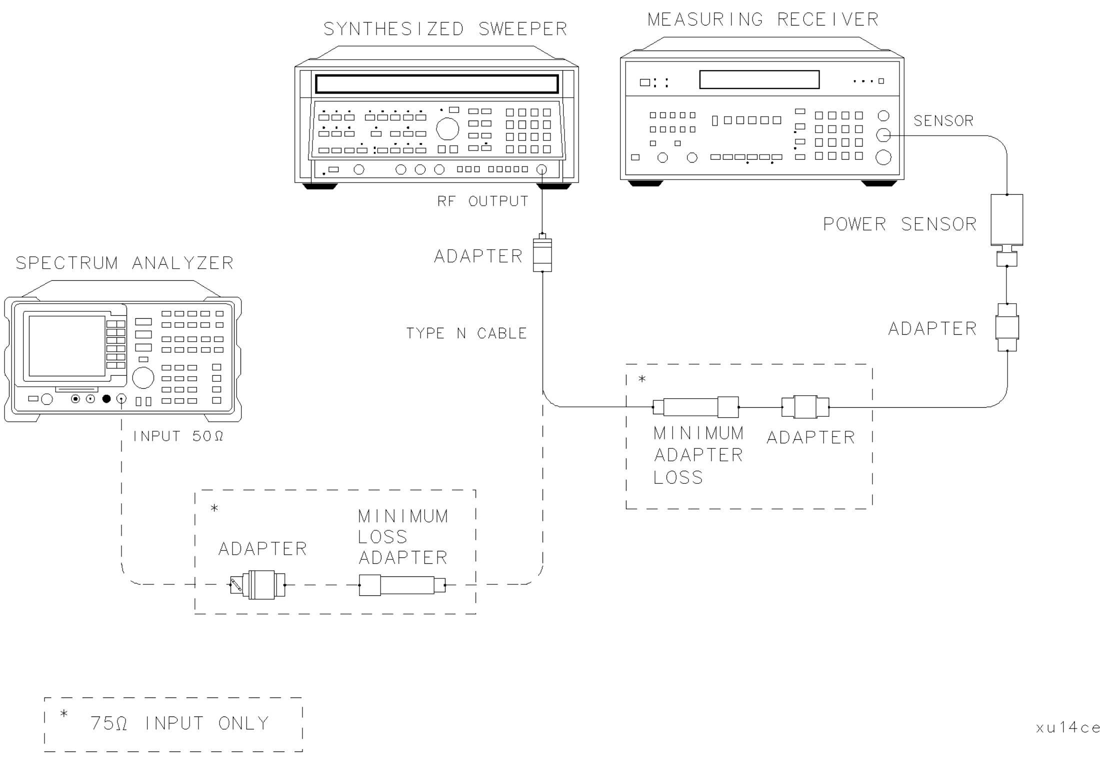
   POWER LEVEL .... –20 dBm

   75 Ω input only: POWER LEVEL –14.3 dBm

3. Connect the equipment as shown in Figure 2-19. Connect the output of the synthesizer to the 100 kHz to 1800 MHz power sensor using adapters.

   75 Ω input only: Use the minimum loss adapter and 75 Ω adapter to connect to the 75 Ω power sensor.

Figure 2-19 Other Input Related Spurious Responses Test Setup



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

4. Adjust the synthesized sweeper power level for a –20 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 –20 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 –20 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.

    75 Ω input only: Use the minimum loss adapter and 75 Ω adapter as shown in Figure 2-19.

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

    FREQUENCY, 500, **MHz**

    SPAN, 10, **MHz**

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

    AMPLITUDE, –10, **dBm**

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

    PEAK SEARCH

    MKR FCTN, MK TRACK ON OFF (ON)

    SPAN, 200, **kHz**

16. Wait for the AUTO ZOOM message to disappear. Then press the following spectrum analyzer keys:

PEAK SEARCH

MKR →, **MARKER** →**REF LVL**

MKR FCTN, **MK TRACK ON OFF** (OFF)

PEAK SEARCH, **MARKER** ∆

AMPLITUDE, ⇓ (step-down key).

SGL SWP

17. For each of the frequencies listed in Table 2-17, 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 1142.8 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 2-17 as the Actual MKR ∆ Amplitude.

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

NOTE The Maximum MKR ∆ Amplitude is 10 dB more positive than the specification. This is due to the 10 dB change in reference level made in step 14.

18. Record the Maximum MKR ∆ Amplitude from Table 2-17 as TR Entry 1 in the appropriate performance verification test record in Chapter 3.

Table 2-17 Image Responses

Synthesized Sweeper CW Frequency	TR Entry Actual MKR ∆ Amplitude (dBc)	Maximum MKR ∆ Amplitude (dBc)
542.8 MHz	____________	–55
1142.8 MHz	____________	–55

15. Spurious Response

This test is performed in two parts. Part 1 measures second harmonic distortion; part 2 measures third order intermodulation distortion.

To test second harmonic distortion, a 50 MHz low pass filter is used to filter the source output, ensuring that harmonics read by the 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) *(2 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)

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."

Part 1: Second Harmonic Distortion, 30 MHz

1. Set the synthesizer level generator controls as follows:

   FREQUENCY .... 30 MHz

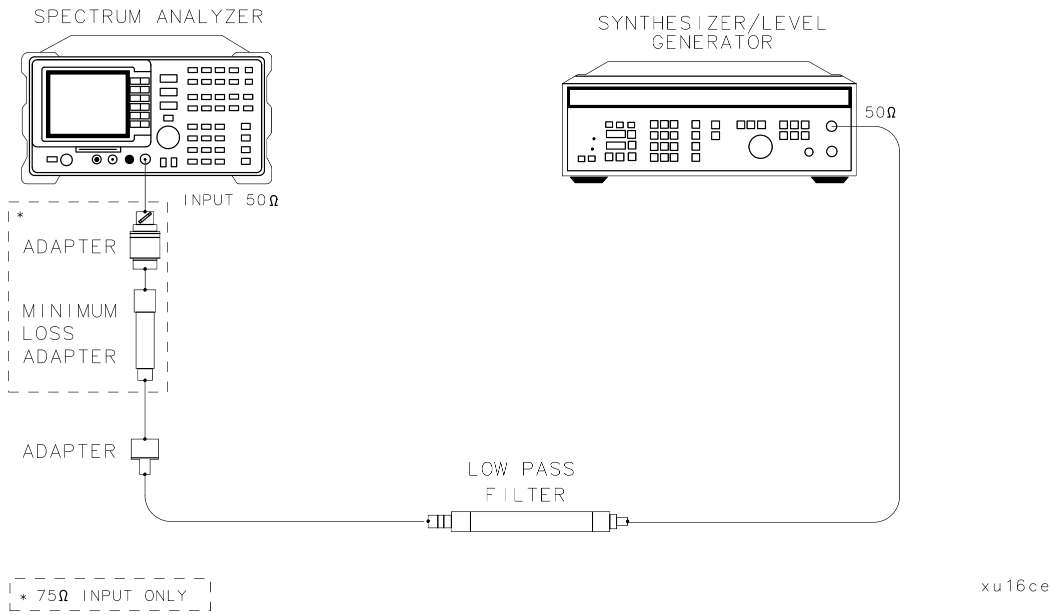
   AMPLITUDE .... –10 dBm

   AMPLITUDE (*75 Ω input only*) .... –4.3 dBm

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

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

Figure 2-20 Second Harmonic Distortion Test Setup, 30 MHz



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

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 ∆

   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 ∆ Amplitude reading in the performance verification test record as TR Entry 1.

Part 2: Third Order Intermodulation Distortion, 50 MHz

1. Zero and calibrate the measuring receiver and 100 kHz to 1800 MHz power sensor in log mode (power reads out in dBm), as described in the measuring receiver operation manual. Enter the power sensor's 50 MHz Cal Factor into the measuring receiver.

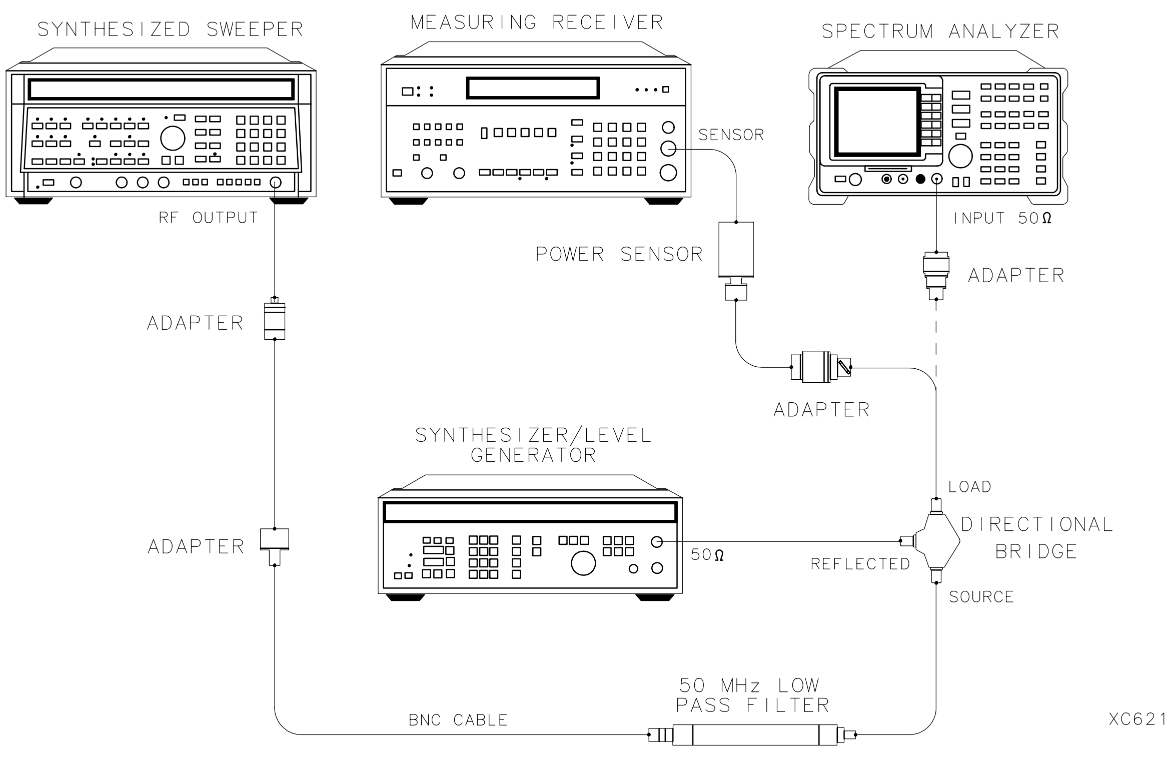
   75 Ω input only: Use a 75 Ω power sensor.

2. Connect the equipment as shown in Figure 2-21 with the output of the directional bridge connected to the 100 kHz to 1.8 GHZ power sensor.

   75 Ω input only: 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.

   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.

Figure 2-21 Third Order Intermodulation Distortion Test Setup



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

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

   POWER LEVEL ....–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**, then wait until the preset routine is finished. Set the spectrum analyzer by pressing the following keys:

   FREQUENCY, 50, **MHz**

   SPAN, 10, **MHz**

   75 Ω input only: **AMPLITUDE**, **More 1 of 2**, **Amptd Units**, **dBm**

   AMPLITUDE, –10, **dBm**

   PEAK SEARCH, **More 1 of 2, PEAK EXCURSN**, 3, **dB**

   DISPLAY, **More 1 of 2**, **THRESHLD ON OFF** (ON), 90, –**dBm**

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

7. Disconnect the 100 kHz to 4.2 GHZ power sensor from the directional bridge. Connect the directional bridge directly to the spectrum analyzer RF INPUT using an adapter (do not use a cable).

   75 Ω input 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 ON OFF** (OFF)

   PEAK SEARCH

   MKR →, **MARKER** →**REF LVL**

9. On the synthesized 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, then set the spectrum analyzer by pressing the following keys:

    BW, 3, **kHz**

    VID BW AUTO MAN, 300, **Hz**

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

    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.

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

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

    b. Repeatedly press **NEXT PEAK** until the active marker is on the highest distortion product.

    c. Record the MKR Δ amplitude reading below and as TR Entry 1 in the performance verification test record. The MKR Δ reading should be less than –54 dBc.

       Third Order Intermodulation Distortion, 50 MHz__________dBc

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

   a. On both the synthesized sweeper and the synthesized 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 **PEAK SEARCH**, **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 below and as TR Entry 2 in the performance verification test record. The MKR Δ reading should be less than –54 dBc.

   Third Order Intermodulation Distortion, 50 MHz__________dBc

Performance verification test “Spurious Response” is now complete.

16. Gain Compression

Gain compression is measured by applying two signals, separated by 3 MHz. First, the test places a –20 dBm signal at the input of the spectrum analyzer (the spectrum analyzer reference level is also set to –20 dBm). Then, a 0 dBm signal is applied to the spectrum analyzer, overdriving its input. The decrease in the first signal's amplitude (gain compression) caused by the second signal is the measured gain compression.

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

There are no related adjustment procedures for this performance test.

Equipment Required

Synthesized sweeper

Synthesizer/level generator

Measuring receiver *(used as a power meter)*

Power sensor, 100 kHz to 1800 MHz

Directional bridge

Cable, BNC, 120 cm (48 in) *(2 required)*

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)

Additional Equipment for 75 Ω Input

Power sensor, 75 Ω

Adapter, Type N (f) to BNC (m), 75 Ω

Adapter, BNC (m) to BNC (m), 75 Ω

Procedure

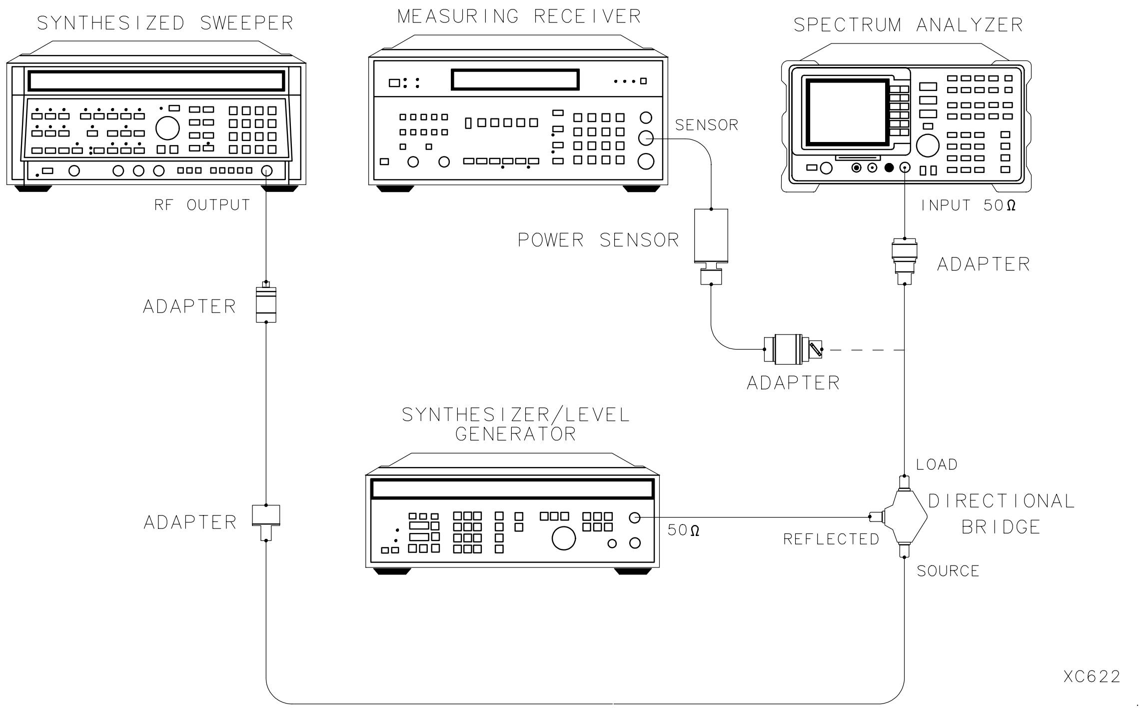
1. Zero and calibrate the measuring receiver and 100 kHz to 1800 MHz power sensor combination in log mode (power reads out in dBm) as described in the measuring receiver operation manual. Enter the power sensor's 50 MHz Cal Factor into the measuring receiver.

   75 Ω input only: Calibrate the 75 Ω power sensor.

2. Connect the equipment as shown in Figure 2-22, with the load of the directional bridge connected to the power sensor.

   75 Ω input only: Use the 75 Ω power sensor with a Type N (f) to BNC (m) 75 Ω adapter and a BNC (m) to BNC (m) adapter. 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.

Figure 2-22 Gain Compression Test Setup



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

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

   CW .... 53 MHz

   POWER LEVEL ....6 dBm

4. Set the synthesized/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**, then wait for the preset routine to finish. Press the spectrum analyzer keys as follows:

   FREQUENCY, 50, **MHz**

   SPAN, 20, **MHz**

   75 Ω input: 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.

7. 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.

8. Disconnect the power sensor from the directional bridge and connect the directional bridge to the INPUT 50 Ω connector of the spectrum analyzer using an adapter. Do not use a cable.

   75 Ω input only: Use a 75 Ω adapter, BNC (m) to BNC (m).

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

   PEAK SEARCH

   MKR FCTN, **MK TRACK ON OFF** (ON)

   SPAN, 10, **MHz**

   Wait for the `AUTO ZOOM` routine to finish.

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

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

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

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

    The active marker should be on the lower amplitude signal and not on the signal that is off the top of the screen. If it is not on the lower amplitude signal, reposition the marker to this peak using the spectrum analyzer knob.

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

    Performance verification test “Gain Compression” is now complete.

17. Displayed Average Noise Level

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

The 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 “Frequency Response Adjustment.”

Equipment Required

Termination, 50 Ω

Cable, BNC, 23 cm (9 in)

Adapter, Type N (m) to BNC (f)

Additional Equipment for 75 Ω input

Cable, BNC 75 Ω, 30 cm (12 in)

Termination, 75 Ω, Type N (m)

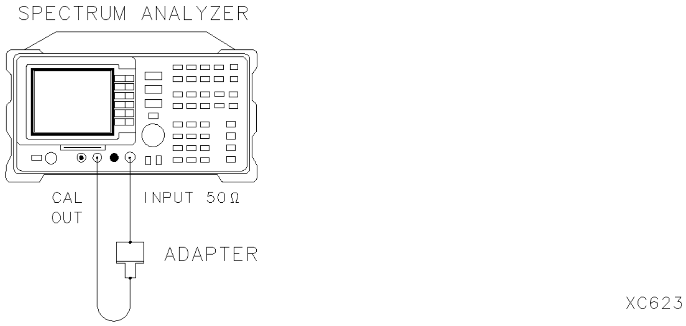
Adapter, Type N (f) to BNC (m) 75 Ω

Procedure

1. Connect a cable from the CAL OUT to the INPUT 50 Ω of the spectrum analyzer as shown in Figure 2-23.

   75 Ω input only: Use a 75 Ω cable and omit the adapter.

Figure 2-23 Displayed Average Noise Level Test Setup



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

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

   FREQUENCY, 300, **MHz**

   SPAN, 10, **MHz**

   AMPLITUDE, –20, **dBm**

   75 Ω input only: Press **AMPLITUDE,** +28.75, **dBmV**.

   ATTEN AUTO MAN, 0, **dB**

3. Press the following spectrum analyzer keys:

   PEAK SEARCH

   MKR FCTN, **MK TRACK ON OFF** (ON)

   SPAN, 100, **kHz**

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

   BW, **VID BW AUTO MAN**, 30, **Hz**

   MKR FCTN, **MK TRACK ON OFF** (OFF)

5. Press **SGL SWP** and wait for the completion of a new sweep. Then press the following spectrum analyzer keys:

   PEAK SEARCH

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

6. 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 75 Ω input: If the marker reads 26.4 dBmV, enter +2.35 dBmV (28.75 dBmV – 26.4 dBmV = 2.35 dBmV).

   REF LVL OFFSET_______________dB

   75 Ω input: REF LVL OFFSET_______________dBmV

7. 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.

   75 Ω input only: Use the 75 Ω termination.

400 kHz

If testing an instrument equipped with a 75 Ω input, omit step 8 through step 14, then proceed to step 15 (“1 MHz”).

8. 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 (CONT)

9. Press the following spectrum analyzer keys:

   PEAK SEARCH

   MKR FCTN, MK TRACK ON OFF (ON)

   SPAN, 800, **kHz**

10. 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**

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

SPAN, 0, **Hz**

AMPLITUDE, −50, **dBm**

BW, 1, **kHz**

VID BW AUTO MAN, 30, **Hz**

SWEEP, 5, **sec**

TRACE, **More 1 of 3**, **DETECTOR SMP PK** (SP)

SGL SWP

12.Wait for the completion of a new sweep. Then press the following spectrum analyzer keys:

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

13.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).

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

1 MHz

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

AUTO COUPLE, RES BW AUTO MAN (AUTO)

VID BW AUTO MAN (AUTO)

FREQUENCY, 0, **Hz**

SPAN,10, **MHz**

AMPLITUDE, −10, **dBm**

75 Ω input only: **AMPLITUDE**, +35, **dBmV**

TRIG, SWEEP CONT SGL (CONT)

16.Press the following spectrum analyzer keys:

PEAK SEARCH

MKR FCTN, MK TRACK ON OFF (ON)

MKR →, **MARKER** →**REF LVL**

SPAN, 2, **MHz**

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

18. Press **FREQUENCY** and adjust the center frequency until the LO feedthrough peak is on the left-most graticule line, then press the following spectrum analyzer keys:

    SPAN, 50, **kHz**

    AMPLITUDE, −50, **dBm**

    75 Ω input only: **AMPLITUDE**, −1.2, **dBmV**

    AUTO COUPLE, VID BW AUTO MAN, 30, **Hz**

    SGL SWP

19. Wait for the completion of a new sweep. Then press the following spectrum analyzer keys:

    DISPLAY, DSP LINE ON OFF (ON)

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

21. Record the display line amplitude setting as TR Entry 2 of the performance verification 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

22. 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)

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

24. Press the following spectrum analyzer keys:

    SGL SWP

    TRACE, **CLEAR WRITE A**

    More 1 of 3, **VID AVG ON OFF** (ON), 10, **Hz**

25. Wait until AVG 10 is displayed to the left of the graticule (the spectrum analyzer will take ten sweeps, then stop). Then press **PEAK SEARCH** and record the MKR frequency as the Measurement Frequency in Table 2-18 for 1 MHz to 1.5 GHz.

26. 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 MAN (AUTO)

    SPAN, 50, **kHz**

    FREQUENCY

27. Set the center frequency to the Measurement Frequency recorded in Table 2-18 for 1 MHz to 1.5 GHz.

28. Press the following spectrum analyzer keys:

    BW, 1, **kHz**

    VID BW AUTO MAN, 30, **Hz**

    SGL SWP

29. Wait for the sweep to finish.

30. Press the following spectrum analyzer keys:

    DISPLAY, DSP LINE ON OFF (ON)

31. 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).

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

1.5 GHz to 1.8 GHz

33. Press the following spectrum analyzer keys:

AUTO COUPLE, **RES BW AUTO MAN** (AUTO)

VID BW AUTO MAN (AUTO)

SPAN, 10, **MHz**

AMPLITUDE, –50, **dBm**

75 Ω input only: Press **AMPLITUDE**, –1.2, **dBmV**.

TRIG,**SWEEP CONT SGL** (CONT)

FREQUENCY, **START FREQ,** 1.5, **GHz**

STOP FREQ, 1.8, **GHz**

34. Repeat step 23 through step 29 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 within 1.8 GHz.

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

Performance verification test “Displayed Average Noise Level” is now complete.

Table 2-18 Displayed Average Noise Level Worksheet

Frequency Range	Measurement Frequency	TR Entry Displayed Average Noise Level	Specification
400 kHz	400 kHz	**(1)**________	–115 dBm
1 MHz	1 MHz	**(2)**________	–115 dBm *(75 Ω input: ≤ –63 dBmV)*
1 MHz to 1.5 GHz	________	**(3)**________	–115 dBm *(75 Ω input: ≤ –63 dBmV)*
1.5 GHz to 1.8 GHz	________	**(4)**________	–113 dBm *(75 Ω input: ≤ –61 dBmV)*

18. Residual Responses

The spectrum analyzer input is terminated and the spectrum analyzer is swept from 150 kHz to 1 MHz. Then the spectrum analyzer is swept in 10 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 75 Ω input

Termination, 75 Ω, Type N (m)

Adapter, Type N (f) to BNC (m), 75 Ω

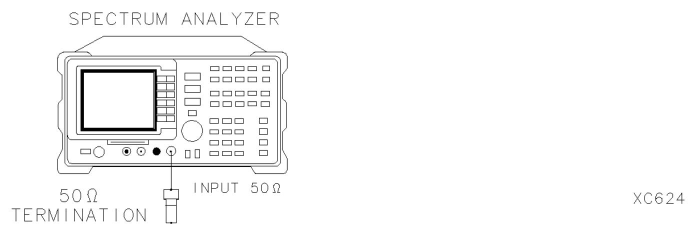
Procedure

150 kHz to 1 MHz

1. Connect the termination to the spectrum analyzer input as shown in Figure 2-24.

   75 Ω input only: Use the adapter to connect the 75 Ω termination, and proceed with step 5.

Figure 2-24 Residual Response Test Setup



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

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

   PEAK SEARCH

   MKR FCTN, MK TRACK ON OFF (ON)

   SPAN, 1, **MHz**

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

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

   PEAK SEARCH

   MKR, MARKER Δ, 150, **kHz**

   MARKER NORMAL

   AMPLITUDE, –60, **dBm**

   ATTEN AUTO MAN, 0, **dB**

   BW, 3, **kHz**

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

   DISPLAY, DSP LINE ON OFF, –90, **dBm**

   75 Ω input only: **DISPLAY, DSP LINE ON OFF,** –38, **dBmV**.

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 2-19.

1 MHz to 1.8 GHz

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

   FREQUENCY, 25, **MHz**

   SPAN, 50, **MHz**

   AMPLITUDE, –60, **dBm**

   75 Ω input only: Press **AMPLITUDE**, –11.25, **dBmV**.

   ATTEN AUTO MAN, 0, **dB**

6. Press **FREQUENCY**, then 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. Press the following spectrum analyzer keys:

   FREQUENCY, CF STEP AUTO MAN, 45, **MHz**

   BW, 10, **kHz**

   VID BW AUTO MAN, 3, **kHz**

   DISPLAY, DSP LINE ON OFF (ON), –90, **dBm**

   75 Ω input only: **DISPLAY**, **DSP LINE ON OFF** (ON), –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 2-19.

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

9. Repeat step 8 until the range from 1 MHz to 1.8 GHz has been checked. (This requires 183 additional frequency steps.) The test for this band requires about 10 minutes 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 at or below the specification limits.

10. Record the highest residual from Table 2-19 as TR Entry 1 in the performance verification test record. If no residuals are found, then record “N/A” in the performance verification test record.

Performance verification test “Residual Responses” is now complete.

Table 2-19 Residual Responses above Display Line Worksheet

Frequency (MHz)	Amplitude (dBm)
________	________
________	________
________	________
________	________
________	________
________	________
________	________

19. Absolute Amplitude, Vernier, and Power Sweep Accuracy

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 –10 dBm (*75 Ω input only:* +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 the 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 “Modulator Gain and Offset Adjustment.”

Equipment Required

Measuring receiver

Power sensor, 100 kHz to 1800 MHz

Cable, Type N, 62 cm (24 in)

Additional Equipment for 75 Ω Input

Power sensor, 75 Ω

Cable, BNC, 75 Ω

Adapter, Type N (f) to BNC (m), 75 Ω

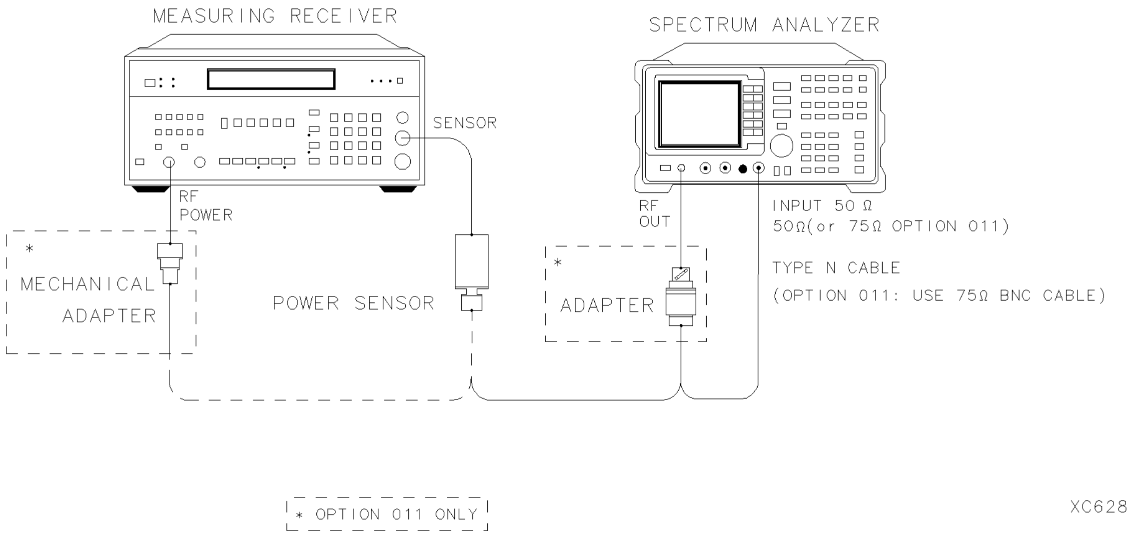
Adapter, mechanical, Type N, 50 Ω (m) to 75 Ω (f)

Procedure

1. Connect the Type N cable between the RF OUT 50 Ω and INPUT 50 Ω connectors on the spectrum analyzer. See Figure 2-25.

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

Figure 2-25 Absolute Amplitude, Vernier, and Power Sweep Accuracy Test Setup



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.

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

   FREQUENCY, 300, **MHz**

   SPAN, 0, **Hz**

   MKR

   AUX CTRL, **Track Gen**

   SRC PWR ON OFF (ON), –5, **dBm**

   75 Ω input only: **SRC PWR ON OFF** (ON), 38, **dBm**

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

4. Zero and calibrate the measuring receiver and 100 kHz to 1800 MHz power sensor in log mode (power reads out in dBm), as described in the measuring receiver operation manual. Enter the power sensor's 300 MHz Cal Factor into the measuring receiver.

5. Disconnect the Type N cable from the RF OUT 50 Ω and connect the 100 kHz to 1800 MHz power sensor to the RF OUT 50 Ω as shown in Figure 2-25.

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

6. On the spectrum analyzer, press:

   –10 **dBm**, **SGL SWP**

   75 Ω input only: 38.8, **dBm**, (+38.8 dBmV), **SGL SWP**

   AUX CTRL, **Track Gen**, **SRC ATN MAN AUTO** (MAN)

7. Subtract –10 dBm from the power level displayed on the measuring receiver and record the resulting Absolute Amplitude Accuracy as TR Entry 1 in the performance verification test record.

8. 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.

   75 Ω input only: 38.8 dBmV output power level setting

9. Set the SRC POWER to the settings indicated in Table 2-20. At each setting, record the power level displayed on the measuring receiver in Table 2-20.

10. Calculate the Absolute Vernier Accuracy by subtracting the SRC POWER setting and 10 dB from the Measured Power Level (MPL) for each SRC POWER setting in Table 2-20.

    Absolute Vernier Accuracy = MPL – SRC POWER – 10 dB

    75 Ω input 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 2-20.

    Absolute Vernier Accuracy = MPL – SRC POWER + 38.8 dB

11. Locate the most positive and most negative Absolute Vernier Accuracy values in Table 2-20. Record the most Positive Vernier Accuracy below and as TR Entry 2 in the performance verification test record. Record the most Negative Vernier Accuracy below and as TR Entry 3 in the performance verification test record.

    Most Positive Power Sweep Accuracy_______________dB

    Most Negative Power Sweep Accuracy_______________dB

12. Calculate the power sweep accuracy by subtracting the Negative Power Sweep Accuracy (NPSA) recorded in the previous step from the Positive Power Sweep Accuracy (PPSA) recorded in the previous step. Record Power Sweep Accuracy as TR Entry 4 in the performance verification test record in Chapter 3.

    Power Sweep Accuracy = PPSA – NPSA

Performance verification test “Absolute Amplitude, Vernier, and Power Sweep Accuracy” is now complete.

Table 2-20 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
+32.76	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

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 then 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 “Modulator Gain and Offset Adjustment.”

Equipment Required

Measuring receiver

Power sensor, 100 kHz to 1800 MHz

Cable, Type N, 62 cm (24 in)

Additional Equipment for 75 Ω Input

Power sensor, 75 Ω

Cable, BNC, 75 Ω

Adapter, Type N (f) to BNC (m), 75 Ω

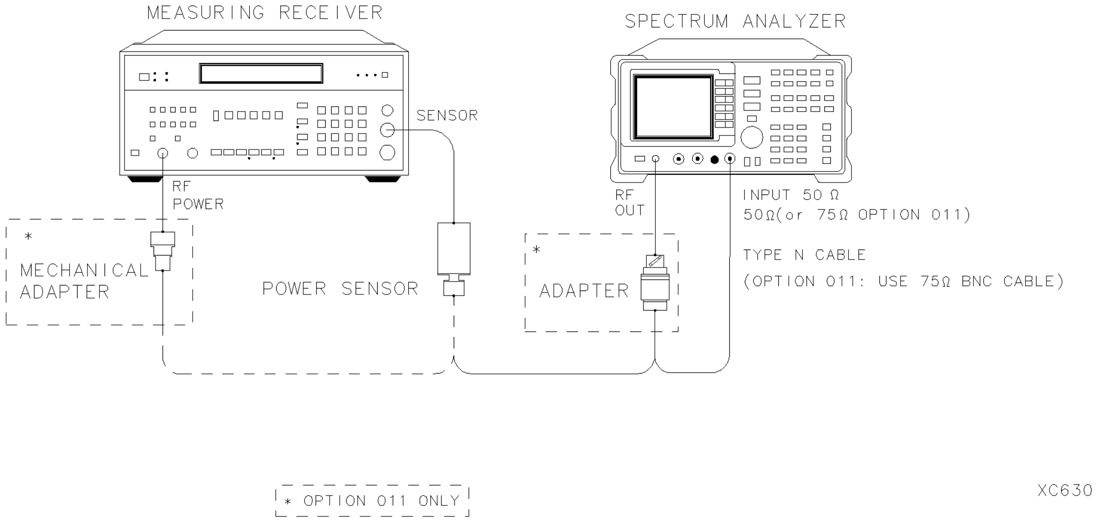
Adapter, mechanical, Type N, 50 Ω (m) to 75 Ω (f)

Procedure

1. Connect the Type N cable between the RF OUT 50 Ω and INPUT 50 Ω connectors on the spectrum analyzer. See Figure 2-26.

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

Figure 2-26 Tracking Generator Level Flatness Test Setup



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.

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, 0, **Hz**

   SPAN, 15, **MHz**

3. On the spectrum analyzer, press **PEAK SEARCH**, **MKR FCTN**, **MK TRACK ON OFF** (ON), **SPAN**, 100, **kHz**.

4. 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.

5. Set the spectrum analyzer controls as follows:

   MKR FCTN, **MK TRACK ON OFF** (OFF)

   SPAN, **ZERO SPAN**

   BW, 1, **MHz**

6. Set the spectrum analyzer controls as follows:

   FREQUENCY, 300, **MHz**

   CF STEP AUTO MAN, 100, **MHz**

   SPAN, 0, **Hz**

7. Set the spectrum analyzer controls as follows:

   MKR

   AUX CTRL, **Track Gen**

   SRC PWR ON OFF, –5, **dBm**

   75 W input only: **SRC PWR ON OFF**, +38, **dBm** (+38 dBmV)

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

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

10. Disconnect the Type N cable from the RF OUT 50 Ω and connect the 100 kHz to 4.2 GHz power sensor to the RF OUT 50 Ω.

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

11. On the spectrum analyzer, press **AUX CTRL**, **Track Gen**, **SRC PWR ON OFF**, –10, **dBm**, then **SGL SWP**.

    75 Ω input only: **SRC PWR ON OFF**, +38.8, **dBm**.

12. Press RATIO on the measuring receiver. The measuring receiver readout is now in power levels relative to the power level at 300 MHz.

13. Set the spectrum analyzer center frequency to 100 kHz. Press **SGL SWP**.

    75 Ω input only: Set the spectrum analyzer center frequency to 1 MHz. Press **SGL SWP**.

14. Enter the appropriate power sensor Cal Factor into the measuring receiver as indicated in Table 2-21.

15. Record the power level displayed on the measuring receiver as the Level Flatness in Table 2-21.

16. Repeat step 13 through to step 15 measure the flatness at each center frequency setting listed in Table 2-21. The ⇑ (step-up key) may be used to tune to center frequencies above 100 MHz.

NOTE Spectrum analyzers equipped with 75 Ω input should be tested only at frequencies of 1 MHz to 1.8 GHz.

17. Locate the most positive Level Flatness reading in Table 2-21 for the frequency ranges listed in Table 2-22 and record as the Maximum Flatness in the performance verification test record as shown in Table 2-22.

18. Locate the most negative Level Flatness reading in Table 2-21 for the frequency ranges listed in Table 2-23 and record as the Minimum Flatness in the performance verification test record as shown in Table 2-23.

Performance verification test “Tracking Generator Level Flatness” is now complete.

Table 2-21 Tracking Generator Level Flatness Worksheet

Center Frequency	Level Flatness (dB)	Cal Factor (MHz)
100 kHz*	__________	0.1
300 kHz*	__________	0.3
500 kHz*	__________	0.3
1 MHz	__________	1
2 MHz	__________	3
5 MHz	__________	3
10 MHz	__________	10
20 MHz	__________	30
50 MHz	__________	50
100 MHz	__________	100
200 MHz	__________	300
300 MHz	0 (Ref)	300
400 MHz	__________	300
500 MHz	__________	300
600 MHz	__________	300
700 MHz	__________	1000
800 MHz	__________	1000
900 MHz	__________	1000
1000 MHz	__________	1000
1100 MHz	__________	1000
1200 MHz	__________	1000
1300 MHz	__________	1000
1400 MHz	__________	1000
1500 MHz	__________	2000
1600 MHz	__________	2000
1700 MHz	__________	2000
1800 MHz	__________	2000
*These frequencies are tested on spectrum analyzers equipped with Option 010 only.		

Table 2-22 Maximum Flatness

Frequency Range	TR Entry Maximum Flatness
For Option 010	
100 kHz	**(1)**__________
300 kHz to 5 MHz	**(2)**__________
10 MHz to 1800 MHz	**(3)**__________
For Option 011	
1 MHz to 1800 MHz	**(4)**__________

Table 2-23 Minimum Flatness

Frequency Range	TR Entry Minimum Flatness
For Option 010	
100 kHz	**(5)**__________
300 kHz to 5 MHz	**(6)**__________
10 MHz to 1800 MHz	**(7)**__________
For Option 011	
1 MHz to 1800 MHz	**(8)**__________

21. Harmonic Spurious Outputs

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 tuned to several different 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

Cable, Type N, 62 cm (24 in)

Cable, BNC, 23 cm (9 in)

Adapter, Type N (m) to BNC (f)

Additional Equipment for 75 Ω Input

Adapter, minimum loss

Cable, BNC, 75 Ω

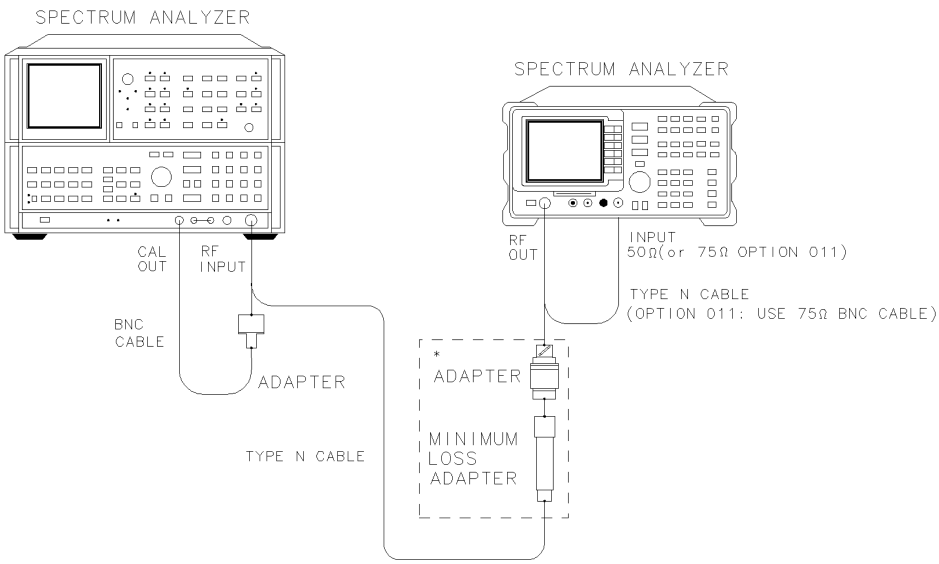
Adapter, Type N (f) to BNC (m), 75 Ω

Procedure

1. Connect the Type N cable between the RF OUT 50 Ω and INPUT 50 Ω connectors on the spectrum analyzer. See Figure 2-27.

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

Figure 2-27 Harmonic Spurious Outputs Test Setup



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.

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

   FREQUENCY, 300, **MHz**

   SPAN, 0, **Hz**

   MKR

   AUX CTRL, **Track Gen**

   SRC PWR ON OFF (ON), –5, **dBm**

   75 Ω input only: **SRC PWR ON OFF**, 42, **dBm** (+42 dBmV).

3. On the spectrum analyzer, press **TRACKING PEAK**. Wait for the PEAKING message to disappear, then press the following keys:

   0, **dBm**

   FREQUENCY, 10, **MHz**

   SGL SWP

   75 Ω input only: 42.8 **dBm** (42.8 dBmV)

NOTE It is only necessary to perform the next step if more than two hours have elapsed since a front-panel calibration of the microwave spectrum analyzer was performed.

The microwave spectrum analyzer should be allowed to warm up for at least 30 minutes before proceeding.

4. Perform a front-panel calibration of the microwave spectrum analyzer by performing the following steps:

NOTE The following steps are for an 8566A/B microwave spectrum analyzer, the steps may be different if you are using another microwave spectrum analyzer.

   a. Connect a BNC cable between the CAL OUTPUT and the 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.

5. Connect the Type N cable from the tracking generator output to the microwave spectrum analyzer RF INPUT as shown in Figure 2-27.

   75 Ω input only: Use the minimum loss adapter and Type N (f) to BNC (m) adapter.

6. Set the microwave spectrum analyzer controls as follows:

   CENTER FREQUENCY .... 10 MHz

   SPAN ....100 kHz

   REFERENCE LEVEL ....+5 dBm

   RES BW ....30 kHz

   LOG dB/DIV ....10 dB

7. Set up the microwave spectrum analyzer by performing the following steps:

NOTE The following steps are for an 8566A/B microwave spectrum analyzer, the steps may be different if you are using another microwave spectrum analyzer.

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, Δ, 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 2-24 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 2-24 as the 3rd Harmonic Level for the 10 MHz Tracking Generator Output Frequency.

e. Press **MARKER** (OFF).

8. Change the microwave spectrum analyzer center frequency to the next frequency listed in Table 2-24, then repeat step 7. Note that the microwave spectrum analyzer CENTER FREQ is the same as the Tracking Generator Output Frequency.

9. Locate the most positive 2nd Harmonic Level in Table 2-24 and record as TR Entry 1 of the performance verification test record.

10. Locate the most positive 3rd Harmonic Level in Table 2-24 and record as TR Entry 2 of the performance verification test record.

Performance verification test “Harmonic Spurious Outputs” is now complete.

Table 2-24 Harmonic Spurious Responses Worksheet

Tracking Generator Frequency	2nd Harmonic Level (dBc)	3rd Harmonic Level (dBc)
10 MHz	________	________
100 MHz	________	________
300 MHz	________	________
850 MHz	________	N/A

22. Non-Harmonic Spurious Outputs

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 adjustments for this performance test.

Equipment Required

Microwave spectrum analyzer

Cable, Type N, 62 cm (24 in)

Cable, BNC, 23 cm (9 in)

Adapter, Type N (m) to BNC (f)

Additional Equipment for 75 Ω Input

Adapter, minimum loss

Cable, BNC, 75 Ω

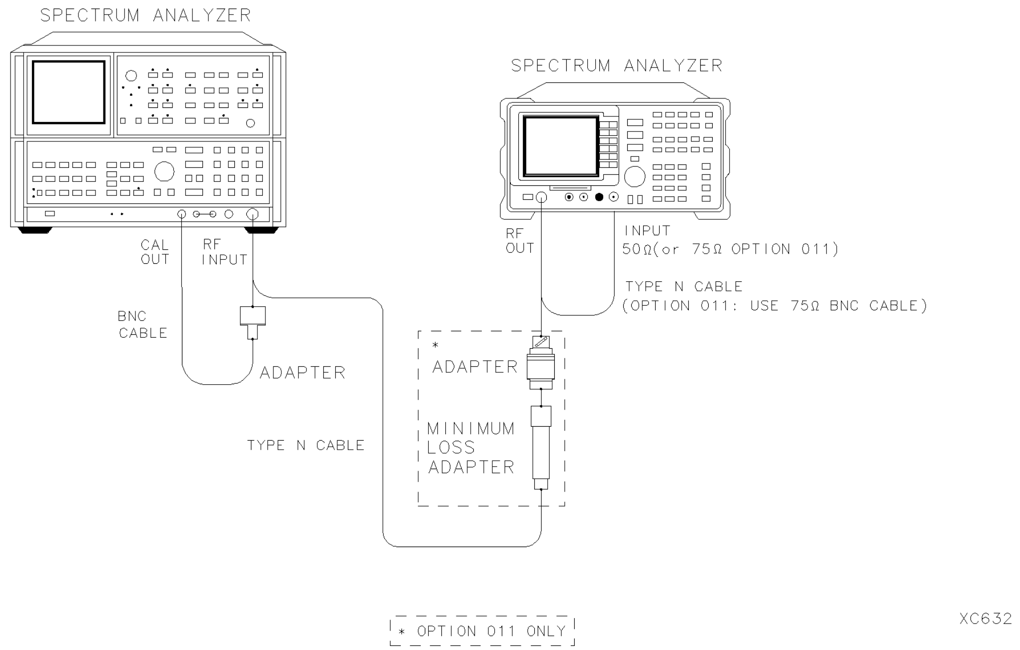
Adapter, Type N (f) to BNC (m), 75 Ω

Procedure

1. Connect the Type N cable between the RF OUT 50 Ω and INPUT 50 Ω connectors on the spectrum analyzer. See Figure 2-28.

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

Figure 2-28 Non-Harmonic Spurious Outputs Test Setup



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.

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

   FREQUENCY, 300, **MHz**

   SPAN, 0, **Hz**

   BW, **RES BW AUTO MAN**, 30, **kHz**

   MKR

   AUX CTRL, Track Gen

   SRC PWR ON OFF (ON), –5, **dBm**

   75 Ω input only: **AUX CTRL**, **Track Gen**,
   SRC PWR ON OFF (ON), 38, **dBm** (+38 dBmV).

3. On the spectrum analyzer, press **TRACKING PEAK**, then wait for the `PEAKING` message to disappear.
4. On the spectrum analyzer, press 0, **dBm**, **SGL SWP**.

   75 Ω input only: Press 42.8, **dBm** (+42.8 dBmV) then **SGL SWP**.

NOTE It is only necessary to perform the next step 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.

5. Perform a front-panel calibration of the microwave spectrum analyzer by performing the following steps:
   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.
   d. Press **SHIFT**, **FREQUENCY SPAN** to start the 30 second internal error correction routine.
   e. Press **SHIFT**, **START FREQ** to use the error correction factors just calculated.
6. Connect the Type N cable from the tracking generator output to the microwave spectrum analyzer RF INPUT as shown in Figure 2-28.

   75 Ω input only: Use the minimum loss adapter and Type N (f) to BNC (m) adapter.

Measuring Fundamental Amplitudes

7. Set the spectrum analyzer center frequency to the Fundamental Frequency listed in Table 2-25.

8. Set the microwave spectrum analyzer controls as follows:

   SPAN ....100 kHz

   REFERENCE LEVEL .... +5 dBm

   ATTEN ....20 dB

   LOG dB/DIV ....10 dB

9. Set the microwave spectrum analyzer CENTER FREQUENCY to the Fundamental Frequency listed in Table 2-25.

10. On the microwave spectrum analyzer, press **PEAK SEARCH**. Press **MKR** → **CF**, **MKR** → **REF LVL.** Wait for another sweep to finish.

11. Record the microwave spectrum analyzer marker amplitude reading in Table 2-25 as the Fundamental Amplitude.

Measuring Non-Harmonic Responses

12. Set the microwave spectrum analyzer START FREQ, STOP FREQ, and RES BW as indicated in the first row of Table 2-26.

13. Press **SINGLE** on the microwave spectrum analyzer and wait for the sweep to finish. Press **PEAK SEARCH**.

14. Verify that the marked signal is not the fundamental or a harmonic of the fundamental by performing the following steps:

    a. Divide the marker frequency by the fundamental frequency (the spectrum analyzer center frequency 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, 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.

15. 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.

16. If the marked signal is either the fundamental or a harmonic of the fundamental (see step 14) or a noise peak (see step 15) move the marker to the next highest signal by pressing **SHIFT**, **PEAK SEARCH**. Continue with step 18.

17. If the marked signal is *not* the fundamental or a harmonic of the fundamental (see step 14) and is a true response (see step 15) calculate the difference between the amplitude of marked signal and the Fundamental Amplitude as listed in Table 2-25.

Non-Harmonic AMP = Marker AMP – Fundamental AMP

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 2-26.

18.If a true non-harmonic spurious response is not found, record "NOISE" as the Non-Harmonic Response Amplitude in Table 2-26 for the appropriate spectrum analyzer center frequency and microwave spectrum analyzer start and stop frequency settings.

19.Repeat step 13 through step 18 for the remaining microwave spectrum analyzer settings for start frequency, stop frequency, and resolution bandwidth; and for the spectrum analyzer center frequency setting of 10 MHz.

20.Repeat step 12 through step 18 with the spectrum analyzer center frequency set to 900 MHz.

21.Repeat step 12 through step 18 with the spectrum analyzer center frequency set to 1.8 GHz.

22.Locate in Table 2-26 the most-positive Non-Harmonic Response Amplitude. Record this amplitude as the Highest Non-Harmonic Response Amplitude in TR Entry 1 of the performance verification test record.

Performance verification test "Non-Harmonic Spurious Outputs" is now complete.

Table 2-25 Fundamental Response Amplitudes Worksheet

Fundamental Frequency	Fundamental Amplitude (dBm)
10 MHz	__________
900 MHz	__________
1.8 GHz	__________

Table 2-26 Non-Harmonic Responses Worksheet

Microwave Spectrum Analyzer Settings			Non-Harmonic Response Amplitude (dBc)		
Start Frequency (MHz)	Stop Frequency (MHz)	Resolution Bandwidth	at 10 MHz Center Frequency	at 900 MHz Center Frequency	at 1.8 GHz Center Frequency
0.1*	5.0	10 kHz	__________	__________	__________
5.0	55	100 kHz	__________	__________	__________
55	1240	1 MHz	__________	__________	__________
1240	1800	1 MHz	__________	__________	__________
* Option 011: Set the START FREQ to 1 MHz.					

23. Tracking Generator Feedthrough

This procedure is only for spectrum analyzers equipped with Option 010 or Option 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 are no related adjustments for this performance test.

Equipment Required

50 Ω Termination *(2 required)*

Adapter, Type N, 62 cm (24 in)

Cable, BNC, 23 cm (9 in)

Cable, Type N (m) to BNC (f)

Additional Equipment for 75 Ω Input

Termination, 75 Ω, Type N (m) *(2 required)*

Cable, BNC, 75 Ω

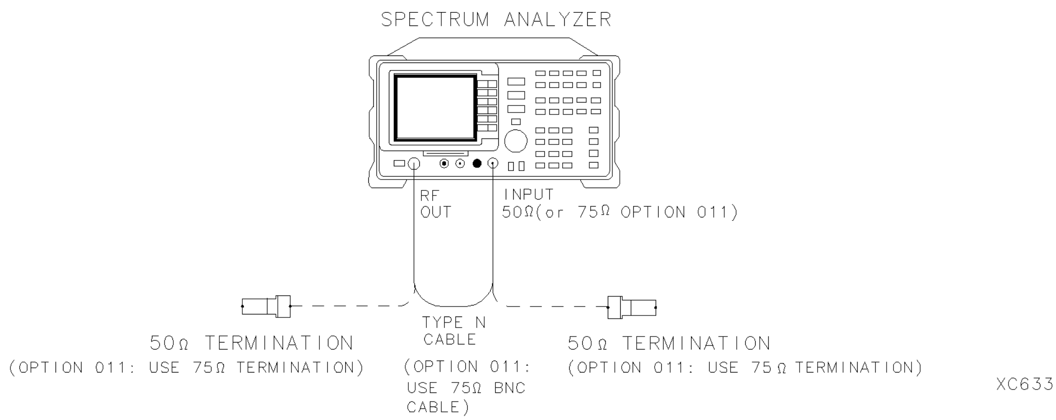
Adapter, Type N (f) to BNC (m), 75 Ω *(2 required)*

Procedure

1. Connect the Type N cable between the RF OUT 50 Ω and INPUT 50 Ω connectors on the spectrum analyzer. See Figure 2-29.

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

Figure 2-29 Tracking Generator Feedthrough Test Setup



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

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

   FREQUENCY, 300, **MHz**

   SPAN,1, **MHz**

   MKR

   AUX CTRL, Track Gen

   SRC PWR ON OFF (ON), –5, **dBm**

   75 Ω input only: 42 **dBm** (+42 dBmV)

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

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

   75 Ω input only: Connect the CAL OUTPUT to the INPUT 75 Ω.

5. Set the spectrum analyzer controls as follows:

   AMPLITUDE, –20, **dBm**

   75 Ω input only: Press **AMPLITUDE, REF LVL,** +28.75, **dBmV**.

   SPAN, 10, **MHz**

   AMPLITUDE

   ATTEN ATUO MAN, 0, **dB**

   SPAN, 100, **kHz**

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

   PEAK SEARCH

   MKR FCTN, MK TRACK ON OFF (ON)

   SPAN, 100, **kHz**

7. Wait for the `AUTO ZOOM` message to disappear, then set the spectrum analyzer as follows:

   BW VID BW AUTO MAN 30 **Hz**

   MKR FCTN MK TRACK ON OFF (OFF)

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

   PEAK SEARCH

   AMPLITUDE, More 1 of 3

   REF LVL OFFSET

9. Subtract the MKR amplitude reading from –20 dBm, then enter the result in the spectrum analyzer as the REF LVL OFFSET.

   REF LVL OFFSET_______________dB

   For example, if the marker reads –20.21 dBm, enter +0.21 dB.

   –20 dBm – (–20.21 dBm) = +0.21 dB

   Example for 75 Ω input:

   If the marker reads 26.4 dBmV, enter +2.35 dB

   28.75 dBmV – 26.4 dBmV = 2.35 dB

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

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

11.Press **AUX CTRL**, **Track Gen**, then **SRC PWR ON OFF** (OFF).

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

FREQUENCY, 0, **Hz**

SPAN, 10, **MHz**

AMPLITUDE, –10, **dBm**

75 Ω input only: **AMPLITUDE**, +38.75, **dBmV**

AUTO COUPLE, **VID BW AUTO MAN** (AUTO)

MKR, **More 1 of 2**, **MARKER ALL OFF**

TRIG, **SWEEP CONT SGL** (CONT)

13.Press the following spectrum analyzer keys:

PEAK SEARCH

MKR FCTN, **MK TRACK ON OFF** (ON)

MKR →, **MARKER** →**REF LVL**

SPAN, 2, **MHz**

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

15.Press **FREQUENCY** and adjust the center frequency until the LO feedthrough peak is on the left-most graticule line, then set the spectrum analyzer as follows:

SPAN, 50, **kHz**

AMPLITUDE, –50, **dBm**

75 Ω input only: Press **AMPLITUDE,** –1.25, **dBmV**.

BW, **VID BW AUTO MAN,** 30, **Hz**

16.Press **AUX CTRL**, **Track Gen**, **SRC PWR ON OFF** (ON), and enter 0, **dBm**.

75 Ω input only: Press **AUX CTRL**, **Track Gen**, **SRC PWR ON OFF** (ON), and enter 42.8 **dBm** (+42.8 dBmV).

17.Press **SGL SWP**, then wait for completion of a new sweep. Press **DISPLAY**, **DSP LINE ON OFF** (ON).

18.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 2-27 as the noise level at 1 MHz.

19.Repeat step 17 through step 18 for the remaining Tracking Generator Output Frequencies (spectrum analyzer center frequency) listed in Table 2-27.

20. In Table 2-27, locate the most positive Noise Level Amplitude. Record this amplitude as TR Entry 1 of the performance verification test record.

Performance verification test “Tracking Generator Feedthrough” is now complete.

Table 2-27 TG Feedthrough Worksheet

Tracking Generator Output Frequency	Noise Level Amplitude (dbm or dBmV)
1 MHz	__________
20 MHz	__________
50 MHz	__________
100 MHz	__________
250 MHz	__________
400 MHz	__________
550 MHz	__________
700 MHz	__________
850 MHz	__________
1000 MHz	__________
1150 MHz	__________
1300 MHz	__________
1450 MHz	__________
1600 MHz	__________
1750 MHz	__________

2a Performance Verification Tests: If 3335A Source Not Available

This chapter provides alternative performance verification tests for the spectrum analyzer which do not require the use of the 3335A Synthesizer Level Generator. Substitute the tests in this chapter for those of the same number found in Chapter 2 , “Performance Verification Tests,” when the 3335A Synthesizer Level Generator is not available.

5a. 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

Synthesized signal generator

Signal generator

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, 152 cm (60 in) *(2 required)*

Additional Equipment for 75 Ω Input

Pad, 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

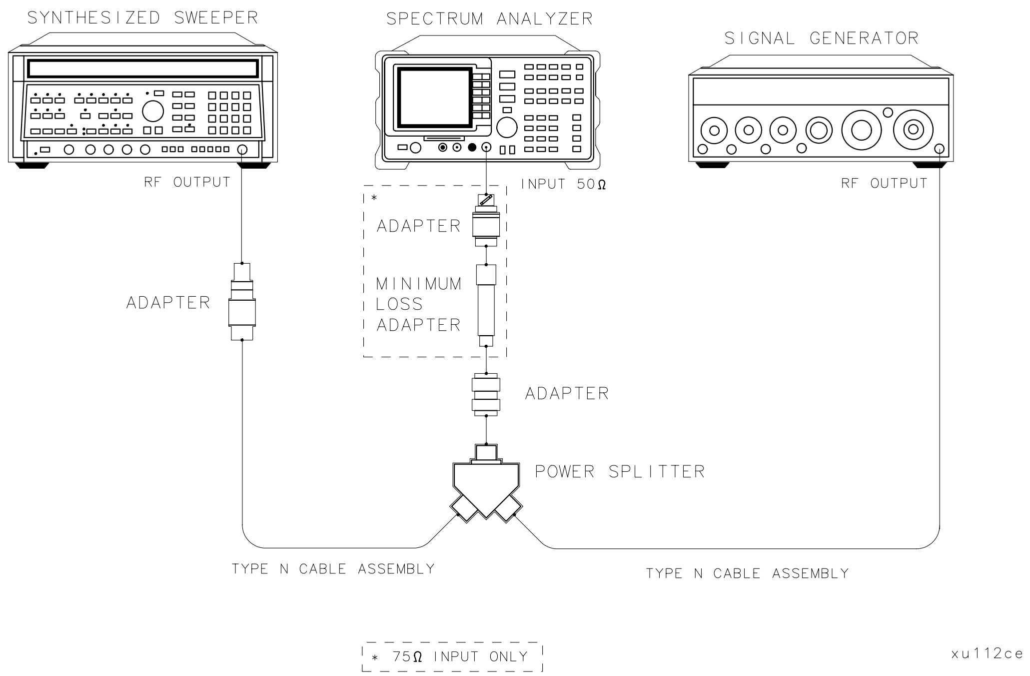
Part 2: 10.1 MHz to 10 kHz Frequency Span Readout Accuracy

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 2a-1. Note that the power splitter is used as a combiner.

Figure 2a-1 1800 MHz Frequency Span Readout Accuracy Test Setup



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

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 .... 1800 MHz

   POWER LEVEL ....–5 dBm

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

   FREQUENCY (LOCKED MODE) .... 200 MHz

   CW OUTPUT ....0 dBm

5. Adjust the spectrum analyzer center frequency, if necessary, to place the lower frequency on the second vertical graticule line (one division from the left-most graticule line).

6. On the spectrum analyzer, press **SGL SWP**. Wait for the completion of a new sweep, then press 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** Δ, then continue pressing **NEXT PK RIGHT** until the marker Δ is on the right-most signal (1700 MHz).

8. Record the MKR Δ frequency reading as TR Entry 1 in the appropriate performance verification test record in Chapter 3 .

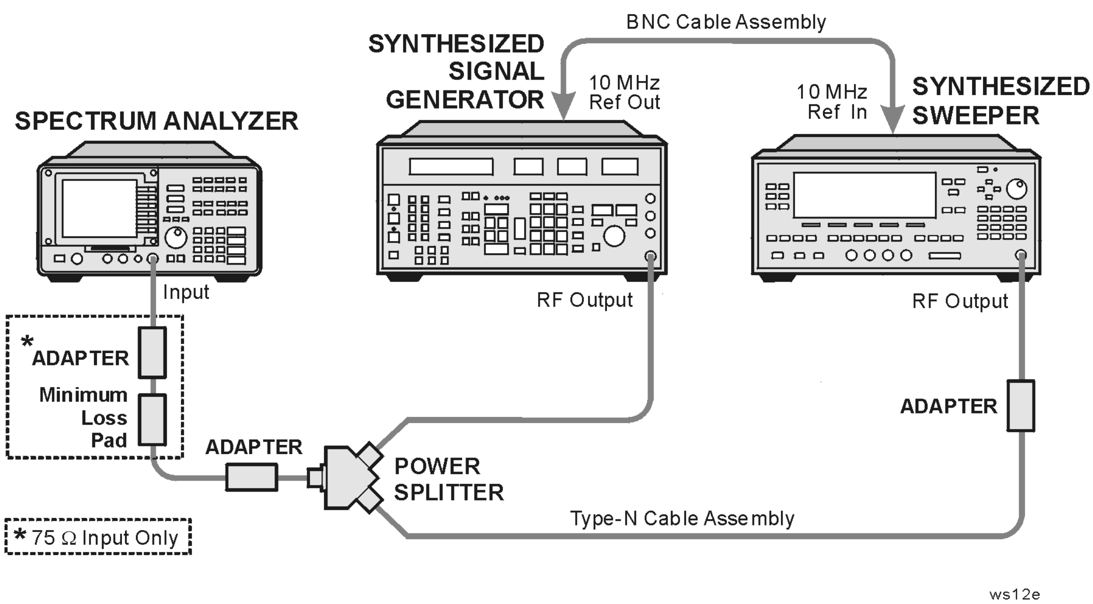
   The MKR reading should be within the 1446 MHz and 1554 MHz.

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. Additional steps are included for spectrum analyzers equipped with Option 130 to measure frequency span accuracies at 1 kHz and 300 Hz.

1. Connect the equipment as shown in Figure 2a-2. Note that the power splitter is used as a combiner.

Figure 2a-2 10.1 MHz to 10 kHz Frequency Span Readout Accuracy Test Setup



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

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 synthesized signal 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 Table 2a-1. The MKR-Δ frequency reading corresponds to TR Entry 2 in Table 2a-1 and should be within the limits shown.

8. Press **MKR**, **More 1 of 2**, then **MARKER ALL OFF** on the spectrum analyzer.

9. Adjust the spectrum analyzer span setting to the next frequency listed in Table 2a-1. Likewise, adjust the synthesizer sweeper CW and the synthesized signal generator to the corresponding frequencies in Table 2a-1.

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 Table 2a-1. The MKR-Δ frequency reading corresponds to the next TR Entry in Table 2a-1 and should be within the limits shown.

12. Repeat step 9 through step 11 for spectrum analyzer span settings 100 kHz, 99 kHz, and 10 kHz.

13. Record TR Entry 2 through TR Entry 6 in the appropriate performance verification test record in Chapter 3 .

Performance test “Frequency Span Readout Accuracy” is now complete.

Table 2a-1 Frequency Span Readout Accuracy

Spectrum Analyzer Span Setting	Synthesized Signal Generator Frequency	Synthesized Sweeper Frequency	MKR-Δ Reading		
			Min.	TR Entry	Max.
10.10 MHz	66.000 MHz	74.000 MHz	7.70 MHz	**(2)**______	8.30 MHz
10.00 MHz	66.000 MHz	74.000 MHz	7.80 MHz	**(3)**______	8.20 MHz
100.00 kHz	69.960 MHz	70.040 MHz	78.00 kHz	**(4)**______	82.00 kHz
99.00 kHz	69.960 MHz	70.040 MHz	78.00 kHz	**(5)**______	82.06 kHz
10.00 kHz	69.996 MHz	70.004 MHz	7.80 kHz	**(6)**______	8.20 kHz

8a. Scale Fidelity

A 50 MHz CW signal is applied to the input of the analyzer through two calibrated step attenuators. The attenuators are the amplitude reference standard. The source is adjusted for a response at the reference level. The attenuators are then set to achieve a nominal amplitude below the reference level. The analyzer's amplitude marker is compared to the actual total attenuation to determine the scale fidelity error.

The test is performed in both log and linear amplitude scales.

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

Equipment Required

Synthesized signal generator

Attenuator, 1 dB step

Attenuator, 10 dB step

Attenuator/switch driver (if programmable step attenuators are used)

Cable, Type N, 152cm (60 in)

Cable, BNC, 122 cm (48 in) *(2 required)*

Attenuator interconnect kit

Adapter, Type N (m) to BNC (f) *(2 required)*

Additional Equipment for 75 Ω Input

Pad, minimum loss

Adapter, Type N (f) to BNC (m), 75 Ω

Procedure

Calculate Actual Attenuation Values

14. From the calibration data supplied with the 1 dB step attenuator, enter the actual attenuation for the corresponding nominal attenuation settings in Table 2a-2 and Table 2a-3. If the calibration data does not indicate an actual attenuation value for the 0 dB setting, enter 0 dB. If using a programmable attenuator, enter the data for the section three 4 dB step.

15. From the calibration data supplied with the 10 dB step attenuator, enter the actual attenuation for the corresponding nominal attenuation settings in Table 2a-2 and Table 2a-3. If the calibration data does not indicate an actual attenuation value for the 0 dB setting, enter 0 dB. If using a programmable attenuator, enter the data for the section three 40 dB step.

16. Calculate the total actual attenuation for each dB from REF LVL setting (including 0 dB) in Table 2a-2 and Table 2a-3 by adding the 1 dB step attenuator actual attenuation to the 10 dB step attenuator actual attenuation.

    For example, if the 1 dB step attenuator actual attenuation for the 6 dB from REF LVL setting is 5.998 dB and the 10 dB step attenuator actual attenuation for the 30 dB from REF LVL setting is 30.012 dB, the total attenuation for the -36 dB from REF LVL setting would be:

    Total Actual Attenuation = 5.998 dB + 30.012 dB = 36.01 dB

Linear Scale

Setup for Linear Scale Measurement

1. 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)

   75 Ω input only: **More 1 of 2**, **INPUT Z 50 W 75 W** (50 W)

   FREQUENCY, 50, **MHz**

   SPAN, 10, **MHz**

   PEAK SEARCH

   MKR FCTN, **MK TRACK ON OFF** (ON)

   SPAN, 50, **kHz**

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

   BW

   RES BW AUTO MAN, 3, **kHz**

   VID BW AUTO MAN, 30, **Hz**

2. Preset the synthesized signal generator and set the controls as follows:

   FREQUENCY, 50, **MHz**

   AMPLITUDE, -3, **dBm** (50 Ω Input only)

   AMPLITUDE, +4, **dBm** (75 Ω Input only)

   AM OFF

   FM OFF

3. Set the step attenuators to 0 dB attenuation. Refer to Table 2-1 for information on manually controlling a programmable step attenuator with an 11713A attenuator/switch driver.
4. Press **PEAK SEARCH** on the analyzer.
5. Adjust the synthesized signal generator's amplitude until the analyzer's marker amplitude reads `223.6 mV    4 mV`
6. Do not adjust the synthesized signal generator's amplitude after the 223.6 mV reference is established.

Calculate Ideal Marker Amplitude

Consider the Total Actual Attenuation at the 0 dB from REF LVL setting to be ATref, and the Total Actual Attenuation at any other dB from Ref Level setting to be ATmeas.

7. Calculate the Ideal Mkr Reading (IMR) for each dB from REF LVL in Table 2a-3 as follows:

   IMR = 1000 × SQRT[0.05 × 10((–ATmeas + ATref)/10)] mV

   For example, if the Total Actual Attenuation at the 0 dB from REF LVL is 0.012 dB and the Total Actual Attenuation at the -8 dB from REF LVL is 7.982, the Ideal Mkr Reading (IMR) for the -8 dB from REF LVL would be:

   IMR = 1000 × SQRT[0.05 × 10((–ATmeas + ATref)/10)]

   = 1000 × SQRT[0.05 × 10((–7.982+0.012)/10)]

   = 89.3 mV

   Record each Ideal Mkr Reading in Table 2a-3.

Measure Linear Fidelity

1. Set the 1 dB and 10 dB step attenuators as indicated in Table 2a-3 for the -4 dB from REF LVL setting.
2. Press **Peak Search** on the analyzer and record the Mkr amplitude reading in Table 2a-3.
3. Calculate the Linear Fidelity Error (LFE) as a percentage of Reference Level (REF LVL) as follows:

   LFE = 100 × (Actual Mkr Reading – Ideal Mkr Reading) / 223.6%

   For example, if the Ideal Mkr Reading is 89.3 mV and the Actual Mkr Reading is 85 mV, the Linear Fidelity Error would be:

   LFE = 100 × (85 – 89.3) / 223.6 = 1.92% of REF LVL
4. Repeat step 1 through step 3 above for the remaining dB from REF LVL settings in Table 2a-3.

5. Record TR Entry 33 through TR Entry 36 in the appropriate performance verification test record in Chapter 3a .

6. Press **Amplitude**, **More**, **Input Z**, 75, Preset, on the spectrum analyzer.

The “Linear Scale” portion of the performance verification test “Scale Fidelity” is now complete. Proceed to step 1 of “Log to Linear Switching.”

Log to Linear Switching

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

2. Set the synthesizer controls as follows:

   FREQUENCY .... 50 MHz

   AMPLITUDE .... +6 dBm

3. 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**

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

   PEAK SEARCH

   MKR →, **MARKER** →**REF LVL**

   PEAK SEARCH

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

   Log Mode Amplitude Reading: _______________dBm

6. 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.

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

   Linear Mode Amplitude Reading: _______________dBm

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

   Log/Linear Error: _______________dBm

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

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

    MKR →, **MARKER** →**REF LVL**

    PEAK SEARCH

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

    Linear Mode Amplitude Reading: _______________dBm

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

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

    PEAK SEARCH

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

    Log Mode Amplitude Reading: _______________dBm

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

    Linear/Log Error: _______________dBm

15. Record the Linear/Log Error as TR Entry 37 in the appropriate performance verification test record in Chapter 3a . The absolute value of the reading should be less than 0.25 dB.

The performance verification test “Scale Fidelity” is now complete.

Table 2a-2 Scale Fidelity, Log Mode

dB from REF LVL	1 dB step Atten. Nom-inal Atten.	1 dB step Atten. Nom-inal Atten.	10 dB step Atten. Nom-inal Atten.	10 dB step Atten. Nom-inal Atten.	Total Actual Atten.	Mkr Δ Reading	TR Entry Cumu-lative Log Fidelity Error	TR Entry Incre-mental Log Fidelity Error
(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)
0(Ref)	0	_______	0	_______	_______	0(Ref)	0(Ref)	0(Ref)
−4	4	_______	0	_______	_______	_______	(1)______	(18)_____
−8	8	_______	0	_______	_______	_______	(2)______	(19)_____
−12	2	_______	10	_______	_______	_______	(3)______	(20)_____
−16	6	_______	10	_______	_______	_______	(4)______	(21)_____
−20	0	_______	20	_______	_______	_______	(5)______	(22)_____
−24	4	_______	20	_______	_______	_______	(6)______	(23)_____
−28	8	_______	20	_______	_______	_______	(7)______	(24)_____
−32	2	_______	30	_______	_______	_______	(8)______	(25)_____
−36	6	_______	30	_______	_______	_______	(9)______	(26)_____
−40	0	_______	40	_______	_______	_______	(10)_____	(27)_____
−44	4	_______	40	_______	_______	_______	(11)_____	(28)_____
−48	8	_______	40	_______	_______	_______	(12)_____	(29)_____
−52	2	_______	50	_______	_______	_______	(13)_____	(30)_____
−56	6	_______	50	_______	_______	_______	(14)_____	(31)_____
−60	0	_______	60	_______	_______	_______	(15)_____	(32)_____
−64	4	_______	60	_______	_______	_______	(16)_____	N/A
−68	8	_______	60	_______	_______	_______	(17)_____	N/A

Table 2a-3 Scale Fidelity, Linear Mode

dB from REF LVL	1 dB step Atten. Nom-inal Atten.	1 dB step atten. Nominal Atten.	10 dB step atten. Nominal Atten.	10 dB step atten. Nominal Atten.	Total Actual Atten.	Ideal Mkr Reading	Actual Mkr Reading	TR Entry Linear Fidelity Error
(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(mV)	(mV)	% of RL
0(Ref)	0	_______	0	_______	_______	0(Ref)	0(Ref)	0(Ref)
–4	4	_______	0	_______	_______	_______	_______	**(33)**_____
–8	8	_______	0	_______	_______	_______	_______	**(34)**_____
–12	2	_______	10	_______	_______	_______	_______	**(35)**_____
–16	6	_______	10	_______	_______	_______	_______	**(36)**_____
–20	0	_______	20	_______	_______	_______	_______	N/A

9a. Reference Level Accuracy

A 50 MHz CW signal is applied to the INPUT 50 Ω of the spectrum analyzer through two step attenuators. 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

Synthesized signal generator

1 dB step Attenuator

10 dB step Attenuator

Attenuator/switch driver (if programmable step attenuators are used)

Cable, Type N, 152 cm (60 in)

Cable, BNC, 122 cm (48 in) *(2 required)*

Attenuator interconnect kit

Adapter, Type N (m) to BNC (f) (*2 required*)

Additional Equipment for 75 Ω Input

Adapter, minimum loss

Adapter, Type N (f) to BNC (m) 75 Ω

Procedure

Calculate Actual Attenuation Errors

1. From the calibration data supplied with the 10 dB step attenuator, enter the 10 dB actual attenuation for the corresponding nominal attenuation settings in Table 2a-4 and Table 2a-5. If using a programmable attenuator, enter the data for the section three 40 dB step.

2. Calculate the reference attenuation error by subtracting 40 dB from the actual attenuation for the 40 dB nominal attenuator setting as follows:

   Ref Atten Error = Actual Atten (40 dB) – 40 dB

   Record this value as the reference attenuation error below:

   Reference Attenuation Error: _______________dB

3. To calculate the attenuation error at other nominal attenuator settings, subtract the reference attenuation error from the attenuation error at the other settings as follows:

   Atten Error = (Actual Atten – Nominal Atten) – Ref Atten Error

   For example, if the Actual Attenuation for the 40 dB Nominal Attenuation setting is 40.15 dB and the Actual Attenuation for 50 dB Nominal Attenuation setting is 50.08 dB, then the Reference Attenuation Error is 0.15 dB and the Attenuation Error for the 50 dB Nominal Attenuation setting is:

   Atten Error = (50.08 dB – 50 dB) – 0.15 dB = –0.07 dB

   Record the results in Table 2a-4 and Table 2a-5.

Log Scale

1. Set the synthesized signal generator controls as follows:

   FREQUENCY .... 50 MHz

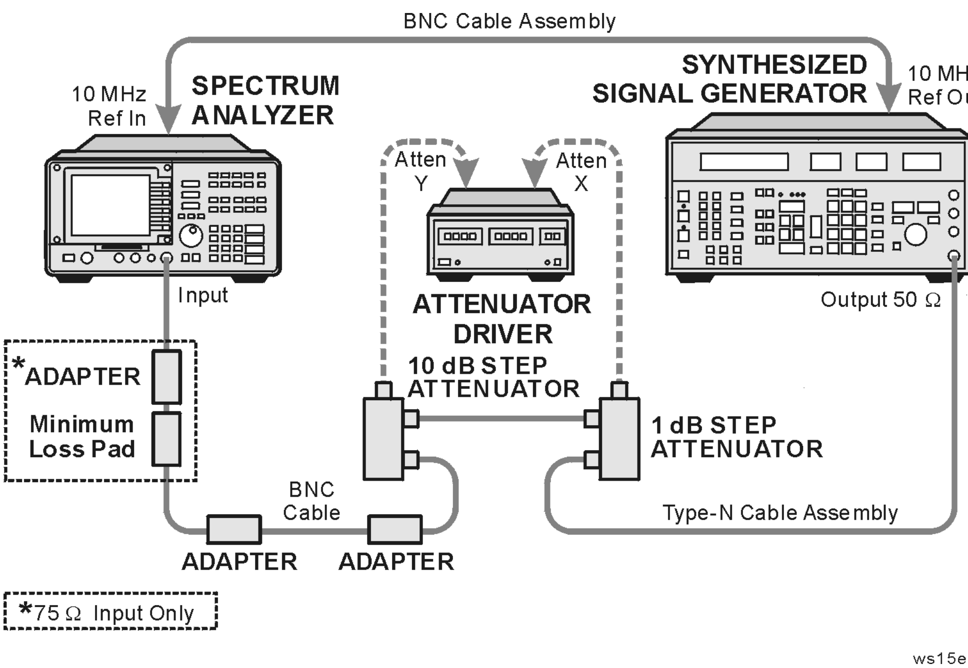
   AMPLITUDE .... –10 dBm

   AMPTD INCR .... 10 dB

2. Connect the equipment as shown in Figure 2a-3. Set the 10 dB step attenuator to 10 dB attenuation and the 1 dB step attenuator to 0 dB attenuation.

   75 Ω input 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.

Figure 2a-3 Reference Level Accuracy Test Setup



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

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**

   75 Ω input only: **AMPLITUDE**, **More 1 of 2**, **Amptd Units**, **dBm**

   AMPLITUDE, –20, **dBm**, **SCALE LOG LIN** (LOG), 1, **dB**

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

4. Set the 1 dB step attenuator signal peak between 1 dB and 2 dB (one to two divisions) below the reference level. Refer to Table 2-1 for information on manually controlling a programmable step attenuator with an 11713A attenuator/switch driver.

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

   SGL SWP

   PEAK SEARCH, **MARKER Δ**

6. Set the 10 dB step attenuator and spectrum analyzer reference level according to Table 2a-4.

7. At each 10 dB Nominal Attenuation setting in Table 2a-4:

   a. Press **SGL SWP, PEAK SEARCH** on the spectrum analyzer.

   b. Record the MKR Δ amplitude reading as indicated in Table 2a-4.

   c. Add the Actual Attenuation error to the analyzer MKR Δ amplitude reading for each Nominal Attenuation setting in Table 2a-4.

      For example, if the Attenuation Error at the 50 dB Nominal Attenuation setting is -0.07 dB and the MKR D amplitude reading is +0.17 dB, the result corresponding to the 50 dB Nominal Attenuation setting is:

      MKR D Read + Atten Error = +0.17 dB + (–0.07 dB) = +0.10 dB

      Record the result corresponding to each Nominal Attenuation setting in Table 2a-4.

8. Record TR Entry 1 through TR Entry 9 in the appropriate performance verification test record in Chapter 3a .

Linear Scale

9. Set the 10 dB attenuator to 10 dB attenuation.

10. Set the 1 dB step attenuator to 10 dB attenuation.

    75 Ω input only: Set the 1 dB step attenuator to 0 dB.

11. 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**

12. Set the 1 dB step attenuator to place the signal peak between 1 dB and 2 dB (one to two divisions) below the reference level.

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

    SGL SWP

    PEAK SEARCH, **MARKER Δ**

    MKR FCTN, **MK TRACK ON OFF** (OFF)

14. Set the 10 dB step attenuator and spectrum analyzer reference level according to Table 2a-5.

15. At each 10 dB Nominal Attenuation setting in Table 2a-5:

    a. Press **SGL SWP, PEAK SEARCH** on the spectrum analyzer.

    b. Record the MKR Δ amplitude reading as indicated in Table 2a-5.

    c. Add the Actual Attenuation error to the analyzer MKR Δ amplitude reading for each Nominal Attenuation setting in Table 2a-5 (see example in step 7c).

       Record the result corresponding to each Nominal Attenuation setting in Table 2a-5.

16. Record TR Entry 10 through TR Entry 18 in the appropriate performance verification test record in Chapter 3a .

Performance test “Reference Level Accuracy” is now complete.

Table 2a-4 Reference Level Accuracy, Log Mode

10 dB Att Nominal Atten (dB)	10 dB Att Actual Atten (dB)	Atten Error (dB)	Spectrum Analyzer Reference Level (dBm)	MKR Δ Reading (dB) Min.	MKR Δ Reading	Max.	TR Entry MKR D Reading + Atten Error
20	________	________	–20	0 (Ref)	________	0 (Ref)	0 (Ref)
10	________	________	–10	–0.4	________	+0.4	**(1)**________
0	________	________	0	–0.5	________	+0.5	**(2)**________
30	________	________	–30	–0.4	________	+0.4	**(3)**________
40	________	________	–40	–0.5	________	+0.5	**(4)**________
50	________	________	–50	–0.8	________	+0.8	**(5)**________
60	________	________	–60	–1.0	________	+1.0	**(6)**________
70	________	________	–70	–1.1	________	+1.1	**(7)**________
80	________	________	–80	–1.2	________	+1.2	**(8)**________
90	________	________	–90	–1.3	________	+1.3	**(9)**________

Table 2a-5 Reference Level Accuracy, Linear Mode

10 dB Att Nominal Atten	10 dB Att Actual Atten	Atten Error	Spect-rum Analyzer Refer-ence Level	MKR Δ Reading (dB)			TR Entry MKR D Reading + Atten Error
(dB)	(dB)	(dB)	(dBm)	Min.	MKR Δ Reading	Max.	
20	________	________	−20	0 (Ref)	________	0 (Ref)	0 (Ref)
10	________	________	−10	−0.4	________	+0.4	**(10)**________
0	________	________	0	−0.5	________	+0.5	**(11)**________
30	________	________	−30	−0.4	________	+0.4	**(12)**________
40	________	________	−40	−0.5	________	+0.5	**(13)**________
50	________	________	−50	−0.8	________	+0.8	**(14)**________
60	________	________	−60	−1.0	________	+1.0	**(15)**________
70	________	________	−70	−1.1	________	+1.1	**(16)**________
80	________	________	−80	−1.2	________	+1.2	**(17)**________
90	________	________	−90	−1.3	________	+1.3	**(18)**________

11a. Resolution Bandwidth Accuracy

The output of a synthesized signal generator is connected to the input of the spectrum analyzer, characterized through a 1 dB step attenuator set to 3 dB.

The amplitude of the synthesized signal generator is set to a reference amplitude 5 dB below the top of the screen. A marker reference is set and the attenuator is set to 0 dB.

The markers of the analyzer are then used to measure the 3 dB bandwidth. The first marker is set on the left filter skirt so that the marker delta amplitude is 1 db plus the attenuator error for the 3 dB setting. The second marker is similarly set on the right filter skirt. The frequency difference between the two markers is the 3 dB bandwidth.

There are no related adjustment procedures for this performance test.

Equipment Required

Synthesized Signal Generator

Cable, BNC, 122 cm (48 in)

Cable, Type N, 152 cm (60 in) *(2 required)*

1 dB step attenuator

Attenuator/switch driver *(if programmable step attenuators are used)*

Additional Equipment for 75 Ω Input

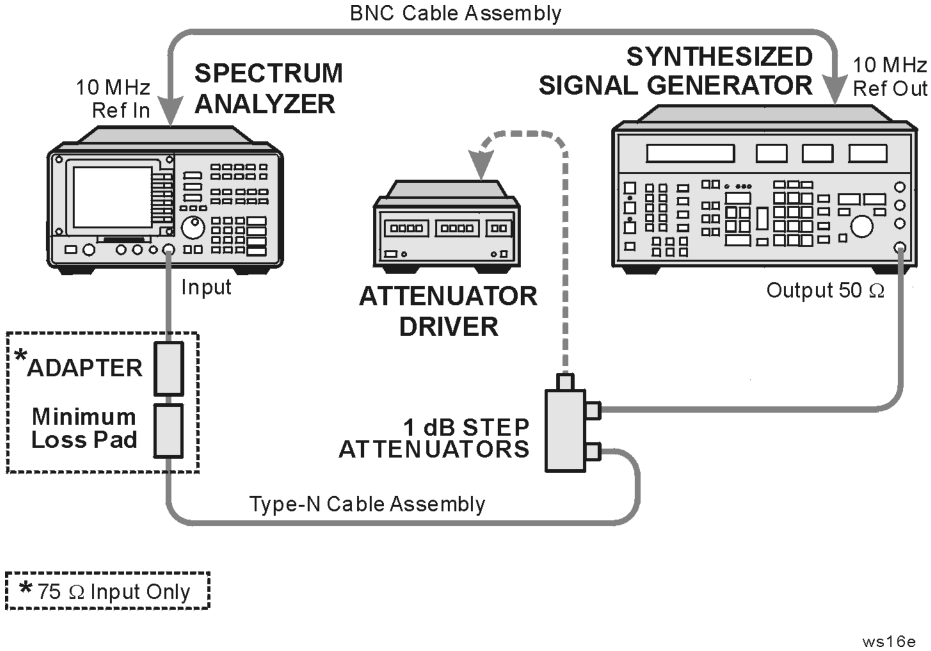
Pad, minimum loss

Adapter, Type N (f) to BNC (m), 75 Ω

Procedure

1. Connect the equipment as shown in Figure 2a-4.

Figure 2a-4 Resolution Bandwidth Accuracy Test Setup



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

2. Set the synthesized signal generator, press **Blue Key**, **Special**, **0**, **0** and set the controls as follows:

   FREQUENCY, 50, **MHz**

   AMPLITUDE, 0, **dBm** *(50 Ω input only)*

   AMPLITUDE, 6, **dBm** *(75 Ω input only)*

3. 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, 7.5, **MHz**

   AMPLITUDE, SCALE, 1, **dB**

   AMPLITUDE, More 1 of 2, Amptd Units, dBm

   BW, 3, **MHz**

   BW, Video BW, 30, **Hz**

4. Set the 1 dB step attenuator to 3 dB.

5. Note the error of the external 1 dB step attenuator at 3 dB and 6 dB below using its calibration records.

Attenuator Error (3 dB)_______________dB

Attenuator Error (6 dB)_______________dB

3 dB Resolution Bandwidth Accuracy

6. Press **Peak Search**, **Mkr** → **CF** on the analyzer.
7. Adjust the amplitude of the synthesized signal generator for a marker amplitude reading of –5 dBm ± 0.2 dB.
8. Press **Peak Search**, **Mkr** Δ on the analyzer.
9. Set the attenuator to 0 dB.
10. On the analyzer, press **Marker**. Lower the marker frequency by adjusting the knob until the marker delta amplitude is 0 dB plus the attenuator error (3 dB) noted in step 5 to a tolerance of ± 0.05 dB.
11. Record the marker frequency readout as the Lower Marker Frequency in Table 2a-6.
12. Using the analyzer knob, raise the marker frequency so that the marker delta amplitude is maximum. Continue increasing the marker frequency until the marker reads 0.0 dB plus the attenuator error (3 dB) noted in step 5 to a tolerance of ± 0.05 dB.
13. Record the marker frequency readout as the Upper Marker Frequency in Table 2a-6.
14. Set the attenuator to 3 dB.
15. Press **Marker**, **Normal** on the analyzer.
16. Repeat step 6 through step 15 for each of the Analyzer Res BW and Analyzer Span settings listed in Table 2a-6.
17. Subtract the Lower Marker Frequency from the Upper Marker Frequency. Record the difference as the 3 dB Bandwidth in Table 2a-6.

    3 dB Bandwidth = Upper Marker Freq. – Lower Marker Freq.

18. Record TR Entry 1 through TR Entry 8 in the appropriate performance verification test record in Chapter 3a.

6 dB EMI Bandwidths

19. Set the Analyzer Res BW to 120 kHz and the Analyzer Span to 180 kHz as shown in Table 2a-7.
20. On the analyzer, press **Peak Search**, **Mkr** → **CF**.
21. Set the attenuator to 0 dB.
22. On the analyzer, press **Marker**. Lower the marker frequency by adjusting the knob until the marker delta amplitude is 0 dB plus the attenuator error (6 dB) noted in step 5 to a tolerance of ± 0.05 dB.
23. Record the marker frequency readout as the Lower Marker Frequency in Table 2a-7.
24. Using the analyzer knob, raise the marker frequency so that the marker delta amplitude is maximum. Continue increasing the marker frequency until the marker reads 0.0 dB plus the attenuator error (6 dB) noted in step 5 to a tolerance of ± 0.05 dB.
25. Record the marker frequency readout as the Upper Marker Frequency in Table 2a-7.
26. Set the attenuator to 6dB.
27. Press **Marker**, **Normal** on the analyzer.
28. Repeat step 20 through step 27 for each of the Analyzer Res BW and Analyzer Span settings listed in Table 2a-7.
29. Subtract the Lower Marker Frequency from the Upper Marker Frequency. Record the difference as the 6dB Bandwidth in Table 2a-7.

    6 dB Bandwidth = Upper Marker Freq. – Lower Marker Freq.

30. Record TR Entry 12 through TR Entry 13 in the appropriate performance verification test record in Chapter 3a.

The performance verification test “Resolution Bandwidth Accuracy” is now complete.

Table 2a-6 3 dB Resolution Bandwidth Accuracy

Analyzer RES BW	Analyzer Span	Lower Marker Frequency	Upper Marker Frequency	TR Entry 3 dB Bandwidth
3 MHz	4.5 MHz	________	________	(1)________
1 MHz	1.5 MHz	________	________	(2)________
300 kHz	450 kHz	________	________	(3)________
100 kHz	150 kHz	________	________	(4)________
30 kHz	45 kHz	________	________	(5)________
10 kHz	15 kHz	________	________	(6)________
3 kHz	4.5 kHz	________	________	(7)________
1 kHz	1.5 kHz	________	________	(8)________

Table 2a-7 6 dB Resolution Bandwidth Accuracy

Analyzer RES BW	Analyzer Span	Lower Marker Frequency	Upper Marker Frequency	TR Entry 6 dB Bandwidth
9 kHz	180 kHz	________	________	(9)________
120 kHz	13.5 kHz	________	________	(10)________

13a. Frequency Response

The output of the synthesized signal generator is fed through a power splitter to a power sensor and the spectrum analyzer. The synthesized signal generator's power level is adjusted at 300 MHz to place the displayed signal at the spectrum analyzer’s center horizontal graticule line. The measuring receiver, used as a power meter, is placed in RATIO mode. At each new 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). A low frequency function generator is used for frequencies below 100 kHz in addition to using a Digital Voltmeter (DVM) as a power sensor.

The related adjustment for this performance test is “Frequency Response Error Correction.”

A system characterization is performed before testing the flatness of 8591C spectrum analyzers and spectrum analyzers equipped with 75 Ω INPUT.

Equipment Required

Measuring receiver *(used as a power meter)*

Synthesized signal generator

Power sensor, 100 kHz to 1800 MHz

Power splitter

Adapter, Type N (f) to APC 3.5 (f)

Adapter, Type N (m) to BNC (f) *(2 required)*

Adapter, Type N (m) to Type N (m)

Cable, BNC, 122 cm (48 in)

Cable, Type N, 183 cm (72 in)

Synthesizer/function generator

Dual banana plug to BNC (f)

BNC tee (BNC f, m, f)

Termination, 50 W

DVM (3458 or 34401A *only*)

Additional Equipment for 75 Ω Input

Power meter

Power sensor, 75 W, 1 MHz to 2 GHz

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 75 W Input

The following procedure is for spectrum analyzers equipped with 75 Ω input *only*. If your spectrum analyzer is *not* equipped with 75 Ω input, proceed to step 1 of "Frequency Response, ≥ 100 MHz."

1. Zero and calibrate the 100 kHz to 1800 MHz power sensor and the measuring receiver as described in the measuring receiver operation manual.
2. Zero and calibrate the power meter and the 1 MHz to 2 GHz, 75 W power sensor as described in the power meter operation manual.
3. Press INSTRUMENT PRESET on the synthesized signal generator, then set the controls as follows:

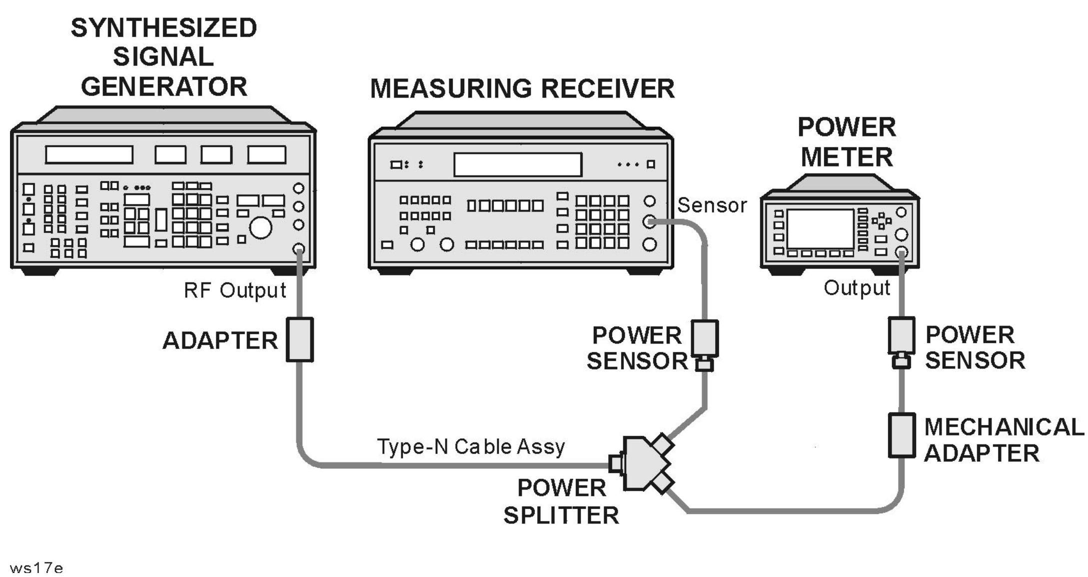
   CW .... 50 MHz

   FREQ STEP .... 50 MHz

   POWER LEVEL ....5 dBm

4. Connect the equipment as shown in Figure 2a-5.

Figure 2a-5 System Characterization Test Setup for 75 Ω Input



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

5. Adjust the synthesized signal generator power level for a 0 dBm reading on the measuring receiver.
6. Record the power meter system error reading corresponding to 50 MHz in Table 2a-8.
7. Enter each power sensor's Cal Factor into the respective power meter.
8. On the synthesized signal generator, press **CW**.
9. For the frequencies 20 MHz, 10 MHz, 5 MHz, and 1 MHz, repeat step 5 through step 8. Do not test below 1 MHz.
10. On the synthesized signal generator, press **CW**, 50, **MHz**. The **Freq INCR set** should still be 50 MHz. If not, readjust the **Freq INCR set** to 50 MHz.
11. On the synthesized signal generator, press **FREQUENCY** and ⇑ (step-up key). Repeat step 5 through step 8 for the remaining frequencies listed in Table, entering each power sensor's Cal Factor into the respective power meter.
12. At each new frequency repeat step 5 through step 8, entering each power sensor's Cal Factor into the respective power meter.

System characterization is now complete for spectrum analyzers equipped with 75 Ω Input. Proceed to step 1 of “Frequency Response, ≥100 kHz.”

Frequency Response, ≥100 kHz

If your spectrum analyzer is equipped with 75 Ω input, perform “System Characterization Procedure” before proceeding.

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.
2. If your spectrum analyzer is *not* an 8591C spectrum analyzer and is *not* equipped with 75 W input, connect the equipment as shown in Figure 2a-6. Otherwise, connect the equipment as shown in Figure 2a-7.

Figure 2a-6 Frequency Response Test Setup, ≥100 kHz

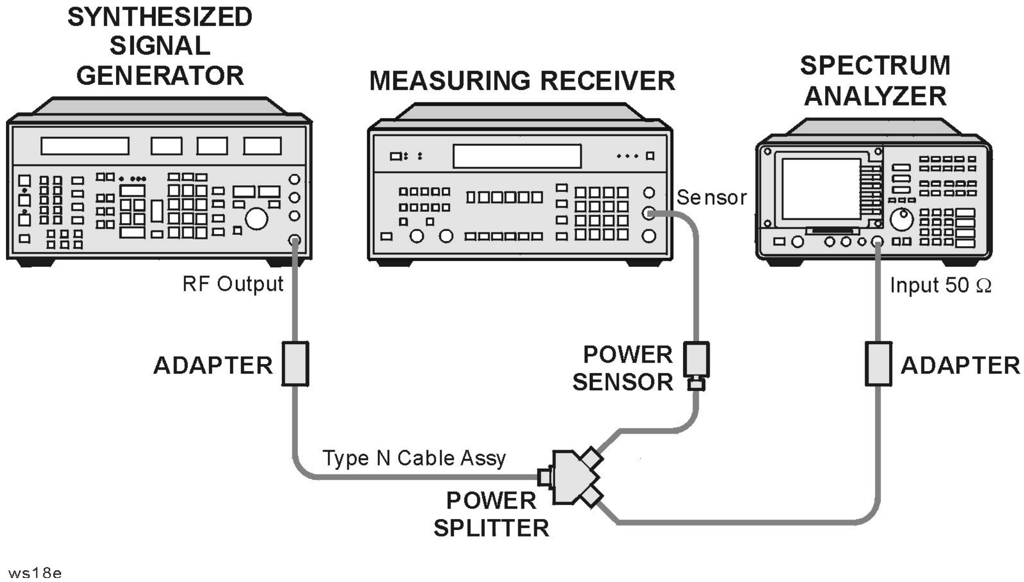
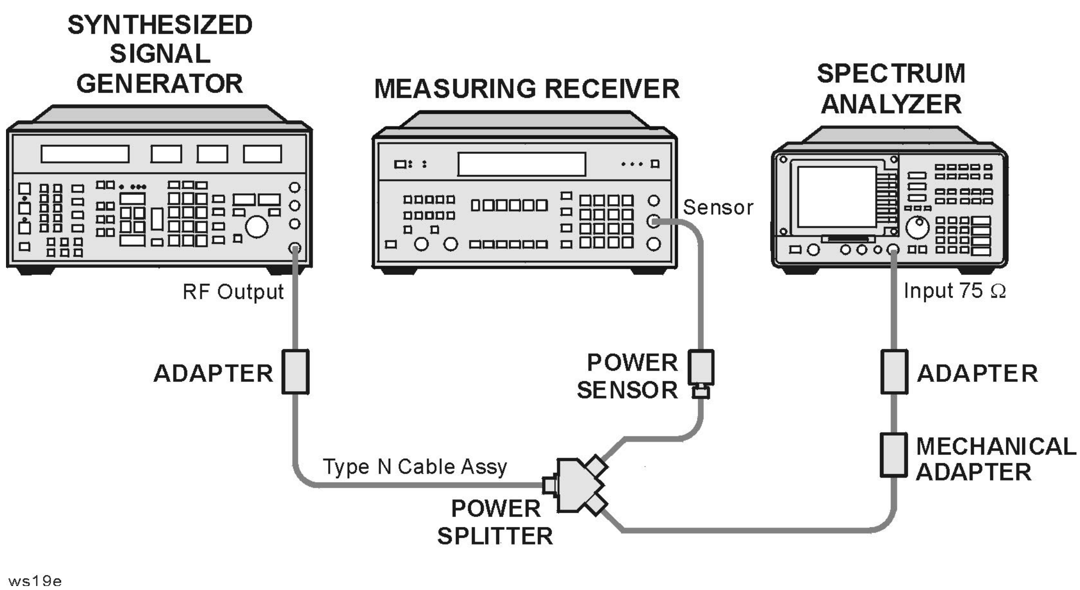


Figure 2a-7 Frequency Response Test Setup, ≥100 kHz, 75 Ω Input



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

3. Press INSTRUMENT PRESET on the synthesized signal generator. Set the synthesized signal generator controls as follows:

   CW .... 300 MHz

   FREQ STEP .... 50 MHz

   POWER LEVEL ....–8 dBm

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

   FREQUENCY, 300, **MHz**

   CF STEP AUTO MAN, 50, **MHz**

   SPAN, 5, **MHz**

   75 Ω input only: **AMPLITUDE**, **More 1 of 2**, **Amptd Units**, **dBm**

   AMPLITUDE, –10, **dBm**

   SCALE LOG LIN (LOG), 1, **dB**

   BW, 1, **MHz**

   VID BW AUTO MAN, 3, **kHz**

   PEAK SEARCH

   MKR FCTN, MK TRACK ON OFF (ON)

5. Adjust the synthesized signal generator power level for a MKR-TRK amplitude reading of –14 dBm ±0.05 dB.

6. Set the sensor Cal Factor on the measuring receiver as indicated in Table 2a-8, then press RATIO.

7. Set the synthesized signal generator CW to 50 MHz.

8. Press **FREQUENCY,** 50, **MHz** on the spectrum analyzer.

9. Adjust the synthesized signal generator power level for a spectrum analyzer MKR-TRK amplitude reading of –14 dBm ±0.05 dB.

10. Set the sensor Cal Factor on the measuring receiver as indicated in Table 2a-8, then record the negative of the power ratio displayed on the measuring receiver in Table 2a-8 as the Error Relative to 300 MHz at 50 MHz.

11. Repeat step 7 through step 10 for each frequency below 50 MHz.

12. Press **FREQUENCY**, 50, **MHz** and then **Freq INCR set**, 50, **MHz** on the synthesized signal generator.

13.On the synthesized signal generator, press **CW**, ⇑ (step-up key). Then, on the spectrum analyzer, press **FREQUENCY**, ⇑ (step-up key).

14.Set the sensor Cal Factor on the measuring receiver as indicated in Table 2a-8, then record the negative of the power ratio displayed on the measuring receiver in Table 2a-8 as the Error Relative to 300 MHz at 100 MHz.

15.Repeat step 13 through step 14 for the remaining frequencies listed in Table 2a-8.

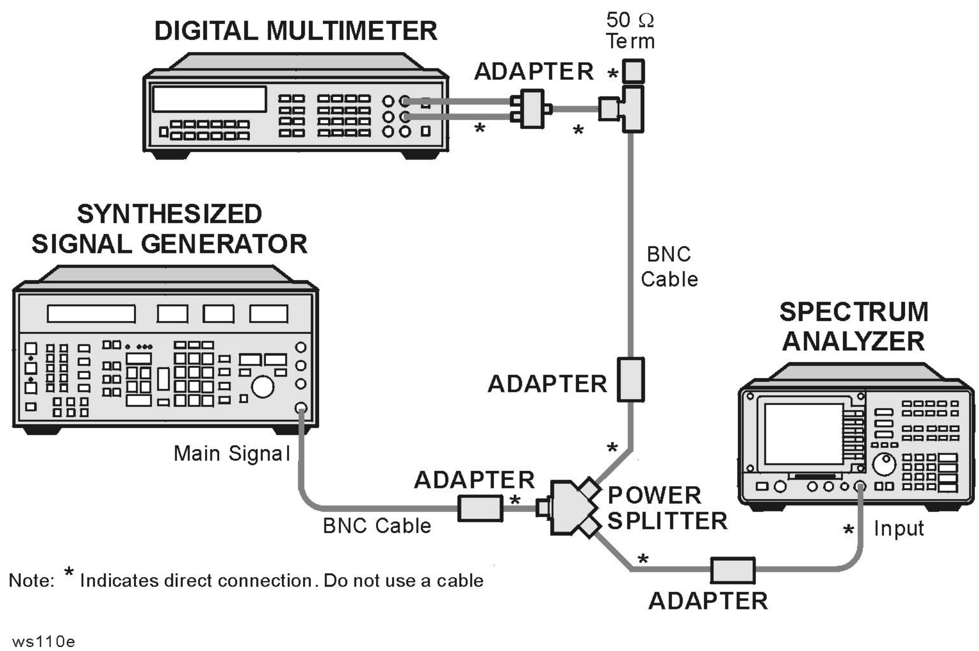
If your spectrum analyzer *is* equipped with 75 Ω input, continue with step 16. If you spectrum analyzer *is not* equipped with 75 Ω input, skip step 16 through step 17 and proceed to step 18.

16.Starting with the error at 1 MHz, calculate the Corrected Error by subtracting the System Error from the Error Relative to 300 MHz. Record the result in Table 2a-8.

17.Skip step 18 through step 29 and proceed to “Test Results.”

18.Connect the equipment as shown in Figure 2a-8.

Figure 2a-8 Frequency Response Test Setup, <100 kHz



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

FREQUENCY, 100, **kHz**

AMPLITUDE, –8, **dBm**

AMPTD INCR, 0.05, **dB**

20. Set the DVM as follows:

    Function .... Sync AC Volts

    Math .... dBm

    Res Register .... 50 W

    Front/Rear Terminals .... Front

    Resolution .... 7.5 digits

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

    Frequency, 100, **kHz**

    SPAN, 100, **kHz**

22. Adjust the synthesizer/function generator amplitude until the spectrum analyzer marker reads –14 dBm. This corresponds to the amplitude at 100 kHz recorded in step 17. Record the DVM amplitude in Table 2a-9.

23. On the spectrum analyzer, press **Peak Search**, **Marker**, **Marker** Δ.

24. Set the spectrum analyzer and the synthesizer/function generator to the next frequency setting listed in Table 2a-9.

25. Adjust the frequency synthesizer/function generator amplitude for a Sig-Δ-Trk amplitude reading of 0.00 ± 0.05 dB.

26. Record the DVM amplitude setting in Table 2a-9.

27. Calculate the Response Relative to 100 kHz by subtracting the DVM Amplitude from the DVM Amplitude at 100 kHz. Record the result as the Response Relative to 100 kHz in Table 2a-9.

28. Calculate the Response Relative to 300 kHz by adding the 100 kHz Error Relative to 300 MHz, recorded in Table 2a-8, to the Response Relative to 100 kHz, recorded inTable 2a-9. Record the result as the Response Relative to 300 kHz in Table 2a-9.

29. Repeat step 23 through step 26 for each frequency setting listed in Table 2a-9.

Test Results

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

1. Enter the most positive Response Relative to 300 MHz from Table 2a-9.

   _______________dB

2. If your spectrum analyzer is equipped with 75 W input, enter the most positive Corrected Error from Table 2a-8. If your spectrum analyzer is not equipped with 75 W input, enter the most positive Error Relative to 300 MHz from Table 2a-8.

   _______________dB

3. Record the most positive number from step 1 and step 2 above as TR Entry 1 in the appropriate performance verification test record in Chapter 3a.

   The absolute value should be less than 1.5 dB.

4. Enter the most negative Response Relative to 300 MHz from Table 2a-9.

   _______________dB

5. If your spectrum analyzer is equipped with 75 W input, enter the most negative Corrected Error from Table 2a-8. If your spectrum analyzer is not equipped with 75 W input, enter the most negative Error Relative to 300 MHz from Table 2a-8.

   _______________dB

6. Record the most negative number from step 4 and step 5 above as TR Entry 2 in the appropriate performance verification test record in Chapter 3a.

   The absolute value should be less than 1.5 dB.

7. Subtract the most negative number of step 6 from the most positive number of step 3. Record the result as TR Entry 3 in the appropriate performance verification test record in Chapter 3a.

   The result should be less than 2.0 dB.

Performance verification test “Frequency Response” is now complete.

Table 2a-8 Frequency Response Errors Worksheet

Spectrum Analyzer Frequency (MHz)	Error Relative to 300 MHz (dB)	CAL FACTOR Frequency (GHz)	System Error (75 Ω input only) (dB)	Corrected Error (75 Ω input only) (dB)
100 kHz	________	0.0001	N/A	N/A
200 kHz	________	0.0001	N/A	N/A
1	________	0.001	________	________
5	________	0.003	________	________
10	________	0.01	________	________
20	________	0.01	________	________
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	________	________

Table 2a-8 Frequency Response Errors Worksheet (Continued)

Spectrum Analyzer Frequency (MHz)	Error Relative to 300 MHz (dB)	CAL FACTOR Frequency (GHz)	System Error (75 Ω input only) (dB)	Corrected Error (75 Ω input only) (dB)
1100	________	1.0	________	________
1150	________	1.0	________	________
1200	________	1.0	________	________
1250	________	1.0	________	________
1300	________	1.0	________	________
1350	________	1.0	________	________
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 2a-9 Frequency Response, ≤100 kHz Worksheet

Spectrum Analyzer Frequency (kHz)	Frequency Synthesizer Amplitude (dBm)	Response Relative to 100 MHz	Response Relative to 300 MHz
100	________	0 (Ref)	________
75	________	________	________
50	________	________	________
20	________	________	________
9	________	________	________

15a. Spurious Response

This test is performed in two parts. Part 1 measures second harmonic distortion and part 2 measures third order intermodulation distortion.

To test second harmonic distortion, a 50 MHz low pass filter is used to filter the source output, ensuring that harmonics read by the 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

Synthesized signal 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) *(2 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)

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.”

Part 1: Second Harmonic Distortion, 30 MHz

1. Set the synthesized signal generator controls as follows:

   FREQUENCY .... 30 MHz

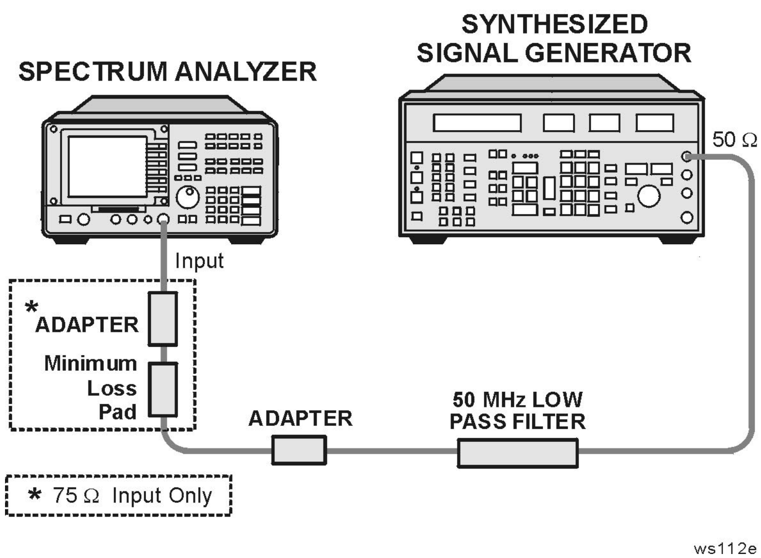
   AMPLITUDE .... –10 dBm

   AMPLITUDE (*75 Ω input only:*) .... –4.3 dBm

2. Connect the equipment as shown in Figure 2a-9.

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

Figure 2a-9 Second Harmonic Distortion Test Setup, 30 MHz



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

3. Press **PRESET** on the spectrum analyzer and wait for the preset routine to finish. Then press the following spectrum analyzer keys:

   FREQUENCY, 30, **MHz**

   SPAN 10 **MHz**

   75 Ω input only: **AMPLITUDE**, **More 1 of 2**, **Amptd Units**, **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 synthesized signal generator amplitude to place the peak of the signal at the reference level by pressing **AMPLITUDE**, **INCR SET**, 1, **dBm**.Press the ⇑ (step-up key) or the ⇓ (step-down key) until the spectrum analyzer marker read –10.0 dBm 0.1 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 ∆

   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 ∆ Amplitude reading as TR Entry 1 in the appropriate performance verification test record in Chapter 3a.

Part 2: Third Order Intermodulation Distortion, 50 MHz

1. Zero and calibrate the measuring receiver and 100 kHz to 1800 MHz power sensor in log mode (power reads out in dBm), as described in the measuring receiver operation manual. Enter the power sensor's 50 MHz Cal Factor into the measuring receiver.

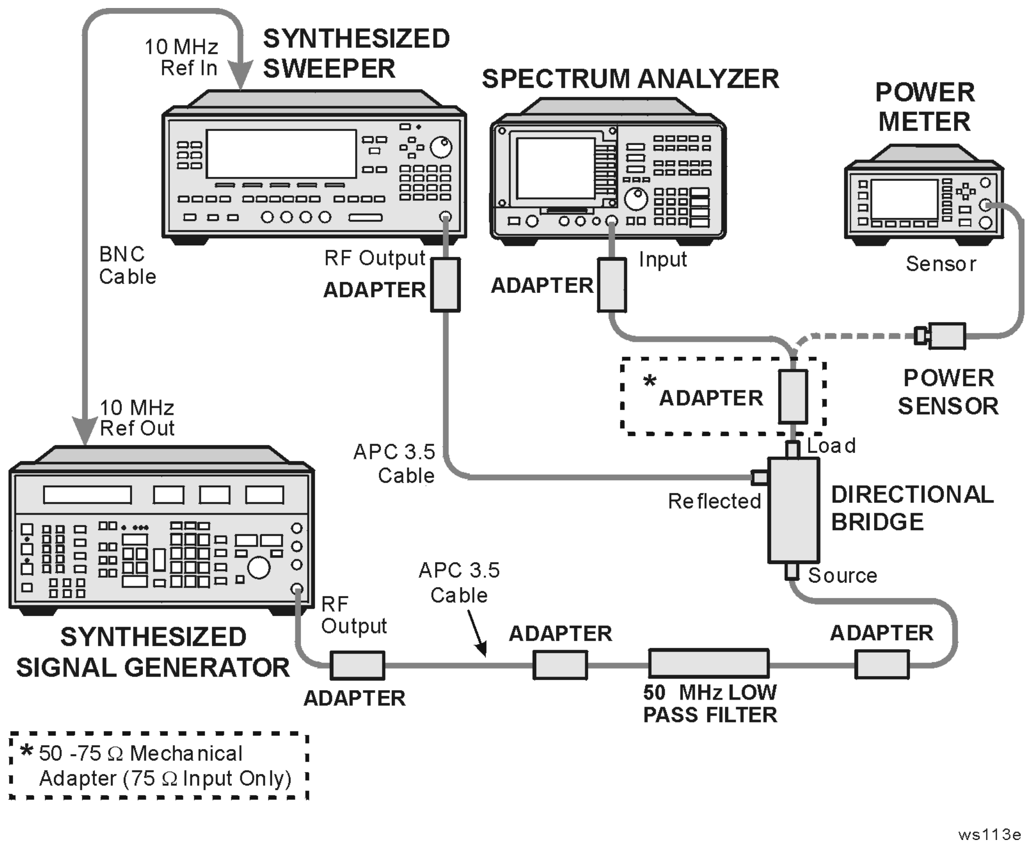
   75 Ω input only: Use a 75 Ω power sensor.

2. Connect the equipment as shown in Figure 2a-10 with the output of the directional bridge connected to the 100 kHz to 1.8 GHZ power sensor.

   75 Ω input only: 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.

   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.

Figure 2a-10 Third Order Intermodulation Distortion Test Setup



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

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

   POWER LEVEL ....–6 dBm

   CW .... 50 MHz

   RF ....OFF

4. Set the synthesized signal generator controls as follows:

   FREQUENCY .... 50.050 MHz

   AMPLITUDE ....–100 dBm

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

   FREQUENCY, 50, **MHz**

   SPAN, 10, **MHz**

   75 Ω input only: **AMPLITUDE**, **More 1 of 2**, **Amptd Units**, **dBm**

   AMPLITUDE, –10, **dBm**

   PEAK SEARCH, **More 1 of 2, PEAK EXCURSN**, 3, **dB**

   DISPLAY, **More 1 of 2**, **THRESHLD ON OFF** (ON), 90, –**dBm**

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

7. Disconnect the 100 kHz to 1.8 GHz power sensor from the directional bridge. Connect the directional bridge directly to the spectrum analyzer RF INPUT using an adapter (do not use a cable).

   75 Ω input 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**

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

   MKR FCTN, **MK TRACK ON OFF** (OFF)

   PEAK SEARCH

   MKR →, **MARKER** →**REF LVL**

10. On the synthesized signal generator, adjust the amplitude until the two signals are displayed at –6 dBm.

11. If necessary, adjust the spectrum analyzer center frequency until the two signals are centered on the display, then set the spectrum analyzer by pressing the following keys:

    BW, 3, **kHz**

    VID BW AUTO MAN, 300, **Hz**

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

    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 **PEAK SEARCH**, **MARKER** Δ.

    b. Repeatedly press **NEXT PEAK** until the active marker is on the highest distortion product.

    c. Record the MKR Δ amplitude reading below. The MKR Δ reading should be less than –54 dBc.

    MKR Δ amplitude reading _______________dBc

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

    a. On both the synthesized sweeper and the synthesized signal 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 **PEAK SEARCH**, **MARKER** Δ.

    c. Repeatedly press **NEXT PEAK** until the active marker is on the highest distortion product.

    d. On both the synthesized sweeper and the synthesizer signal generator, reduce the power level by 5 dB and wait for the completion of a new sweep.

    e. Record the MKR Δ amplitude reading below. The MKR Δ reading should be less than –54 dBc.

    MKR Δ amplitude reading dBc

    f. Record the MKR D amplitude reading as TR Entry 2 in the appropriate performance verification test record in Chapter 3a.

Performance verification test “Spurious Response” is now complete.

16a. Gain Compression

Gain compression is measured by applying two signals, separated by 3 MHz. First, the test places a –20 dBm signal at the input of the spectrum analyzer (the spectrum analyzer reference level is also set to –20 dBm). Then, a 0 dBm signal is applied to the spectrum analyzer, overdriving its input. The decrease in the first signal's amplitude (gain compression) caused by the second signal is the measured gain compression.

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

There are no related adjustment procedures for this performance test.

Equipment Required

Synthesized sweeper

Synthesized signal generator

Measuring receiver *(used as a power meter)*

Power sensor, 100 kHz to 1800 MHz

Directional bridge

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)

Cable, BNC, 120 cm (48 in) *(2 required)*

Additional Equipment for 75 Ω Input

Power sensor, 75 Ω

Adapter, BNC (m) to BNC (m), 75 Ω

Adapter, Type N (f) to BNC (m), 75 Ω

Procedure

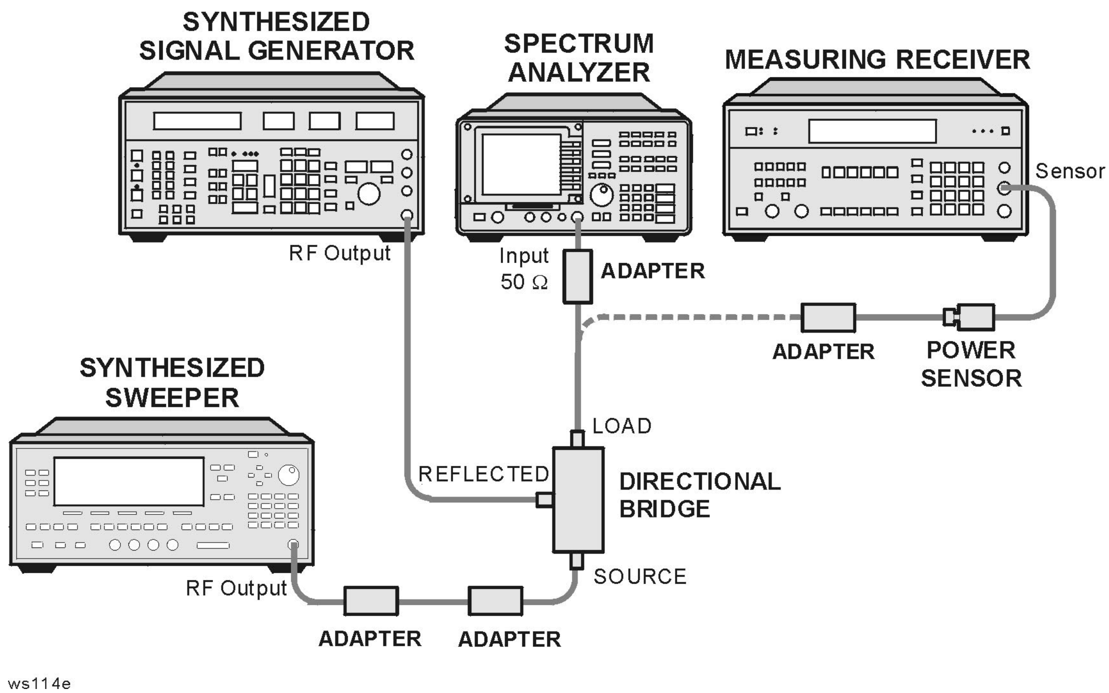
1. Zero and calibrate the measuring receiver and 100 kHz to 1800 MHz power sensor combination in log mode (power reads out in dBm) as described in the measuring receiver operation manual. Enter the power sensor's 50 MHz Cal Factor into the measuring receiver.

   75 Ω input only: Calibrate the 75 Ω power sensor.

2. Connect the equipment as shown in Figure 2a-11, with the load of the directional bridge connected to the power sensor.

   75 Ω input only: Use the 75 Ω power sensor with a Type N (f) to BNC (m) 75 Ω adapter and a BNC (m) to BNC (m) adapter. 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.

Figure 2a-11 Gain Compression Test Setup



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

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

   CW .... 53 MHz

   POWER LEVEL ....6 dBm

4. Set the synthesized signal generator controls as follows:

   CW .... 50 MHz

   AMPLITUDE ....–100 dBm

5. On the spectrum analyzer, press **PRESET** and wait for the preset routine to finish. Then press the following spectrum analyzer keys:

   FREQUENCY, 50, **MHz**

   SPAN, 20, **MHz**

   75 Ω input: **AMPLITUDE**, **More 1 of 2**, **Amptd Units**, **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.

7. On the synthesized signal generator, set the RF OUTPUT POWER to –14 dBm.

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

8. Disconnect the power sensor from the directional bridge and connect the directional bridge to the INPUT 50 Ω connector of the spectrum analyzer using an adapter. Do not use a cable.

   75 Ω input only: Use a 75 Ω adapter, BNC (m) to BNC (m).

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

   PEAK SEARCH

   MKR FCTN, **MK TRACK ON OFF** (ON)

   SPAN, 10, **MHz**

10. Wait for the AUTO ZOOM routine to finish. Then adjust the amplitude on the synthesized signal generator to place the signal 1 dB below the spectrum analyzer reference level.

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

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

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

    The active marker should be on the lower amplitude signal and not on the signal that is off the top of the screen. If it is not on the lower amplitude signal, reposition the marker to this peak using the spectrum analyzer knob.

14. Record the MKR Δ amplitude reading as TR Entry 1 in the appropriate performance verification test record in Chapter 3a. The absolute value of this amplitude should be less than 0.5 dB.

Performance verification test “Gain Compression” is now complete.

3 Performance Test Records

These test records correspond to the verification tests found in Chapter 2.

If a 3335A source is not available, use the alternative test record with the same number found in Chapter 3a, corresponding to the verification test in Chapter 2a.

8590L Performance Test Record

Table 3-1 8590L Performance Verification Test Record Part 1

Agilent Technologies

Address ______________________ Report Number ______________

______________________ Date ______________

______________________ (e.g. 10 JAN 2000)

Customer ______________________

Tested by ______________________

Model 8590L

Serial Number ________________ Ambient temperature __________ °C

Options ________________ Relative humidity __________ %

Firmware Revision ________________ Power mains line frequency __________ Hz (nominal)

Test Equipment Used:

Description	Model No.	Trace No.	Cal Due Date
Frequency Standard			
Measuring Receiver			
Microwave Frequency Counter			
Power Meter			
High-Sensitivity Power Sensor			
RF Power Sensor			
Pulse Generator			
AM/FM Signal Generator			
Microwave Spectrum Analyzer (Option 010 and 011 only)			
Synthesized Sweeper			
Synthesizer/Function Generator			
Synthesizer/Level Generator			
Universal Frequency Counter			
Base Band Signal Source			
Video Modulator			

Notes/Comments: ____

Table 3-2 8590L Performance Verification Test Record Part 2

Agilent Technologies				
Model 8590L		**Report No. ________**		
Serial No. ________		**Date ________**		
Test Description	**Results Measured**			**Measurement Uncertainty**
	Min.	**TR Entry**	**Max.**	
1. 10 MHz Frequency Reference Accuracy				
	Frequency (MHz)			
Settability	−150 Hz	**(1)**________	+150 Hz	$\pm 4.2 \times 10^{-9}$
2. Frequency Readout Accuracy and Marker Count Accuracy				
Frequency Readout Accuracy	Frequency (GHz)			
SPAN				
20 MHz	1.49918	**(1)** ________	1.50082	±2.5 Hz
10 MHz	1.49968	**(2)** ________	1.50042	±12.5 Hz
1 MHz	1.4999680	**(3)** ________	1.500032	±25.0 Hz
Marker Count Accuracy				
SPAN				
(CNT RES = 100 Hz) 20 MHz	1.4999989	**(4)**________	1.5000011	±1.0 Hz
(CNT RES = 10 Hz) 1 MHz	1.49999989	**(5)**________	1.50000011	±1.0 Hz
3. Noise Sidebands				
Suppression at 10 kHz		**(1)**________	−60 dBc	±1.0 dB
Suppression at 20 kHz		**(2)**________	−70 dBc	±1.0 dB
Suppression at 30 kHz		**(3)**________	−75 dBc	±1.0 dB
4. System Related Sidebands				
Sideband Below Signal		**(1)**________	−65 dBc	±1.0 dB
Sideband Above Signal		**(2)**________	−65 dBc	±1.0 dB

Table 3-2 8590L Performance Verification Test Record Part 2 (Continued)

Agilent Technologies

Model 8590L **Report No.** ____________________

Serial No. ____________________ **Date** ____________________

Test Description	Results Measured			Measurement
	Min.	TR Entry	Max.	Uncertainty
5. Frequency Span Readout Accuracy				
SPAN	MKRΔ Reading			
1800 MHz	1446.00MHz	(1) ________	1554.00MHz	±6.37 MHz
10.10 MHz	7.70 MHz	(2) ________	8.30 MHz	±35.4 kHz
10.00 MHz	7.80 MHz	(3) ________	8.20 MHz	±35.4 kHz
100.00 kHz	78.00 kHz	(4) ________	82.00 kHz	±354 Hz
99.00 kHz	78.00 kHz	(5) ________	82.06 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
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

Table 3-2 8590L Performance Verification Test Record Part 2 (Continued)

Agilent Technologies				
Model 8590L			**Report No.** ______	
Serial No. ______			**Date** ______	
Test Description	**Results Measured**			**Measurement**
	Min.	**TR Entry**	**Max.**	**Uncertainty**
8. Scale Fidelity				
−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
Log Mode	Incremental Error			
dB from Ref Level				
0	0 (Ref)	0 (Ref)	0 (Ref)	
−4	−0.4 dB	**(18)** ______	+0.4 dB	±0.06 dB
−8	−0.4 dB	**(19)** ______	+0.4 dB	±0.06 dB
−12	−0.4 dB	**(20)** ______	+0.4 dB	±0.06 dB
−16	−0.4 dB	**(21)** ______	+0.4 dB	±0.06 dB
−20	−0.4 dB	**(22)** ______	+0.4 dB	±0.06 dB
−24	−0.4 dB	**(23)** ______	+0.4 dB	±0.06 dB
−28	−0.4 dB	**(24)** ______	+0.4 dB	±0.06 dB
−32	−0.4 dB	**(25)** ______	+0.4 dB	±0.06 dB
−36	−0.4 dB	**(26)** ______	+0.4 dB	±0.06 dB

Table 3-2 8590L Performance Verification Test Record Part 2 (Continued)

Agilent Technologies				
Model 8590L			**Report No. __________**	
Serial No. __________			**Date __________**	
Test Description	**Results Measured**			**Measurement**
	Min.	**TR Entry**	**Max.**	**Uncertainty**
8. Scale Fidelity				
−40	−0.4 dB	**(27)** ______	+0.4 dB	±0.06 dB
−44	−0.4 dB	**(28)** ______	+0.4 dB	±0.06 dB
−48	−0.4 dB	**(29)** ______	+0.4 dB	±0.06 dB
−52	−0.4 dB	**(30)** ______	+0.4 dB	±0.06 dB
−56	−0.4 dB	**(31)** ______	+0.4 dB	±0.06 dB
−60	−0.4 dB	**(32)** ______	+0.4 dB	±0.11
−60	−61.00 dB	**(47)** ______	−59.00 dB	±0.11 dB
−64	−65.04 dB	**(48)** ______	−62.96 dB	±0.11 dB
−68	−69.08 dB	**(49)** ______	−66.92 dB	±0.11 dB
9. Reference Level Accuracy				
Log Mode				
Reference Level (dBm)				
−20	0 (Ref)	0 (Ref)	0 (Ref)	
−10	−0.40 dB	**(1)** ______	+0.40 dB	±0.06 dB
0	−0.50 dB	**(2)** ______	+0.50 dB	±0.06 dB
−30	−0.40 dB	**(3)** ______	+0.40 dB	±0.06 dB
−40	−0.50 dB	**(4)** ______	+0.50 dB	±0.08 dB
−50	−0.80 dB	**(5)** ______	+0.80 dB	±0.08 dB
−60	−1.00 dB	**(6)** ______	+1.00 dB	±0.12 dB
−70	−1.10 dB	**(7)** ______	+1.10 dB	±0.12 dB
−80	−1.20 dB	**(8)** ______	+1.20 dB	±0.12 dB
−90	−1.30 dB	**(9)** ______	+1.30 dB	±0.12 dB

Table 3-2 8590L Performance Verification Test Record Part 2 (Continued)

Agilent Technologies

Model 8590L **Report No. ____________________**

Serial No. ____________________ **Date ____________________**

Test Description	Results Measured			Measurement
	Min.	**TR Entry**	**Max.**	**Uncertainty**
9. Reference Level Accuracy				
Linear Mode				
Reference Level (dBm)				
–20	0 (Ref)	0 (Ref)	0 (Ref)	
–10	–0.40 dB	**(10)** ________	+0.40 dB	±0.06 dB
0	–0.50 dB	**(11)** ________	+0.50 dB	±0.06 dB
–30	–0.40 dB	**(12)** ________	+0.40 dB	±0.06 dB
–40	–0.50 dB	**(13)** ________	+0.50 dB	±0.08 dB
–50	–0.80 dB	**(14)** ________	+0.80 dB	±0.08 dB
–60	–1.00 dB	**(15)** ________	+1.00 dB	±0.12 dB
–70	–1.10 dB	**(16)** ________	+1.10 dB	±0.12 dB
–80	–1.20 dB	**(17)** ________	+1.20 dB	±0.12 dB
–90	–1.30 dB	**(18)** ________	+1.30 dB	±0.12 dB
10. Absolute Amplitude Calibration and Resolution Bandwidth Switching Uncertainties				
Absolute Amplitude Uncertainty	–20.15 dB	**(1)** ________	–19.85 dB	N/A
Resolution Bandwidth Switching Uncertainty				
Resolution Bandwidth				
3 kHz	0 (Ref)	0 (Ref)	0 (Ref)	
1 kHz	–0.5 dB	**(2)** ________	+0.5 dB	+0.07/–0.08 dB
9 kHz	–0.4 dB	**(3)** ________	+0.4 dB	+0.07/–0.08 dB
10 kHz	–0.4 dB	**(4)** ________	+0.4 dB	+0.07/–0.08 dB
30 kHz	–0.4 dB	**(5)** ________	+0.4 dB	+0.07/–0.08 dB

Table 3-2 8590L Performance Verification Test Record Part 2 (Continued)

Agilent Technologies				
Model 8590L			**Report No.** ______	
Serial No. ______			**Date** ______	
Test Description	**Results Measured**			**Measurement**
	Min.	**TR Entry**	**Max.**	**Uncertainty**
10. Absolute Amplitude Calibration and Resolution Bandwidth Switching Uncertainties				
100 kHz	–0.4 dB	**(6)** ______	+0.4 dB	+0.07/–0.08 dB
120 kHz	–0.4 dB	**(7)** ______	+0.4 dB	+0.07/–0.08 dB
300 kHz	–0.4 dB	**(8)** ______	+0.4 dB	+0.07/–0.08 dB
1 MHz	–0.4 dB	**(9)** ______	+0.4 dB	+0.07/–0.08 dB
3 MHz	–0.4 dB	**(10)** ______	+0.4 dB	+0.07/–0.08 dB
11. Resolution Bandwidth Accuracy				
3 dB Resolution Bandwidth				
3 MHz	2.4 MHz	**(1)** ______	3.6 MHz	±138 kHz
1 MHz	0.8 MHz	**(2)** ______	1.2 MHz	±46 kHz
300 kHz	240 kHz	**(3)** ______	360 kHz	±13.8 kHz
100 kHz	80 kHz	**(4)** ______	120 kHz	±4.6 kHz
30 kHz	24 kHz	**(5)** ______	36 kHz	±1.38 kHz
10 kHz	8 kHz	**(6)** ______	12 kHz	±460 Hz
3 kHz	2.4 kHz	**(7)** ______	3.6 kHz	±138 Hz
1 kHz	0.8 kHz	**(8)** ______	1.2 kHz	±46 Hz
6 dB EMI Bandwidth				
9 kHz	7.2 kHz	**(9)** ______	10.8 kHz	±333 Hz
120 kHz	96 kHz	**(10)** ______	144 kHz	±4.44 kHz
12. Calibrator Amplitude Accuracy				
	–20.4 dBm	**(1)** ______	–19.6 dBm	±0.2 dB
75 Ω input only:	+28.35 dBmV	**(2)** ______	+29.15 dBmV	±0.2 dB

Table 3-2 8590L Performance Verification Test Record Part 2 (Continued)

Agilent Technologies

Model 8590L **Report No. ______________**

Serial No. ______________ **Date ______________**

Test Description	Results Measured			Measurement
	Min.	TR Entry	Max.	Uncertainty
13. Frequency Response				
Max Positive Response		(1) ________	+1.5 dB	+0.32/–0.33 dB
Max Negative Response	–1.5 dB	(2) ________		+0.32/–0.33 dB
Peak-to-Peak Response		(3) ________	2.0 dB	+0.32/–0.33 dB
14. Other Input Related Spurious Responses				
542.8 MHz		(1) ________	–55 dBc	±1.0 dB
1142.8 MHz		(2) ________	–55 dBc	±1.0 dB
15. 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
16. Gain Compression				
		(1) ________	0.5 dB	+0.21/–0.22 dB
17. Displayed Average Noise				
Frequency				
400 kHz		(1) ________	–115 dBmV	+1.15/–1.25 dB
1 MHz		(2) ________	–115 dBmV	+1.15/–1.25 dB
1 MHz to 1.5 GHz		(3) ________	–115 dBmV	+1.15/–1.25 dB
1.5 GHz to 1.8 GHz		(4) ________	–113 dBmV	+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 3-2 8590L Performance Verification Test Record Part 2 (Continued)

Agilent Technologies

Model 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 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

Table 3-2 8590L Performance Verification Test Record Part 2 (Continued)

Agilent Technologies

Model 8590L **Report No.** ______________________

Serial No. ______________________ **Date** ______________________

Test Description	Results Measured			Measurement
	Min.	**TR Entry**	**Max.**	**Uncertainty**
20. Tracking Generator Level Flatness				
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 dBmV	+1.15/–1.24 dB
Option 011 only:		**(1)** ________	–57.24 dBmV	+1.15/–1.24 dB

3a Performance Test Records: If 3335A Source Not Available

This chapter provides alternative test records, corresponding to the alternative performance tests in Chapter 2a, to be used when a 3335A source is not available. Substitute the test records in this chapter for those of the same number found in Chapter 3 when a 3335A Synthesizer Level Generator is not available.

8590L Performance Test Record

Table 3a-1 8590L Performance Verification Test Record Part 1: 3335A Source Not Available

Agilent Technologies

Address	____________	Report Number	____________	
	____________	Date	____________	
	____________		(e.g. 10 JAN 2000)	
Customer	____________			
Tested by	____________			
Model 8590L				
Serial Number	____________	Ambient temperature	________	°C
Options	____________	Relative humidity	________	%
Firmware Revision	____________	Power mains line frequency	________	Hz
			(nominal)	

Test Equipment Used:

Description	**Model No.**	**Trace No.**	**Cal Due Date**
Frequency Standard	____________	____________	____________
Measuring Receiver	____________	____________	____________
Microwave Frequency Counter	____________	____________	____________
Power Meter	____________	____________	____________
High-Sensitivity Power Sensor	____________	____________	____________
RF Power Sensor	____________	____________	____________
Pulse Generator	____________	____________	____________
AM/FM Signal Generator	____________	____________	____________
Microwave Spectrum Analyzer (Option 011 only)	____________	____________	____________
Synthesized Sweeper	____________	____________	____________
Synthesizer/Function Generator	____________	____________	____________
Synthesized Signal Generator	____________	____________	____________
Universal Frequency Counter	____________	____________	____________
Base Band Signal Source	____________	____________	____________
Video Modulator	____________	____________	____________

Notes/Comments: ____

____

____

Table 3a-2 8590L Performance Verification Test Record Part 2: 3335A Source Not Available

Agilent Technologies

Model 8590L **Report No. ______________**

Serial No. ______________ **Date ______________**

Test Description	Results Measured			Measurement
	Min.	TR Entry	Max.	Uncertainty
5a. Frequency Span Readout Accuracy				
SPAN	MKRΔ Reading			
1800 MHz	1446.00MHz	(1) ________	1554.00MHz	±6.37 MHz
10.10 MHz	7.70 MHz	(2) ________	8.30 MHz	±35.4 kHz
10.00 MHz	7.80 MHz	(3) ________	8.20 MHz	±35.4 kHz
100.00 kHz	78.00 kHz	(4) ________	82.00 kHz	±354 Hz
99.00 kHz	78.00 kHz	(5) ________	82.06 kHz	±354 Hz
10.00 kHz	7.80 kHz	(6) ________	8.20 kHz	±3.54 Hz

Table 3a-2 8590L Performance Verification Test Record Part 2: 3335A Source Not Available (Continued)

Agilent Technologies				
Model 8590L			**Report No. ____________**	
Serial No. ____________			**Date ____________**	
Test Description	**Results Measured**			**Measurement**
	Min.	**TR Entry**	**Max.**	**Uncertainty**
8a. 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 3a-2 8590L Performance Verification Test Record Part 2: 3335A Source Not Available (Continued)

Agilent Technologies

Model 8590L **Report No. ____________**

Serial No. ____________ **Date ____________**

Test Description	Results Measured			Measurement
	Min.	**TR Entry**	**Max.**	**Uncertainty**
8a. Scale Fidelity				
Log Mode	Incremental Error			
dB from Ref Level				
0	0 (Ref)	0 (Ref)	0 (Ref)	
–4	–0.4 dB	**(18)** ______	+0.4 dB	±0.06 dB
–8	–0.4 dB	**(19)** ______	+0.4 dB	±0.06 dB
–12	–0.4 dB	**(20)** ______	+0.4 dB	±0.06 dB
–16	–0.4 dB	**(21)** ______	+0.4 dB	±0.06 dB
–20	–0.4 dB	**(22)** ______	+0.4 dB	±0.06 dB
–24	–0.4 dB	**(23)** ______	+0.4 dB	±0.06 dB
–28	–0.4 dB	**(24)** ______	+0.4 dB	±0.06 dB
–32	–0.4 dB	**(25)** ______	+0.4 dB	±0.06 dB
–36	–0.4 dB	**(26)** ______	+0.4 dB	±0.06 dB
–40	–0.4 dB	**(27)** ______	+0.4 dB	±0.06 dB
–44	–0.4 dB	**(28)** ______	+0.4 dB	±0.06 dB
–48	–0.4 dB	**(29)** ______	+0.4 dB	±0.06 dB
–52	–0.4 dB	**(30)** ______	+0.4 dB	±0.06 dB
–56	–0.4 dB	**(31)** ______	+0.4 dB	±0.06 dB
–60	–0.4 dB	**(32)** ______	+0.4 dB	±0.11
–62	–61.00 dB	**(47)** ______	–59.00 dB	±0.11 dB
–64	–65.04 dB	**(48)** ______	–62.96 dB	±0.11 dB
–68	–69.08 dB	**(49)** ______	–66.92 dB	±0.11 dB

Table 3a-2 8590L Performance Verification Test Record Part 2: 3335A Source Not Available (Continued)

Agilent Technologies				
Model 8590L			Report No. ______	
Serial No. ______			Date ______	
Test Description	**Results Measured**			**Measurement**
	Min.	**TR Entry**	**Max.**	**Uncertainty**
9a. Reference Level Accuracy				
Log Mode **Reference Level (dBm)**				
−20	0 (Ref)	0 (Ref)	0 (Ref)	
−10	−0.40 dB	**(1)** ______	+0.40 dB	±0.06 dB
0	−0.50 dB	**(2)** ______	+0.50 dB	±0.06 dB
−30	−0.40 dB	**(3)** ______	+0.40 dB	±0.06 dB
−40	−0.50 dB	**(4)** ______	+0.50 dB	±0.08 dB
−50	−0.80 dB	**(5)** ______	+0.80 dB	±0.08 dB
−60	−1.00 dB	**(6)** ______	+1.00 dB	±0.12 dB
−70	−1.10 dB	**(7)** ______	+1.10 dB	±0.12 dB
−80	−1.20 dB	**(8)** ______	+1.20 dB	±0.12 dB
−90	−1.30 dB	**(9)** ______	+1.30 dB	±0.12 dB

Table 3a-2 8590L Performance Verification Test Record Part 2: 3335A Source Not Available (Continued)

Agilent Technologies				
Model 8590L		**Report No.** ______		
Serial No. ______		**Date** ______		
Test Description	**Results Measured**			**Measurement**
	Min.	**TR Entry**	**Max.**	**Uncertainty**
9a. Reference Level Accuracy				
Linear Mode **Reference Level (dBm)**				
−20	0 (Ref)	0 (Ref)	0 (Ref)	
−10	−0.40 dB	**(10)** ______	+0.40 dB	±0.06 dB
0	−0.50 dB	**(11)** ______	+0.50 dB	±0.06 dB
−30	−0.40 dB	**(12)** ______	+0.40 dB	±0.06 dB
−40	−0.50 dB	**(13)** ______	+0.50 dB	±0.08 dB
−50	−0.80 dB	**(14)** ______	+0.80 dB	±0.08 dB
−60	−1.00 dB	**(15)** ______	+1.00 dB	±0.12 dB
−70	−1.10 dB	**(16)** ______	+1.10 dB	±0.12 dB
−80	−1.20 dB	**(17)** ______	+1.20 dB	±0.12 dB
−90	−1.30 dB	**(18)** ______	+1.30 dB	±0.12 dB

Table 3a-2 8590L Performance Verification Test Record Part 2: 3335A Source Not Available (Continued)

Agilent Technologies

Model 8590L **Report No.** ____________

Serial No. ____________ **Date** ____________

Test Description	Results Measured			Measurement
	Min.	TR Entry	Max.	Uncertainty
11a. 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
13a. 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
15a. 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
16a. Gain Compression				
		(1) ________	0.5 dB	+0.21/–0.22 dB

4 Specifications and Characteristics

This chapter contains specifications and characteristics for the 8590L 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 non-warranted 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. 11/1990 Group 1 Class A.

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

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

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

Frequency Specifications

Frequency Range	
50 Ω	9 kHz to 1.8 GHz
75 Ω *(Option 001)*	1 MHz to 1.8 GHz

Frequency Reference	
Aging	±2 × 10^{-6}/year
Settability	±0.5 × 10^{-6}
Temperature Stability	±5 × 10^{-6}

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

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

‡ See “Drift” under “Stability” in Frequency Characteristics.

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

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

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

Frequency Span	
Range	0 Hz (zero span), 10 kHz to 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 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 101)****	±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* $\times$ 300 MHz)
* frequency reference error = (aging rate $\times$ 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)
dc	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.)

Residual Responses	(Input terminated and 0 dB attenuation)	
	50 Ω	**75** Ω *(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
	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	±0.01 dB
Linear Scale	±0.12% of reference level
Accuracy	(referenced to –20 dBm reference level, 10 dB input attenuation, at a single frequency, in a fixed RBW)
0 dBm to –59.9 dBm	±(0.3 dB + 0.01 × dB from –20 dBm)
–60 dBm and below	
1 kHz to 3 MHz RBW	±(0.6 dB + 0.01 × dB from –20 dBm)
30 Hz to 300 Hz RBW *(Option 130)****	±(0.7 dB + 0.01 × dB from –20 dBm)

** See “Amplitude Range.”

*** Not available in 8590L 8592L.

Frequency Response	(10 dB input attenuation)	
	Absolute §	**Relative Flatness** †
9 kHz to 1.8 GHz	±1.5 dB	±1.0 dB

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

§ Referenced to 300 MHz CAL OUT.

Calibrator Output Amplitude	
50 Ω	–20 dBm ±0.4 dB
75 Ω *(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 × dB from reference level)
RBW ≤ 1 kHz	± (0.4 dB + 0.01 × dB from reference level)
Log Incremental Accuracy	
0 to –60 dB from Reference Level	±0.4 dB/4 dB
Linear Accuracy	±3% of reference level

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) *(Option 011: use +38.8 dBmV instead of –10 dBm)*
Vernier	
Range	15 dB
Accuracy	±1.0 dB (referenced to –10 dBm source power) *(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 non-warranted information about instrument performance.

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

Stability	
Drift* (after warmup at stabilized temperature)	
Frequency Span ≤10 MHz, Free Run	<2 kHz/minute of sweep time

* Because the analyzer is locked at the center frequency before each sweep, drift occurs only during the time of one sweep. For Line, Video or External trigger, additional drift occurs while waiting for the appropriate trigger signal.

Resolution Bandwidth (–3 dB)	
Range	1 kHz to 3 MHz, selectable in 1, 3 and 10 increments, and 5 MHz. Resolution bandwidths may be selected manually, or coupled to frequency span.
*(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†	3.63×	1.5×	1×
3 dB Bandwidth†	3.60×	1.48×	1×
Sidelobe Height	<–90 dB	–32 dB	–13 dB
Amplitude Uncertainty	0.10 dB	1.42 dB	3.92 dB
Shape Factor (60 dB BW/3 dB BW)	2.6	9.1	>300
† Multiply entry by one-divided-by-sweep time.			

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/2
FM Linearity (for modulating frequency < bandwidth/100)	≤ 1% of FM deviation + 290 Hz

Amplitude Characteristics

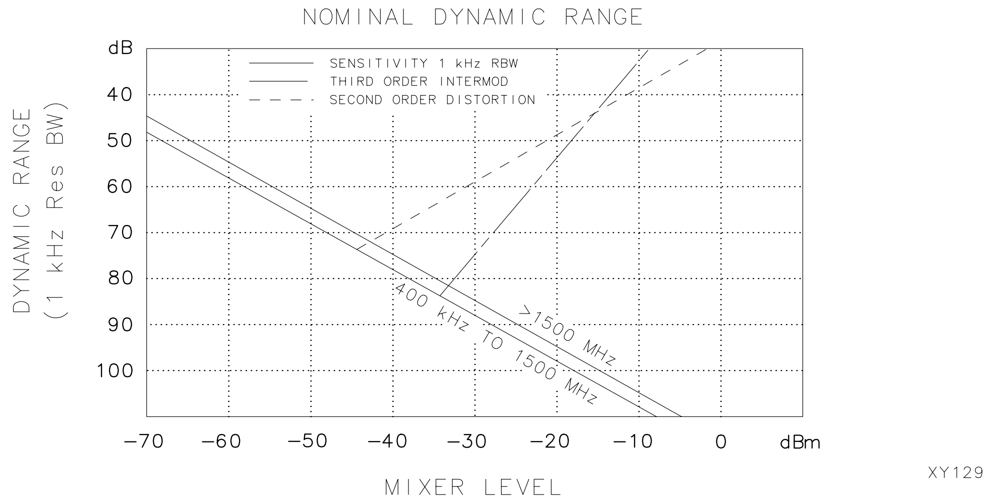
These are not specifications. Characteristics provide useful but non-warranted information about instrument performance.

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	±1.0 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 “Frequency Response.”	

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


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

Physical Characteristics

Rear-Panel Inputs and Outputs

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

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

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

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

EXT 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 part number C1405B using adapter C1405-60015 and most IBM/AT non-auto switching keyboards.

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

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

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

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

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

AUX INTERFACE

Connector Type: 9 Pin Subminiature "D"

Connector Pinout

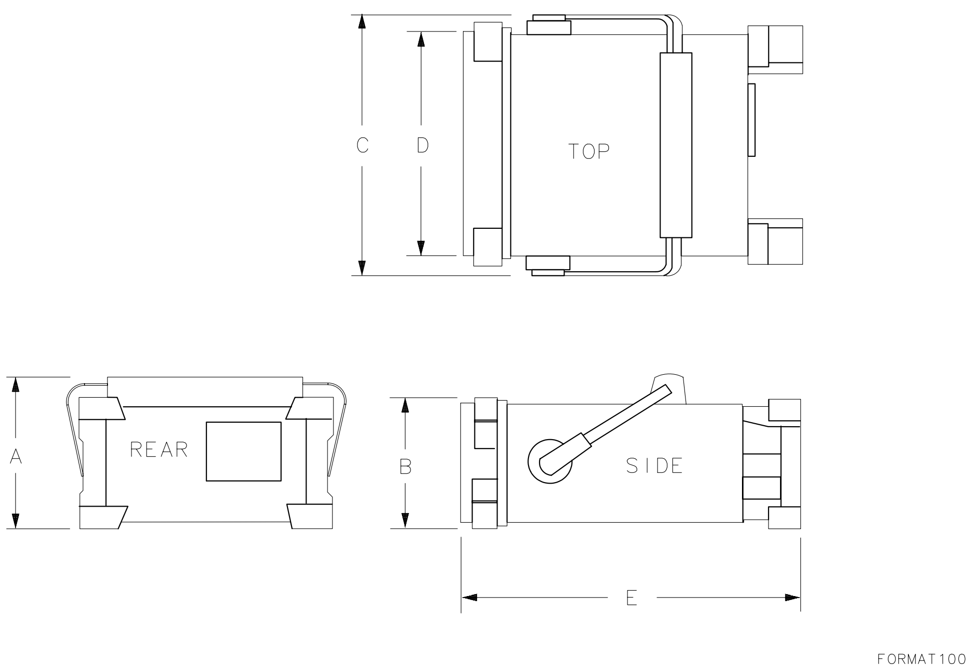
Pin #	Function	Current	"Logic" Mode	"Serial Bit" Mode
1	Control A	—	TTL Output Hi/Lo	TTL Output Hi/Lo
2	Control B	—	TTL Output Hi/Lo	TTL Output Hi/Lo
3	Control C	—	TTL Output Hi/Lo	Strobe
4	Control D	—	TTL Output Hi/Lo	Serial Data
5	Control I	—	TTL Input Hi/Lo	TTL Input Hi/Lo
6	Gnd	—	Gnd	Gnd
7†	−15 Vdc ±7%	150 mA	—	—
8*	+5 Vdc ±5%	150 mA	—	—
9†	+15 Vdc ±5%	150 mA	—	—

* Exceeding the +5 V current limits may result in loss of factory correction constants.

† Total current drawn from the +15 Vdc on the PROBE POWER and the AUX INTERFACE cannot exceed 150 mA. Total current drawn from the −12.6 Vdc on the PROBE POWER and the −15 Vdc on the AUX INTERFACE cannot exceed 150 mA.

WEIGHT	
Net	
8590L	15.2 kg (33.5 lb)
Shipping	
8590L	16.8 kg (37 lb)

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)



5 If You Have a Problem

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

Calling Agilent Technologies 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, get in touch with the nearest Agilent Technologies Sales and Service Office listed in Table 5-1. In any correspondence or telephone conversations, refer to the spectrum analyzer by its model number and full serial number. With this information, the Agilent Technologies representative can quickly determine whether your unit is still within its warranty period.

Before calling Agilent Technologies

Before calling Agilent Technologies 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.

Agilent Technologies offers several maintenance plans to service your spectrum analyzer after warranty expiration. Call your Agilent Technologies Sales and Service Office for full details.

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

Check the basics

In general, a problem can be caused by a hardware failure, a software error, or a user error. Often problems may be solved by repeating what was being done when the problem occurred. A few minutes spent in performing these simple checks may eliminate time spent waiting for instrument repair.

- ❑ Check that the spectrum analyzer is plugged into the proper ac power source.
- ❑ Check that the line socket has power.
- ❑ Check that the rear-panel voltage selector switch is set correctly.
- ❑ Check that the line fuse is good.
- ❑ Check that the spectrum analyzer is turned on.
- ❑ Check that the light above **LINE** is on, indicating that the power supply is on.
- ❑ Check that the other equipment, cables, and connectors are connected properly and operating correctly.
- ❑ Check the equipment settings in the procedure that was being used when the problem occurred.
- ❑ Check that the test being performed and the expected results are within the specifications and capabilities of the spectrum analyzer. Refer to Chapter 4 of this guide.
- ❑ Check the spectrum analyzer display for error messages. Refer to the *8590 E-Series and L-Series Spectrum Analyzer User's Guide*.
- ❑ Check operation by performing the verification procedures in Chapter 2 of this guide. Record all results in the performance test record.
- ❑ Check for problems similar to those described in the *8590 E-Series and L-Series Spectrum Analyzer User's Guide*.

By internet, phone, or fax, get assistance with all your test and measurement needs.

Table 5-1 Contacting Agilent

Online assistance: www.agilent.com/find/assist

United States	**Japan**	**New Zealand**	**Europe**
(tel) 1 800 452 4844	(tel) (+81) 426 56 7832 (fax) (+81) 426 56 7840	(tel) 0 800 738 378 (fax) (+64) 4 495 8950	(tel) (+31) 20 547 2323 (fax) (+31) 20 547 2390
Canada	**Latin America**	**Australia**	
(tel) 1 877 894 4414 (fax) (905) 282 6495	(tel) (305) 269 7500 (fax) (305) 269 7599	(tel) 1 800 629 485 (fax) (+61) 3 9210 5947	

Asia Call Center Numbers

Country	Phone Number	Fax Number
Singapore	1-800-375-8100	(65) 836-0252
Malaysia	1-800-828-848	1-800-801664
Philippines	(632) 8426802 1-800-16510170 (PLDT Subscriber Only)	(632) 8426809 1-800-16510288 (PLDT Subscriber Only)
Thailand	(088) 226-008 (outside Bangkok) (662) 661-3999 (within Bangkok)	(66) 1-661-3714
Hong Kong	800-930-871	(852) 2506 9233
Taiwan	0800-047-866	(886) 2 25456723
People's Republic of China	800-810-0189 (preferred) 10800-650-0021	10800-650-0121
India	1-600-11-2929	000-800-650-1101

Returning the Spectrum Analyzer for Service

Use the information in this section if it is necessary to return the spectrum analyzer to Agilent Technologies.

Package the spectrum analyzer for shipment

Use the following steps to package the spectrum analyzer for shipment to Agilent Technologies for service:

1. Fill in a service tag (available in the *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.

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

2. Use the original packaging materials or a strong shipping container that is made of double-walled, corrugated cardboard with 159 kg (350 lb) bursting strength. The carton must be both large enough and strong enough to accommodate the spectrum analyzer and allow at least 3 to 4 inches on all sides of the spectrum analyzer for packing material.
3. If you have a front-panel cover, install it on the instrument; if not, protect the front panel with cardboard.
4. Surround the instrument with at least 3 to 4 inches of packing material, or enough to prevent the instrument from moving in the carton. If packing foam is not available, the best alternative is SD-240 Air Cap™ from Sealed Air Corporation (Commerce, CA 90001). Air Cap looks like a plastic sheet covered with 1-1/4 inch air-filled bubbles. Use the pink Air Cap to reduce static electricity. Wrap the instrument several times in the material to both protect the instrument and prevent it from moving in the carton.

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

6 Safety and Regulatory Information

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

Safety Symbols

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

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.**

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.

General Safety Considerations

WARNING

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

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

WARNING

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

If this instrument is to be energized via an external autotransformer for voltage reduction, make sure that its common terminal is connected to a neutral (earthed pole) of the power supply.

WARNING

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

WARNING

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

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

WARNING

If this product is not used as specified, the protection provided by the equipment could be impaired. This product must be used in a normal condition (in which all means for protection are intact) only.

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.

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 **The detachable power cord is the instrument disconnecting device. It disconnects the mains circuits from the mains supply before other parts of the instrument. The front panel switch is only a standby switch and is not a LINE switch (disconnecting device).**

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

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

CAUTION Always use the three-prong ac power cord supplied with this instrument. Failure to ensure adequate earth grounding by not using this cord may cause instrument damage.

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. Assure the supply voltage is in the specified range.

This instrument has autoranging line voltage input; be sure the supply voltage is within the specified range.

CAUTION This product is designed for use in Installation Category II and Pollution Degree 2 per IEC 1010 and 664 respectively.

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

Regulatory Information

IEC Compliance

This instrument has been designed and tested in accordance with IEC Publications 1010, Safety Requirements for Electronic Measuring Apparatus, and has been supplied in a safe condition. The instruction documentation contains information and warnings which must be followed by the user to ensure safe operation and to maintain the instrument in a safe condition.

Instrument Markings

The instruction documentation symbol. The product is marked with this symbol when it is necessary for the user to refer to the instructions in the documentation.

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

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

ISM1-A

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

~

This symbol indicates that the input power required is AC.

|

This symbol is used to mark the ON position of the power line switch.

O

This symbol is used to mark the OFF position of the power line switch.

Notice for Germany: Noise Declaration

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

Declaration of Conformity

DECLARATION OF CONFORMITY

According to ISO/IEC Guide 22 and CEN/CENELEC EN 45014

Manufacturer's Name:	Agilent Technologies, Inc.
Manufacturer's Address:	1400 Fountaingrove Parkway Santa Rosa, CA 95403-1799 USA

Declares that the product

Product Name:	Spectrum Analyzer
Model Number:	8590L
Product Options:	This declaration covers all options of the above product.

Conform to the following product specifications:

	Standard	Limit
EMC:	CISPR 11:1990 / EN 55011-1991	Group 1, Class A
	IEC 801-2:1984/EN 50082-1:1992	4 kV CD, 8 kV AD
	IEC 801-3:1984/EN 50082-1:1992	3 V/m, 80 - 1000 MHz
	IEC 801-4:1988/EN 50082-1:1992	0.5 kV sig., 1 kV power

Safety: IEC 61010-1:1990 +A1:1992 +A2:1995 / EN 61010-1:1993 +A21995
CAN/CSA- C22.2 No. 1010.1-92

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

Santa Rosa, CA, USA 28 March 2001

Greg Pfeiffer/Quality Engineering Manager

For further information, please contact your local Agilent Technologies sales office, agent or distributor.

Rev A