

Service Guide

8590 Series Analyzers Assembly-Level Repair



Agilent Technologies

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8590 E-Series and L-Series Spectrum Analyzer Documentation Description

The following guides are shipped with your 8590 E-Series or L-Series spectrum analyzer.

8590 E-Series Spectrum Analyzers and 8591C Cable TV Analyzer Calibration Guide

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

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

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

8590 E-Series and L-Series Spectrum Analyzers Quick Reference Guide

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

8591C Cable TV Analyzer Documentation Description

The following guides are shipped with your cable TV analyzer.

*8590 E-Series Spectrum Analyzers and 8591C Cable TV Analyzer
Calibration Guide*

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

8591C Cable TV Analyzer User's Guides

Cable TV Measurements

- Tells you how to make cable TV measurements with your analyzer.
- Describes the cable TV analyzer mode features.

Spectrum Analyzer Reference

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

8591C Cable TV Analyzer Getting Started and Quick Reference Guide

- Describes how to make a simple measurement with your analyzer.
- Briefly describes the cable TV and spectrum analyzer functions.
- Provides a quick reference for cable TV and spectrum analyzer softkeys.

*8590 E-Series and L-Series Spectrum Analyzers, and 8591C Cable TV
Analyzer Programmer's Guide*

- Describes analyzer operation via a remote controller (computer) for Parallel/RS-232 or Parallel/GPIB interface. This manual is provided when ordering either Option 041, Option 043, or 8591C.

8594Q QAM Analyzer Documentation Description

The following guides are shipped with your QAM analyzer.

8590 Series Analyzers Calibration Guide

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

8594Q QAM Analyzer User's Guides

Option 190/195 DVB-C/Data Measurements

- Tells you how to make QAM measurements with your analyzer.
- Describes the QAM analyzer mode features.

Spectrum Analyzer Reference

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

8594Q Option 190/195 DVB-C/Data Measurement QAM Analyzer Getting Started and Quick Reference Guide

- Provides a quick reference for QAM and spectrum analyzer softkeys.

Documentation Options

Option 041 or 043: Programmer's Guide

8590 E-Series and L-Series Spectrum Analyzers, and 8591C Cable TV Analyzer Programmer's Guide

- Describes analyzer operation via a remote controller (computer) for Parallel/RS-232 or Parallel/GPIB interface.

Option 910: Additional User's Documentation

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

Option 915: Service Guide and Component-Level Information

Describes troubleshooting and repair of the analyzer.

Option 915 consists of two manuals:

8590 Series Analyzers Assembly-Level Repair Service Guide

- Describes adjustment and assembly level repair of the analyzer.

8590 Series Analyzers Component-Level Repair Service Guide

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

How to Order Guides

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

How to Use This Guide

This guide uses the following conventions.

Front-Panel Key This represents a key physically located on the instrument front panel.

Softkey This indicates a "softkey," a key whose label is determined by the instrument's firmware. Softkeys are located on the display bezel.

Screen Text This indicates text displayed on the instrument screen.

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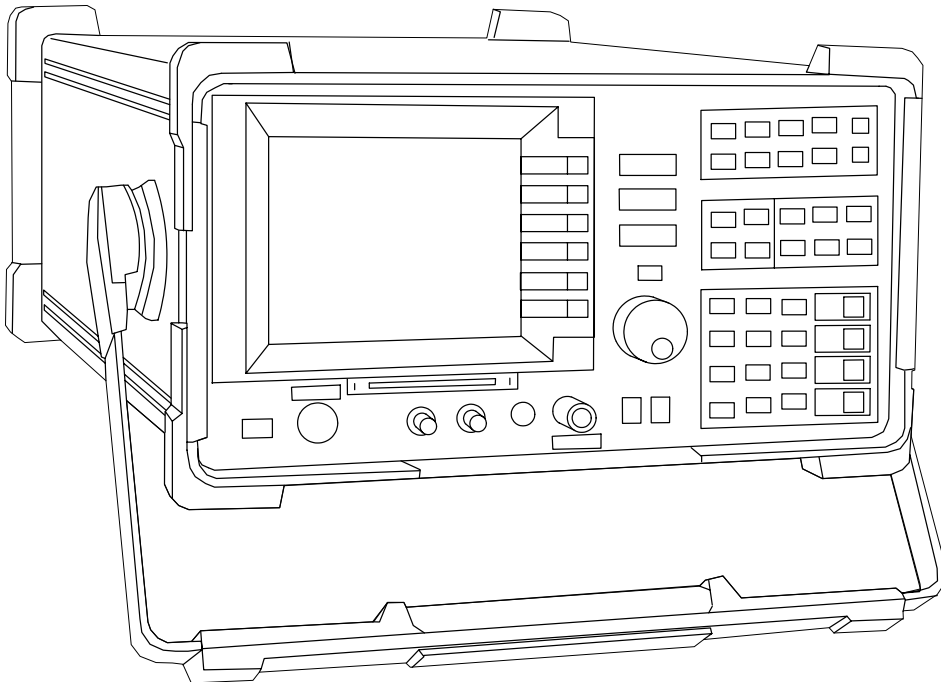
1 Introduction

The 8590 Series Analyzers Assembly-Level Repair Service Guide provides the information needed to adjust and repair the 8590 E-Series and L-Series spectrum analyzers, the 8591C cable TV analyzer and 8594Q QAM analyzer to the assembly level.

The 8590 Series Analyzers Assembly-Level Repair Service Guide

The *8590 Series Analyzers Component-Level Repair Service Guide* provides component-level information for the repair of individual analyzer assemblies. The binder contains Component-Level Information Packets (CLIPs) for selected assemblies. Each CLIP contains component-level schematics, a component parts list, and illustrations for component location by reference designator. Each CLIP has its own part number which is changed whenever the part number for its related analyzer assembly is changed. A list of all CLIP part numbers for the 8590 E-Series and L-Series spectrum analyzers, 8591C cable TV analyzers, and 8594Q QAM analyzers is provided in [Chapter 12](#) of this service guide.

Figure 1-1 8590 E-Series and L-Series Spectrum Analyzers, 8591C Cable TV Analyzers, and 8594Q QAM Analyzer



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Service Guide Organization

The guide is divided into the following chapters.

- **Chapter 1**, “Introduction,” contains information on the analyzer identification, firmware revisions and upgrades, and safety and reliability considerations.
- **Chapter 2**, “Making Adjustments,” contains the adjustment procedures needed to adjust the analyzer to meet its specifications.
- **Chapter 2a**, “Making Adjustments: 3335A Source Not Available,” contains the adjustment procedures needed to adjust the analyzer to meet its specifications when a 3335A source is not available.
- **Chapter 3**, “Backing Up and Reloading Correction Constants,” contains information for safe-guarding the correction data stored in the analyzer and restoring the analyzer memory.
- **Chapter 4**, “Troubleshooting the Analyzer,” contains information for starting to troubleshoot a analyzer failure.
- **Chapter 5**, “Troubleshooting the IF Section,” contains specific troubleshooting information for selected assemblies in the IF section and the A15 Motherland assembly.
- **Chapter 6**, “Troubleshooting the RF Section,” contains troubleshooting information for the RF and LO sections of the 8590 E-Series and L-Series spectrum analyzer and 8591C cable TV analyzer. The information is separated by the following tabs.
- **Chapter 6a**, “8590L, 8591C and 8591E,” contains specific troubleshooting information for selected assemblies within the RF and LO sections of the 8590L, 8591E spectrum analyzers, and 8591C cable TV analyzers.
- **Chapter 6b**, “8592L/94L, 8594Q, and 8593E/94E/95E/96E,” contains specific troubleshooting information for selected assemblies within the RF and LO sections of the 8592L, 8594L, 8593E, 8594E, 8595E, 8596E spectrum analyzers, and the 8594Q QAM analyzer.
- **Chapter 7**, “Replacing Major Assemblies,” contains instructions for the removal and replacement of most major assemblies.
- **Chapter 8**, “Contacting Agilent Technologies,” contains information on how to contact Agilent Technologies and return the analyzer for repair.
- **Chapter 9**, “Assembly Descriptions and Block Diagrams,” contains information and block diagrams describing analyzer operation and individual assemblies.

- **Chapter 10**, “Analyzer Options and Block Diagrams,” contains information on the available analyzer options.
- **Chapter 11**, “Major Assembly and Cable Locations,” contains figures identifying all major assemblies and cables.
- **Chapter 12**, “Replaceable Parts,” contains information needed to order assemblies and component-level information for the analyzer.
- **Chapter 13**, “Softkey Descriptions,” contains a description of the calibration, service, and diagnostic softkeys.
- **Chapter 14**, “Analyzer Messages,” contains a description of the analyzer messages that are displayed when there is a problem with the analyzer.
- **Chapter 15**, “Service Equipment and Tools,” contains information about equipment and tools used to service the analyzer.

Analyzer Description

The 8590 E-Series and L-Series spectrum analyzers, 8591C cable TV analyzers, and 8594Q QAM analyzers provide measurement capabilities over the RF and Microwave frequency ranges.

The frequency ranges of 8590 E-Series and L-Series spectrum analyzers, 8591C cable TV analyzers, and 8594Q QAM analyzers are described below.

All 8590 E-Series spectrum analyzers, 8591C cable TV analyzers and 8594Q QAM analyzers are equipped with a memory card reader. The memory card reader allows the analyzer to use downloadable software programs. The functional “personality” of the analyzer can also be altered using the memory card reader. This feature provides the user with one analyzer that can perform the function of other types of microwave test equipment.

Further information about the 8590 E-Series and L-Series spectrum analyzers, and the available options, is provided in [Chapter 10](#), “Analyzer Options and Block Diagrams,” of this service guide and the *8590 E-Series and L-Series Spectrum Analyzers User's Guide*. Further information about the 8591C cable TV analyzer and 8594Q QAM analyzer is provided in the spectrum analyzer reference for your instrument. Further information about the 8594Q QAM analyzer is provided in *8594Q QAM Analyzer Spectrum Analyzer Reference User's Guide*.

Table 1-1 8590 E-Series and L-Series Spectrum Analyzer, 8591C Cable TV Analyzer and 8594Q QAM Analyzer Frequency Ranges

Analyzer Model	Frequency Range
8590L	9 kHz to 1.8 GHz
8591E	9 kHz to 1.8 GHz
8591C	1 MHz to 1.8 GHz
8592L	9 kHz to 22.0 GHz
8592L (<i>Option 026</i>)	9 kHz to 26.5 GHz
8593E	9 kHz to 22.0 GHz
8593E (<i>Option 026</i>)	9 kHz to 26.5 GHz
8594E	9 kHz to 2.9 GHz
8594L	9 kHz to 2.9 GHz
8594Q	9 kHz to 2.9 GHz
8595E	9 kHz to 6.5 GHz
8596E	9 kHz to 12.8 GHz

Firmware Revision Date

When the analyzer is first turned on, a display appears that contains the copyright date and firmware revision date. (If the analyzer has either Option 041, IB and parallel I/O, or Option 043, RS-232 and parallel I/O, the display will also contain the entries shown on the first line of the example below.)

The version of firmware installed in the analyzer is identified by the year, month, and day in the following format.

```
(IB: nn) or (RS232: nnnn)
COPYRIGHT 1986
rev yy.mm.dd
```

Whenever you contact Agilent Technologies about your analyzer, be sure to provide the firmware date along with the complete serial number and option designation. This will ensure that you obtain accurate service information.

Firmware Upgrade Kit Ordering Information

There are occasions when the factory revises the analyzer firmware to correct defects or make performance improvements. When a firmware revision is needed, a service note is distributed by the factory to all Agilent Technologies service centers. The service note identifies, by serial-number prefix, the analyzers that require the latest firmware upgrade kit.

If your analyzer requires a firmware upgrade kit, it can be obtained by ordering as described in [Chapter 12, "Replaceable Parts."](#) Instructions for the replacement of the firmware ROMs is located under "A16 Processor/Video Board Firmware ROM" in [Chapter 7, "Replacing Major Assemblies,"](#) of this guide.

Reliability Considerations

Analyzer Input Protection

The analyzer input circuitry can be damaged by power levels that exceed the maximum safe input-level specifications. [Table 1-2](#) through [Table 1-5](#) provides the input specifications. To prevent input damage, these specified levels for your analyzer must not be exceeded.

The analyzer input can also be damaged by large transients. If it is likely that your analyzer will be exposed to potentially damaging transients, take whatever precautions are necessary to protect its input circuitry.

The analyzer input can easily be protected by disconnecting it from the signal source whenever it is likely that large transients will be present. When it is impractical to disconnect the analyzer, a transient-limiting device should be used.

The 11947A Transient Limiter is an analyzer accessory that protects the input circuitry from transients and accidental overloads. Contact your local Agilent Technologies sales or service office for more information about the 11947A.

CAUTION

Transients are often produced during electromagnetic interference (EMI) conducted emissions testing. One type of device, the line impedance stabilization network (LISN), can produce large transients when its switch position or voltage input is changed.

Table 1-2 8590L and 8591E Spectrum Analyzer and 8591C Cable TV Analyzer & Maximum Safe Input Level

	INPUT 50Ω (Input Attenuation ≥10 dB)	INPUT 75Ω (Input Attenuation ≥10 dB)
Average Continuous Power Peak Pulse Power	+30 dBm (1 W) +30 dBm (1 W)	+75 dBmV (0.4 W) +75 dBmV (0.4 W)
dc	25 Vdc	100 Vdc

Table 1-3 8592L and 8593E Spectrum Analyzer Maximum Safe Input Level

	INPUT 50Ω (Input Attenuation ≥10 dB bands 1 through 4)
Average Continuous Power Peak Pulse Power	+30 dBm (1 W, 7.1 V rms), input attenuation ≥10 dB +50 dBm (100 W) for <10 μs pulse width and <1% duty cycle, ssfs input attenuation ≥30 dB
dc	0 Vdc

Table 1-4 8594E and 8594L Spectrum Analyzer and 8594Q Analyzer Maximum Safe Input Level

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

Table 1-5 8595E and 8596E Spectrum Analyzer Maximum Safe Input Level

	INPUT 50Ω (Input Attenuation ≥10 dB above 2.75 GHz)
Average Continuous Power Peak Pulse Power	+30 dBm (1 W, 7.1 V rms) +50 dBm (100 W) for <10 μs pulse width and <1% duty cycle, input attenuation ≥30 dB
dc	0 V (dc coupled) 50 V (ac coupled)

Adjustment Procedures

The following table lists the analyzer adjustments in Chapter 2 and Chapter 2a and the models that they apply to. Select the model of the analyzer being adjusted and note the adjustments marked in the analyzer model column to determine which adjustments should be performed.

Table 1-6 8590 E-Series and L-Series Spectrum Analyzer, 8591C Cable TV and 8594Q QAM Analyzer Adjustment Procedures

Adjustment Procedure Name		Adjustment for Spectrum Analyzer Model:								
		8590L	8591C	8591E	8592L	8593E 8596E	8594E	8594L	8594Q	8595E
1.	Display	•	•	•	•	•	•	•	•	•
2.	Sampler Match	•	•	•	•	•	•	•	•	•
3.	10 MHz Reference	•	•	•	•	•	•	•	•	•
4.	10 MHz Precision Frequency Reference		•	•		•	•		•	•
5.	Crystal and LC Bandwidth Filter	•	•	•	•	•	•	•	•	•
6.	Cal Attenuator Error ^a	•	•	•	•	•	•	•	•	•
6a.	Cal Attenuator Error ^b	•	•	•	•	•	•	•	•	•
7.	Log and Linear Amplifier ^a	•	•	•	•	•	•	•	•	•
7a.	Log and Linear Amplifier ^b	•	•	•	•	•	•	•	•	•
8.	CAL FREQ Adjustment Routine	•	•	•	•	•	•	•	•	•
9.	CAL AMPTD Adjustment Routine	•	•	•	•	•	•	•	•	•
10.	CAL YTF Adjustment Routine				•	•				•
11.	CAL MXR Adjustment Routine				•	•				•
12.	Second Converter	•	•	•						
13.	Third Converter and Second IF Bandpass	•	•	•	•	•	•	•	•	•
14.	Comb Generator				•	•				
15.	Frequency Response of the 8590L, 8591C, and 8591E ^a	•	•	•						

Table 1-6 8590 E-Series and L-Series Spectrum Analyzer, 8591C Cable TV and 8594Q QAM Analyzer Adjustment Procedures

Adjustment Procedure Name		Adjustment for Spectrum Analyzer Model:								
		8590L	8591C	8591E	8592L	8593E 8596E	8594E	8594L	8594Q	8595E
15a.	Frequency Response of the 8590L, 8591C, and 8591E ^b	•	•	•						
16.	Frequency Response of the 8592L, 8593E, 8594E, 8594L, 8594Q, 8595E, 8596E				•	•	•	•	•	•
17.	Time and Date	•	•	•	•	•	•	•	•	•
18.	Modulator Offset and Gain for Option 010 or 011	•	•	•						
19.	Entering External ALC Correction Constants for Option 010 or 011	•	•	•						
20.	Checking the External ALC for Option 010 or 011	•	•	•						
21.	Correcting the External ALC Error for Option 010 or 011	•	•	•						
22.	First LO Distribution Amplifier for Option 009 or 010					•	•			•
23.	BITG Power Level for Option 010					•	•			•
24.	Tracking Oscillator for Option 010					•	•		•	
25.	Checking the Absolute Amplitude Accuracy for Option 050			•		•	•			•
26.	Correcting for Absolute Amplitude Accuracy for Option 050			•		•	•			•
27.	Checking the Absolute Amplitude Accuracy for Option 051			•		•	•			•
28.	Correcting for Absolute Amplitude Accuracy for Option 051			•		•	•			•

- a. If a 3335A source is not available, use the alternative adjustment with the same number found in [Chapter 2a](#), “Making Adjustments: If 3335A Source Not Available.”
- b. If a 3335A source is not available, substitute this adjustment for the one with the same number found in [Chapter 2](#), “Making Adjustments.”

Safety

Familiarize yourself with the safety symbols marked on the analyzer, and read the general safety instructions and the symbol definitions given in [Chapter 16](#), “[Safety and Regulatory Information](#),” *before* you begin the procedures in this chapter.

Test Equipment You Will Need

Refer to Chapter 1 of the calibration guide for your instrument for a list of recommended equipment for the analyzer adjustments. 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 Chapter 1 of the calibration guide for your instrument for alternative recommended test equipment, accessories, and adapters.

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 service guide has been revised to add new adjustments that do not use the 3335A Synthesizer Level Generator. This revision includes the addition of signal sources required to replace the 3335A, changes i to the test equipment setup illustrations, and changes in the steps required to execute the adjustments.

Since all of our customers will not need to replace their 3335A Synthesizer Level Generators immediately, the original adjustments which use the 3335A signal generator have been retained. The revisions have been incorporated in this service guide as [Chapter 2a](#), “[Making Adjustments: If 3335A Source Not Available](#).”

If There Are Abnormal Indications During Adjustment

If the indications received during an adjustment do not agree with the normal conditions given in the adjustment procedures, a fault exists in your analyzer. The fault should be repaired *before* proceeding with any further adjustments. Refer to the troubleshooting and repair information in [Chapter 4, “Troubleshooting the Analyzer,”](#) of this guide.

Periodically Verifying Calibration

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 located in the calibration guide for your instrument.

When test results show proper operation and calibration, no adjustments are necessary. However, if test results indicate that the instrument does not meet specifications, the cause should be determined and rectified. Refer to the troubleshooting information in [Chapter 4, “Troubleshooting the Analyzer,”](#) before attempting recalibration.

Standard-Value Replacement Components

Part numbers for standard-value replacement components used in the adjustment procedures are located in [Chapter 12, “Replaceable Parts,”](#) of this service guide.

If You Replace or Repair an Assembly

If one or more analyzer assemblies has been replaced or repaired, related adjustment procedures should be done prior to verifying operation. Refer to [Table 1-7](#) to determine which adjustment to perform after replacing or repairing an assembly. Find the assembly that has been repaired or replaced in the left-hand column. Then perform the adjustments marked across the adjustment column for that assembly. It is important that adjustments are performed in the order indicated to ensure that the instrument meets all of its specifications.

Table 1-7 Adjustments and Tests for Replaced or Repaired Assemblies

Replaced or Repaired Assembly	Related Adjustments and Adjustment Routines	Related Performance Verification Tests
A1 Front Frame	CAL AMPTD	Frequency Response Residual Responses
A2 Display	Display CAL AMPTD	Frequency Response Residual Responses
A3A1 Comb Generator	Comb Generator CAL YTF	Comb Generator Frequency Accuracy Frequency Response Residual Responses
A3A2 Microwave Switch	CAL FREQ CAL AMPTD CAL YTF	Frequency Response Residual Responses
A3A3 Low-Pass Filter	CAL FREQ CAL AMPTD CAL YTF	Frequency Response Residual Responses
A3A4 Second Converter	CAL FREQ CAL AMPTD CAL YTF	Noise Sidebands System Related Sidebands Frequency Response Other Input Related Spurious Responses Spurious Response Gain Compression Displayed Average Noise Residual Responses
A3A5 Input Attenuator	CAL FREQ CAL AMPTD CAL YTF Frequency Response	Frequency Response Residual Responses

Table 1-7 Adjustments and Tests for Replaced or Repaired Assemblies

Replaced or Repaired Assembly	Related Adjustments and Adjustment Routines	Related Performance Verification Tests
A3A6 Dual Mixer or Low Band Mixer	CAL FREQ CAL AMPTD CAL YTF CAL MXR Frequency Response	Noise Sidebands System Related Sidebands Frequency Response Other Input Related Spurious Responses Spurious Response Gain Compression Displayed Average Noise Residual Responses
A3A7 YIG-Tuned Oscillator	First LO Distribution Amplifier for Option 009 or 010 CAL FREQ CAL AMPTD CAL YTF	Frequency Readout & Marker Count Accy Noise Sidebands System Related Sidebands Residual FM Frequency Span Readout Accy Frequency Response Other Input Related Spurious Responses Spurious Response Residual Responses
A3A8 YIG-Tuned Filter or A3A8 Switched YIG-Tuned Filter	CAL FREQ CAL AMPTD CAL YTF CAL MXR Frequency Response	Noise Sidebands System Related Sidebands Frequency Response Other Input Related Spurious Responses Spurious Response Displayed Average Noise Residual Responses
A3A9 Bandpass Filter	CAL FREQ CAL AMPTD	None
A3A10 Directional Coupler	CAL FREQ CAL AMPTD CAL YTF	System Related Sidebands Frequency Response Other Input Related Spurious Responses Spurious Responses Residual Responses
A3A11 Step-Recovery Diode	CAL FREQ CAL AMPTD	Comb Generator Frequency Accuracy
A3A12 3 dB Attenuator	CAL FREQ CAL AMPTD	None
A3A13 Isolator	CAL FREQ CAL AMPTD CAL YTF	System Related Sidebands Frequency Response Other Input Related Spurious Responses Spurious Responses Residual Responses

Table 1-7 Adjustments and Tests for Replaced or Repaired Assemblies

Replaced or Repaired Assembly	Related Adjustments and Adjustment Routines	Related Performance Verification Tests
A3A14 LO Distribution Amplifier (LODA)	First LO Distribution Amplifier for Option 009 or 010 only CAL FREQ CAL AMPTD CAL YTF	Frequency Readout and Marker Count Accy Noise Sidebands System Related Sidebands Residual FM Frequency Span Readout Accuracy Frequency Response Other Input Related Spurious Responses Spurious Response Residual Responses
A3A15 Tracking Generator	First LO Distribution Amplifier for Option 009 or 010 CAL FREQ CAL AMPTD CAL YTF BITG Power Level for Option 010	Frequency Readout and Marker Count Accy Noise Sidebands System Related Sidebands Residual FM Frequency Span Readout Accuracy Frequency Response Other Input Related Spurious Responses Spurious Response Residual Responses
A3 Input Attenuator	CAL FREQ CAL AMPTD	Frequency Response
A4 First Converter	Frequency Response CAL FREQ CAL AMPTD	Noise Sidebands System Related Sidebands Frequency Response Spurious Response Gain Compression Displayed Average Noise Residual Responses
A5 Second Converter	Second Converter CAL FREQ CAL AMPTD	Noise Sidebands Residual FM System Related Sidebands Frequency Response Spurious Response Gain Compression Displayed Average Noise Residual Responses
A6 YIG-Tuned Oscillator	CAL FREQ CAL AMPTD	Noise Sidebands Residual FM System Related Sidebands Frequency Span Readout Accuracy Frequency Response Spurious Response Displayed Average Noise Residual Responses

Table 1-7 Adjustments and Tests for Replaced or Repaired Assemblies

Replaced or Repaired Assembly	Related Adjustments and Adjustment Routines	Related Performance Verification Tests
A7 Analog Interface	CAL FREQ CAL AMPTD CAL YTF (8592L, 8593E, 8595E, 8596E only)	Frequency Readout and Marker Count Accy Noise Sidebands Residual FM System Related Sidebands Frequency Span Readout Accuracy Sweptime Accuracy Scale Fidelity Reference Level Accuracy Absolute Amplitude Calibration and Resolution Bandwidth Switching Uncertainties Frequency Response
A7A1 Tracking Generator Control	Modulator Offset and Gain for Option 010 or 011 Entering External ALC Correction Constants for Option 010 or 011 Checking the External ALC for Option 010 or 011 Correcting the External ALC Error for Option 010 or 011	Absolute Amplitude, Vernier, and Power Sweep Accuracy Tracking Generator Level Flatness Harmonic Spurious Outputs Non-Harmonic Spurious Outputs Tracking Generator Feedthrough
A8 Power Supply	None	System Related Sidebands Spurious Responses Residual Responses
A9 Third Converter	Third Converter & Second IF Bandpass CAL FREQ CAL AMPTD BITG Power Level for Option 010 only	Noise Sidebands System Related Sidebands Absolute Amplitude Calibration and Resolution Bandwidth Switching Uncertainties Other Input Related Spurious Spurious Responses Displayed Average Noise Residual Responses
A10 LODA Control (Opt. 009) or Tracking Generator Control (Opt. 010)	First LO Distribution Amplifier for Option 009 or 010 only CAL FREQ CAL AMPTD CAL YTF	Frequency Response Absolute Amplitude, Vernier and Power Sweep Accuracy Tracking Generator Level Flatness

Table 1-7 Adjustments and Tests for Replaced or Repaired Assemblies

Replaced or Repaired Assembly	Related Adjustments and Adjustment Routines	Related Performance Verification Tests
A11 Bandwidth	Crystal and IC Bandwidth Filter CAL FREQ CAL AMPTD	Resolution Bandwidth Accuracy Absolute Amplitude Calibration and Bandwidth Switching Uncertainties
A12 Amplitude Control	CAL FREQ CAL AMPTD	Scale Fidelity Displayed Average Noise
A13 Bandwidth	Crystal and IC Bandwidth Filter CAL FREQ CAL AMPTD	Resolution Bandwidth Accuracy Absolute Amplitude Calibration and Bandwidth Switching Uncertainties
A14 Log Amplifier	Log and Linear Amplifier CAL FREQ CAL AMPTD	Scale Fidelity Reference Level Accuracy
A15 Motherboard	CAL FREQ CAL AMPTD	Complete Operation Verification
A16 Processor/Video A16A1 Memory	10 MHz Reference CAL FREQ CAL AMPTD CAL YTF (8592L, 8593E, 8595E, 8596E only) CAL MXR † (8592L, 8593E, 8595E, 8596E only) Cal Attenuator Error † Frequency Response † Time and Date	Reference Level Accuracy Frequency Response
† These adjustments are not necessary if valid correction constants are recovered from the defective A16 processor/video assembly. See the A16 processor/video board assembly replacement procedure in this service guide.		

Introduction
If You Replace or Repair an Assembly

2 Making Adjustments

The procedures in this chapter adjust the analyzer electrical performance to the specifications described in Chapter 2 of the calibration guide for your instrument.

Most adjustments require access to the interior of the analyzer.

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

Before You Start

There are three things you should do before starting an adjustment procedure.

- Check that you are familiar with the safety symbols marked on the analyzer, and read the general safety considerations and the symbol definitions given in the front of this service guide.
- Check that the analyzer has been turned on and allowed to warm up for at least 30 minutes at room temperature before making any adjustments. The analyzer *must* be allowed to stand at room temperature at least 2 hours prior to the 30 minute warmup.
- Read the rest of this section.

1a. Display (with four access holes in top of shield)

This adjustment applies to:

All 8590 E-Series and L-Series spectrum analyzers

8591C cable TV analyzers

8594Q QAM analyzers

There are two different types of displays. If your display has four holes in the top of the shield, continue with this procedure. If it has eight holes, go to the next procedure.

The horizontal and vertical display positions are adjusted using front-panel softkeys. These positions are then stored in nonvolatile memory.

There are two focus adjustments, fine and coarse. The fine adjustment is located on the left side of the display assembly and can be accessed with the instrument cover on or off. The coarse adjustment is located on the rear of the display assembly and can only be adjusted with the instrument cover off.

Procedure

Display Position

1. Press the following analyzer keys to adjust the horizontal position.

PRESET

CAL, More 1 of 4

CRT HORZ POSITION

2. Rotate the knob until the display is centered horizontally.
3. Press the following analyzer softkey to adjust the vertical position.

CRT VERT POSITION

4. Rotate the knob until the display is centered vertically.
5. Press the following analyzer keys to store the horizontal and vertical position values into nonvolatile memory.

CAL

CAL STORE

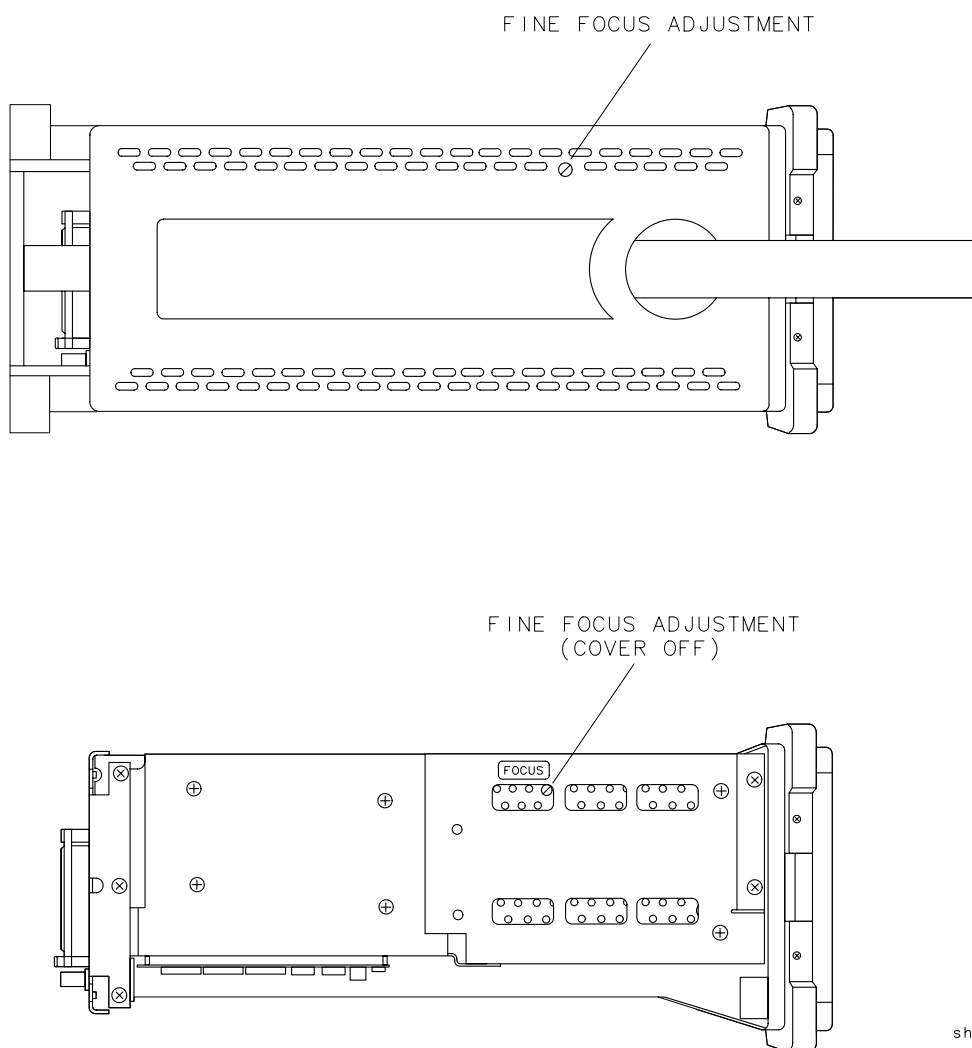
Making Adjustments

1a. Display (with four access holes in top of shield)

Fine Focus

1. Adjust the front panel INTENSITY control for a comfortable viewing intensity.
2. Use an adjustment tool to access the fine focus adjustment. See [Figure 2-1](#). Adjust as necessary for a focused display. If one of the end-stops of the fine focus adjustment is reached, proceed with the “Coarse Focus Adjustment” section.

Figure 2-1 Fine Focus Adjustment Location



sh22e

Coarse Focus

The Coarse Focus adjustment point is located at the rear of the display assembly, therefore, it is required to place the display in a service position to perform this procedure.

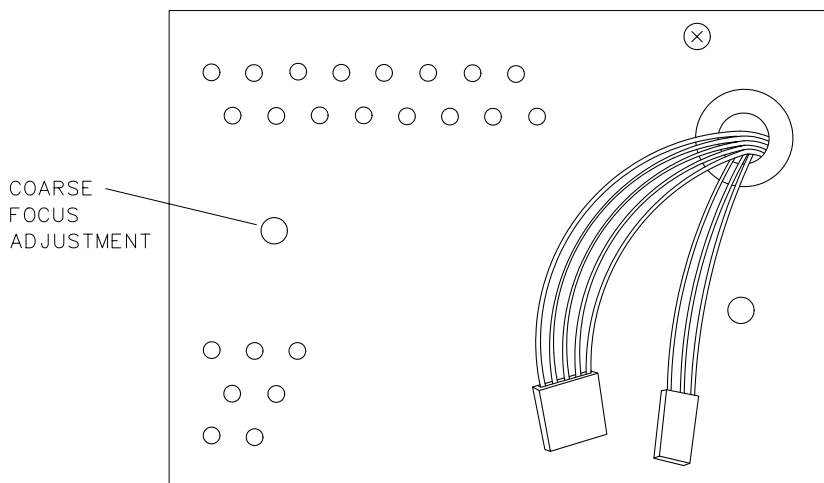
1. Turn the analyzer **LINE** switch to OFF. Remove the instrument cover assembly.
2. Place the display in a service position.

WARNING

The analyzer contains potentially hazardous voltages. Refer to the safety symbols provided on the analyzer, and in the general safety instructions in this guide, before operating the unit with the cover removed. Ensure that safety instructions are strictly followed. Failure to do so can result in severe or fatal injury.

3. Turn the analyzer **LINE** switch to ON.
4. Center the fine focus adjustment. Refer to [Figure 2-1](#) for the adjustment location.
5. Adjust the coarse focus adjustment for the best possible focus. See [Figure 2-2](#).

Figure 2-2 Coarse Focus Adjustment Location
(rear view of display assembly)



sh23e

1b. Display (with eight access holes in top of shield)

This adjustment applies to:

- All 8590 E-Series and L-Series spectrum analyzers
- 8591C cable TV analyzers
- 8594Q QAM analyzers

CAUTION

All display adjustments are described in this adjustment procedure. However, the **FOCUS** adjustment is the only adjustment that can be performed without removing the instrument cover.

For all other adjustments, it is *strongly* recommended that you return the instrument to your local sales and service office.

There are two different types of displays. If your display has eight holes in the top of the shield, continue with this procedure. If it has four holes, go to the preceding procedure.

If you are going to make adjustments to your display, only make the adjustments that would correct the problem that the display is experiencing.

The following is a list of adjustments described in this procedure:

- Focus
- Centering
- Horizontal Hold
- Vertical Hold
- Vertical Size
- Vertical Linearity
- Brightness
- Contrast

The horizontal and vertical display positions should first be adjusted using front-panel softkeys. These positions are then stored in nonvolatile memory.

The Focus adjustment is located on the left side of the instrument and can be accessed with the instrument cover on or off. All other adjustments must be made with the instrument cover removed.

Equipment Required

Display adjustment tool, 0.075 inch hex (part number 8710-1010)

Procedures

Before Performing any Adjustment

Before performing any display adjustment, press the following analyzer keys.

CONFIG, More 1 of 3, More 2 of 3

DEFAULT SYNC

CAL, More 1 of 4, More 2 of 4

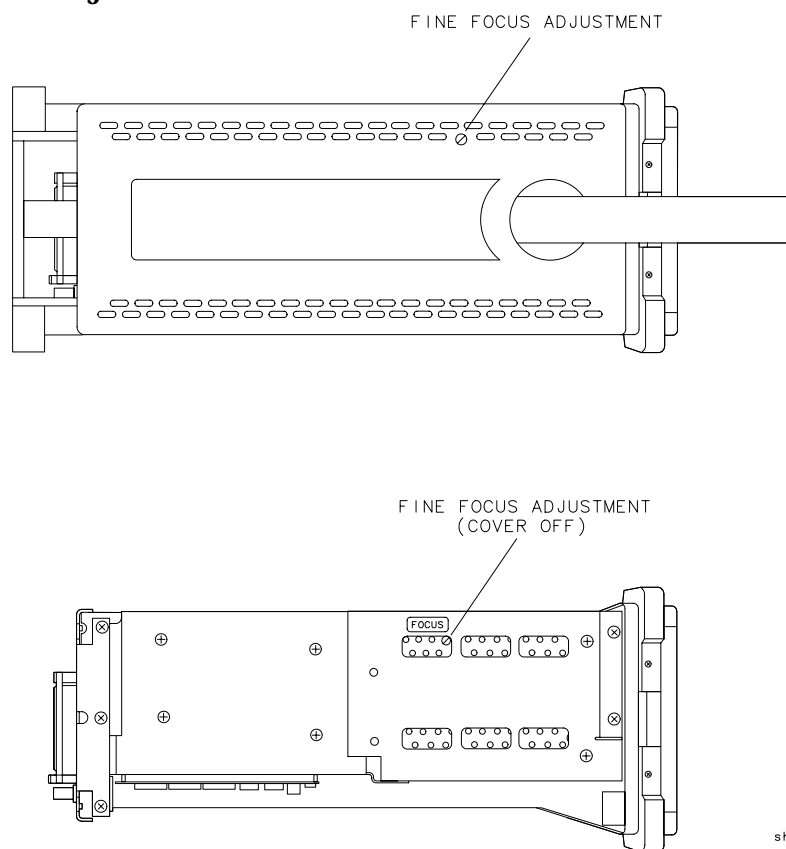
DEFAULT CAL DATA

Focus

The Focus potentiometer is located on the left side of the instrument and can be accessed with the instrument cover on or off. Use the specified adjustment tool to make this adjustment.

1. Adjust the front-panel INTENSITY control for a comfortable viewing intensity.
2. Adjust as necessary for a focused display. See [Figure 2-1](#).

Figure 2-3 Focus Adjustment Location



sh22e

Making Adjustments

1b. Display (with eight access holes in top of shield)

Centering

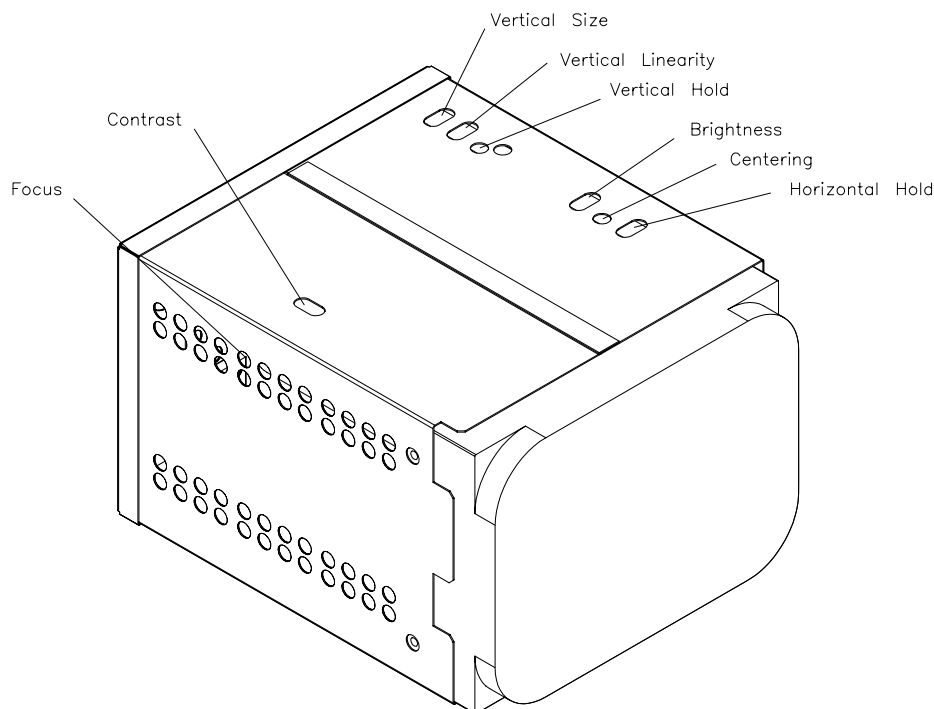
Perform this adjustment only if the displayed image is not horizontally centered on the display.

The Centering potentiometer is accessible through the top of the display's cover. The instrument cover must be removed for access to the display's cover. Refer to [Figure 2-4](#) for the location of this adjustment. Use the specified adjustment tool to make this adjustment.

1. Press **CAL, More 1 of 4, CRT HORZ POSITION**.
2. Set the CRT horizontal position setting to 12.
3. Set the Centering potentiometer so the displayed image is positioned approximately at the center of the display.

Figure 2-4

Display Adjustment Locations



dispadj

Horizontal Hold

Perform this adjustment only if the displayed image is rolling horizontally across the display.

The Horizontal Hold potentiometer is accessible through the top of the display's cover. The instrument cover must be removed for access to the display's cover. Refer to [Figure 2-4](#) for the location of this adjustment. Use the specified adjustment tool to make this adjustment.

1. If the display is unreadable, first adjust the Horizontal Hold potentiometer for a stable display.
2. Press **CAL, More 1 of 4, CRT HORZ POSITION**.
3. Set the CRT horizontal position setting to 12.
4. Find the clockwise position of the Horizontal Hold potentiometer where the display begins to roll horizontally.
5. Find the counter-clockwise position of the Horizontal Hold potentiometer where the display begins to roll horizontally.
6. Set the adjustment to a position approximately midway between the clockwise and counter clockwise position where the display does not roll horizontally.

Vertical Hold

Perform this adjustment only if the displayed image is rolling vertically on the display.

The Vertical Hold potentiometer is accessible through the top of the display's cover. The instrument cover must be removed for access to the display's cover. Refer to [Figure 2-4](#) for the location of this adjustment. Use the specified adjustment tool to make this adjustment.

1. If the display is unreadable, first adjust the Vertical Hold potentiometer for a stable display.
2. Press **CONFIG, More 1 of 3, More 2 of 3**.
3. Press **SYNC NRM NTSC** (NTSC).
4. Adjust the Vertical Hold potentiometer so that the display image is not rolling vertically.

Making Adjustments

1b. Display (with eight access holes in top of shield)

5. Press **SYNC NRM PAL** (PAL).
6. Adjust the Vertical Hold potentiometer so that the display image is not rolling vertically.
7. Repeat [step 1](#) to [step 5](#) until no adjustment is necessary for either the NTSC or the PAL mode.
8. Press **DEFAULT SYNC**.

This is the third softkey from the top.

Vertical Size

Perform this adjustment only if the displayed image is too tall or too short for the display.

The Vertical Size potentiometer is accessible through the top of the display's cover. The instrument cover must be removed for access to the display's cover. Refer to [Figure 2-4](#) for the location of this adjustment. Use the specified adjustment tool to make this adjustment.

1. Press **CAL, More 1 of 4, CRT VERT POSITION**.
2. Set the CRT vertical position setting so that softkey labels are adjacent to the keys at the right to which they are associated.
3. Adjust the Vertical Size potentiometer so that the uppermost softkey label is adjacent to the uppermost softkey and the lowermost softkey label is adjacent to the lowermost softkey.
4. Repeat [step 2](#) and [step 3](#) if necessary.

Vertical Linearity

Perform this adjustment only if the vertical space between the horizontal graticules are not equal on the display.

The Vertical Linearity potentiometer is accessible through the top of the display's cover. The instrument cover must be removed for access to the display's cover. Refer to [Figure 2-4](#) for the location of this adjustment. Use the specified adjustment tool to make this adjustment.

1. Adjust the Vertical Linearity potentiometer so that the vertical space between each of horizontal graticules are approximately equal.

Brightness and Contrast

Perform these adjustments only if the brightness and contrast of the display is not correct.

The Brightness and Contrast potentiometers are accessible through the top of the display's cover. The instrument cover must be removed for access to the display's cover. Refer to [Figure 2-4](#) for the locations of these adjustments. Use the specified adjustment tool to make these adjustments. The Brightness and Contrast potentiometers are interactive adjustments.

1. Adjust the Contrast potentiometer to the full clockwise position (the image is no longer displayed).
2. Adjust the front-panel *INTEN* knob to the full clockwise position.
3. Adjust the Bright potentiometer until the background is just barely extinguished (the background is dark).
4. Adjust the front-panel *INTEN* knob to the full counter-clockwise position.
5. Adjust the Contrast potentiometer until the image is just barely extinguished.
6. Adjust the front-panel *INTEN* knob to the full clockwise position and verify there is not background illumination. If necessary, re-adjust brightness and contrast so that the front-panel *INTEN* will go from a dark screen to a bright screen with a dark background.
7. Adjust the front-panel *INTEN* knob for comfortable brightness and adjust the display focus.

2. Sampler Match

This adjustment applies to:

All 8590 E-Series and L-Series spectrum analyzers

8591C cable TV analyzers

8594Q QAM analyzers

The match between the sampling oscillator and the sampler is optimized by first setting the sampling-oscillator frequency for midrange, then adjusting the sampler-match adjustment for maximum dc volts as read on a digital multimeter.

Equipment Required

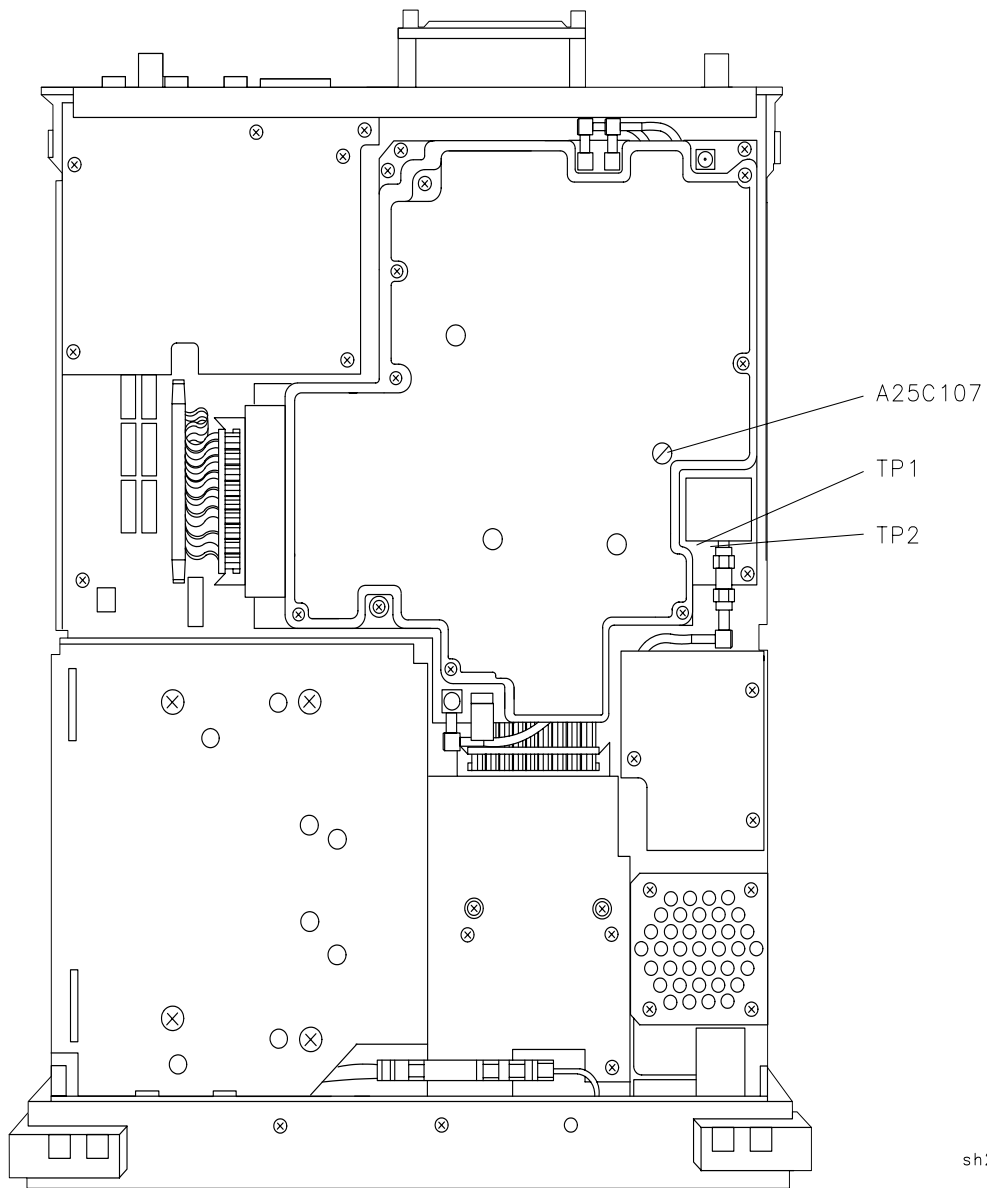
Digital multimeter

DMM test leads

Procedure

1. Turn the analyzer **LINE** switch to OFF. Remove the instrument over assembly.
2. Turn the analyzer **LINE** switch to ON.
3. Set the center frequency of the analyzer to 194 MHz. If you are adjusting an 8590L, or 8591E spectrum analyzer, or an 8591C cable TV analyzer, set the center frequency to 265 MHz.
4. Press the following analyzer keys.
SPAN, 10, MHz
5. Connect the digital multimeter (DMM) from chassis ground to A25TP1. Refer to [Figure 2-5](#).
6. Adjust A25C107 for maximum voltage as read on the DMM. This voltage must be $-1.5\text{ V} \pm 1.0\text{ V}$.
7. Measure the voltage at A25TP2. It should be $+1.5\text{ V} \pm 1.0\text{ V}$. If it is not, readjust A25C107 until a compromise is established between the two test points, such that the voltage specifications of [step 6](#) and [step 7](#) are met.

Figure 2-5 A25 Counter Lock Assembly Test Points



sh223e

3. 10 MHz Reference

This adjustment applies to:

- All 8590 E-Series and L-Series spectrum analyzers
- 8591C cable TV analyzers with Option 704
- 8594Q QAM analyzers with Option 704

The internal 10 MHz time base is adjusted for frequency accuracy. This procedure does not adjust for long-term drift or aging rate. Only short-term accuracy is adjusted.

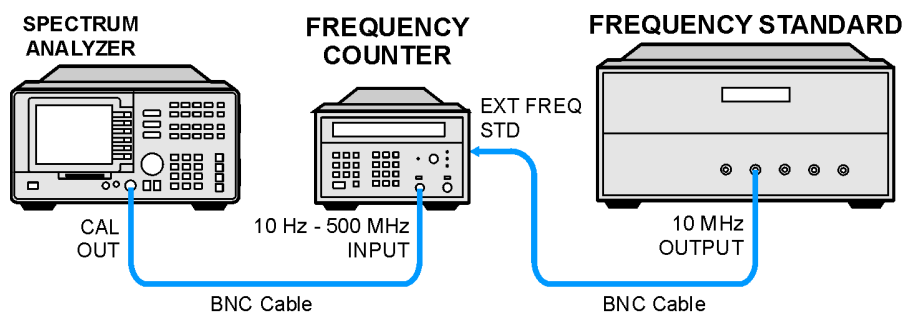
A frequency counter is connected to the CAL OUT, which is locked to the 10 MHz reference. This yields better effective resolution.

The time base is adjusted for a frequency of 300 MHz as read by the frequency counter.

Equipment Required

- Microwave frequency counter
- Frequency standard
- Cable, 122 cm (48 in) (*two required*)

Figure 2-6 10 MHz Reference Adjustment Setup



sh24e

Procedure

Note that to properly adjust the time base, a frequency standard with a better time base accuracy than that of the analyzer is required.

1. Connect the equipment as shown in [Figure 2-6](#).
2. Set the microwave frequency counter controls as follows:

50 Ω /1 M Ω50 Ω Impedance

10 Hz–500 MHz/500 MHz–18 GHz ... 10 Hz–500 MHz

SAMPLE RATE Midrange

FREQUENCY STANDARD EXTERNAL

3. Press the following analyzer keys.

PRESET

FREQUENCY, –2001, Hz

CAL, More 1 of 4, More 2 of 4, More 3 of 4

SERVICE CAL, CAL TIMEBASE

4. A number will be displayed in the active function block of the analyzer display. This is the setting of the DAC (0 to 255) which controls the frequency of the internal time base. Use the knob or keyboard to change the DAC setting until the frequency counter reads 300 MHz \pm 75 Hz (\pm 0.25 ppm).
5. Once the time base has been adjusted for minimum deviation from 300 MHz, press **CAL, CAL STORE**. The new DAC number is now stored in nonvolatile memory.

4. 10 MHz Precision Frequency Reference

This adjustment applies to:

- All 8590 E-Series spectrum analyzers, Option 004
- 8591C cable TV analyzers
- 8594Q QAM analyzers

Replacement oscillators are factory adjusted after a complete warmup and after the specified aging rate has been achieved. Readjustment should not be necessary after oscillator replacement, and is not recommended.

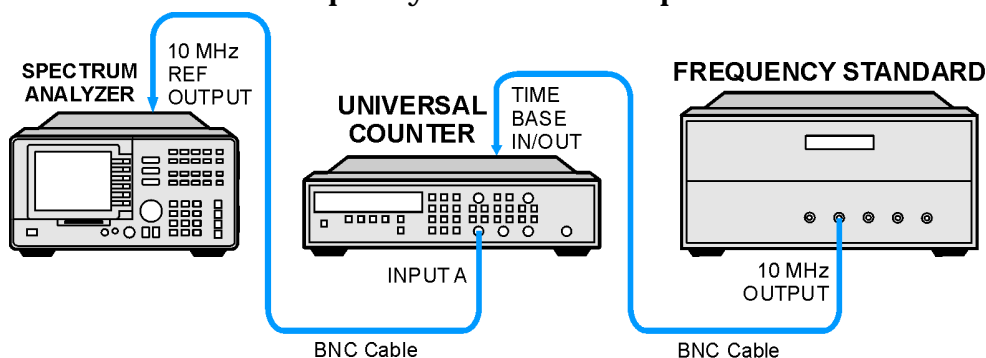
Note that the analyzer must be ON continuously for at least 24 hours immediately prior to adjusting the oscillator to allow both the temperature and frequency of the oscillator to stabilize. Failure to allow sufficient stabilization time could result in the misadjustment of the oscillator.

The frequency of the internal 10 MHz frequency reference is compared to a known frequency standard and adjusted for minimum frequency error. This procedure does not adjust the short-term stability or long-term stability of the 10 MHz Ovenized Crystal Oscillator (OCXO), which are determined by characteristics of the particular oscillator and the environmental and warmup conditions to which it has been recently exposed. The analyzer must be ON continuously for at least 24 hours immediately prior to oscillator adjustment to allow both the temperature and frequency of the oscillator to stabilize.

Equipment Required

- Frequency standard
- Frequency counter
- Cable, BNC, 122 cm (48 in) (*two required*)

Figure 2-7 Precision Frequency Reference Setup



Procedure

1. Place the analyzer on its side as shown in [Figure 2-7](#) and set the LINE switch of the analyzer to ON.
2. Allow the analyzer to remain powered ON and undisturbed for at least 24 hours, so that both the temperature and frequency of the OCXO can stabilize.
3. Connect the frequency standard to the frequency counter rear-panel TIMEBASE IN/OUT connector. Refer to [Figure 2-7](#).
4. Disconnect the jumper between the 10 MHz REF OUTPUT and EXT REF IN jacks on the analyzer rear panel. Connect a BNC cable between the 10 MHz REF OUTPUT jack and INPUT A on the frequency counter.
5. Set the frequency counter controls as follows:

FUNCTION/DATA FREQ A

INPUT A:

x10 ATTN OFF

AC OFF (DC coupled)

50 Ω Z OFF (1 M Ω input impedance)

AUTO TRIG ON

100 kHz FILTER A OFF

INT/EXT switch (rear panel) EXT

6. On the frequency counter select a 1 second gate time and a 10 MHz offset of the displayed frequency by pressing the following frequency counter keys.

GATE TIME, 1, GATE TIME

MATH, SELECT/ENTER

CHS/EEX, 10, CHS/EEX, 6, SELECT/ENTER

SELECT/ENTER

The frequency counter should now display the difference between the frequency of the INPUT A signal and 10.0 MHz with a displayed resolution of 10 MHz (0.010 Hz).

7. Locate the FREQ ADJ control on the OCXO. See [Figure 2-8](#). Remove the dust cap screw.
8. Use a nonconductive adjustment tool to adjust the FREQ ADJ control on the OCXO for a frequency counter indication of 0.00 Hz.

Making Adjustments

4. 10 MHz Precision Frequency Reference

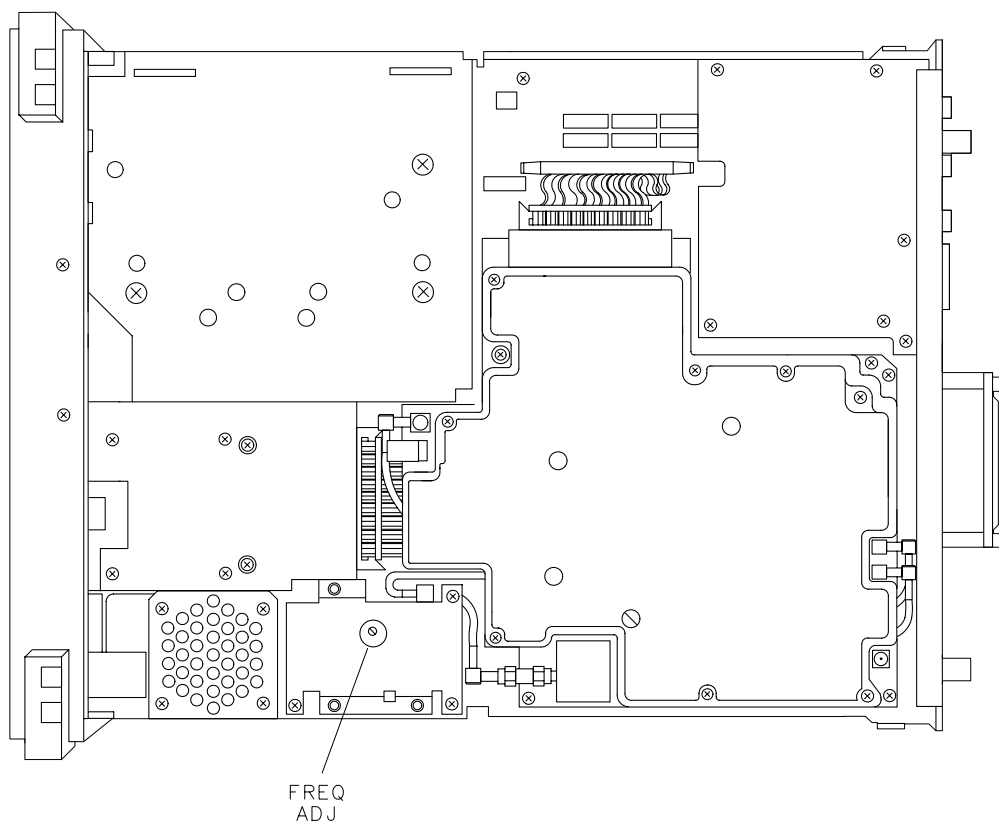
9. Select a 10 second gate time by pressing the following frequency counter keys.

GATE TIME, 10, GATE TIME

The frequency counter should now display the difference between the frequency of the INPUT A signal and 10.0 MHz with a resolution of 0.001 Hz (1 MHz).

10. Wait at least 2 gate periods for the frequency counter to settle, and then adjust the **FREQ ADJ** control on the OCXO for a stable frequency counter indication of 0.000 ± 0.010 Hz.
11. Replace the dust cap screw on the OCXO.

Figure 2-8 Oven Reference Adjustment Location



sh224e

5. Crystal and LC Bandwidth Filter

This adjustment applies to:

All 8590 E-Series and L-Series spectrum analyzers
8591C cable TV analyzers
8594Q QAM analyzers

The crystal and LC bandwidth filter circuits are adjusted for symmetry, center frequency, and peak amplitude.

First, correction constants are turned off. This allows for uncorrected 3 dB resolution bandwidth centering and amplitude adjustments.

New corrections are then generated by performing the CAL FREQ and CAL AMPTD adjustment routines.

Equipment Required

Crystal shorts (*set of three*)
Cable, BNC, 23 cm (9 in)

Additional Equipment for 75 Ω Input

Cable, BNC, 75 Ω , 30 cm (12 in)

Procedure

1. Turn the analyzer **LINE** switch to OFF. Remove the instrument cover assembly.
2. Turn the analyzer **LINE** switch to ON, then press the following analyzer keys.

PRESET

CAL, More 1 of 4

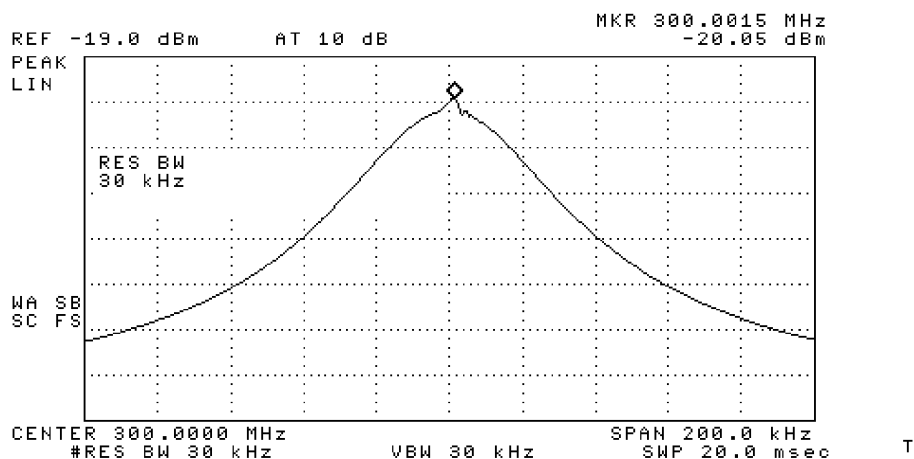
CORRECT ON OFF (OFF)

Crystal Alignment

3. Connect the CAL OUT to the INPUT 50 Ω with the BNC cable.

75 Ω input: Connect the CAL OUT to the INPUT 75 Ω with the 75 Ω BNC cable.

Figure 2-9 Crystal Symmetry and Centering



CAUTION

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

4. Press the following analyzer keys.

FREQUENCY, 300, MHz

SPAN, 10, MHz

PEAK SEARCH

MKR FCTN, MK TRACK ON OFF (ON)

75 Ω input: **AMPLITUDE, More 1 of 2, AMPTD UNITS, dBm**

SPAN, 200, kHz

AMPLITUDE, 20, -dBm

SCALE LOG LIN (LIN)

More 1 of 2, AMPTD UNITS, dBm

BW, 3, kHz

5. Press **AMPLITUDE**, then use the knob to place the signal at the sixth graticule line from the bottom.
6. Press **BW, 30, kHz** on the analyzer.

CAUTION

Shorting the crystal test points to ground may permanently damage the bandwidth board assembly. If you make your own shorts, it is advisable to insulate the bare wires and connectors.

7. Connect the crystal shorts (through the access holes on the assembly cover) across the following pairs of test points.
 - A13TP1 and A13TP2
 - A11TP1 and A11TP2
 - A11TP4 and A11TP5
8. Adjust A13C54 CTR for minimum signal amplitude. Then adjust A13C38 SYM and A13C54 CTR for a centered and symmetrical bandpass response as shown in [Figure 2-9](#).
9. Remove the crystal short from A13TP1 and A13TP2 and connect it across A13TP4 and A13TP5.
10. Adjust A13C25 CTR for minimum signal amplitude. Then adjust A13C15 SYM and A13C25 CTR for a centered and symmetrical bandpass response.
11. Remove the crystal short from A11TP4 and A11TP5. Connect the short across A13TP1 and A13TP2.
12. Adjust A11C54 CTR for minimum signal amplitude. Then adjust A11C38 SYM and A11C54 CTR for a centered and symmetrical bandpass response.
13. Remove the crystal short from A11TP1 and A11TP2. Connect the short across A11TP4 and A11TP5.
14. Adjust A11C25 CTR for minimum signal amplitude. Then adjust A11C15 SYM and A11C25 CTR for a centered and symmetrical bandpass response.

5. Crystal and LC Bandwidth Filter

15. Remove the crystal shorts and press the following analyzer keys.

PEAK SEARCH

MKR FCTN, MK TRACK ON OFF (ON)

SPAN, 50, kHz

MKR FCTN, MK TRACK ON OFF (OFF)

BW, 3, kHz

PEAK SEARCH, MARKER DELTA

BW, 30, kHz

PEAK SEARCH

16. Verify that the MARKER Δ frequency does not exceed 3 kHz.

If the signal shift is out of tolerance, repeat [step 3](#) to [step 16](#).

17. Press the following analyzer keys.

MKR

MARKER 1 ON OFF (OFF)

LC Alignment

18. Press the following analyzer keys.

BW, 100, kHz
SPAN, 5, MHz

19. Widen all but one of the LC filter poles by shorting A11TP10 and A11TP11, A11TP12 and A11TP13, and A13TP10 and A13TP11 using the crystal shorts.

CAUTION

Use a tool with a nonmetallic body to make the LC dip adjustment.

Shorting components to ground may result in permanent damage to the bandwidth board assembly.

20. Center the signal on the analyzer display by pressing the following analyzer keys.

PEAK SEARCH
MKR FCTN, MK TRACK ON OFF (ON)

21. Adjust A13C47 LC dip for a minimum signal amplitude.

22. Move the short from A13TP10 and A13TP11 to A13TP12 and A13TP13, then adjust A13C17 LC dip for a minimum signal amplitude.

23. Move the short from A11TP10 and A11TP11 to A13TP10 and A13TP11, then adjust A11C17 LC dip for a minimum signal amplitude.

24. Move the short from A11TP12 and A11TP13 to A11TP10 and A11TP11, then adjust A11C47 LC dip for a minimum signal amplitude.

LC Centering

Note that the center frequency of the 100 kHz bandwidth is referenced to the 30 kHz bandwidth. During this procedure it is advisable to switch to the 30 kHz bandwidth occasionally and recenter it using **PEAK SEARCH, MARKER → CF**.

25. Short A11TP10 and A11TP11, A11TP12 and A11TP13, and A13TP10 and A13TP11 using the crystal shorts used in the crystal alignment section. Press the following analyzer keys.

BW, 30, kHz
SPAN, 200, kHz
MKR FCTN, MK TRACK ON OFF (OFF)
BW, 100, kHz

5. Crystal and LC Bandwidth Filter

26. Adjust A13C45 LC CTR for maximum signal at center-screen.
27. Move the short from A11TP10 and A11TP11 to A11TP12 and A11TP13, then adjust A11C23 LC CTR for maximum signal at center-screen.
28. Move the short from A13TP12 and A13TP13 to A11TP10 and A11TP11, then adjust A13C45 LC CTR for maximum signal at center-screen.
29. Move the short from A13TP10 and A13TP11 to A13TP12 and A13TP13, then adjust A13C23 LC CTR for maximum signal at center-screen.
30. Disconnect all the shorts from A11 and A13 bandwidth board assemblies.

LC Amplitude

31. Press the following analyzer keys.

BW, 3, MHz

SPAN, 2, MHz

32. Press **AMPLITUDE** and adjust the signal level one division below the top graticule using the knob.

33. Press the following analyzer keys.

PEAK SEARCH, MARKER Δ

MKR FCTN, MK TRACK ON OFF (ON)

BW, 100, kHz

It may be necessary to occasionally recenter the 30 kHz bandwidth.

34. Adjust A11R26 LC and A13R26 LC equally for a MARKER Δ amplitude of 0 dB. Each potentiometer should be adjusted to accomplish one-half of the necessary increase in signal amplitude. If A11R26 or A13R26 reaches its limit, recenter both potentiometers and repeat [step 31](#) to [step 35](#).
35. Press **MKR FCTN, MK TRACK ON OFF (OFF)** on the analyzer.

Final LC Centering

36. Press the following analyzer keys.

BW, 30, kHz
SPAN, 100, kHz
PEAK SEARCH, MARKER → CF
BW, 100, kHz

37. Make final adjustments by adjusting A11C23, A11C45, A13C23, and A13C45 in succession to peak the amplitude of the marker at center-screen.

38. Repeat [step 36](#) and [step 37](#) until the 30 kHz and 100 kHz bandwidths are centered in relation to each other.

39. Press the following analyzer keys.

BW, 30, kHz
PEAK SEARCH
MARKER Δ
BW, 100, kHz
PEAK SEARCH

40. Verify that the MARKER Δ frequency does not exceed 10 kHz.

If the signal shift is out of tolerance, repeat [step 26](#) to [step 39](#).

Crystal Amplitude

41. Press the following analyzer keys.

BW, 30, kHz
SPAN, 10, kHz
PEAK SEARCH
MARKER Δ
MKR FCTN, MK TRACK ON OFF (ON)
BW, 1, kHz

42. Adjust A11R31 XTL and A13R31 XTL equally for a MARKER Δ amplitude reading of 0 dB. Each potentiometer should be adjusted to accomplish one-half of the necessary increase in signal amplitude.

43. If A11R31 or A13R31 reaches its limit, recenter both potentiometers and repeat [step 41](#) and [step 42](#).

Final BW Amplitude Check

44. Run the “CAL FREQ Adjustment Routine” and the “CAL AMPTD Adjustment Routine.”
45. Remember to press **CAL STORE** after the completion of the routines to store data in nonvolatile memory.
46. Press the following analyzer keys to verify that the bandwidth amplitude corrections are within specifications.

CAL, More 1 of 4, More 2 of 4

SERVICE DIAG

DISPLAY CAL DATA

47. Refer to the BW-AMP column of the analyzer display to locate the XTAL and LC bandwidth amplitude-correction numbers of the analyzer. All LC and XTAL bandwidth readings should be between -0.8 dB to $+0.5$ dB. [Table 2-1](#) describes and shows an example of the XTAL and LC bandwidth amplitude-correction numbers that will be displayed on the analyzer. Perform the following steps that apply to your analyzer.
 - If the difference between the bandwidth amplitude-correction numbers of the 30 kHz XTAL and 3 MHz LC is greater than 0.8 dB, pad A11R8 or A13R8 and repeat the Final BW Amplitude Check. Refer to the Component-Level Information Package for the location of A11R8 and A13R8.
 - If the 30 kHz XTAL bandwidth amplitude correction is greater than the 3 MHz LC bandwidth correction, increase the value of A11R8 or A13R8.
 - If the 3 MHz LC bandwidth amplitude correction is greater than the 30 kHz XTAL bandwidth correction, decrease the value of A11R8 or A13R8.
 - If just the 100 kHz LC amplitude is out of range, repeat [step 23](#) to [step 38](#) and [step 44](#) to [step 47](#).
 - If the 1 kHz XTAL amplitude is out of the above range, repeat [step 44](#) to [step 46](#).

Table 2-1 Bandwidth Amplitude-Correction Map

Resolution Bandwidths		BW-AMP Correction Numbers
	not used	0.00
	not used	0.00
	not used	0.00
	not used	0.00
XTAL:	9 kHz	0.00
	300 Hz	0.46
	1 kHz	0.06
	3 kHz	-0.02
	10 kHz	0.00
	30 kHz	0.00
LC:	100 kHz	-0.27
	300 kHz	-0.40
	1 MHz	-0.43
	3 MHz	-0.47
	5 MHz	-0.54
	120 kHz	-0.17

6. Cal Attenuator Error

This adjustment applies to:

- All 8590 E-Series and L-Series spectrum analyzers
- 8591C cable TV analyzers
- 8594Q QAM analyzers

The A12 amplitude control assembly has one 10 dB and two 20 dB nonadjustable amplifiers. It also has 1 dB, 2 dB, 4 dB, 8 dB, and 16 dB attenuators which are correctable. The 16 dB step is not used at this time.

The attenuator error correction procedure involves disabling the attenuator correction constants, determining the attenuator step errors, and entering the new correction constants into the analyzer memory.

Equipment Required

- Synthesizer/level generator
- Cable, BNC, 120 cm (48 in)
- Adapter, Type N (m) to BNC (f)

Additional Equipment for Option 026

- Adapter, Type BNC (f) to SMA (m)

Additional Equipment for 75 Ω Input

- Cable, BNC, 75 Ω , 120 cm (48 in)

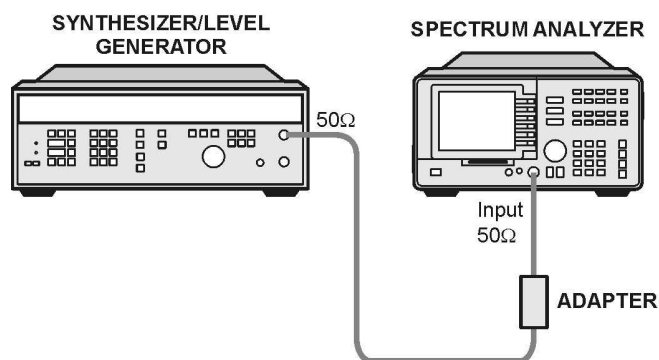
Procedure

The accuracy of the amplitude control attenuator is critical to the proper calibration of the instrument; therefore, this procedure must be carefully and accurately performed.

1. Turn the analyzer **LINE** switch to OFF. Remove the instrument cover assembly.
2. Turn the analyzer **LINE** switch to ON.
3. Connect the 50 Ω output of the synthesizer/level generator to the analyzer INPUT 50 Ω . See Figure 2-10.

75 Ω input: Connect the 75 Ω output of the synthesizer/level generator to the analyzer INPUT 75 Ω

Figure 2-10 Cal Attenuator Error Correction Setup



sh26e

CAUTION

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

4. Set the frequency of the synthesizer/level generator to 25 MHz and the output to -19 dBm.
5. To turn the amplitude attenuator correction constants off, press the following analyzer keys.

PRESET

CAL, More 1 of 4

CORRECT ON OFF (OFF)

1 dB Step Check

6. To measure the 1 dB step correction, press the following analyzer keys.

FREQUENCY, 25, MHz

SPAN, 10, MHz

75 Ω input: **AMPLITUDE, More 1 of 2, AMPTD UNITS, dBm**

AMPLITUDE, 18, -dBm

SCALE LOG LIN (LIN), More 1 of 2

AMPTD UNITS, dBm

PEAK SEARCH

MKR FCTN, MK TRACK ON OFF (ON)

SPAN, 50, kHz

BW, 3, kHz

VID BW AUTO MAN, 300, Hz

7. Press the following analyzer keys.

PEAK SEARCH, MARKER DELTA

MKR FCTN, MK TRACK ON OFF (ON)

8. The MKR Δ amplitude reading should be 0.0 dB \pm 0.01 dB. If it is not, repeat step 7.
9. Set the analyzer by pressing **AMPLITUDE, 17, -dBm**.
10. Set the amplitude of the synthesizer/level generator to -18 dBm.
11. Press **MKR** on the analyzer.
12. Record the MKR Δ amplitude reading in [Table 2-2](#). This is the 1 dB attenuator step error of the A12 amplitude control assembly.

2 dB Check

13. Press the following analyzer keys.

AMPLITUDE, 16, **-dBm**.

14. Set the amplitude of the synthesizer/level generator to -17 dBm.

15. Press the following analyzer keys.

PEAK SEARCH

MARKER DELTA, **MARKER DELTA**

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

16. MKR Δ amplitude reading should be 0.0 ± 0.01 . If it is not, repeat step 15.

17. Set the analyzer by pressing **AMPLITUDE**, 14, **-dBm**.

18. Set the amplitude of the synthesizer/level generator to -15 dBm.

19. Press **MKR** on the analyzer.

20. Record the MKR Δ amplitude reading in [Table 2-2](#). This is the 2 dB attenuator step error of the A12 amplitude control assembly.

4 and 8 dB Step Error

21. Repeat [step 13](#) to [step 20](#) for attenuator steps 4 dB and 8 dB. Use [Table 2-2](#) for synthesizer values and analyzer reference-level values.

Table 2-2 A12 Amplitude Control Assembly Attenuator Errors

Synthesizer Settings (dBm)		Reference Level Settings (dBm)		Attenuator Step (dB)	Error
Attenuator OFF	Attenuator ON	Attenuator OFF	Attenuator ON		
-19	-18	-18	-17	1	_____
-17	-15	-16	-14	2	_____
-18	-14	-17	-13	4	_____
-19	-11	-18	-10	8	_____

Entering Attenuator Error Correction Data

22. Press the following analyzer keys.

PRESET

75 Ω input: **AMPLITUDE, More 1 of 2, AMPTD UNITS, dBm**

FREQUENCY, -2001, Hz

CAL, More 1 of 4, More 2 of 4

SERVICE CAL, SET ATTN ERROR

Note that the frequency of **-2001 Hz** is necessary to access the **SERVICE CAL** routines.

23. When the analyzer prompts you with the message **ENTER CAL ATTN ERROR**, enter the data from [Table 2-2](#) and terminate with the reverse sign using the **dBm** or **-dBm** keys. For example, if the error recorded in [Table 2-2](#) is 0.07, enter 0.07 and terminate with **-dBm**.

24. When the analyzer prompts you to enter the 16 dB step, enter 0 dBm. At the completion of entering the 16 dB error, the analyzer will reset.

25. To confirm that the correct data is stored, access the cal attenuator corrections by pressing the following analyzer keys.

CAL, More 1 of 4, More 2 of 4

SERVICE DIAG

DISPLAY CAL DATA

Note that the cal-attenuator correction data are the first five corrections located in the **ERR** column.

7. Log and Linear Amplifier

This adjustment applies to:

- All 8590 E-Series and L-Series spectrum analyzers
- 8591C cable TV analyzers
- 8594Q QAM analyzers

A 21.4 MHz signal is injected into an IF test board that has been inserted in place of the first resolution bandwidth assembly, A11. The gain of the A14 log amplifier assembly is adjusted by observing the voltage at the AUX VIDEO OUT on the rear panel with a digital multimeter.

Equipment Required

- Synthesizer/level generator
- Digital multimeter (DMM)
- IF test board
- Cable, BNC, 120 cm (48 in)
- Cable, BNC (f) to dual banana plug
- Test cable

Procedure

1. Turn the analyzer **LINE** switch to OFF. Remove the instrument cover assembly.
2. Remove the first IF bandwidth filter assembly, A11. Install the IF test board into the A11 slot. Turn the analyzer **LINE** switch to ON.
3. Set the DMM to read dc volts.
4. Press the following analyzer keys.

PRESET

CAL, More 1 of 4

CORRECT ON OFF (OFF), More 2 of 4

SERVICE DIAG

STP GAIN ZERO

SPAN, 0, Hz

BW, 10, kHz

VID BW AUTO MAN, 300, Hz

AMPLITUDE, 10, -dBm

SCALE LOG LIN (LIN)

5. Set the synthesizer as follows:

FREQUENCY 21.4 MHz

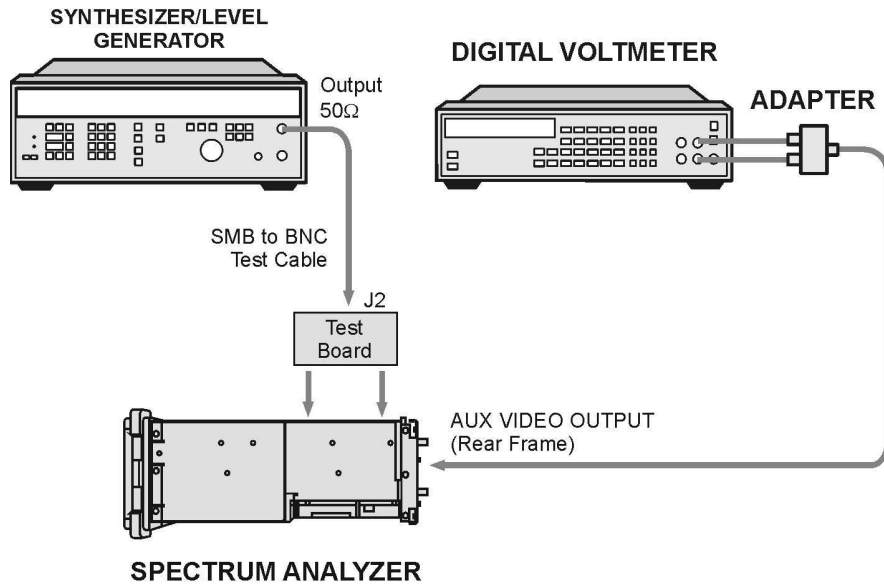
MANUAL TUNE ON

AMPTD INCR 0.01 dBm

AMPLITUDE -6 dBm

6. Connect equipment as shown in [Figure 2-11](#). Connect the output of the synthesizer to J2 of the IF test board. Connect the DMM to AUX VIDEO OUT (located on the rear panel).

Figure 2-11 Log and Linear Amplifier Adjustment Setup

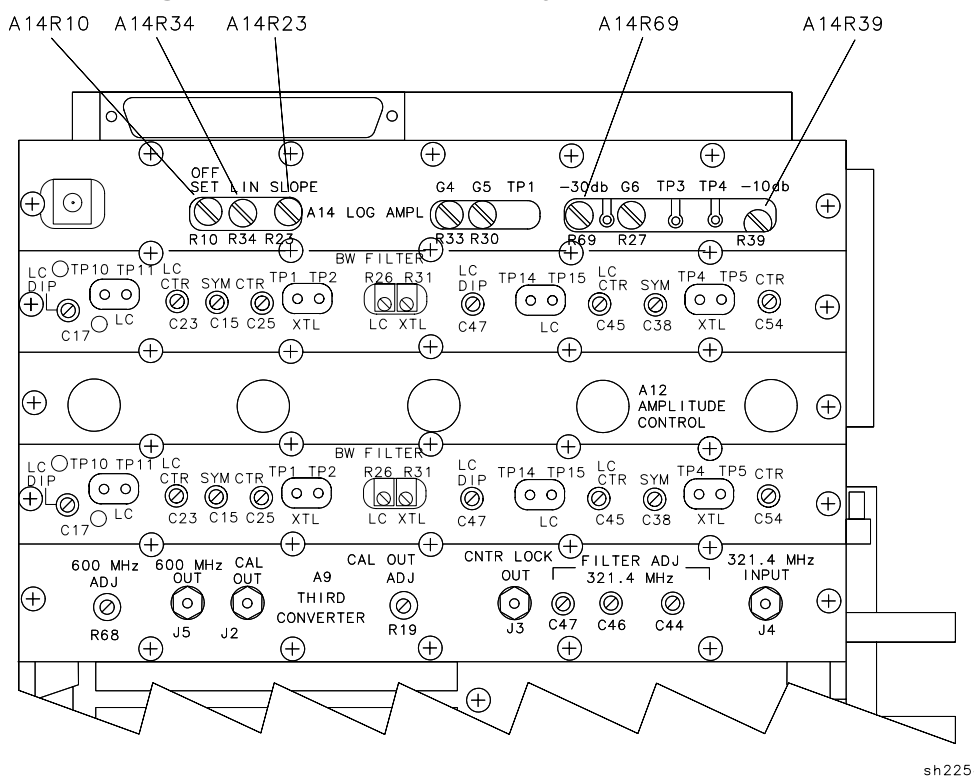


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Log Fidelity Adjustment

7. Adjust the synthesizer knob for maximum signal amplitude on the display. Adjust the synthesizer amplitude as necessary to keep the signal on the display.
8. Adjust the synthesizer output level for a DMM reading of 1000 mV \pm 1.0 mV. Record the synthesizer amplitude readout for later reference:
_____dBm
9. Press **AMPTD, INCR, 10, dB** on the synthesizer.
10. Press **SCALE (LOG)** on the analyzer.
11. Set the synthesizer to the level recorded in [step 8](#) and adjust A14R23 SLOPE (refer to [Figure 2-12](#)) for a DMM reading of 1000 mV \pm 1 mV.

Figure 2-12 Log and Linear Amplifier Adjustment Location



12. Set the synthesizer amplitude 60 dB below that recorded in step 8 by pressing **AMPLITUDE** and then pressing ↓ (step-down key) six times. Adjust A14R10 OFFSET for the DMM reading of 250 mV ±1 mV.
13. Repeat step 10 and step 11 until no further adjustment is necessary.
14. Set the synthesizer amplitude 30 dB below that recorded in step 8 and adjust the A14R23 SLOPE for a DMM reading of 625 mV ±1 mV.
15. Set the synthesizer amplitude to the level recorded in step 8 and adjust the A14R69 -30 dB for a DMM reading of 1000 mV ±1 mV.
16. Repeat step 13 and step 14 until no further adjustment is necessary.
17. Set the synthesizer amplitude 10 dB below that recorded in step 8 and adjust the A14R23 SLOPE for a DMM reading of 875 mV ±1 mV.
18. Set the synthesizer amplitude to the level recorded in step 8 and adjust the A14R39 -10 dB for a DMM reading of 1000 mV ±1 mV.
19. Repeat step 16 and step 17 until no further adjustment is necessary.
20. Repeat step 10 to step 18 until the limits in [Table 2-3](#) are met.

Table 2-3 Log Fidelity Check

Synthesizer Level	DMM Reading
Reference from step 8	1000 mV \pm 1 mV
Reference – 10 dB	875 mV \pm 3 mV
Reference – 20 dB	750 mV \pm 4 mV
Reference – 30 dB	625 mV \pm 4 mV
Reference – 40 dB	500 mV \pm 5 mV
Reference – 50 dB	375 mV \pm 6 mV
Reference – 60 dB	250 mV \pm 7 mV
Reference – 70 dB	125 mV \pm 8 mV

Linear Output and Step Gain Adjustments

21.Press the following analyzer keys.

AMPLITUDE, 50, –dBm

SCALE LOG LIN (LIN), More 1 of 2

AMPTD UNITS, dBm

22.Set the synthesizer amplitude to the level recorded in step 8 and adjust A14R34 LIN for a DMM reading of 1000 mV \pm 1 mV.

23.Make the adjustments indicated in [Table 2-9](#).

Table 2-4 Linear Gain Check

Adjust	Synthesizer Level	Reference Level (dBm)	DMM Reading
A14R34	Reference from step 8	–50	1000 mV \pm 1 mV
A14R33	Reference – 10 dB	–60	1000 mV \pm 5 mV
A14R30	Reference – 20 dB	–70	1000 mV \pm 5 mV
A14R27	Reference – 30 dB	–80	1000 mV \pm 5 mV
N/A	Reference – 40 dB	–90	1000 mV \pm 30 mV

8. CAL FREQ Adjustment Routine

This adjustment applies to:

All 8590 E-Series and L-Series spectrum analyzers

8591C cable TV analyzers

8594Q QAM analyzers

The **CAL FREQ** softkey accesses an internal self-adjustment routine. The “CAL FREQ Adjustment Routine” adjusts the analyzer to obtain frequency accuracy using CAL OUT signal. The following adjustments are automatically performed by **CAL FREQ** routine.

Sweeptime calibration

YTO offset and slope

FM coil timing constants

Span attenuator

FM detector sensitivity

Equipment Required

Cable, BNC, 20 cm (9 in)

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

Additional Equipment for Option 026

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

Additional Equipment for 75 Ω Input

Cable, BNC, 75 Ω , 30 cm (12 in)

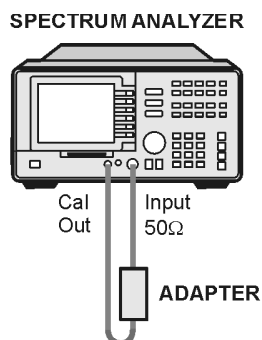
Procedure

Interrupting this routine may result in corrupt data being stored in RAM. If this occurs, rerun the **CAL FREQ** adjustment routine.

1. Connect the CAL OUT to the INPUT 50 Ω with the BNC cable. See [Figure 2-13](#).

75 Ω input: Connect the CAL OUT to the INPUT 75 Ω with the 75 Ω BNC cable.

Figure 2-13 CAL FREQ Adjustment Routine Setup



sh28e

CAUTION

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

2. Press the following analyzer keys.

CAL, CAL FREQ

The **CAL FREQ** adjustment routine will take a few minutes to run.

The internal adjustment data will be stored in working RAM. To store this data in nonvolatile memory, press **CAL STORE**.

If the **CAL AMPTD** adjustment routine has not been done, the following error message will be displayed: 'CAL: DATA NOT STORED' and 'CAL AMP NEEDED'. Proceed with the **CAL AMPTD** adjustment routine and then press **CAL STORE** when done.

9. CAL AMPTD Adjustment Routine

This adjustment applies to:

All 8590 E-Series and L-Series spectrum analyzers

8591C cable TV analyzers

8594Q QAM analyzers

The **CAL AMPTD** softkey accesses an internal self-adjustment routine. The following adjustments are automatically performed by **CAL AMPTD**.

- The reference level is calibrated by adjusting the gain of the IF section.
- The 3 dB resolution bandwidths are adjusted.
- Bandwidth amplitude errors are determined. Errors are corrected with video offsets.
- Step-gain and input-attenuator errors are determined. Errors are corrected with video offsets.
- Log fidelity is checked in 1 dB steps. Errors are corrected with video offsets.
- Frequency accuracy is tested and adjusted by using frequency offsets.

Equipment

Cable, BNC, 20 cm (9 in)

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

Additional Equipment for Option 026

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

Additional Equipment for 75 Ω Input

Cable, BNC, 75 Ω , 30 cm (12 in)

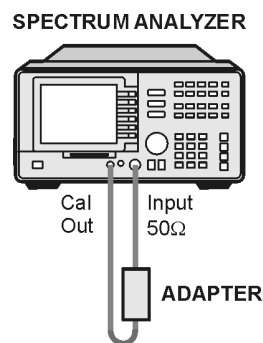
Procedure

It is recommended to complete the “CAL FREQ Adjustment Routine” prior to performing the “CAL AMPTD Adjustment Routine.”

1. Connect the CAL OUT to the INPUT 50 Ω using a BNC cable. See [Figure 2-14](#).

75 Ω input: Connect the CAL OUT to the INPUT 75 Ω with the 75 Ω BNC cable.

Figure 2-14 CAL AMPTD Adjustment Routine Setup



sh28e

CAUTION

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

2. Press the following analyzer keys.

CAL, CAL AMPTD

The **CAL AMPTD** routine takes approximately 5 to 7 minutes to run. The internal adjustment data will be stored in working RAM. To store this data in nonvolatile memory, press **CAL STORE**.

10. CAL YTF Adjustment Routine

This adjustment applies to:

- 8592L spectrum analyzers
- 8593E spectrum analyzers
- 8595E spectrum analyzers
- 8596E spectrum analyzers

The **CAL YTF** softkey accesses an internal adjustment routine. This routine adjusts the slope and offset of the A3A8 YTF tune voltage for each harmonic mixing band. The “CAL FREQ Adjustment Routine” must be performed prior to this adjustment.

Equipment Required

- Cable, Type N (m) to SMA (m) (part number 8120-5148)

Additional Equipment for Option 026

- Cable, SMA (m) to (m)
- Adapter, Type APC-3.5 (f) to APC-3.5 (f)

Additional Equipment for Model 8595E

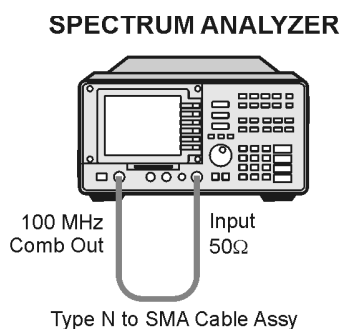
- Cable, BNC, 20 cm (9in)

Procedure

1. Perform the CAL FREQ routine as indicated in the “CAL FREQ Adjustment Routine” in this chapter.
2. Connect the 100 MHz COMB OUT to INPUT 50 Ω using the YTF CAL cable. Refer to [Figure 2-15](#).

Model 8595E only: Connect the CAL OUT to the INPUT 50 Ω using a BNC cable.

Figure 2-15 CAL YTF Adjustment Setup



sh29e

3. Press the following keys.

PRESET

CAL, CAL YTF

The **CAL YTF** routine will take a few minutes to run. The message “CAL: DONE” will be displayed when the routine has finished. The internal adjustment data will be stored in working RAM.

If the message “LOST COMB SIGNAL” is displayed, perform the Mixer Bias DAC Initialization procedure.

4. Press **CAL STORE** to store the YTF correction data in nonvolatile memory.

Mixer Bias DAC Initialization

If the message “LOST COMB SIGNAL” is displayed, the current mixer bias DAC settings may not be adequate to ensure that a comb signal is displayed. Initialization of the mixer bias DAC may be required.

Perform this procedure only if the “LOST COMB SIGNAL” message is displayed while performing the **CAL YTF** routine and the analyzer firmware is version 3.1.90 or later.

Making Adjustments
10. CAL YTF Adjustment Routine

1. Press the following keys to activate title mode.

PRESET
CAL, More 1 of 4, More 2 of 4
SERVICE DIAG
DISPLAY CAL DATA

2. Record the displayed “Optimum Bias” DAC values for each frequency band.

Table 2-5 Acceptable Mixer Bias DAC Correction Values

Band	Optimum Bias	Acceptable Bias Range
1	_____	800 to 1900
2	_____	0 to 200
3	_____	1000 to 1800
4	_____	400 to 750

3. If the recorded “Optimum Bias” values are within the acceptable ranges indicated in [Table 2-5](#), RF section troubleshooting is necessary.

If the recorded “Optimum Bias” values are not within the acceptable ranges indicated in [Table 2-5](#), complete the rest of this procedure to initialize the mixer bias DAC values.

4. Press the following keys to allow entry of the default mixer bias DAC values.

PRESET
FREQUENCY, -2001, Hz
DISPLAY
CHANGE TITLE

5. Enter `CALMXRDATA 1600,1;` as a title entry to set the mixer bias value to 1600 for band 1.
6. Press the following keys to store the mixer bias value for band 1 in nonvolatile memory.

CAL, More 1 of 4, More 2 of 4
SERVICE CAL
EXECUTE TITLE

7. Press the following keys to allow entry of the default mixer bias DAC value for band 2.

DISPLAY

CHANGE TITLE

CLEAR

8. Enter `CALMXRDATA 20,2;` as a title entry to set the mixer bias value to 20 for band 2.

Press the following keys to store the mixer bias value for band 2 in nonvolatile memory.

CAL, More 1 of 4, More 2 of 4

SERVICE CAL

EXECUTE TITLE

9. Press the following keys to allow entry of the default mixer bias DAC value for band 3.

DISPLAY

CHANGE TITLE

CLEAR

10. Enter `CALMXRDATA 1300,3;` as a title entry to set the mixer bias value to 1300 for band 3.

11. Press the following keys to store the mixer bias value for band 3 in nonvolatile memory.

CAL, More 1 of 4, More 2 of 4

SERVICE CAL

EXECUTE TITLE

12. Press the following keys to allow entry of the default mixer bias DAC value for band 4.

DISPLAY

CHANGE TITLE

CLEAR

13. Enter `CALMXRDATA 520,4;` as a title entry to set the mixer bias value to 520 for band 4.

10. CAL YTF Adjustment Routine

14. Press the following keys to store the mixer bias value for band 4 in nonvolatile memory.

CAL, More 1 of 4, More 2 of 4

SERVICE CAL

EXECUTE TITLE

15. Press the following keys to check the default mixer bias DAC values.

PRESET

CAL, More 1 of 4, More 2 of 4

SERVICE DIAG

DISPLAY CAL DATA

Confirm that the "Optimum Bias" DAC values displayed for band 1 through band 4 are 1600, 20, 1300, and 520.

16. Repeat the CAL YTF adjustment procedure.

17. Perform the CAL MXR adjustment procedure.

11. CAL MXR Adjustment Routine

This adjustment applies to:

- 8592L spectrum analyzers
- 8593E spectrum analyzers
- 8595E spectrum analyzers
- 8596E spectrum analyzers

The **CAL MXR** softkey accesses an internal adjustment routine which optimizes the dc bias for the A3A6 Dual Band Mixer when in high band (2.75 to 22 GHz). The CAL YTF routine must be performed prior to this adjustment. New frequency response correction constants must be developed following the CAL MXR Adjustment Routine.

Equipment Required

- Cable, Type N (m) to SMA (m)

Additional Equipment for Option 026

- Cable, CAL Comb
- Adapter, Type APC-3.5 (f) to APC-3.5 (f)

Additional Equipment for Model 8595E

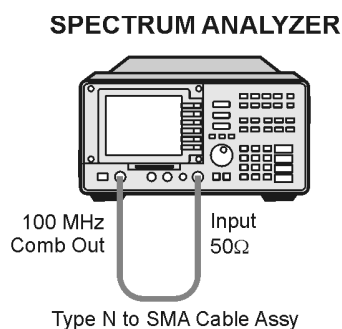
- Cable, BNC, 20 cm (9in)

Procedure

1. Perform the CAL YTF routine as indicated in the “CAL YTF Adjustment Routine” in this chapter.
2. Connect the 100 MHz COMB OUT to INPUT 50 Ω using the CAL YTF cable (Type N to SMA cable). Refer to [Figure 2-16](#).

Model 8595E only: Connect the CAL OUT to the INPUT 50 Ω using a BNC cable.

Figure 2-16 CAL MXR Adjustment Setup



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3. Press the following analyzer keys.

PRESET

FREQUENCY, -2001, Hz

CAL, More 1 of 4, More 2 of 4

SERVICE CAL, CAL MXR

Note that the frequency of **-2001 Hz** is necessary to access the **SERVICE CAL** routines.

The **CAL MXR** routine will take a few minutes to run. The message “CAL: DONE” will be displayed when the routine has finished. The internal adjustment data will be stored in working RAM.

4. Press **CAL STORE** to store the correction data in nonvolatile memory.

12. Second Converter

This adjustment applies to:

- 8590L spectrum analyzers
- 8591E spectrum analyzers
- 8591C cable TV analyzers

The RF output of the tripler is adjusted by observing an analyzer connected to the 321.4 MHz second converter output, and adjusting the slug-tuned cavity for maximum signal.

The second IF bandpass filter is adjusted for a 2.1214 GHz bandpass using the Dishal method. The second mixer match is adjusted for maximum output.

The LO is swept through the range of the 2.1214 GHz bandpass while the output is observed with an analyzer and the characteristics are evaluated.

Equipment Required

- Microwave spectrum analyzer
- Tuning tool
- Cable, SMB (f) to BNC (m)
- Adapter, SMB (f) to SMB (f)
- Adapter SMB (m) to SMB (m)
- Adapter, N (m) to BNC (f)

Procedure

Tripler Adjustment

1. Turn the analyzer **LINE** switch to OFF. Remove the instrument cover assembly. Refer to the “Instrument Cover” removal procedure in [Chapter 3](#).

2. Turn the analyzer **LINE** switch to ON.

3. Press INSTRUMENT PRESET on the microwave spectrum analyzer and set the controls as follows:

CENTER FREQUENCY 1.8 GHz

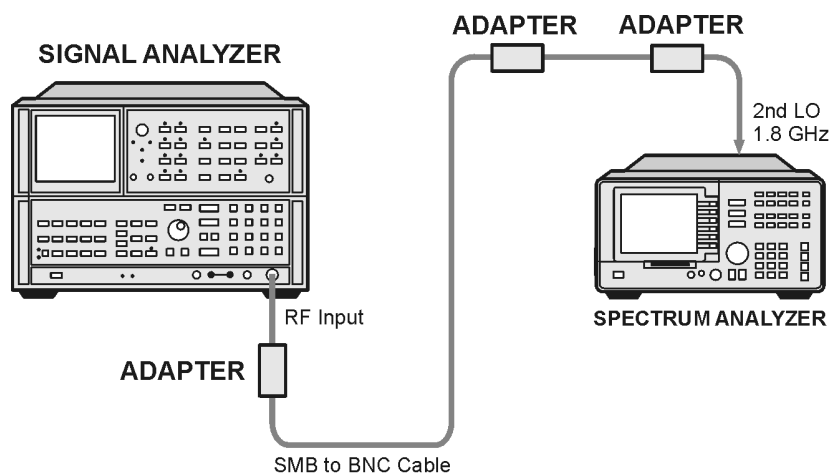
FREQUENCY SPAN 10 MHz

REFERENCE LEVEL -20 dBm

dB/DIV 2 dB/DIV

4. Connect the microwave spectrum analyzer to the 2ND LO 1.8 GHz port on the A5 Second Converter using SMB adapters and the test cable. See [Figure 2-17](#).

Figure 2-17 Tripler Adjustment Setup

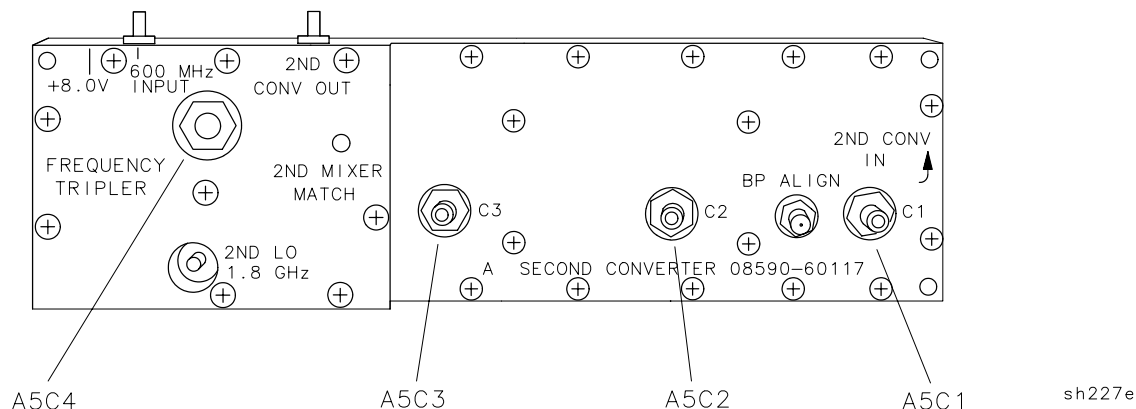


sh226e

5. Use the tuning tool to adjust A5C4 FREQUENCY TRIPLER (see [Figure 2-18](#)) for maximum signal amplitude as observed on the analyzer. Readjust the reference level of the microwave spectrum analyzer as necessary to keep the signal on screen. The 1.8 GHz signal should be -19 dBm to -24 dBm.

Note that when adjusting with the tuning tool, the signal amplitude will change as the lock nuts are tightened. Optimum signal amplitude should be maintained while tightening these lock nuts.

Figure 2-18 Second Converter Adjustment Location



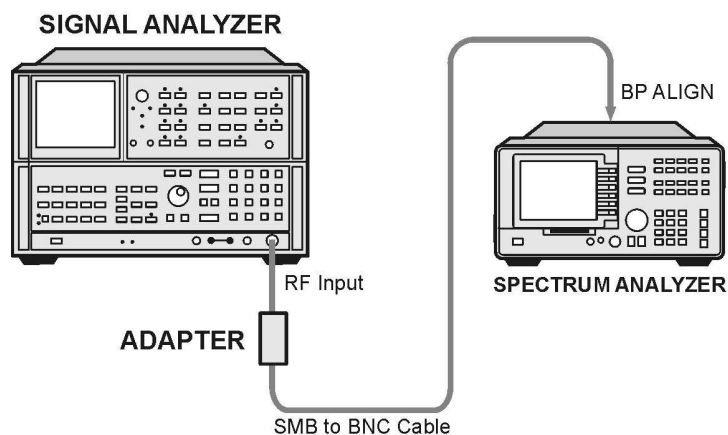
Second Converter Bandpass

6. Set the microwave spectrum analyzer controls as follows:

- CENTER FREQUENCY 2.1214 GHz
- FREQUENCY SPAN 5 MHz
- REFERENCE LEVEL -30 dBm

7. Connect the microwave spectrum analyzer to the BP ALIGN port on the A5 Second Converter of the analyzer using the test cable. See [Figure 2-17](#).

Figure 2-19 Second Converter Bandpass Adjustment Setup



sh228e

12. Second Converter

8. With nothing connected to the analyzer INPUT 50 Ω (*Option 001: INPUT 75 Ω*), press the following keys.

PRESET

PEAK SEARCH

MKR FCTN, MK TRACK ON OFF (ON)

SPAN, 10, MHz

Wait for AUTO ZOOM message to disappear.

9. Set the analyzer as follows:

MKR FCTN, MK TRACK ON OFF (OFF)

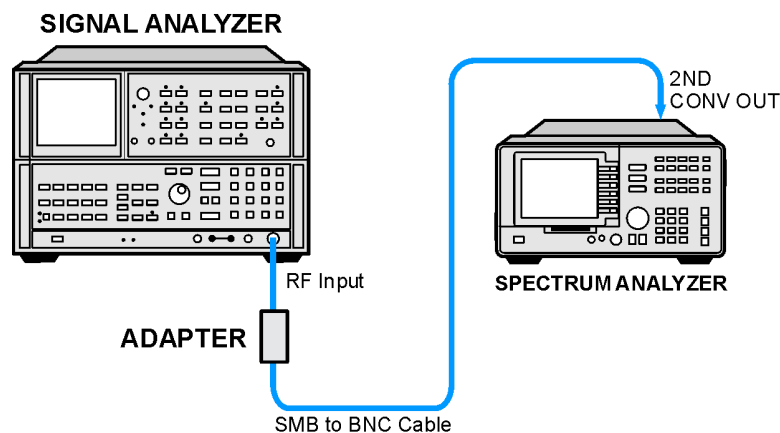
SPAN, 0, Hz

10. Loosen the lock nut on A5C1, A5C2, and A5C3. Carefully turn tuning screws clockwise until they reach the bottom of the cavity. *Do not force the tuning screws down.*
11. Turn A5C1 counterclockwise for a peaked signal on the 8566A/B. Lightly tighten the lock nut.
12. Turn A5C2 counterclockwise for a minimum signal on the analyzer. Lightly tighten the lock nut.
13. Turn A5C3 counterclockwise for peak signal on the analyzer. Lightly tighten the lock nut.
14. Repeat [step 11](#) to [step 13](#) until no further improvement is noticeable. Tighten the lock nuts without changing the amplitude on the display.

Second Mixer Match

15. After removing W10, connect the microwave spectrum analyzer to the 2ND CONV OUT port (see [Figure 2-18](#)) using the test cable. See [Figure 2-20](#).

Figure 2-20 Second Mixer Match Adjustment Setup



sh229e

16. Set the microwave spectrum analyzer controls as follows:

CENTER FREQUENCY 321.4 MHz
 REFERENCE LEVEL -40 dBm
 SPAN 20 MHz
 dB/DIV 1 dB/DIV

17. Adjust A5 2ND MIXER MATCH (refer to Figure 2-18) for maximum amplitude as displayed on the microwave spectrum analyzer. Adjust the reference level as necessary to keep the signal near top-screen.

Swept Bandpass Check

18. Set the analyzer controls as follows:

SPAN, 20, MHz
SWEEP, 20, SEC

19. On the microwave spectrum analyzer, press trace B and MAX HOLD. Wait for at least one complete sweep. Then press the following keys to measure the 3 dB bandwidth.

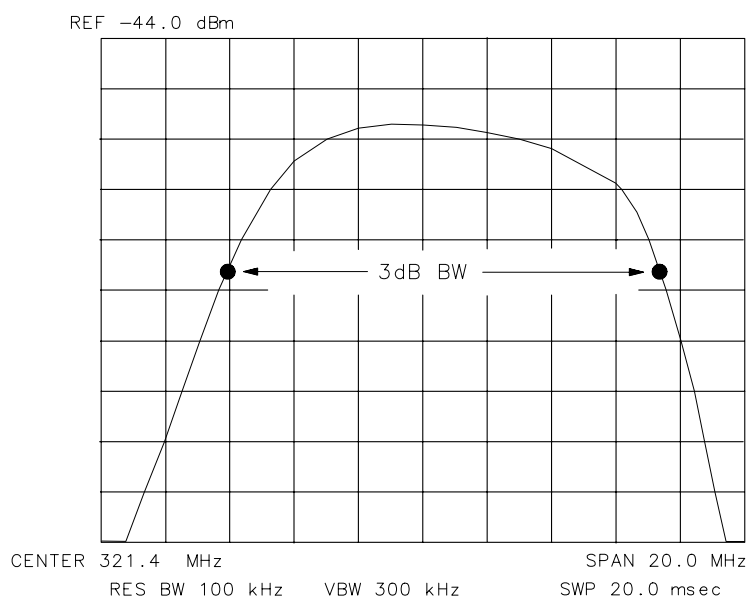
TRACE B VIEW
A $\Leftarrow \Rightarrow$ B
PEAK SEARCH
MARKER MODE, Δ

20. Rotate the knob counterclockwise so that the marker delta amplitude reads -3 dB.

Making Adjustments
12. Second Converter

21. Press **MARKER MODE**, Δ and rotate the knob clockwise so that the marker delta amplitude reads 0 dB and is on the right-hand side of the response. Read the marker delta frequency; it should be 15 MHz \pm 2.5 MHz. See [Figure 2-21](#).
22. The maximum ripple should be less than 1 dB for a bandwidth of 6 MHz.

Figure 2-21 Second Converter Bandpass Ripple Measurement



8566A/B DISPLAY

sh230e

13. Third Converter and Second IF Bandpass

This adjustment applies to:

- All 8590 E-Series and L-Series spectrum analyzers
- 8591C cable TV analyzers
- 8594Q QAM analyzers

The 321.4 MHz, second IF bandpass filter is adjusted for maximum signal amplitude.

The CAL OUT amplitude is measured and adjusted for -20 dBm ± 0.4 dB. The insertion loss of a low-pass filter (LPF) and 10 dB attenuator are characterized. The harmonics of the CAL OUT signal are suppressed with the LPF before the amplitude accuracy is measured using a power meter.

Equipment Required

- Synthesized sweeper
- Microwave spectrum analyzer
- Measuring receiver (*used as a power meter*)
- Power meter
- Low power sensor with a 50 MHz reference attenuator
- Power sensor, 300 MHz
- Power splitter
- Attenuator, 10 dB, Type N (m to f), dc-12.4 GHz
- Low-pass filter, 300 MHz
- IF test board
- Cable, Type N, 152 cm (60 in)
- Cable, BNC, 120 cm (48 in)
- Test cable, SMB (f) to BNC (m) (*two required*)
- Adapter, APC 3.5 (f) to Type N (f)
- Adapter, Type N (f) to BNC (m) (*two required*)
- Adapter, Type N (m) to BNC (f)

Additional Equipment for Models 8590L Option 713

Microwave frequency counter

Additional Equipment for 75 Ω Input

Adapter, minimum loss

Adapter, 75 Ω to 50 Ω

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

Cable, BNC, 75 Ω , 30 cm (12 in)

Procedure

Second IF Bandpass Filter

1. Press INSTRUMENT PRESET on the microwave spectrum analyzer, then set the controls as follows:

CENTER FREQUENCY 21.4 MHz

FREQUENCY SPAN 50 MHz

REFERENCE LEVEL -30 dBm

dB/DIV 1 dB/DIV

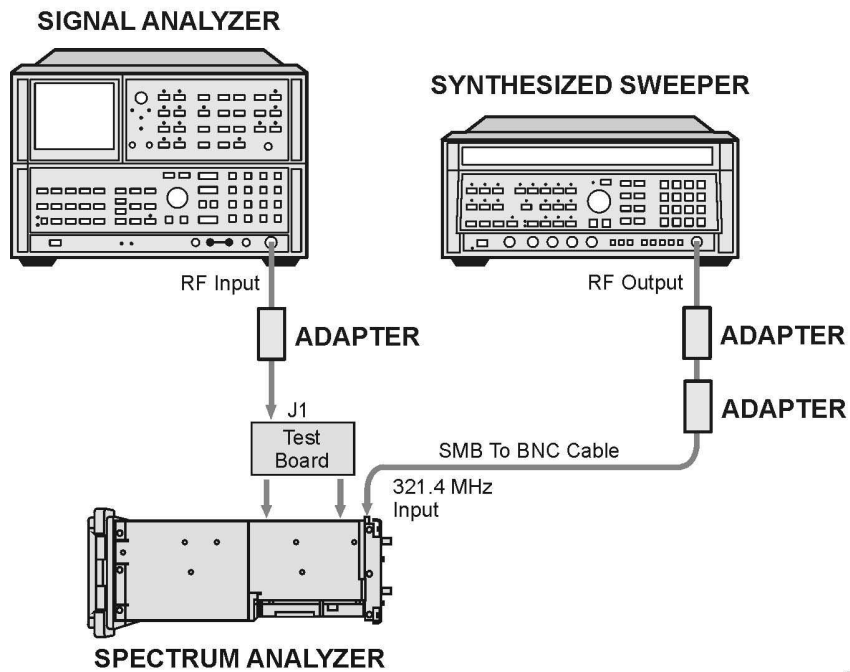
2. Set the synthesized sweeper controls as follows:

CW 321.4 MHz

POWER LEVEL -26 dBm

3. Turn the analyzer **LINE** switch to OFF. Remove the instrument cover assembly.
4. Remove the first IF bandwidth filter assembly, A11.
5. Install the IF test board into the A11 slot.
6. Remove the W9 cable from A9J4, 321.4 MHz IF INPUT.
7. Connect the synthesized sweeper output to A9J4. Refer to [Figure 2-22](#).

Figure 2-22 Second IF Bandpass Filter Adjustment Setup



sh210e

8. Press the analyzer **LINE** switch to ON.
9. Press the following analyzer keys.

PRESET

SPAN, 0, Hz

10. Connect the microwave spectrum analyzer RF INPUT to J1 of the IF test board. Refer to [Figure 2-22](#).
11. Adjust A9C44, A9C46, and A9C47 for maximum signal amplitude as observed on the microwave spectrum analyzer. Adjust the reference level of the microwave spectrum analyzer, as necessary, to display the signal below the top graticule.
12. Remove the test board from the A11 slot and install the A11 bandwidth filter assembly.
13. Reconnect W9 to A9J4, 321.4 MHz INPUT.

If you are adjusting an 8590L Option 713, continue with the “600 MHz Adjustment.”

If you are adjusting an 8591C 8591E, 8593E, 8594E, 8594Q, 8595E, or 8596E, continue with the “LPF, Attenuator and Adapter Insertion Loss Characterization.”

13. Third Converter and Second IF Bandpass

600 MHz Adjustment

14. Set the microwave frequency counter controls as follows:
50 Ω /1 M Ω 50 Ω Impedance
10 Hz–500 MHz/500 MHz–18 GHz . 10 Hz–500 MHz
SAMPLE RATE Midrange
15. Disconnect W8 from A9J5 600 MHz OUT, then connect the microwave frequency counter to A9J5.
16. Adjust A9R68, 600 MHz ADJ, for a frequency of 600 MHz \pm 2 kHz (599.998000 MHz to 600.002000 MHz).
17. Remove the test cable from A9J5, then reconnect W8.
18. Continue with “LPF, Attenuator and Adapter Insertion Loss Characterization.”

LPF, Attenuator and Adapter Insertion Loss Characterization

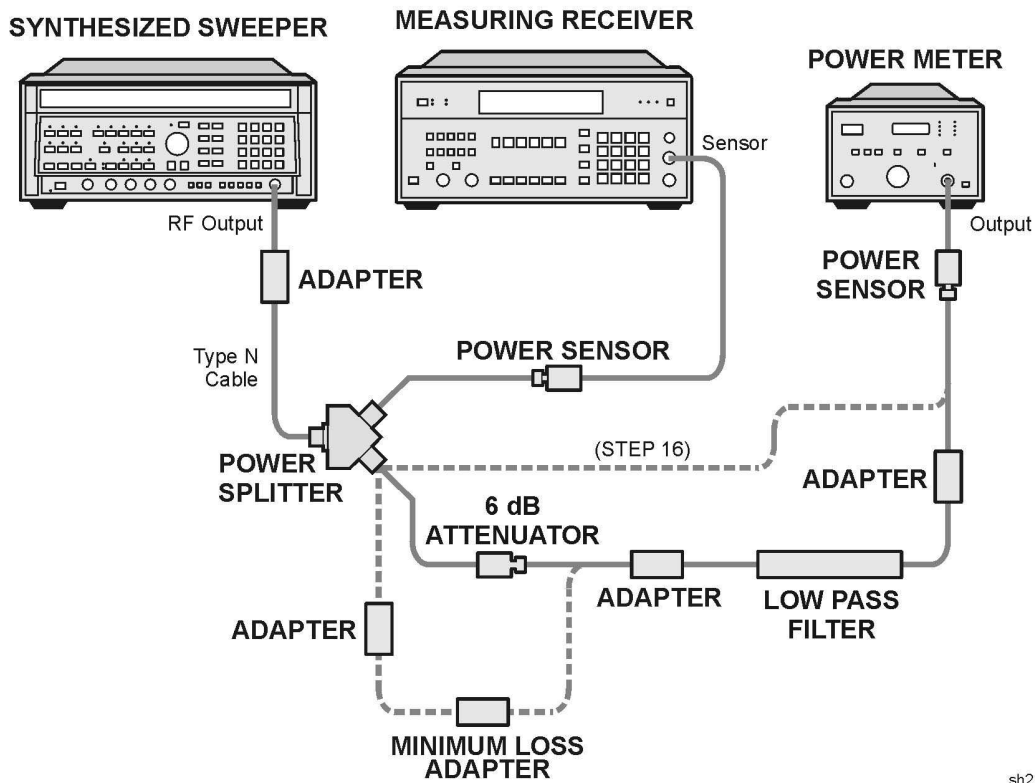
19. Zero and calibrate the measuring receiver and power sensor combination in LOG mode as described in the measuring receiver operation manual.

CAUTION

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

20. Zero and calibrate the power meter and 300 MHz power sensor, as described in the power meter operation manual.
21. Connect the equipment as shown in [Figure 2-23](#). Connect the 300 MHz power sensor directly to the Power Splitter (bypass the LPF, Attenuator and Adapters).

Figure 2-23 LPF Characterization



sh211e

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

CW 300 MHz

POWER LEVEL -15 dBm

23. Allow the power sensors to settle, then on the measuring receiver, press RATIO mode. Power indication should be 0 dB.

24. On the power meter, press the dB REF mode key. Power indication should be 0 dB.

25. Connect the LPF, Attenuator and adapters as shown in [Figure 2-23](#).

26. Record the measuring receiver reading in dB. This is the relative error due to mismatch.

Mismatch Error _____ dB

27. Record the power meter reading in dB. This is the relative uncorrected insertion loss of the LPF, attenuator, and adapters.

Uncorrected Insertion Loss _____ dB

13. Third Converter and Second IF Bandpass

28. Subtract the Mismatch Error (step 22) from the Uncorrected Insertion Loss (step 22). This is the corrected insertion loss.

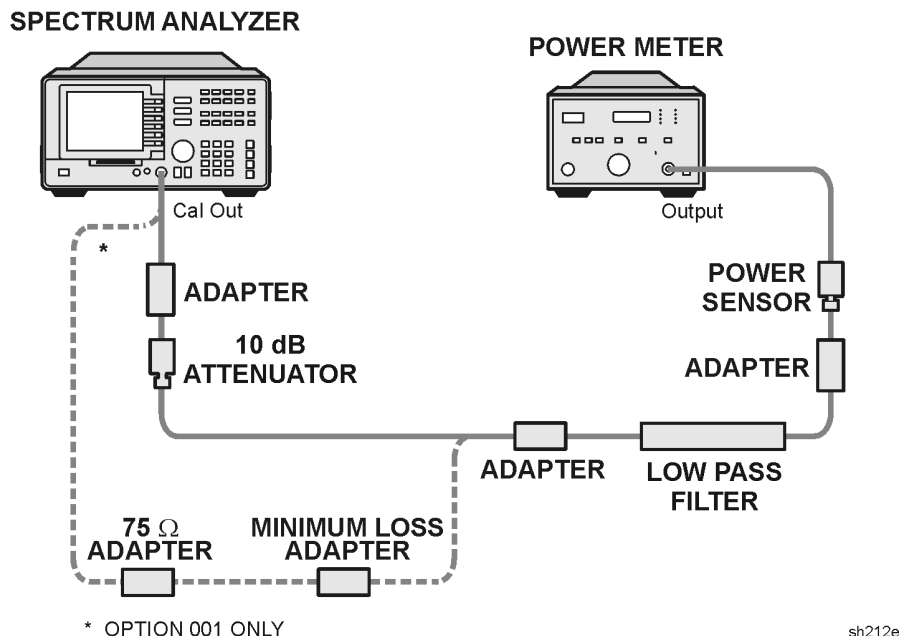
Corrected Insertion Loss _____ dB

For example, if the Mismatch Error is +0.3 dB and the uncorrected Insertion Loss is -10.2 dB, subtracting the mismatch error to the insertion loss gives a corrected reading of -10.5 dB.

300 MHz Calibrator Amplitude Adjustment

29. Connect the equipment as shown in Figure 2-24. The 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 2-24 300 MHz Calibrator Amplitude Accuracy Test Setup



30. On the power meter, press the dBm mode key. Record the power meter reading in dBm.

Power Meter Reading _____ dBm

31. Subtract the Corrected Insertion Loss (step 23) from the power meter reading (step 25) and record as the CAL OUT power. The CAL OUT should be -20 dBm ±0.4 dB.

CAL OUT Power = Power Meter Reading - Corrected Insert Loss

13. Third Converter and Second IF Bandpass

For example, if the Corrected Insertion Loss is -10.0 dBm, and the measuring receiver reading is -30 dBm, then -30 dBm $- (-10.0)$ dBm = -20 dBm.

CAL OUT Power _____ dBm

32. Adjust A9R19 CAL OUT ADJ accordingly if the CAL OUT amplitude is not -20 dBm ± 0.4 dB as calculated in [step 26](#).

14. Comb Generator

This adjustment applies to:

8592L spectrum analyzers

8593E spectrum analyzers

8596E spectrum analyzers

The output signal from the A3A1 comb generator assembly, with the Step Recovery Diode Module (SRD) disconnected, is adjusted for maximum peak-to-peak voltage. A3A1C5 FREQ is centered, and the comb generator frequency is measured with a frequency counter. If the measured frequency is not $100.000 \text{ MHz} \pm 0.0004 \text{ MHz}$, A3A1L3 is selected to bring the frequency within tolerance.

The comb generator signal is adjusted for maximum output power as measured with a measuring receiver (used as a power meter). If the amplitude is not $+26.0 \pm 0.8 \text{ dBm}$, A3A1R6 is selected to bring the amplitude within tolerance.

A3A1C5 FREQ is adjusted for a comb generator frequency of $100.000000 \text{ MHz} \pm 0.000010 \text{ MHz}$ (tolerance of $\pm 10 \text{ Hz}$).

Equipment Required

Oscilloscope

Frequency counter

Measuring receiver (*used as a power meter*)

Power sensor, 300 MHz

Attenuator, 20 dB

Cable, SMA, 90 cm (36 in.)

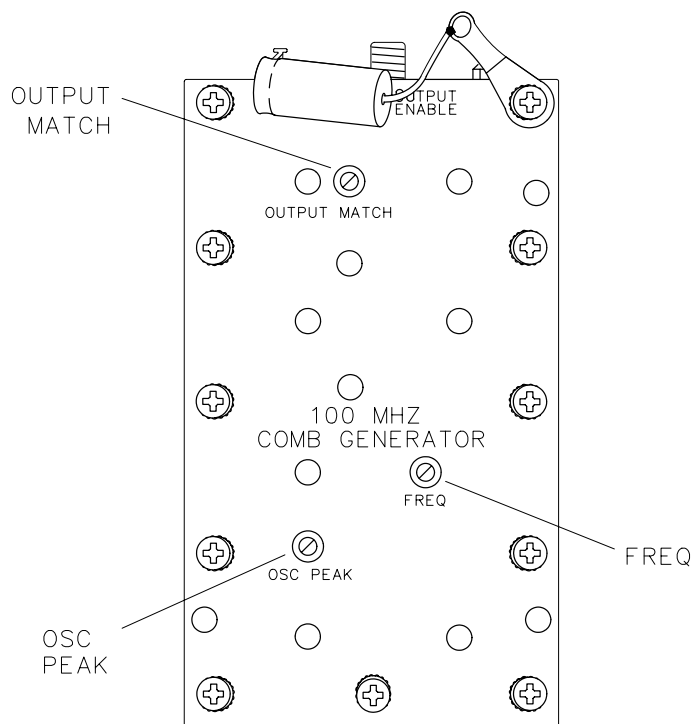
Cable, BMC, 120 cm (48 in.)

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

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

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

Figure 2-25 Comb Generator Adjustment Location



sh213e

Procedure

1. Turn the analyzer **LINE** switch to OFF. Remove the instrument cover assembly.
2. Remove the front-end assembly. Refer to the “Front-End Assembly” removal procedure.
3. Remove the A3A1 comb generator assembly from the front-end assembly and place in a service position, leaving W13 connected to the A7 Analog Interface.
4. Remove W24 from the A3A1J1 comb generator output connector. Connect the SMA cable to A3A1J1. Refer to [Figure 2-25](#).
5. Turn the analyzer **LINE** switch to ON.
6. Press the following analyzer keys.

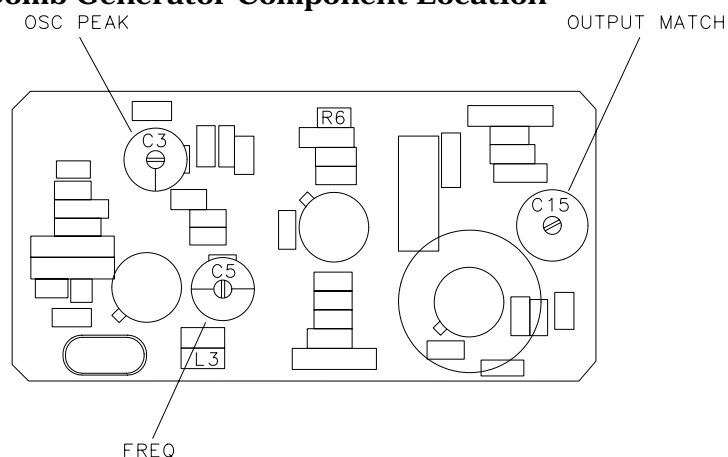
AUX CTRL, COMB GEN ON OFF (ON)

Frequency

7. Connect the other end of the SMA cable to the 20 dB attenuator. Connect the output of the 20 dB attenuator to the 10 Hz to 500 MHz input of the frequency counter using adapters and the BNC cable.
8. Adjust A3A1C5 FREQ for 100.000000 MHz \pm 0.00004 MHz. Refer to [Figure 2-25](#) for adjustment location.
9. Disconnect the BNC cable from the frequency counter and 20 dB attenuator, then connect the BNC cable to CH1 of the oscilloscope. Set the oscilloscope by activating AUTOSCALE, located under the setup key.
10. Adjust both A3A1C15 OUTPUT MATCH and A3A1C3 OSC PEAK for maximum peak-to-peak voltage on the oscilloscope display.
11. Reconnect the BNC cable through the 20 dB attenuator to the frequency counter input. The comb generator frequency must be 100.000000 MHz \pm 0.00004 MHz.
12. Repeat [step 8](#) to [step 11](#) until the frequency is within specification.
13. Perform the following steps only if the comb generator frequency cannot be brought within tolerance with the output power peaked.
 - Set the **LINE** switch to OFF and remove the power cord. Remove the A3A1 comb generator cover plate.
 - Change the selected value of A3A1L3 to obtain an output frequency of 100.000500 MHz \pm 0.004 MHz with A3A1C5 FREQ centered.

Increasing the value of A3A1L3 increases the output frequency of the comb generator. The frequency of the oscillator decreases about 500 Hz when the cover plate is installed. Refer to [Figure 2-26](#) for component location.

Figure 2-26 Comb Generator Component Location



sh214e

- Each time the value of A3A1L3 is changed, reconnect the power cord, set the **LINE** switch to ON, and adjust A3A1C3 OSC PEAK for maximum signal. The output frequency changes when A3A1C3 OSC PEAK is adjusted. Reinstall the comb generator cover plate and repeat [step 8](#) to [step 12](#).

Output Power

14. Zero and calibrate the power sensor/measuring receiver combination in log mode (power reads out in dBm). Enter the power sensor 0.1 GHz cal factor into the measuring receiver.
15. Connect the power sensor to the output of the 20 dB attenuator using an adapter.
16. Adjust A3A1C15 OUTPUT MATCH for maximum power output. The measuring receiver should measure +6 dBm \pm 0.8 dB.
17. If the output power of the comb generator is out of tolerance, perform the following:
 - Set the **LINE** switch to OFF, remove the power cord, and remove the A3A1 comb generator cover plate.
 - Change the selected value of A3A1R6 to obtain an output power reading of +6.0 dBm \pm 0.8 dB. Increasing the value of A3A1R6 decreases the output power of the comb generator, while decreasing the value increases the output power. Refer to [Figure 2-26](#) for component location.
 - Each time the value of A3A1R6 is changed, reconnect the power cord, set the **LINE** switch to ON, and adjust A3A1C16 OUTPUT MATCH for maximum power out.
18. Reinstall the comb generator assembly cover plate and all the screws. Connect a BNC cable from the 20 dB attenuator to the frequency counter input using adapters.
19. Adjust A3A1C5 FREQ for a frequency counter reading of 100.000000 MHz \pm 0.000010 MHz (tolerance of \pm 10 Hz).
20. Set the **LINE** switch to OFF and reconnect W24 to A3A1J1.
21. Reinstall A3A1 comb generator assembly into RF Section. Refer to the A3A1 comb generator assembly replacement procedure.
22. Reinstall the front-end assembly in the analyzer. Refer to the “Front-End Assembly” replacement procedure.

15. Frequency Response of the 8590L, 8591C, and 8591E

This adjustment applies to:

8590L spectrum analyzers

8591E spectrum analyzers

8591C cable TV analyzers

The frequency response (flatness) of the analyzer is measured with the corrections off. The source is adjusted to place the displayed signal at the analyzer center horizontal graticule line.

The flatness data is then entered into the analyzer using the **SERVICE CAL** functions. The error corrections are stored in battery backed RAM on the A16 processor/video assembly.

For analyzers equipped with 75 Ω inputs, the 50 Ω system is characterized before starting the "Frequency Response" adjustment procedure.

Equipment Required

Synthesized sweeper

Measuring receiver (*used as a power meter*)

Frequency synthesizer

Power sensor, 1 MHz to 1.8 GHz

Power splitter

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

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 Inputs

Power meter

Power sensor, 75 Ω

Cable, BNC, 120 cm (48 in) 75 Ω

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

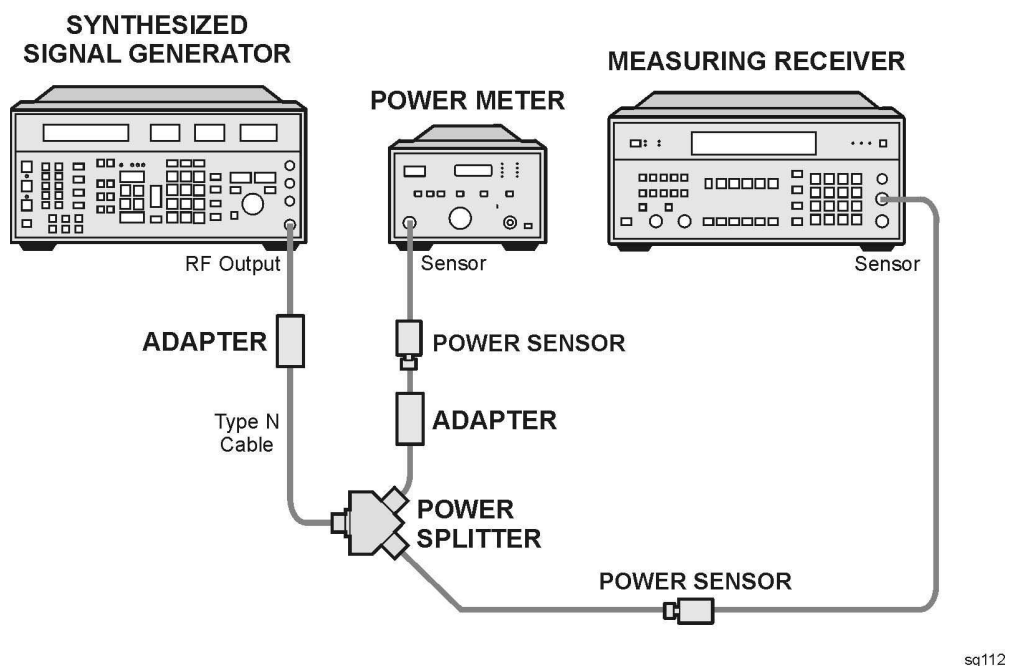
Adapter, Type N (m) to BNC (m), 75 Ω

Procedure for System Characterization (75 Ω input)

1. Zero and calibrate the measuring receiver and 1 MHz to 1.8 GHz power sensor as described in the measuring receiver operation manual.
2. Zero and calibrate the power meter and the 75 Ω power sensor as described in the power meter operation manual.
3. Press INSTRUMENT PRESET on the synthesized sweeper. Set the synthesized sweeper controls as follows:

CW	41 MHz
FREQ STEP	37 MHz
POWER LEVEL	5 dBm
4. Connect the equipment as shown in [Figure 2-27](#).

Figure 2-27 System Characterization Test Setup for 75 Ω inputs



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

5. Adjust the synthesized sweeper POWER LEVEL for a 0 dBm reading on the measuring receiver.
6. Record the power meter reading in Column 4 of [Table 2-6](#), taking into account the cal factors of both power sensors.

15. Frequency Response of the 8590L, 8591C, and 8591E

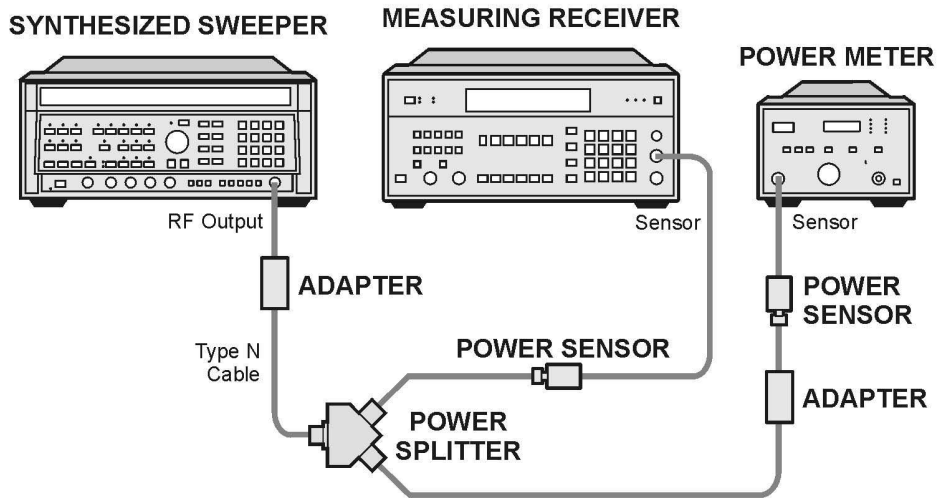
7. On the synthesized sweeper, press CW and STEP UP, to step through the remaining frequencies listed in Table 2-6.

At each new frequency repeat step 5 and step 6, and enter each power sensor cal factor into the respective power meter.

Procedure

1. Zero and calibrate the measuring receiver and 1 MHz to 1.8 GHz power sensor in log mode as described in the measuring receiver operation manual.
2. Connect the equipment as shown in Figure 2-28.

Figure 2-28 Frequency Response Setup



sh233e

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

CW 300 MHz
FREQ STEP 37 MHz
POWER LEVEL -9 dBm

15. Frequency Response of the 8590L, 8591C, and 8591E

4. On the analyzer, press the following keys.

PRESET

CAL, More 1 of 4

CORRECT ON OFF (OFF)

FREQUENCY, 300, MHz

CF STEP AUTO MAN, 37, MHz

SPAN, 12, MHz

75 Ω input: press **AMPLITUDE, More 1 of 2, AMPTD UNITS, dBm**

AMPLITUDE, 10, -dBm

SCALE LOG LIN (LOG), 1, dB

BW, 1, MHz

PEAK SEARCH

MKR FCTN, MK TRACK ON OFF (ON)

5. Adjust the synthesized sweeper POWER LEVEL for a MKR-TRK amplitude reading of $-14 \text{ dBm} \pm 0.1 \text{ dB}$.
6. Press RATIO mode on the measuring receiver.
7. Press the following analyzer keys.

FREQUENCY, 41, MHz

8. Set the synthesized sweeper CW to 41 MHz.
9. Adjust the synthesized sweeper POWER LEVEL for an analyzer MKR-TRK amplitude reading of $-14 \text{ dBm} \pm 0.1 \text{ dB}$.
10. Record the power ratio here and in Column 2 of [Table 2-6](#) for 41 MHz.

Measuring Receiver Reading at 41 MHz _____ dB

11. Press the following analyzer keys.

FREQUENCY, 78, MHz

12. Set the synthesized sweeper CW to 78 MHz.
13. Adjust the synthesized sweeper POWER LEVEL for an analyzer MKR-TRK amplitude reading of $-14 \text{ dBm} \pm 0.1 \text{ dB}$.
14. Record the power ratio displayed on the measuring receiver in Column 2 of [Table 2-6](#) for 78 MHz.

15. Frequency Response of the 8590L, 8591C, and 8591E

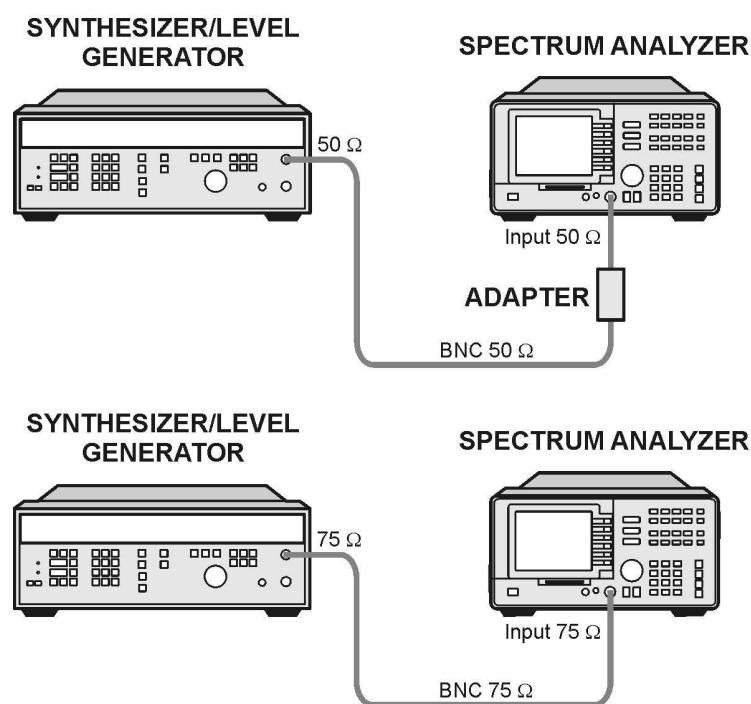
15. On the analyzer, press **FREQUENCY** and \uparrow (step up), to step through the remaining frequencies listed in Column 1 of Table 2-6. At each new frequency repeat step 13 to step 15, entering the power sensor Cal Factor into the measuring receiver as indicated in Column 3 of Table 2-6.

16. On the synthesized sweeper, press CW and STEP UP.

Frequency Response Error At 4 MHz

17. Using a cable, connect the frequency synthesizer directly to the INPUT 50 Ω . See Figure 2-29. For 75 Ω inputs use a 75 Ω cable to connect the frequency synthesizer 75 Ω OUTPUT to the INPUT 75 Ω of the analyzer. Set the frequency synthesizer 50–75 Ω switch to the 75 Ω position. See Figure 2-29.

Figure 2-29 Frequency Response for 4 MHz Setup



sh234e

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

15. Frequency Response of the 8590L, 8591C, and 8591E

18. Set the frequency synthesizer controls as follows:

FREQUENCY 41 MHz
 AMPLITUDE -15 dBm
 AMPTD INCR 0.05 dB

19. Press the following analyzer keys.

MKR, MARKER 1 ON OFF (OFF)
SPAN, 12, MHz
FREQUENCY, 41, MHz
PEAK SEARCH
MKR FCTN, MK TRACK ON OFF (ON)
BW, 10, kHz
SPAN, 100, kHz

Wait for AUTO ZOOM message to disappear.

20. Adjust the frequency synthesizer AMPLITUDE until the MKR-TRK reads -14 dBm. This corresponds to the amplitude at 41 MHz recorded in [step 10](#). Record the frequency synthesizer amplitude here.

AMPLITUDE setting (41 MHz) _____ dBm

21. Set the frequency synthesizer FREQUENCY to 4 MHz.

22. AUTO ZOOM on the 4 MHz signal by pressing the following analyzer keys.

FREQUENCY, 4, MHz
MKR, MKR FCTN, MK TRACK ON OFF (OFF)
FREQUENCY, 4, MHz
SPAN, 12, MHz
PEAK SEARCH, NEXT PK RIGHT
MKR FCTN, MK TRACK ON OFF (ON)
SPAN, 100, kHz

Wait for AUTO ZOOM message to disappear.

15. Frequency Response of the 8590L, 8591C, and 8591E

23. Adjust the frequency synthesizer AMPLITUDE for a MKR amplitude reading of $-14.00 \text{ dBm} \pm 0.05 \text{ dB}$. Record the frequency synthesizer AMPLITUDE setting here.

AMPLITUDE setting (4 MHz) _____ dBm

24. Subtract the frequency synthesizer AMPLITUDE setting (4 MHz) recorded in [step 23](#) from the frequency synthesizer AMPLITUDE setting (41 MHz) recorded in [step 20](#). Record the result as the Amplitude Relative to 41 MHz here.

4 MHz Amplitude Relative to 41 MHz _____ dBm

25. Add the result from [step 24](#) to the reading from [step 10](#) and enter that result in Column 2 of [Table 2-6](#) (*Option 001 only*: Column 5) as the 4 MHz error (relative to 300 MHz).

75 Ω input only: Starting with the error at 41 MHz, add Column 3 (System Error) to Column 2 (Error Relative to 300 MHz) and record the result in Column 5 (Corrected Error Relative to 300 MHz).

Entering Flatness Correction Data

26. Enter the pass code by pressing the following analyzer keys.

PRESET

FREQUENCY, -2001, Hz

75 Ω input only: **AMPLITUDE, More 1 of 2, AMPTD UNITS, dBm**

27. To access the flatness correction menu, press the following analyzer keys.

CAL, More 1 of 4, More 2 of 4

SERVICE CAL

FLATNESS DATA

Perform the next step *only if* all the flatness correction data must be replaced in memory due to the repair or replacement of the A16 processor/video assembly.

28. To initialize the area of memory where the flatness correction data is stored, press the following keys.

INIT FLT

PRESET

FREQUENCY, –2001, Hz

75 Ω input only: **AMPLITUDE**, More 1 of 2, **AMPTD UNITS**, dBm

CAL, More 1 of 4, More 2 of 4

SERVICE CAL

FLATNESS DATA

29. To enter flatness corrections, press **EDIT FLATNESS**.

30. The frequency of the first data point, 4.00 MHz, will be displayed in the active function block of the analyzer display.

31. Use the data keys on the analyzer to enter the amplitude value for 4 MHz from Column 2 of [Table 2-6](#) (*75 Ω input*: Column 5), Frequency Response Errors. Terminate the entry with the **dB** key. When entering negative amplitude values, precede the numeric entry with the – and **dB** keys or the **–dB** key.

The **BK SP** (backspace) key may be used to correct any entry if the terminator, **dB** or **–dB** key has *not* been pressed. Re-enter the data if the terminator has been pressed.

32. Press \uparrow (step-up key) and enter the data from [Table 2-6](#), Column 2 (*75 Ω input*: Column 5) for the next data point as described in [step 30](#).

33. Repeat [step 30](#) for the remaining flatness correction data points listed in [Table 2-6](#).

At each point, verify that the frequency listed in the active function block corresponds to the frequency at which the data was taken. If these two frequencies do not correspond, press \uparrow (step up) or \downarrow (step down) until the proper frequency is displayed in the active function block.

If some data is incorrect after entering all of the data from [Table 2-6](#), select the incorrect data point using \uparrow (step up) or \downarrow (step down) and re-enter the proper data.

34. After all corrections have been input, press the **STORE FLATNESS** softkey to store the correction data in nonvolatile memory. The instrument will automatically preset and display **CAL: DONE** in the active function block of the analyzer.

Table 2-6 Frequency Response Errors

Column 1 Frequency (MHz)	Column 2 Error Relative to 300 MHz (dB)	Column 3 Sensor CAL FACTOR (GHz)	Column 4 (75 Ω inputs) System Error (dB)	Column 5 (75 Ω inputs) Corrected Error Relative to 300 MHz (dB)
4	_____	N/A	N/A	_____
41	_____	0.03	_____	_____
78	_____	0.1	_____	_____
115	_____	0.1	_____	_____
152	_____	0.1	_____	_____
189	_____	0.3	_____	_____
226	_____	0.3	_____	_____
263	_____	0.3	_____	_____
300	_____	0.3	_____	_____
337	_____	0.3	_____	_____
374	_____	0.3	_____	_____
411	_____	0.3	_____	_____
448	_____	0.3	_____	_____
485	_____	0.3	_____	_____
522	_____	0.3	_____	_____
559	_____	1.0	_____	_____
596	_____	1.0	_____	_____
633	_____	1.0	_____	_____
670	_____	1.0	_____	_____
707	_____	1.0	_____	_____
744	_____	1.0	_____	_____
781	_____	1.0	_____	_____
818	_____	1.0	_____	_____
855	_____	1.0	_____	_____
892	_____	1.0	_____	_____

Table 2-6 Frequency Response Errors (Continued)

Column 1 Frequency (MHz)	Column 2 Error Relative to 300 MHz (dB)	Column 3 Sensor CAL FACTOR (GHz)	Column 4 (75 Ω inputs) System Error (dB)	Column 5 (75 Ω inputs) Corrected Error Relative to 300 MHz (dB)
929	_____	1.0	_____	_____
966	_____	1.0	_____	_____
1003	_____	1.0	_____	_____
1040	_____	1.0	_____	_____
1077	_____	1.0	_____	_____
1114	_____	1.0	_____	_____
1151	_____	1.0	_____	_____
1188	_____	1.0	_____	_____
1225	_____	1.0	_____	_____
1262	_____	1.0	_____	_____
1299	_____	1.0	_____	_____
1336	_____	1.0	_____	_____
1373	_____	1.0	_____	_____
1410	_____	1.0	_____	_____
1447	_____	1.0	_____	_____
1484	_____	1.0	_____	_____
1521	_____	1.0	_____	_____
1558	_____	2.0	_____	_____
1595	_____	2.0	_____	_____
1632	_____	2.0	_____	_____
1669	_____	2.0	_____	_____
1706	_____	2.0	_____	_____
1743	_____	2.0	_____	_____
1780	_____	2.0	_____	_____
1817	_____	2.0	_____	_____

16. Frequency Response of the 8592L/94L, 8593E/94E/95E/96E, and 8594Q

This adjustment applies to:

8592L spectrum analyzers

8593E spectrum analyzers

8594E spectrum analyzers

8594L spectrum analyzers

8594Q QAM analyzer

8595E spectrum analyzers

8596E spectrum analyzers

Use the following table to determine which bands are measured and adjusted for your analyzer.

Table 2-7 Analyzer Bands Measured and Adjusted

Analyzer Model	Frequency Range	Bands
8592L	22.0 GHz	0 through 4
8592L (Option 026)	26.5 GHz	0 through 4
(Option 027)	26.5 GHz	0 through 4
8593E	22.0 GHz	0 through 4
8593E (Option 026)	26.5 GHz	0 through 4
(Option 027)	26.5 GHz	0 through 4
8594E	2.9 GHz	0 only
8594L	2.9 GHz	0 only
8594Q	2.9 GHz	0 only
8595E	6.5 GHz	0 and 1
8596E	12.8 GHz	0 through 2

The frequency response (flatness) of the analyzer is measured with corrections off. The source amplitude is adjusted for a marker amplitude reading which is dependent upon the harmonic number of the band being measured. This is necessary since the source and power meter combination does not have sufficient dynamic range to measure the uncorrected frequency response.

The difference between the “target” marker amplitudes is taken into account when calculating the uncorrected flatness. The flatness data is then entered into the analyzer using the **SERVICE CAL** functions. The error corrections are stored in battery backed RAM on the A16 processor/video assembly.

Equipment Required

Synthesized sweeper

Measuring receiver (*used as a power meter*)

Power sensor, 50 MHz to 26.5 GHz

Power sensor, 1 MHz to 2.9 GHz

Power splitter

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

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

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

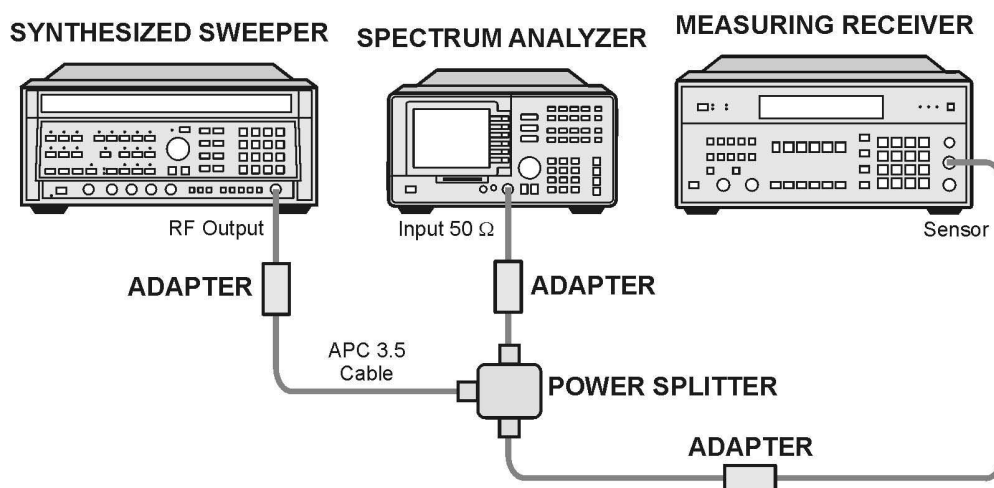
Cable, APC 3.5, 91 cm (36 in.)

Procedure

Measuring Uncorrected Flatness

1. Zero and calibrate the measuring receiver and 1 MHz to 2.9 GHz power sensor in log mode as described in the measuring receiver operation manual.
2. Connect the equipment as shown in [Figure 2-30](#).

Figure 2-30 Frequency Response Setup



sh215e

16. Frequency Response of the 8592L/94L, 8593E/94E/95E/96E, and 8594Q

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

CW 300 MHz
FREQ STEP 72 MHz
POWER LEVEL -3 dBm

4. To enter band 0, press the following analyzer keys.

PRESET

CAL, More 1 of 4

CORRECT ON OFF (OFF)

FREQUENCY, BAND LOCK, 0 - 2.9 Gz BAND 0

(Skip these key presses for the 8594E, 8594L and 8594Q analyzers.)

5. Set the analyzer controls by pressing the following keys.

FREQUENCY, 300, MHz

CF STEP AUTO MAN (MAN), 72, MHz

SPAN, 10, MHz

AMPLITUDE, 0, dBm

SCALE LOG LIN (LOG), 10, dB

BW, 1, MHz

PEAK SEARCH

MKR FCTN, MKR TRACK ON OFF (ON)

6. Adjust the synthesized sweeper POWER LEVEL for a MKR-TRK amplitude reading of -9 dBm \pm 0.1 dB on the analyzer.
7. Press RATIO on the measuring receiver.

Band 0

8. Set the synthesized sweeper CW to 12 MHz.
9. Press the following analyzer keys.

FREQUENCY, 12, MHz

10. Adjust the synthesized sweeper POWER LEVEL for a MKR-TRK amplitude reading of -9 dBm \pm 0.1 dB on the analyzer.
11. Record the power ratio displayed on the measuring receiver in Column 2 of [Table 2-8](#).
12. On the synthesized sweeper, press **CW** and \uparrow (step-up key).

16. Frequency Response of the 8592L/94L, 8593E/94E/95E/96E, and 8594Q

13. On the analyzer, press the following keys.

FREQUENCY, ↑

14. Step through the remaining frequencies listed in [Table 2-8](#). At each new frequency, repeat [step 10](#) to [step 13](#) and enter the appropriate power sensor cal factor into the measuring receiver as listed in Column 3 of [Table 2-8](#).

Adjustment for the 8594E and 8594L spectrum analyzer and 8594Q QAM analyzer is complete. Continue with “Entering Flatness Correction Data” at the end of this adjustment.

Continue with the next step for all other analyzers.

Band 1

15. Replace the 1 MHz to 2.9 GHz power sensor with the 50 MHz to 26.5 GHz power sensor.

16. Calibrate the measuring receiver and 50 MHz to 26.5 GHz power sensor combination in log mode.

17. Set the synthesized sweeper CW to 300 MHz.

18. Press the following analyzer keys.

FREQUENCY, 300, MHz

19. Adjust the synthesized sweeper POWER LEVEL for a MKR-TRK amplitude reading of $-9 \text{ dBm} \pm 0.1 \text{ dB}$ on the analyzer.

20. Press RATIO on the measuring receiver.

21. To enter band 1, press the following analyzer keys.

FREQUENCY, BAND LOCK, 2.75 - 6.4 BAND 1

22. Set the analyzer controls by pressing the following keys.

FREQUENCY, 2.75, GHz

CF STEP AUTO MAN (MAN), 234.9, MHz

SPAN, 10, MHz

BW, 1, MHz

23. Set the synthesized sweeper CW to 2.75 GHz and FREQ STEP to 234.3 MHz.

24. Press the following analyzer keys.

PEAK SEARCH

MKR FCTN, MK TRACK ON OFF (ON)

AMPLITUDE, PRESEL PEAK

16. Frequency Response of the 8592L/94L, 8593E/94E/95E/96E, and 8594Q

25. Adjust the synthesized sweeper POWER LEVEL for a MKR-TRK amplitude reading of $-9 \text{ dBm} \pm 0.1 \text{ dB}$ on the analyzer.
26. Record the power ratio displayed on the measuring receiver in Column 2 of [Table 2-9](#).
27. On the synthesized sweeper, press CW and STEP UP.
28. On the analyzer, press the following keys.

FREQUENCY, ↑

29. Step through the remaining frequencies listed in [Table 2-9](#). At each new frequency, repeat [step 24](#) to [step 28](#) and enter the appropriate power sensor cal factor into the measuring receiver as listed in Column 3 of [Table 2-9](#). Adjustment for the 8595E spectrum analyzer is complete. Continue with “Entering Flatness Correction Data” at the end of the adjustment.

Continue with the next step for all other analyzers.

Band 2

30. To enter band 2, press the following analyzer keys.

FREQUENCY, BAND LOCK, 6.0-12.8 BAND 2

31. Set the analyzer controls by pressing the following keys.

FREQUENCY, 6.2, GHz

CF STEP AUTO MAN (MAN), 184, MHz

SPAN, 10, MHz

BW, 1, MHz

32. Set the synthesized sweeper CW to 6.2 GHz and FREQ STEP to 184 MHz.
33. Press the following analyzer keys.

PEAK SEARCH

MKR FCTN, MK TRACK ON OFF (ON)

AMPLITUDE, PRESEL PEAK

34. Adjust the synthesized sweeper POWER LEVEL for a MKR-TRK amplitude reading of $-15 \text{ dBm} \pm 0.1 \text{ dB}$ on the analyzer.
35. Add 6 dB to the power ratio displayed on the measuring receiver and record the result in [Table 2-11](#).

For example, if the power ratio displayed on the measuring receiver is +2.8 dB, enter 8.8 dB (Error = 2.8 dB + 6.0 dB = 8.8 dB). The 6 dB correction comes from the difference between the MKR-TRK amplitudes set in [step 6](#) (-9 dBm) and [step 34](#) (-15 dBm).

16. Frequency Response of the 8592L/94L, 8593E/94E/95E/96E, and 8594Q

36. On the synthesized sweeper, press CW and STEP UP.

37. Press the following analyzer keys.

FREQUENCY, ↑

38. Step through the remaining frequencies listed in [Table 2-10](#). At each new frequency, repeat [step 33](#) to [step 37](#) and enter the appropriate power sensor cal factor into the measuring receiver as listed in Column 3 of [Table 2-10](#).

Adjustment for the 8596E spectrum analyzer is complete. Continue with “Entering Flatness Correction Data” at the end of this adjustment.

Continue with the next step for all other analyzers.

Band 3

39. To enter band 3, press the following analyzer keys.

FREQUENCY, BAND LOCK, 12.4-19. BAND 3

40. Set the controls of the analyzer by pressing the following keys.

FREQUENCY, 12.45, GHz

CF STEP AUTO MAN, (MAN) 230, MHz

SPAN, 10, MHz

BW, 1, MHz

41. Set the synthesized sweeper CW to 12.45 GHz and FREQ STEP to 230 MHz.

42. Press the following analyzer keys.

PEAK SEARCH

MKR FCTN, MK TRACK ON OFF (ON)

AMPLITUDE, PRESEL PEAK

43. Adjust the synthesized sweeper POWER LEVEL for a MKR-TRK amplitude reading of $-20 \text{ dBm} \pm 0.1 \text{ dB}$ on the analyzer.

44. Add 11 dB to the power ratio displayed on the measuring receiver and record the result in [Table 2-11](#). For example, if the power ratio displayed on the measuring receiver is 6.7 dB, enter 17.7 dB (Error = $6.7 \text{ dB} + 11.0 \text{ dB} = 17.7 \text{ dB}$). The 11 dB correction comes from the difference between the MKR-TRK amplitudes set in [step 6](#) (-9 dBm) and [step 43](#) (-20 dBm).

45. On the synthesized sweeper, press CW and STEP UP.

16. Frequency Response of the 8592L/94L, 8593E/94E/95E/96E, and 8594Q

46. Press the following analyzer keys.

FREQUENCY, ↑

47. Step through the remaining frequencies listed in [Table 2-10](#). At each new frequency, repeat [step 42](#) to [step 46](#) and enter the appropriate power sensor cal factor into the measuring receiver as listed in Column 3 of [Table 2-11](#).

Band 4

48. To enter band 4, press the following analyzer keys.

MKR, MARKERS OFF

SPAN, BAND LOCK, 19.1-22 BAND 4

Option 026 only: 19.1-26.5 BAND 4

49. Set the controls on the analyzer by pressing the following keys.

FREQUENCY, 19.15, GHz

CF STEP AUTO MAN (MAN), 150, MHz

Option 026 only: 148 MHz

SPAN, 5, MHz

BW, 1, MHz

VID BW AUTO MAN (MAN), 300, Hz

50. Set the synthesized sweeper CW to 19.15 GHz and FREQ STEP to 150 MHz (*Option 026: 148 MHz*).

51. Press the following analyzer keys.

PEAK SEARCH

MKR FCTN, MK TRACK ON OFF (ON)

AMPLITUDE, PRESEL PEAK

52. Adjust the synthesized sweeper POWER LEVEL for a MKR-TRK amplitude reading of $-34 \text{ dBm} \pm 0.1 \text{ dB}$ on the analyzer.

53. Add 25 dB to the power ratio displayed on the measuring receiver and record the result in [Table 2-12](#) (*Option 026: Table 2-13*).

For example, if the power ratio displayed on the measuring receiver is -3.4 dB , enter 21.6 dB ($\text{Error} = -3.4 \text{ dB} + 25.0 \text{ dB} = 21.6 \text{ dB}$). The 25 dB correction comes from the difference between the MKR-TRK amplitudes set in [step 6](#) (-9 dBm) and [step 52](#) (-34 dBm).

54. On the synthesized sweeper, press CW and STEP UP.

16. Frequency Response of the 8592L/94L, 8593E/94E/95E/96E, and 8594Q

55. Press the following analyzer keys.

MKR, MARKERS OFF

FREQUENCY, ↑

56. Step through the remaining frequencies listed in [Table 2-12](#) (*Option 026: Table 2-13*). At each new frequency, repeat [step 51](#) to [step 55](#) and enter the appropriate power sensor cal factor into the measuring receiver as listed in Column 2 of [Table 2-12](#) (*Option 026: Table 2-13*).

Adjustment for the 8592L and 8593E spectrum analyzers is complete. Continue with the next step.

Entering Flatness Correction Data

57. Enter the pass code by pressing the following analyzer keys.

PRESET

FREQUENCY, -2001, Hz

58. To access the flatness correction menu, press the following analyzer keys.

CAL, More 1 of 4, More 2 of 4

SERVICE CAL

FLATNESS DATA

CAUTION

The next step will erase all current flatness correction. This step is to be performed *only if* the A16 processor/video assembly has been repaired or replace.

59. Initialize the area of memory where the flatness correction data is stored, by pressing the following keys.

INIT FLT 22 GHz For Option 026, 027 only: Use **INIT FLT 26.5 GHz**

PRESET

FREQUENCY, -2001, Hz

CAL, More 1 of 4, More 2 of 4

SERVICE CAL

FLATNESS DATA

60. Enter the flatness corrections, by pressing **EDIT FLATNESS**.

61. The frequency of the first data point, 12.00 MHz, will be displayed in the active function block of the analyzer display.

16. Frequency Response of the 8592L/94L, 8593E/94E/95E/96E, and 8594Q

62. Use the data keys on the analyzer to enter the amplitude value for 12 MHz from Column 2 of [Table 2-8](#), Frequency Response Errors. Terminate the entry with the **dB** key. When entering negative amplitude values, precede the numeric entry with the **-** and **dB** keys or the **-dB** key.

Note that the **BK SP** (backspace) key may be used to correct any entry if the terminator, **dB** or **-dB** key has *not* been pressed. Re-enter the data if the terminator has been pressed.

63. Press \uparrow (step-up key) and enter the data from Column 2 of the “Frequency Response Errors” tables for the next data point as described in [step 61](#).

64. Repeat [step 62](#) for the remaining flatness correction data points listed in the “Frequency Response Errors” tables. At each point, verify that the frequency listed in the active function block corresponds to the frequency at which the data was taken. If these two frequencies do not correspond, press \uparrow (step up) or \downarrow (step down) until the proper frequency is displayed in the active function block.

If some data is incorrect after entering all of the data from the “Frequency Response Errors” tables, select the incorrect data point using \uparrow (step up) or \downarrow (step down) and re-enter the proper data.

65. After all corrections have been input, press **STORE FLATNESS** to store the correction data in nonvolatile memory. The instrument will automatically preset and display **CAL: DONE** in the active function block of the analyzer.

16. Frequency Response of the 8592L/94L, 8593E/94E/95E/96E, and 8594Q

Table 2-8 Frequency Response Errors

Column 1 Frequency (GHz)	Column 2 Measuring Receiver Reading (dB)	Column 3 CAL FACTOR Frequency (GHz)
Frequency Response Errors Band 0		
0.012	_____	0.05
0.084	_____	0.05
0.156	_____	0.05
0.228	_____	0.05
0.300	_____	0.05
0.372	_____	0.05
0.444	_____	0.05
0.516	_____	0.05
0.588	_____	0.05
0.660	_____	0.05
0.732	_____	0.05
0.804	_____	0.05
0.876	_____	0.05
0.948	_____	0.05
1.020	_____	0.05
1.092	_____	2.0
1.164	_____	2.0
1.236	_____	2.0
1.308	_____	2.0
1.380	_____	2.0
1.452	_____	2.0
1.524	_____	2.0

Table 2-8 **Frequency Response Errors**

Column 1 Frequency (GHz)	Column 2 Measuring Receiver Reading (dB)	Column 3 CAL FACTOR Frequency (GHz)
Frequency Response Errors Band 0		
1.596	_____	2.0
1.668	_____	2.0
1.740	_____	2.0
1.812	_____	2.0
1.884	_____	2.0
1.956	_____	2.0
2.028	_____	2.0
2.100	_____	2.0
2.172	_____	2.0
2.244	_____	2.0
2.316	_____	2.0
2.388	_____	2.0
2.460	_____	2.0
2.532	_____	3.0
2.604	_____	3.0
2.676	_____	3.0
2.748	_____	3.0
2.820	_____	3.0
2.892	_____	3.0
Frequency Response Errors Band 1		
6.100	_____	6.0
6.284	_____	6.0
6.468	_____	6.0
6.652	_____	7.0
6.836	_____	7.0
7.020	_____	7.0
7.204	_____	7.0

16. Frequency Response of the 8592L/94L, 8593E/94E/95E/96E, and 8594Q

Table 2-8 **Frequency Response Errors**

Column 1 Frequency (GHz)	Column 2 Measuring Receiver Reading (dB)	Column 3 CAL FACTOR Frequency (GHz)
Frequency Response Errors Band 1		
7.388	_____	7.0
7.572	_____	8.0
7.756	_____	8.0
7.940	_____	8.0
8.124	_____	8.0
8.308	_____	8.0
8.492	_____	8.0
8.676	_____	9.0
8.860	_____	9.0
9.044	_____	9.0
9.228	_____	9.0
9.412	_____	9.0
9.596	_____	10.0
9.780	_____	10.0
9.964	_____	10.0
10.148	_____	10.0
10.332	_____	10.0
10.516	_____	11.0
10.700	_____	11.0
10.884	_____	11.0
11.068	_____	11.0
11.252	_____	11.0
11.436	_____	11.0
11.620	_____	12.0
11.804	_____	12.0
11.988	_____	12.0
12.172	_____	12.0

Table 2-8 **Frequency Response Errors**

Column 1 Frequency (GHz)	Column 2 Measuring Receiver Reading (dB)	Column 3 CAL FACTOR Frequency (GHz)
Frequency Response Errors Band 1		
12.356	_____	12.0
12.540	_____	13.0
12.724	_____	13.0
Frequency Response Errors Band 2		
6.100	_____	6.0
6.284	_____	6.0
6.468	_____	6.0
6.652	_____	7.0
6.836	_____	7.0
7.020	_____	7.0
7.204	_____	7.0
7.388	_____	7.0
7.572	_____	8.0
7.756	_____	8.0
7.940	_____	8.0
8.124	_____	8.0
8.308	_____	8.0
8.492	_____	8.0
8.676	_____	9.0
8.860	_____	9.0
9.044	_____	9.0
9.228	_____	9.0
9.412	_____	9.0
9.596	_____	10.0
9.780	_____	10.0
9.964	_____	10.0
10.148	_____	10.0

16. Frequency Response of the 8592L/94L, 8593E/94E/95E/96E, and 8594Q

Table 2-8 Frequency Response Errors

Column 1 Frequency (GHz)	Column 2 Measuring Receiver Reading (dB)	Column 3 CAL FACTOR Frequency (GHz)
Frequency Response Errors Band 2		
10.332	_____	10.0
10.516	_____	11.0
10.700	_____	11.0
10.884	_____	11.0
11.068	_____	11.0
11.252	_____	11.0
11.436	_____	11.0
11.620	_____	12.0
11.804	_____	12.0
11.988	_____	12.0
12.172	_____	12.0
12.356	_____	12.0
12.540	_____	13.0
12.724	_____	13.0
Frequency Response Errors Band 3		
12.450	_____	12.0
12.680	_____	13.0
12.910	_____	13.0
13.140	_____	13.0
13.370	_____	13.0
13.600	_____	14.0
13.830	_____	14.0
14.060	_____	14.0
14.290	_____	14.0
14.520	_____	15.0
14.750	_____	15.0
14.980	_____	15.0

Table 2-8 **Frequency Response Errors**

Column 1 Frequency (GHz)	Column 2 Measuring Receiver Reading (dB)	Column 3 CAL FACTOR Frequency (GHz)
Frequency Response Errors Band 3		
15.210	_____	15.0
15.440	_____	15.0
15.670	_____	16.0
15.900	_____	16.0
16.130	_____	16.0
16.360	_____	16.0
16.590	_____	17.0
16.820	_____	17.0
17.050	_____	17.0
17.280	_____	17.0
17.510	_____	18.0
17.740	_____	18.0
17.970	_____	18.0
18.200	_____	18.0
18.430	_____	18.0
18.660	_____	19.0
18.890	_____	19.0
19.120	_____	19.0
19.350	_____	19.0
Frequency Response Errors Band 4		
19.150	_____	19.0
19.300	_____	19.0
19.450	_____	19.0
19.600	_____	20.0
19.750	_____	20.0
19.900	_____	20.0
20.050	_____	20.0

16. Frequency Response of the 8592L/94L, 8593E/94E/95E/96E, and 8594Q

Table 2-8 **Frequency Response Errors**

Column 1 Frequency (GHz)	Column 2 Measuring Receiver Reading (dB)	Column 3 CAL FACTOR Frequency (GHz)
Frequency Response Errors Band 4		
20.200	_____	20.0
20.350	_____	20.0
20.500	_____	20.0
20.650	_____	21.0
20.800	_____	21.0
20.950	_____	21.0
21.100	_____	21.0
21.250	_____	21.0
21.400	_____	21.0
21.550	_____	22.0
21.700	_____	22.0
21.850	_____	22.0
22.000	_____	22.0
Frequency Response Errors Band 4 (<i>Option 026</i>)		
19.100	_____	19.0
19.248	_____	19.0
19.396	_____	19.0
19.544	_____	20.0
19.692	_____	20.0
19.840	_____	20.0
19.988	_____	20.0
20.136	_____	20.0
20.284	_____	20.0
20.432	_____	20.0
20.580	_____	21.0
20.728	_____	21.0
20.876	_____	21.0

Table 2-8 **Frequency Response Errors**

Column 1 Frequency (GHz)	Column 2 Measuring Receiver Reading (dB)	Column 3 CAL FACTOR Frequency (GHz)
Frequency Response Errors Band 4 (<i>Option 026</i>)		
21.024	_____	21.0
21.172	_____	21.0
21.320	_____	21.0
21.468	_____	21.0
21.616	_____	22.0
21.764	_____	22.0
21.912	_____	22.0
22.060	_____	22.0
22.208	_____	22.0
22.356	_____	22.0
22.504	_____	23.0
22.652	_____	23.0
22.800	_____	23.0
22.948	_____	23.0
23.096	_____	23.0
23.244	_____	23.0
23.392	_____	23.0
23.540	_____	24.0
23.688	_____	24.0
23.836	_____	24.0
23.984	_____	24.0
24.132	_____	24.0
24.280	_____	24.0
24.428	_____	24.0
24.576	_____	25.0
24.724	_____	25.0
24.872	_____	25.0

16. Frequency Response of the 8592L/94L, 8593E/94E/95E/96E, and 8594Q

Table 2-8 **Frequency Response Errors**

Column 1 Frequency (GHz)	Column 2 Measuring Receiver Reading (dB)	Column 3 CAL FACTOR Frequency (GHz)
Frequency Response Errors Band 4 (<i>Option 026</i>)		
25.020	_____	25.0
25.168	_____	25.0
25.316	_____	25.0
25.464	_____	25.0
25.612	_____	26.0
25.760	_____	26.0
25.908	_____	26.0
26.056	_____	26.0
26.204	_____	26.0
26.352	_____	26.5
26.500	_____	26.5

17. Time and Date

This adjustment applies to:

All 8590 E-Series and L-Series spectrum analyzers

8591C cable TV analyzers

8594Q QAM analyzers

The time and date are displayed in the top left corner of the display when the timedate mode is activated. The time and date are changed using the front-panel keys.

Procedure

1. To turn the time and date ON or OFF, press the following analyzer keys.

CONFIG

TIMEDATE

TIMEDATE ON OFF (ON) or (OFF) as desired

The time and date will be displayed in the top-left corner with ON underlined.

2. The time and date may be displayed as month, day, and year (MDY) or as day, month, and year (DMY). To change the display, press the following analyzer keys.

CONFIG

TIMEDATE

DATEMODE MDY DMY (MDY) or (DMY) as desired

3. To change the date, press the following analyzer keys.

CONFIG

TIMEDATE

SET DATE

The active function block of the analyzer will display YYMMDD (year, month, and day). Use the data keys on the analyzer to enter the correct date as YYMMDD. Terminate the entry with one of the **ENTER** data keys.

To change the time, press the following analyzer keys.

CONFIG

TIMEDATE

SET TIME

The active function block of the analyzer will display HHMMSS (hours, minutes, and seconds). Use the data keys on the analyzer to enter the correct time as HHMMSS. Terminate the entry with an **ENTER** data key.

18. Modulator Offset and Gain for Option 010 or 011

This adjustment applies to:

8590L spectrum analyzers, Option 010 or 011

8591E spectrum analyzers, Option 010 or 011

8591C cable TV analyzers, Option 011

The gain and offset of the modulator is adjusted with the internal Automatic Level Control disabled. The modulator test point on the A7A1 tracking generator control assembly is multiplexed onto test point A7TP2 located on the A7 Analog Interface assembly. This is done by executing the command MOD_TP in screen title mode.

Equipment Required

Digital multimeter (DMM)

DMM test leads

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

Cable, BNC, 50 Ω

Additional Equipment for Option 011

Cable, BNC, 75 Ω

Procedure

1. Switch the analyzer on and let it warm up 30 minutes.
2. Connect the BNC cable to the analyzer CAL OUT to the RF INPUT connector.

CAUTION

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

3. Press **PRESET**, then perform the CAL AMPTD and CAL FREQ adjustment routines. Refer to “CAL AMPTD Adjustment Routine” and “CAL FREQ Adjustment Routine” procedures.

It is normal for FREQ UNCAL to appear on the display. This will disappear after the CAL routines are finished.

Note that if the display shows **CAL SIGNAL NOT FOUND**, the routines default settings are not sufficient to find the signal. Press **FREQ**, **-37, Hz** before performing the CAL routines. This causes the routines to bypass the CAL signal check.

4. Press **CAL STORE** on the analyzer.

CAUTION

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

5. Connect the analyzer RF OUT to the RF INPUT using a BNC cable and adapters.
6. Perform the tracking generator self-cal routine by pressing the following analyzer keys.

CAL, More 1 of 4, More 2 of 4, CAL TRK GEN

Wait for the completion of the routine (less than 1 minute).

7. Press **CAL STORE**.
8. Press **PRESET**, then wait for preset routine to finish. Set the analyzer by pressing the following keys.

FREQUENCY, 300, MHz

SPAN, 0, Hz

75 Ω only: Press **AMPLITUDE, More 1 of 2, AMPTD UNITS, dBm**.

Set the analyzer reference level to +12 dBm.

9. Press the following analyzer keys.

AUX CTRL, TRACK GENSRC PWR ON OFF (ON)

CAL, More 1 of 4, More 2 of 4

SERVICE DIAG, More 1, More 2, More 3, More 4, More 5

ALC TEST

This breaks the ALC loop, causing **TG UNLVL** to appear on the screen; this is normal.

10. Connect the ground (-) lead of the DMM to A7TP1. Connect the positive (+) lead to A7TP2.
11. Adjust A7A1R43 and A7A1R49 fully clockwise.
12. Connect the MOD_TP test point, located on the A7A1 tracking generator control assembly, to A7TP2 by pressing **DISPLAY, CHANGE TITLE**, then type in the following:

DET TGMOD;

18. Modulator Offset and Gain for Option 010 or 011

13. Press the following analyzer keys to execute the screen title command.

CAL, More 1 of 4, More 2 of 4

SERVICE CAL

EXECUTE TITLE

Note that TGMOD should appear in the upper-left screen annotation below REF.

14. Press the following analyzer keys.

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

AUX CTRL, TRACK GEN, SRC PWR ON OFF (ON)

15. Adjust the front-panel knob for $0.0\text{ V} \pm 0.01\text{ V}$ on the DMM, then press the following keys.

TRACE, CLEAR WRITE A, More 1 of 3, DETECTOR SAMPL PK (PK)

MKR, MARKER Δ

16. Adjust A7A1R49 so that the MKR reading drops approximately 0.1 to 0.15 dB.

17. Press the following analyzer keys.

MKR, MARKER Δ , MARKER Δ

CAL, More 1 of 4, More 2 of 4, SERVICE CAL, EXECUTE TITLE

AMPLITUDE, SCALE LOG LIN (LOG) 10 dB

AUX CTRL, TRACK GEN, SRC PWR ON OFF (ON)

18. Adjust the front-panel knob for $-1.0\text{ V} \pm 0.01\text{ V}$ measured with the DMM, then press the following analyzer keys.

TRACE, CLEAR WRITE A, More 1 OF 4, DETECTOR SAMPL PK (PK)

19. Adjust A7A1R43 so that the MARKER DELTA reading is $-33\text{ dB} \pm 0.5\text{ dB}$.

20. Press **PRESET**, then wait for the preset routine to finish.

21. Perform the tracking generator self-cal routine by pressing the following analyzer keys.

CAL, More 1 of 4, More 2 of 4, CAL TRK GEN

Wait for the completion of the routine (less than 1 minute).

22. Press **CAL STORE**.

19. Entering External ALC Correction Constants for Option 010 or 011

This adjustment applies to:

8590L spectrum analyzers, Option 010 or 011

8591E spectrum analyzers, Option 010 or 011

8591C cable TV analyzers, Option 011

External automatic level control (ALC) operation is corrected by entering the correction constants (CALTGX slope and offset) into analyzer memory using the EXECUTE TITLE function.

Correction constants that pertain to each tracking generator are developed at the factory. The two constants are recorded on a label which is located on the A7A1 tracking generator control board assembly.

Equipment Required

No equipment is required for this procedure.

Procedure

1. Record the CAL TGX slope and offset numbers (located on the A7A1 assembly) below.

Slope = _____

Offset = _____

2. Press the following analyzer keys: **DISPLAY**, **CHANGE TITLE**, **More 1 of 2**.
3. Enter the CALTGX slope and offset correction constants in the format CALTGX *slope, offset*. For example, a slope of 0.3079 and an offset of 3095 would be entered as:

CALTGX 0.3079,3095;

19. Entering External ALC Correction Constants for Option 010 or 011

4. Press the following analyzer keys.

CAL, More 1 of 4, More 2 of 4, SERVICE CAL

EXECUTE TITLE CAL, More 1 of 4, More 2 of 4,

SERVICE DIAG, DISPLAY CAL DATA, NEXT PAGE

Verify that the XSLOP and XOFST values are the same as you entered in [step 3](#).

5. Perform the "Checking the External ALC for Option 010 or 011" procedure.

20. Checking the External ALC for Option 010 or 011

This adjustment applies to:

8590L spectrum analyzers, Option 010 or 011

8591E spectrum analyzers, Option 010 or 011

8591C cable TV analyzers, Option 011

External automatic level control (ALC) operation is verified by measuring the power necessary to level the tracking generator at a source power of 0 dBm and -34 dBV. There are no specifications for this adjustment. The limit set for verification is ± 0.75 dBV.

Note that if the analyzer does not pass this procedure, or if the factory correction constants are not available, perform the "Correcting for External ALC Error for Option 010 or 011" procedure in this chapter.

Equipment Required

Digital multimeter (DMM)

Power meter

Power sensor, 1 MHz to 350 MHz

Cable, BNC (m) to dual banana plug

Cable, BNC, 122 cm (48 in)

Cable, BNC, 23 cm (9 in)

Adapter, BNC Tee

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

Additional Equipment for Option 011

Power sensor, 75 Ω

Cable, BNC, 75 Ω

Adapter, 75 Ω , Type N (f) to BNC (m)

Procedure

1. Switch the analyzer on and let it warm up 30 minutes.
2. Connect the analyzer CAL OUT to the RF INPUT.

CAUTION

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

3. Press **PRESET**, then perform the CAL FREQ and CAL AMPTD adjustment routines. Refer to “CAL FREQ Adjustment Routine” and “CAL AMPTD Adjustment Routine” procedures.

It is normal for FREQ UNCAL to appear on the display. This will disappear after the CAL routines are finished.

Note that if the display shows CAL SIGNAL NOT FOUND, the routines default settings are not sufficient to find the signal. Press **FREQ**, **-37**, **Hz** before performing the CAL routines. This causes the routines to bypass the CAL signal check.

4. Press **CAL STORE** on the analyzer.
5. Connect a BNC cable from the RF INPUT to the RF OUTPUT.
6. Press **PRESET**, then wait for preset routine to finish.
7. Perform the tracking generator self-cal routine by pressing the following analyzer keys.

CAL, More 1 of 4, More 2 of 4, CAL TRK GEN

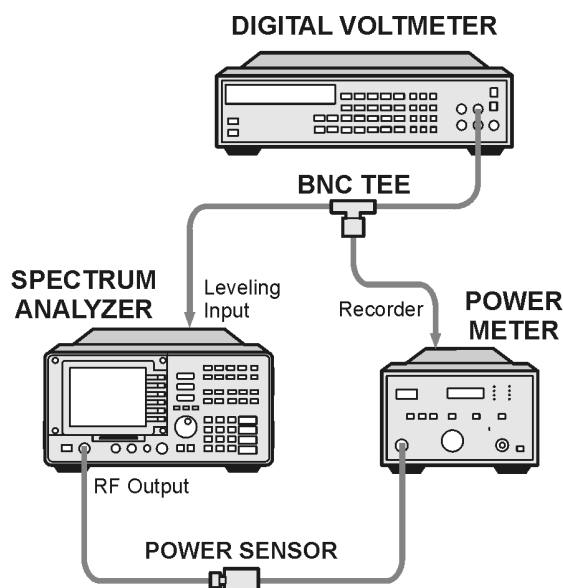
Wait for the completion of the routine (less than 1 minute).

8. Press **CAL STORE**.
9. Zero and calibrate the power meter and power sensor as described in the power meter operation manual.

CAUTION

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

Figure 2-31 External ALC Verification Adjustment



sh231e

10. Connect the equipment as shown in Figure 2-31. For Option 011 only: Use the 75 Ω power sensor with an adapter, instead of the 50 Ω power sensor.

75 Ω input only: Press **AMPLITUDE**, **More 1 of 2**, **AMPTD UNITS**, **dBm**.

11. Set the DMM to measure dc volts.

12. Set the analyzer by pressing the following keys.

FREQUENCY, 300, **MHz**

SPAN, 0, **Hz**

AUX CTRL, **TRACK GEN**, **SRC PWR ON OFF** (ON), 2, **-dBm**.

13. Ensure that the power meter reads -2 ± 2 dB, then press **RANGE HOLD** on the power meter.

14. On the analyzer, press **More 1 OF 2**, **ALC MTR INT XTAL** (MTR).

15. Adjust the SRC PWR for 0 dBV by turning the front-panel knob on the analyzer. Note that the display will read the power dBm.

16. Note the voltage on the DMM. This is the error at source power 0 dBV. Record the automatic leveling control (ALC) voltage in the space provided.

ALC voltage at 0 dBV # = _____ volts dc

Making Adjustments

20. Checking the External ALC for Option 010 or 011

17. Convert the ALC voltage recorded in the previous step to dBV using the following equation.

$$\text{ALC Voltage in dBV} = \text{_____} 20 \log (V)$$

The calculated ALC voltage, in dBV, should be ≥ -0.75 dBV and $\leq +0.75$ dBV.

18. Adjust the SRC PWR to -34 dBV using the front-panel knob. (Display reads -34 dBm.)

19. Note the voltage on the DMM. Wait until the reading stabilizes before recording it in the space provided. This is the error at a source power of -34 dBV.

$$\text{ALC voltage at } -34 \text{ dBV} = \text{_____} \text{ volts dc}$$

20. Convert the ALC voltage recorded in the previous step using the following equation.

$$\text{ALC voltage in fBV} = 20 \log (V)$$

The calculated ALC voltage, in dBV, should be greater than or equal to -34.75 dBV and less than or equal to -33.25 dBV.

21. Correcting for External ALC Error for Option 010 or 011

This adjustment applies to:

8590L spectrum analyzers, Option 010 or 011

8591E spectrum analyzers, Option 010 or 011

8591C cable TV analyzers, Option 011

External automatic level control (ALC) operation is corrected by developing two correction constants (CALTGX Slope and Offset).

This procedure is only necessary if the "Checking the External ALC for Option 010 or 011" procedure does not pass, or if the factory correction constants are not available.

Equipment Required

Digital multimeter (DMM)

Power meter

Power sensor, 1 MHz to 350 MHz

Cable, BNC (m) to dual banana plug

Adapter, BNC Tee

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

Cable, BNC, 122 cm (48 in)

Cable, BNC, 32 cm (9 in)

Additional Equipment for Option 011

Power sensor, 75 Ω

Cable, BNC, 75 Ω

Adapter, 75 Ω Type N (f) to BNC (m)

Procedure

1. Connect a BNC cable from the RF INPUT to the RF OUTPUT.

CAUTION

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

2. Press **PRESET**, then wait for preset routine to finish.
3. Perform the tracking generator self-cal routine by pressing the following analyzer keys.

CAL, More 1 of 4, More 2 of 4, CAL TRK GEN

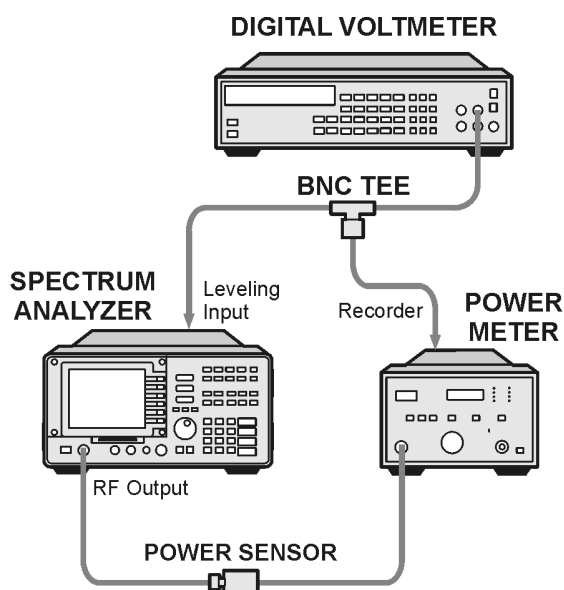
Wait for the completion of the routine (less than 1 minute).

4. Press **CAL STORE**.
5. Zero and calibrate the power meter and power sensor as described in the power meter operation manual.

CAUTION

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

Figure 2-32 External ALC Error Correction Adjustment



sh231e

21. Correcting for External ALC Error for Option 010 or 011

6. Connect the equipment as shown in [Figure 2-32](#). *For Option 011 only:* Use the 75 Ω power sensor with an adapter, instead of the 50 Ω power sensor.

Option 011 only: Press **AMPLITUDE, More 1 of 2, AMPTD UNITS, dBm**.

7. Set the DMM to measure dc volts.

CAUTION

The default values must be entered first for the correction procedure to be successful.

8. Load the default correction constants for Slope and Offset into nonvolatile memory by performing the following steps.

- a. Press the following analyzer keys.

DISPLAY, CHANGE TITLE

- b. Enter the following screen title.

CALTGX 0.3079,3095;

- c. Press the following analyzer keys.

**CAL, More 1 OF 4, More 2 OF 4, SERVICE CAL, EXECUTE TITLE
CAL, More 1 OF 4, More 2 OF 4, SERVICE DIAG, NEXT PAGE**

Verify that the XSLOP and XOFST values are the same as you entered in the previous step.

9. Set the analyzer by pressing the following keys.

FREQUENCY, 300, MHz

SPAN, 0, Hz

AUX CTRL, TRACK GEN, SRC PWR ON OFF (ON), 2, -dBm.

10. Ensure that the power meter reads -2 ± 2 dBm. Press **RANGE HOLD** on the 436A Power Meter.

11. On the analyzer, press **More 1 OF 2, ALC MTR INT XTAL** (until MTR is underlined).

12. Adjust the SRC PWR for 0 dBV as read on the analyzer display. Note that the display will read the power in dBm.

13. Note the voltage on the DMM. Wait until the reading stabilizes before recording it in the space provided. This is the ALC voltage at a source power of 0 dBV (V_{High}).

$V_{\text{High}} = \underline{\hspace{2cm}}$ volts dc

Making Adjustments

21. Correcting for External ALC Error for Option 010 or 011

14. Adjust the SRC PWR for -34 dBV as read on the analyzer display.
15. Note the voltage on the DMM. Wait until the reading stabilizes before recording it in the space provided. This is the ALC voltage at a source power of -34 dBV (V_{Low}).

$$V_{Low} = \text{_____} \text{ volts dc}$$

16. Calculate the actual slope from the two voltage measurements using the following equation.

$$\text{Slope} = \frac{10.47}{20 \times \log \frac{V_{High}}{V_{Low}}}$$

$$\text{Slope} = \text{_____}$$

For example, if V_{High} is 0.949V and V_{Low} is 0.019V, then the slope is 10.47 divided by 33.97, or 0.3082.

17. Calculate the offset from the calculated slope value ([step 16](#)) and the measured V_{High} ([step 13](#)) using the following equation.

$$\text{Offset} = 3095 - (\text{Slope} \times 2000 \times \log(V_{High}))$$

$$\text{Offset} = \text{_____}$$

For example, given the same V_{High} and V_{Low} values as listed in the slope example.

$$\text{Offset} = 3095 - 0.3082 \times -45.47$$

$$\text{Offset} = 3095 - (-14.01)$$

$$\text{Offset} = 3109$$

18. Enter the calculated Slope and Offset correction constants into nonvolatile memory using the TITLE mode as previously described in [step 9](#).
19. Perform the "Checking the External Leveling" procedure to ensure correct operation.

22. First LO Distribution Amplifier for Option 009 or 010

This adjustment applies to:

8593E spectrum analyzers, Option 009 or 010

8594E spectrum analyzers, Option 009 or 010

8595E spectrum analyzers, Option 009 or 010

8596E spectrum analyzers, Option 009 or 010

The gate bias for the A3A14 LO distribution amplifier assembly is adjusted to the value specified on a label on the RF section. The LO power is adjusted so that the LO SENSE voltage is equal to the value specified on the label. The adjustments are made on the A10 tracking generator control assembly, which is located in the card cage.

Equipment Required

Measuring receiver

Digital multimeter

Power sensor

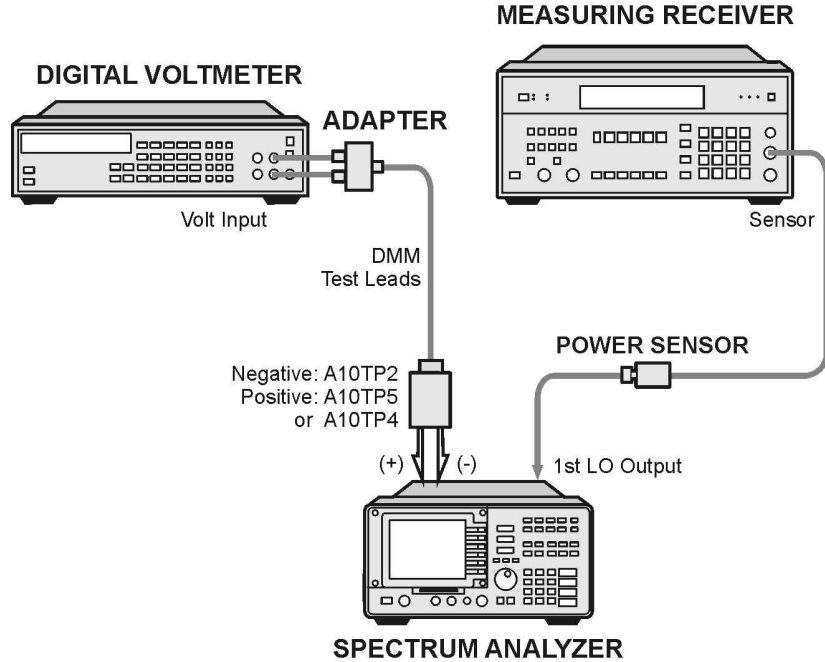
DMM test leads

Adapter, dual banana plug

Procedure

1. Set the analyzer **LINE** switch to off, then disconnect the line cord. Remove the cover assembly, then reconnect the line cord.
2. Remove the 50 Ω termination from the analyzer rear-panel LO OUTPUT connector.
3. Connect the positive DMM test lead to A10TP5, GB (gate bias). Connect the negative DMM test lead to A10TP2, AGND (analog ground). See [Figure 2-33](#).

Figure 2-33 First LO Distribution Amplifier Adjustment Setup



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4. Set the digital voltmeter controls as follows:
 - FUNCTION DC VOLTS
 - RANGE 10 V
 - RESOLUTION 1 mV
5. Set the analyzer **LINE** switch to on.
6. Adjust A10R29 (GATE) for a digital voltmeter reading within 5 mV of the GATE (gate bias) voltage printed on the RF section label.
7. Zero and calibrate the measuring receiver and power sensor in LOG mode. (Power levels read in dBm.) Enter the power sensor's 5 GHz cal factor into the measuring receiver.
8. Connect the power sensor to the analyzer LO OUTPUT.
9. On the analyzer, press **PRESET, SPAN, ZERO SPAN, FREQUENCY, 300, MHz.**
10. Connect the positive DMM test lead to A10TP4, LOS (LO sense).
11. Note the SENS (LO sense) voltage printed on the RF section label. Adjust A10R25, LO AMP (LO power), until the DMM reads equal to the SENS voltage printed on the RF section label.

12. Check that the measuring receiver power level reads greater than +12 dBm.
13. Disconnect the power sensor from LO OUTPUT, then reconnect the 50 Ω termination to LO OUTPUT.
14. Disconnect the DMM leads from A10TP4 and A10TP2.

23. BITG Power Level for Option 010

This adjustment applies to:

8593E spectrum analyzers, Option 010

8594E spectrum analyzers, Option 010

8595E spectrum analyzers, Option 010

8596E spectrum analyzers, Option 010

The BITG has two adjustments for setting the output power. The -10 dB ADJ (A3A15R13) sets the power level when the source power level is set to -10 dBm, and the 0 dB ADJ (A3A15R18) sets the power level when the source power level is set to 0 dBm. The -10 dB ADJ acts as an offset adjustment, while 0 dB ADJ acts as a gain adjustment.

These adjustments are set in the factory for a 10 dB difference in output power between the -10 dBm and 0 dBm source power level settings. When installing a replacement BITG, it should only be necessary to adjust -10 dB ADJ (the offset adjustment) to account for variations in cable loss from the BITG to the RF OUT 50 Ω connector. This adjustment is done at a 0 dBm source power level setting. This ensures that the absolute power level with a 0 dBm source power level setting is 0 dBm, with little or no affect on the vernier accuracy.

In some cases, the power level at the -10 dBm source power level setting might be out of tolerance. In such cases, the -10 dB ADJ is set at a source power level setting of -10 dBm and the 0 dB ADJ is set at a source power level setting of 0 dBm. These two adjustments must be repeated until the power level at the two settings are within the given tolerances.

Equipment Required

Measuring receiver

Power sensor, 1 MHz to 350 MHz

Cable, Type N, 62 cm (24 in.)

Additional Equipment for Option 026

Adapter, Type APC-3.5 (f) to APC-3.5 (f) (two)

Procedure

1. Set the analyzer **LINE** switch to off. Disconnect the line cord. Remove the cover assembly, then reconnect the line cord.
2. Set the analyzer AOFST by pressing the following keys.

PRESET

FREQUENCY, -2001, Hz

CAL, More 1 of 4, More 2 of 4, DEFAULT CAL DATA

CAL, More 1 of 4, More 2 of 4

SERV DIAG, DISPLAY CAL DATA, NEXT PAGE

Verify that AOFST=0 under the tracking generator readouts.

3. Connect the cable between the RF OUT 50 Ω and INPUT 50 Ω connectors on the analyzer.
4. Press **PRESET** on the analyzer and set the controls as follows:

CENTER FREQ 300 MHz

SPAN 0 Hz

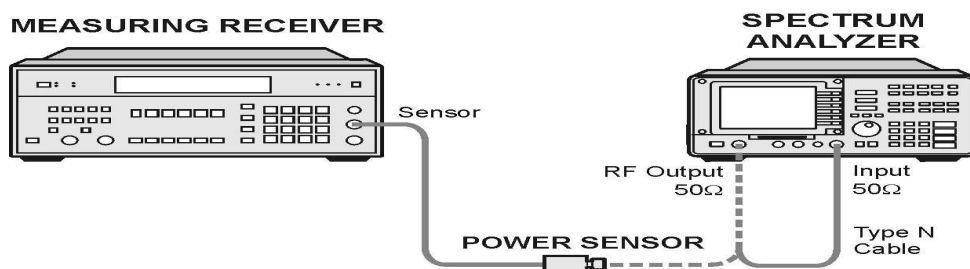
5. On the analyzer, press the following keys.

BW, 10, kHz

AUX CTRL, TRACK GEN, SRC PWR ON OFF (ON), 10, -dBm

6. On the analyzer, press **TRACKING PEAK**. Wait for the **PEAKING** message to disappear.
7. Zero and calibrate the measuring-receiver/power-sensor combination in log mode (power levels readout in dBm). Enter the power sensor 300 MHz cal factor into the measuring receiver.
8. Disconnect the cable from the RF OUT 50 Ω connector, then connect the power sensor to the RF OUT 50 Ω connector. See [Figure 2-34](#).

Figure 2-34 BITG Power Level Adjustment Setup



sh217e

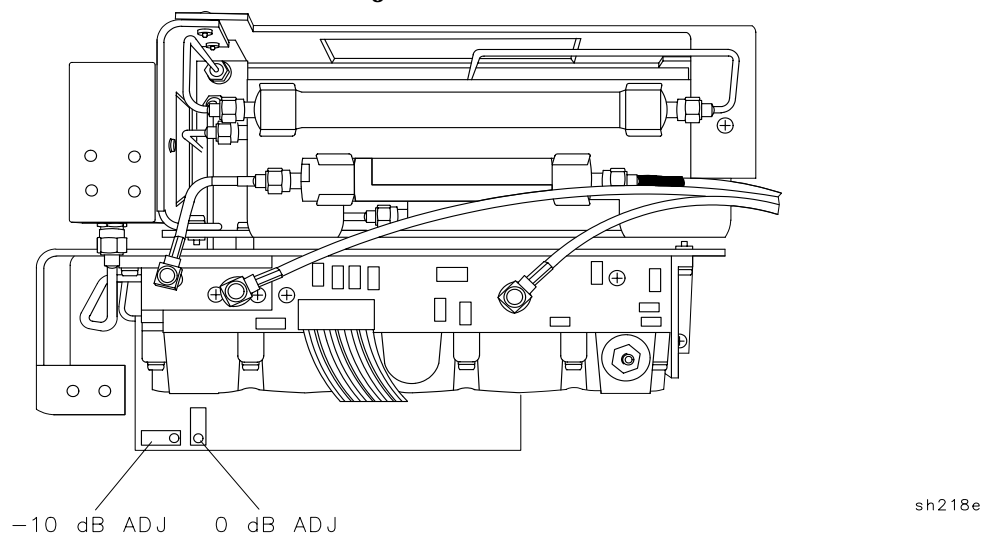
23. BITG Power Level for Option 010

9. On the analyzer, press **SRC PWR ON OFF (ON)**, **0, dBm**, **SGL SWP**.

Note that some analyzers may have sealing compound over A3A15R13 (-10 dB ADJ) and A3A15R18 (0 dB ADJ) adjustments. Remove this compound before making these adjustments.

10. Adjust -10 dB ADJ (A3A15R13) for a 0 dBm ±0.05 dB reading on the measuring receiver. Refer to [Figure 2-35](#) for adjustment location.

Figure 2-35 BITG Power Level Adjustment Locations



11. Set the SRC PWR level to -10 dBm. Note the power displayed on the measuring receiver.

If the power level is -9.77 dBm to -10.23 dBm, then the adjustment is complete. If the power level is not within the range, then continue with [step 11](#).

Power at -10 dBm Setting _____ dBm

If the power level noted in [step 10](#) was outside the range of -10 dBm ±0.23 dB, perform the following:

- a. With the SRC PWR level set to -10 dBm, adjust -10 dB ADJ (A3A15R13) for a -10 dBm ±0.1 dB reading on the measuring receiver. Refer to [Figure 2-35](#) for adjustment location.
- b. Set the SRC PWR level to 0 dBm. Adjust 0 dB ADJ (A3A15R18) for a 0 dBm ±0.2 dB reading on the measuring receiver. Refer to [Figure 2-35](#) for adjustment location.
- c. Repeat this step until the output power level is within the tolerances indicated at both the -10 dBm and 0 dBm SRC PWR level settings. Adjust -10 dB ADJ only with the SRC POWER level set to -10 dBm, and adjust 0 dB ADJ only with the SRC PWR level set to 0 dBm.

24. Tracking Oscillator for Option 010

This adjustment applies to:

8593E spectrum analyzers, Option 010

8594E spectrum analyzers, Option 010

8595E spectrum analyzers, Option 010

8596E spectrum analyzers, Option 010

This is *not* a routine adjustment. This adjustment should only be performed if the range of either the automatic tracking peak adjustment (**TRACKING PEAK**) or the manual tracking peak adjustment (**MAN TRK ADJUST**) is insufficient to peak a signal.

The centering of the tracking oscillator range is adjusted in the factory to ensure that the tracking adjustment will work properly. Over a period of 5 years, however, the center frequency of the tracking oscillator range may drift outside of acceptable limits.

The tracking oscillator range is checked first. A tracking peak test is performed and the output frequency is recorded. Then the manual tracking adjustment is set to its minimum and maximum values and the output frequency is recorded. The minimum and maximum frequencies are compared to the peaked frequency. If the difference is less than 5 kHz, adjustment is necessary.

The adjustment recenters the tracking oscillator range. The A3 RF assembly is placed in its service position to perform this adjustment. A frequency counter is used to measure the output frequency.

Equipment Required

Microwave frequency counter

Termination, 50 Ω termination

Alignment tool, non-metallic

Cable, BNC, 122 cm (48 in.) (*two required*)

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

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

Additional Equipment for Option 026

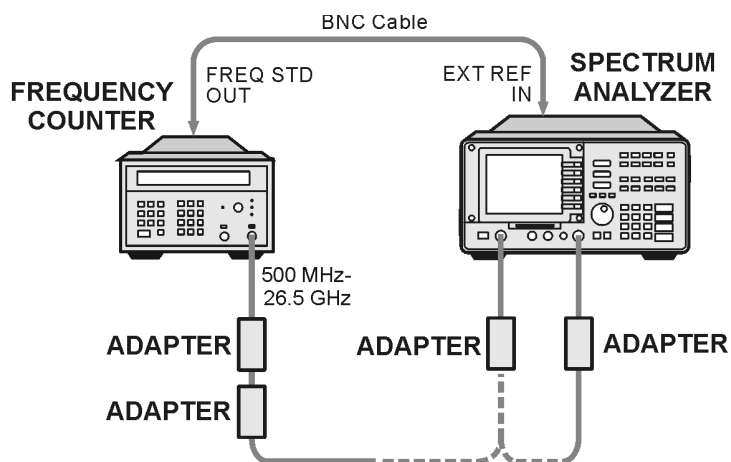
- Cable, CAL comb
- Adapter APC-3.5 (f) to APC-3.5 (f)
- Adapter, Type N (f) to APC-3.5 (f)
- Adapter, Type BNC (f) to SMA (m)

Procedure

Frequency Tracking Range Check

1. Connect a cable between the RF OUT 50 Ω and INPUT 50 Ω connectors on the analyzer.

Figure 2-36 Frequency Tracking Range Setup



2. Remove the rear-panel jumper that is between the 10 MHz REF OUTPUT and EXT REF IN jacks. Connect the frequency counter FREQ STD OUT connector to the analyzer EXT REF IN connector as shown in Figure 2-36.
3. Press **PRESET** on the analyzer, then set the controls as follows:
 - CENTER FREQ 500 MHz
 - SPAN 0 Hz
4. On the analyzer, press the following key.
 - BW, 10, kHz**
 - AUX CTRL, TRACK GEN, SRC PWR ON OFF (ON), 5, -dBm**
5. On the analyzer press **TRACKING PEAK**. Wait for the PEAKING message to disappear.

6. Set the microwave frequency counter controls as follows:
 - SAMPLE RATE Midrange
 - 10 Hz-500 MHz SWITCH 500 MHz - 26.5 GHz
 - 500 MHz-26.5 GHz SWITCH 500 MHz - 26.5 GHz
 - RESOLUTION 1 Hz
7. Connect the RF OUT 50 Ω connector to the microwave frequency counter input as shown in [Figure 2-36](#).
8. Wait for the microwave frequency counter to gate two or three times, then record the microwave frequency counter reading below as the peaked frequency.

Peaked Frequency: _____ MHz
9. On the analyzer, press **MAN TRK ADJUST**, 4095, **ENTER**. Wait for the microwave frequency counter to gate two or three times, then record the microwave frequency counter reading below as the minimum frequency.

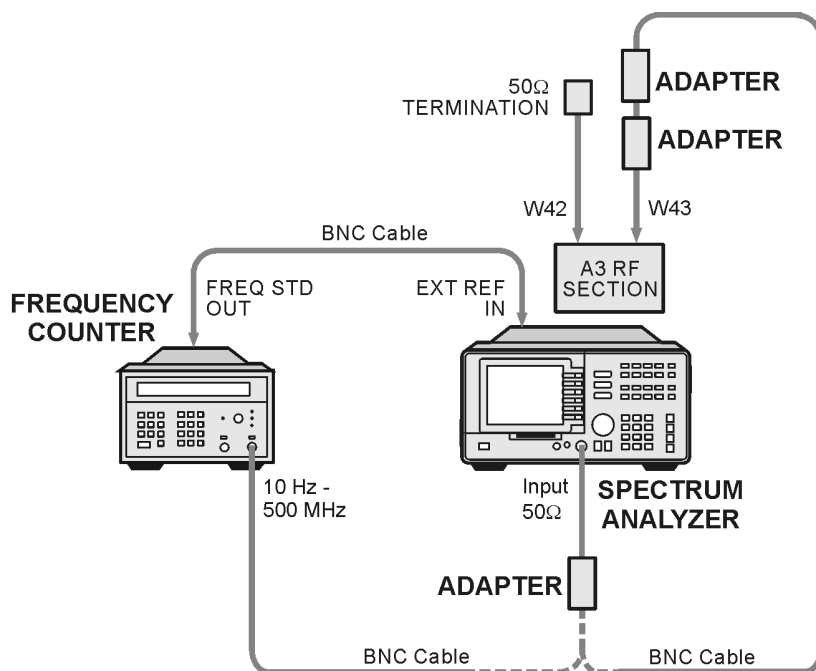
Minimum Frequency: _____ MHz
10. On the analyzer, press **MAN TRK ADJUST**, 0, **ENTER**. Wait for the microwave frequency counter to gate two or three times, then record the microwave frequency counter reading below as the maximum frequency.

Maximum Frequency: _____ MHz
11. If the absolute value of the difference between either the minimum or maximum frequency and the peaked frequency is less than 5 kHz, proceed with the adjustment procedure below. If the differences are greater than 5 kHz, no adjustment is necessary.
12. Disconnect the cable from the EXT REF IN connector, then replace the rear-panel jumper.

Adjust the Tracking Oscillator

13. Remove the A3 RF Section assembly as described in [Chapter 9](#) of this manual. With A3 sitting on top of the A2 display assembly, reconnect all cables from A3 to their respective jacks on A7, A9, A25, and A10. Reconnect W40 to A3A15J8. Connect the 50 Ω termination to the end of W42.
14. Connect the equipment as shown in [Figure 2-37](#). The microwave frequency counter provides the frequency reference for the analyzer.

Figure 2-37 Tracking Oscillator Adjustment Setup



sh220e

15. Set the analyzer **LINE** switch to on. Press **AUX CTRL**, **TRACK GEN**, **SRC PWR ON OFF** (ON). Allow the analyzer to warm up for at least 5 minutes. Set the controls as follows:

CENTER FREQ	300 MHz
SPAN	0 Hz
16. Set the microwave frequency counter controls as follows:

SAMPLE RATE	Fully CCW
10 Hz-500 MHz SWITCH	10 Hz-500 MHz
500 MHz-26.5 GHz SWITCH	10 Hz-500 MHz
50 Ω - 1 MΩ SWITCH	50 Ω
17. Remove the screw, located on the front of the tracking generator, used to seal the tracking oscillator adjustment.
18. On the analyzer, press **AUX CTRL**, **TRACK GEN**, **MAN TRK ADJUST**, 0, **Hz**.
19. Record the microwave frequency counter reading in [Table 2-9](#) as F1.
20. On the analyzer, press **MAN TRK ADJUST**, 4095, **Hz**.
21. Record the microwave frequency counter reading in [Table 2-9](#) as F2.

22. Calculate F_{center} as shown below, and record it in [Table 2-9](#).

$$F_{center} = (F1 + F2)/2$$

24. Tracking Oscillator for Option 010

23. Set SRC TRACK ADJ to 350. This sets the tracking oscillator near the center of its frequency range. (The relationship between the SRC TRACK ADJ DAC number and the output frequency is nonlinear.) Adjust SRC TRACK ADJ until the microwave frequency counter reads $F_{center} \pm 100$ Hz.

24. Record the value of SRC TRACK ADJ in [Table 2-9](#).

CAUTION

A3A15C3 (TRK OSC CTR) is rated for a maximum of 10 adjustment cycles. Due to this limitation, adjust TRK OSC CTR only when absolutely necessary.

25. Adjust A3A15C3 (TRK OSC CTR) until the microwave frequency counter reads $300 \text{ MHz} \pm 500 \text{ Hz}$.

26. Repeat [step 17](#) to [step 24](#) at least once more until no further adjustment of A3A15C3 is necessary.

27. Set the analyzer **LINE** switch to off, then replace the screw removed in [step 17](#).

28. Reinstall the A3 RF Section assembly into the analyzer.

29. Replace the rear-panel jumper between the 10 MHz REF OUTPUT and EXT REF IN connectors.

Table 2-9 Tracking Oscillator Range Centering

N	F1 (MHz)	F2 (MHz)	Fcenter (MHz)	SRC TRACK ADJ Setting
1	_____	_____	_____	_____
2	_____	_____	_____	_____
3	_____	_____	_____	_____
4	_____	_____	_____	_____
5	_____	_____	_____	_____
6	_____	_____	_____	_____

25. Checking the Absolute Amplitude Accuracy for Option 050

This adjustment applies to:

All 8590 E-Series spectrum analyzers, Option 050

To measure the absolute amplitude accuracy of the analyzer, a signal from a synthesized sweeper is output to both the analyzer and a measurement receiver. To determine the absolute amplitude accuracy:

1. The amplitude of the sweeper's signal is adjusted until the analyzer marker reads out a known amplitude.
2. The amplitude of the sweeper's signal is measured by the measuring receiver. (The measurement receiver is used as a power meter.)
3. The difference between the marker readout and the measuring receiver's measurement is determined. This difference is the absolute amplitude accuracy.

Equipment required

Synthesized sweeper

Measurement receiver

Power splitter

Power sensor, 818 MHz to 948 MHz

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

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

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

Cable, Type N, 183 cm (72 in)

Additional Equipment for 026

Adapter, type N (f) to APC-3.5 (f)

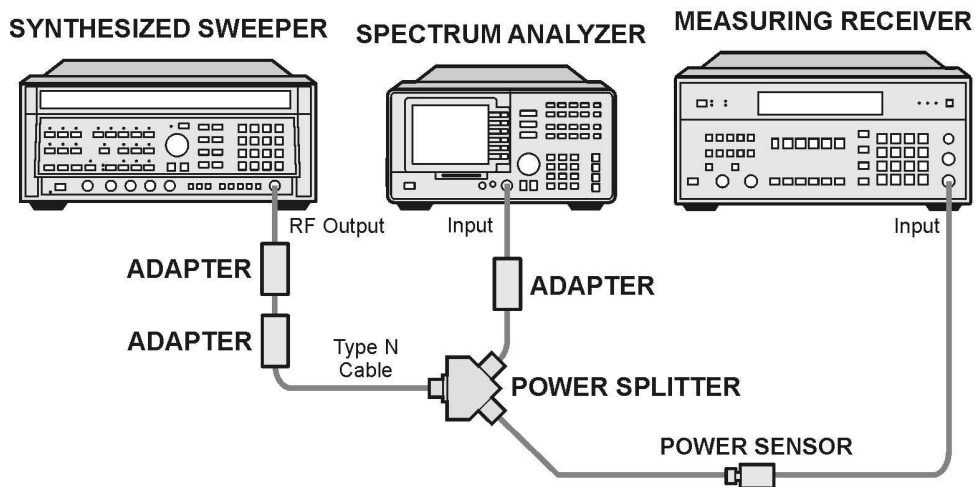
Procedure

1. Zero and calibrate the measuring receiver and power sensor in log mode as described in the measuring receiver operation manual.

Note that the absolute amplitude accuracy test should only be performed if the ambient temperature is between 20 °C and 30 °C.

2. Connect the equipment as shown in Figure 2-38. Connect the power splitter to the analyzer using an adapter.

Figure 2-38 Absolute Amplitude Accuracy Verification



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3. Press instrument preset on the synthesized sweeper, then set the controls as follows:

CW 818 MHz
 POWER LEVEL -2 dBm

25. Checking the Absolute Amplitude Accuracy for Option 050

4. Press **PRESET** on the analyzer and wait for the preset to finish, then press the following analyzer keys.

FREQUENCY, 818, MHz

SPAN, 400, kHz

BW, 100, kHz

VID BW AUTO MAN, 30, kHz

AMPLITUDE, 4, -dBm

ATTEN AUTO MAN, 10, dB

PEAK SEARCH

Log Fidelity

5. Set the power sensor cal factor for 818 MHz on the measuring receiver.
6. On the synthesized sweeper, press **POWER LEVEL** and adjust the output amplitude so that the analyzer marker amplitude reads $-9 \text{ dBm} \pm 0.05 \text{ dB}$.
7. Record the measuring receiver power reading in [Table 2-10](#).
8. Adjust the output amplitude of the sweeper for analyzer marker amplitude readings of -14 dBm and -19 dBm .
9. Record the measuring receiver power readings in [Table 2-10](#). The readings should be within the limits shown.

Table 2-10 Log Fidelity

Analyzer Marker Reading (dBm)	Measuring Receiver		
	Min(dBm)	Reading (dBm)	Max(dBm)
-9	-9.7	_____	-8.3
-14	-14.7	_____	-13.3
-19	-19.7	_____	-21.3

Frequency Response Input Attenuator 10 dB

10. Set the frequency of the analyzer to the first measurement frequency shown in [Table 2-11](#).
11. On the synthesized sweeper, press **CW** and set the frequency to the same measurement frequency as the analyzer is set in the previous step.
12. On the analyzer, press **PEAK SEARCH**.

25. Checking the Absolute Amplitude Accuracy for Option 050

13. On the synthesized sweeper, press **POWER LEVEL** and adjust the output amplitude so the analyzer marker amplitude reads $-9 \text{ dBm} \pm 0.05 \text{ dB}$.
14. Set the power sensor cal factor (for frequency being measured) on the measuring receiver, then record the measuring receiver power reading in [Table 2-11](#).
15. Repeat [step 10](#) to [step 14](#) for frequencies of 836 MHz, 881 MHz, and 948 MHz. Record the results in [Table 2-11](#). The results should be within the limits shown.

Table 2-11 Frequency Response Attenuator 10 dB

Synthesized Sweeper Frequency (MHz)	Measuring Receiver		
	Min (dBm)	Reading (dBm)	Max (dBm)
818	-9.7	_____	-8.3
836	-9.7	_____	-8.3
881	-9.7	_____	-8.3
948	-9.7	_____	-8.3

Frequency Response Input Attenuator 20 dB

16. On the analyzer, press the following keys.
AMPLITUDE, ATTEN AUTO MAN, 20, dB
AMPLITUDE, 6, +dBm
17. Set the **FREQUENCY** of the analyzer to the measurement frequency shown in [Table 2-12](#).
18. On the synthesized sweeper, press CW and set the frequency to the same measurement frequency as the analyzer is set in the previous step.
19. On the analyzer, press **PEAK SEARCH**.
20. On the sweeper, press **POWER LEVEL** and adjust the amplitude so the analyzer marker amplitude reads $+1 \text{ dBm} \pm 0.05 \text{ dB}$.
21. Set the power sensor cal factor (for frequency being measured) on the measuring receiver, then record the measuring receiver power reading in [Table 2-12](#).
22. Repeat [step 17](#) to [step 21](#) for frequencies of 881 MHz, 836 MHz, and 818 MHz. Record the results in [Table 2-12](#). The results should be within the limits shown.

Table 2-12 Frequency Response Attenuator 20 dB

Synthesized Sweeper Frequency (MHz)	Measuring Receiver		
	Min (dBm)	Reading (dBm)	Max (dBm)
948	+0.3	_____	+1.7
881	+0.3	_____	+1.7
836	+0.3	_____	+1.7
818	+0.3	_____	+1.7

Frequency Response Input Attenuator 30 dB

23. On the analyzer, press the following keys.

AMPLITUDE, ATTEN AUTO MAN, 30, dB

AMPLITUDE, 10, +dBm

24. Set the FREQUENCY of the analyzer to the measurement frequency shown in [Table 2-13](#).

25. On the analyzer, press **PEAK SEARCH**.

26. On the synthesized sweeper, press CW and set the frequency to the same measurement frequency as the analyzer is set in the previous step.

27. On the synthesized sweeper, press POWER LEVEL and adjust the amplitude so the analyzer marker amplitude reads +5 dBm \pm 0.05 dB.

28. Set the power sensor cal factor (for frequency being measured) on the measuring receiver, then record the measuring receiver power reading in [Table 2-13](#).

29. Repeat [step 24](#) to [step 28](#) for frequencies of 836 MHz, 881 MHz, and 948 MHz. Record the results in [Table 2-13](#).

Table 2-13 Frequency Response Attenuator 30 dB

Synthesized Sweeper Frequency (MHz)	Measuring Receiver		
	Min (dBm)	Reading (dBm)	Max (dBm)
818	+4.3	_____	+5.7
836	+4.3	_____	+5.7
881	+4.3	_____	+5.7
948	+4.3	_____	+5.7

25. Checking the Absolute Amplitude Accuracy for Option 050

Frequency Response Input Attenuator 40 dB

30. On the analyzer, press the following keys.

AMPLITUDE, ATTEN AUTO MAN, 40, dB

AMPLITUDE, 10, +dBm

31. Set the FREQUENCY of the analyzer to the measurement frequency shown in [Table 2-14](#).

32. On the synthesized sweeper, press CW, then set the frequency to the same measurement frequency as the analyzer is set in the previous step.

33. On the analyzer, press **PEAK SEARCH**.

34. On the synthesized sweeper, press POWER LEVEL and adjust the amplitude so the analyzer marker amplitude reads +5 dBm ± 0.05 dB.

35. Set the power sensor cal factor (for frequency being measured) on the measuring receiver, then record the measuring receiver power reading in [Table 2-14](#).

36. Repeat [step 31](#) to [step 35](#) for frequencies of 881 MHz, 836 MHz, and 818 MHz. Record the results in [Table 2-14](#).

Table 2-14 Frequency Response Attenuator 40 dB

Synthesized Sweeper Frequency (MHz)	Measuring Receiver		
	Min (dBm)	Reading (dBm)	Max (dBm)
948	+4.0	_____	+6.0
881	+4.0	_____	+6.0
836	+4.0	_____	+6.0
818	+4.0	_____	+6.0

26. Correcting for Absolute Amplitude Accuracy for Option 050

This adjustment applies to:

All 8590 E-Series spectrum analyzers, Option 050

The frequency response of the analyzer is adjusted to optimize the amplitude accuracy for the frequency range between 818 MHz and 948 MHz. The amplitude error from "Checking the Absolute Amplitude Accuracy for Option 050" is used to determine how much flatness correction is necessary. Normally, only a small amount of adjustment is needed to bring the absolute amplitude accuracy of 8590 E-Series spectrum analyzer equipped with an Option 050 into specification.

1. Looking at [Table 2-11](#), Frequency Response Attenuator 10 dB, calculate the error from the nominal value of -9 dB. For example, if the measuring receiver reading at 818 MHz is -9.2 dB, then the error is -0.2 dB. Find the average error by adding the four errors for each frequency and then dividing the sum by four.

Average Error _____ dB

Note that if the average error is greater than 0.5 dB, there may be a hardware problem. Typically, front-end component problems are responsible for large amplitude errors. A defective First Mixer or a poor cable connection may cause a power hole near the analyzer Option 050 frequency band. In this case, performing a frequency response check will uncover this type of problem. Perform a functional check of the input attenuator if the errors for some attenuation settings are larger than others.

CAUTION

The next step disables the protection for the factory correction constants.

2. Press the following analyzer keys.

FREQUENCY, -2001, Hz

CAL, More 1 of 4, More 2 of 4

Service Cal

Flatness Data

EDIT FLATNESS

3. Press \uparrow (step up key) until the ERROR readout for 804 MHz is displayed (*781 MHz for an 8591E spectrum analyzer or an 8591C cable TV analyzer*).

26. Correcting for Absolute Amplitude Accuracy for Option 050

4. Read the amplitude error from the display and record it in [Table 2-15](#) for the 8593E, 8594E, 8595E, and 8596E spectrum analyzers. Use [Table 2-16](#) for 8591E spectrum analyzers or 8591C cable TV analyzers.

Table 2-15 Frequency Response Errors: 8593E, 8594E, 8595E, 8596E

Frequency	Amplitude ERROR	Corrected Flatness ERROR
804 MHz		
876 MHz		
948 MHz		
1.02 GHz		

Table 2-16 Frequency Response Errors: 8591C and 8591E

Frequency	Amplitude ERROR	Corrected Flatness ERROR
781 MHz		
818 MHz		
855 MHz		
892 MHz		

Repeat [step 3](#) and [step 4](#) for the next frequency indicated in [Table 2-15](#) or [Table 2-16](#) until all four points have been recorded.

5. Subtract the Average Error, calculated in [step 1](#), from each Amplitude ERROR from [Table 2-15](#) or [Table 2-16](#), then record column 3 as the Corrected Flatness ERROR.

Do not subtract more than 0.5 dB from the Amplitude ERROR. If the Average Error is more than 0.5 dB, it may not be possible to make corrections during the adjustment.

6. Using ↓ (step down key), set the frequency displayed on the analyzer to 804 MHz (*781 MHz for 8591E spectrum analyzers or 8591C cable TV analyzers*).

26. Correcting for Absolute Amplitude Accuracy for Option 050

7. Enter the Corrected Flatness ERROR from [Table 2-15](#) or [Table 2-16](#) for the frequency displayed using the DATA keys. Terminate the entry with the **+dBm**.

After the new data is entered, the analyzer will automatically jump to the next frequency correction point. Enter the next Corrected Flatness ERROR from the table.

To confirm the entries, press ↓ (step down key) to the frequency of interest. Re-check the displayed error against the Corrected Flatness ERROR from column 3.

8. Perform the frequency response verification test from the calibration guide for your instrument. Only checking Band 0 is necessary.

27. Checking the Absolute Amplitude Accuracy for Option 051

This adjustment applies to:

All 8590 E-Series spectrum analyzers, Option 051

To measure the absolute amplitude accuracy of the analyzer in the frequency ranges 810 MHz to 956 MHz and 1429 MHz to 1501 MHz, a signal from a synthesized sweeper is output to both the analyzer and a measurement receiver. To determine the absolute amplitude accuracy:

1. The amplitude of the sweeper's signal is adjusted until the analyzer marker reads out a known amplitude.
2. The amplitude of the sweeper's signal is measured by the measuring receiver. (The measurement receiver is used as a power meter.)
3. The difference between the marker readout and the measuring receiver's measurement is determined. This difference is the absolute amplitude accuracy.

Equipment required

Synthesized sweeper

Measurement receiver

Power splitter

Power sensor, 810 MHz to 1501 MHz

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

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

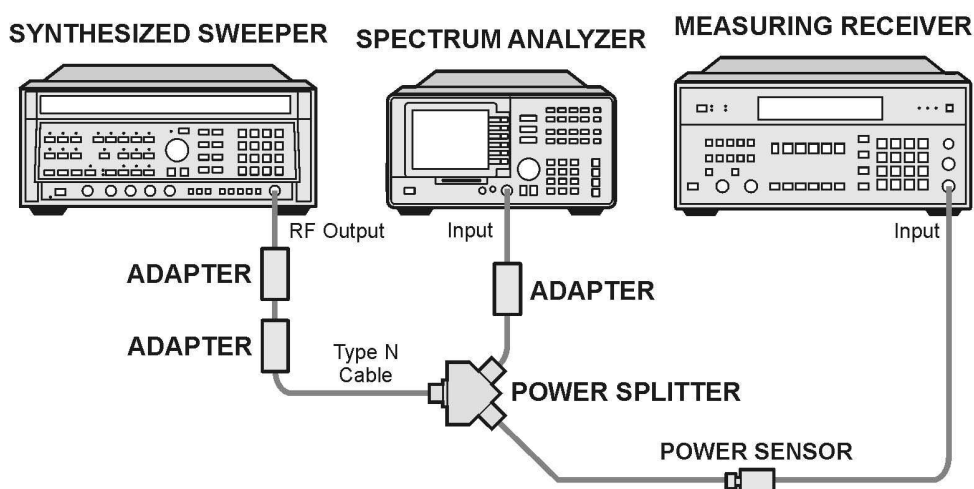
Adapter, Type N (m) to Type N (m)

Cable, Type N, 183 cm (72 in)

Additional Equipment for Option 026

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

Figure 2-39 Absolute Amplitude Accuracy Verification



sh267e

Procedure

1. Zero and calibrate the measuring receiver and power sensor in log mode as described in the measuring receiver operation manual.

Note that the absolute amplitude accuracy test should only be performed if the ambient temperature is between 20 °C and 30 °C.

2. Connect the equipment as shown in [Figure 2-39](#). Connect the power splitter to the analyzer using an adapter.
3. Press instrument preset on the synthesized sweeper, then set the controls as follows:

CW 810 MHz
 POWER LEVEL -2 dBm

4. Press **PRESET** on the analyzer and wait for the preset to finish, then press the following analyzer keys.

FREQUENCY, 810, MHz
SPAN, 400, kHz
BW, 100, kHz
VID BW AUTO MAN, 30, kHz
AMPLITUDE, 4, -dBm
ATTEN AUTO MAN, 10, dB
PEAK SEARCH

Log Fidelity

5. Set the power sensor cal factor for 810 MHz on the measuring receiver.
6. On the synthesized sweeper, press POWER LEVEL and adjust the output amplitude so that the analyzer marker amplitude reads $-9 \text{ dBm} \pm 0.05 \text{ dB}$.
7. Record the measuring receiver power reading in [Table 2-17](#).
8. Adjust the output amplitude of the sweeper for analyzer marker amplitude readings of -14 dBm and -19 dBm .
9. Record the measuring receiver power readings in [Table 2-17](#). The readings should be within the limits shown.

Table 2-17 **Log Fidelity**

Analyzer Marker Reading (dBm)	Measuring Receiver		
	Min (dBm)	Reading (dBm)	Max (dBm)
-9	-9.7	_____	-8.3
-14	-14.7	_____	-13.3
-19	-19.7	_____	-21.3

Frequency Range 810 MHz to 956 MHz**Frequency Response Input Attenuator 10 dB**

10. Set the frequency of the analyzer to the first measurement frequency shown in [Table 2-18](#).
11. On the synthesized sweeper, press **CW** and set the frequency to the same measurement frequency as the analyzer is set in the previous step.
12. On the analyzer, press **PEAK SEARCH**.
13. On the synthesized sweeper, press **POWER LEVEL** and adjust the output amplitude so the analyzer marker amplitude reads $-9 \text{ dBm} \pm 0.05 \text{ dB}$.
14. Set the power sensor cal factor (for frequency being measured) on the measuring receiver, then record the measuring receiver power reading in [Table 2-18](#).
15. Repeat [step 10](#) to [step 14](#) for frequencies of 826 MHz, 940 MHz, and 956 MHz. Record the results in [Table 2-11](#). The results should be within the limits shown.

Table 2-18 Frequency Response Attenuator 10 dB

Synthesized Sweeper Frequency (MHz)	Measuring Receiver		
	Min (dBm)	Reading (dBm)	Max (dBm)
810	-9.6	_____	-8.4
826	-9.6	_____	-8.4
940	-9.6	_____	-8.4
956	-9.6	_____	-8.4

27. Checking the Absolute Amplitude Accuracy for Option 051

Frequency Response Input Attenuator 20 dB

16. On the analyzer, press the following keys.
AMPLITUDE, ATTEN AUTO MAN, 20, dB
AMPLITUDE, 6, +dBm
17. Set the **FREQUENCY** of the analyzer to the measurement frequency shown in [Table 2-19](#).
18. On the synthesized sweeper, press CW and set the frequency to the same measurement frequency as the analyzer is set in the previous step.
19. On the analyzer, press **PEAK SEARCH**.
20. On the sweeper, press POWER LEVEL and adjust the amplitude so the analyzer marker amplitude reads +1 dBm \pm 0.05 dB.
21. Set the power sensor cal factor (for frequency being measured) on the measuring receiver, then record the measuring receiver power reading in [Table 2-12](#).
22. Repeat [step 17](#) to [step 21](#) for frequencies of 948 MHz, 826 MHz, and 810 MHz. Record the results in [Table 2-19](#). The results should be within the limits shown.

Table 2-19 Frequency Response Attenuator 20 dB

Synthesized Sweeper Frequency (MHz)	Measuring Receiver		
	Min (dBm)	Reading (dBm)	Max (dBm)
956	+0.4	_____	+1.6
940	+0.4	_____	+1.6
826	+0.4	_____	+1.6
810	+0.4	_____	+1.6

27. Checking the Absolute Amplitude Accuracy for Option 051

Frequency Response Input Attenuator 30 dB

23. On the analyzer, press the following keys.

AMPLITUDE, ATTEN AUTO MAN, 30, dB

AMPLITUDE, 10, +dBm

24. Set the FREQUENCY of the analyzer to the measurement frequency shown in [Table 2-20](#).

25. On the analyzer, press **PEAK SEARCH**.

26. On the synthesized sweeper, press CW and set the frequency to the same measurement frequency as the analyzer is set in the previous step.

27. On the synthesized sweeper, press POWER LEVEL and adjust the amplitude so the analyzer marker amplitude reads +5 dBm ± 0.05 dB.

28. Set the power sensor cal factor (for frequency being measured) on the measuring receiver, then record the measuring receiver power reading in [Table 2-20](#).

29. Repeat [step 24](#) to [step 28](#) for frequencies of 826 MHz, 940 MHz, and 956 MHz. Record the results in [Table 2-20](#).

Table 2-20 Frequency Response Attenuator 30 dB

Synthesized Sweeper Frequency (MHz)	Measuring Receiver		
	Min (dBm)	Reading (dBm)	Max (dBm)
810	+4.4	_____	+5.6
826	+4.4	_____	+5.6
940	+4.4	_____	+5.6
956	+4.4	_____	+5.6

27. Checking the Absolute Amplitude Accuracy for Option 051

Frequency Response Input Attenuator 40 dB

30. On the analyzer, press the following keys.

AMPLITUDE, ATTEN AUTO MAN, 40, dB

AMPLITUDE, 10, +dBm

31. Set the FREQUENCY of the analyzer to the measurement frequency shown in [Table 2-21](#).

32. On the synthesized sweeper, press CW, then set the frequency to the same measurement frequency as the analyzer is set in the previous step.

33. On the analyzer, press **PEAK SEARCH**.

34. On the synthesized sweeper, press POWER LEVEL and adjust the amplitude so the analyzer marker amplitude reads +5 dBm ± 0.05 dB.

35. Set the power sensor cal factor (for frequency being measured) on the measuring receiver, then record the measuring receiver power reading in [Table 2-21](#).

36. Repeat [step 31](#) to [step 35](#) for frequencies of 940 MHz, 826 MHz, and 810 MHz. Record the results in [Table 2-21](#).

Table 2-21 Frequency Response Attenuator 40 dB

Synthesized Sweeper Frequency (MHz)	Measuring Receiver		
	Min (dBm)	Reading (dBm)	Max (dBm)
956	+4.0	_____	+6.0
940	+4.0	_____	+6.0
826	+4.0	_____	+6.0
810	+4.0	_____	+6.0

Frequency Range 1429 MHz to 1501 MHz**Frequency Response input Attenuator 10 dB**

37. Set the frequency of the analyzer to the first measurement frequency shown in [Table 2-22](#).
38. On the synthesized sweeper, press **CW** and set the frequency to the same measurement frequency as the analyzer is set in the previous step.
39. On the analyzer, press **PEAK SEARCH**.
40. On the synthesized sweeper, press **POWER LEVEL** and adjust the output amplitude so the analyzer marker amplitude reads $-9 \text{ dBm} \pm 0.05 \text{ dB}$.
41. Set the power sensor cal factor (for frequency being measured) on the measuring receiver, then record the measuring receiver power reading in [Table 2-22](#).
42. Repeat [step 37](#) to [step 41](#) for frequencies of 1453 MHz, 1477 MHz, and 1501 MHz. Record the results in [Table 2-22](#). The results should be within the limits shown.

Table 2-22 Frequency Response Attenuator 10 dB

Synthesized Sweeper Frequency (MHz)	Measuring Receiver		
	Min (dBm)	Reading (dBm)	Max (dBm)
1429	-9.6	_____	-8.4
1453	-9.6	_____	-8.4
1477	-9.6	_____	-8.4
1501	-9.6	_____	-8.4

27. Checking the Absolute Amplitude Accuracy for Option 051

Frequency Response Input Attenuator 20 dB

43. On the analyzer, press the following keys.

AMPLITUDE, ATTEN AUTO MAN, 20, dB

AMPLITUDE, 6, +dBm

44. Set the **FREQUENCY** of the analyzer to the measurement frequency shown in [Table 2-23](#).

45. On the synthesized sweeper, press CW and set the frequency to the same measurement frequency as the analyzer is set in the previous step.

46. On the analyzer, press **PEAK SEARCH**.

47. On the sweeper, press POWER LEVEL and adjust the amplitude so the analyzer marker amplitude reads +1 dBm \pm 0.05 dB.

48. Set the power sensor cal factor (for frequency being measured) on the measuring receiver, then record the measuring receiver power reading in [Table 2-23](#).

49. Repeat [step 44](#) to [step 48](#) for frequencies of 1477 MHz, 1453 MHz, and 1428 MHz. Record the results in [Table 2-23](#). The results should be within the limits shown.

Table 2-23 Frequency Response Attenuator 20 dB

Synthesized Sweeper Frequency (MHz)	Measuring Receiver		
	Min (dBm)	Reading (dBm)	Max (dBm)
1501	+0.4	_____	+1.6
1477	+0.4	_____	+1.6
1453	+0.4	_____	+1.6
1429	+0.4	_____	+1.6

27. Checking the Absolute Amplitude Accuracy for Option 051

Frequency Response Input Attenuator 30 dB

50. On the analyzer, press the following keys.

AMPLITUDE, ATTEN AUTO MAN, 30, dB

AMPLITUDE, 10, +dBm

51. Set the FREQUENCY of the analyzer to the measurement frequency shown in [Table 2-24](#).

52. On the analyzer, press **PEAK SEARCH**.

53. On the synthesized sweeper, press CW and set the frequency to the same measurement frequency as the analyzer is set in the previous step.

54. On the synthesized sweeper, press POWER LEVEL and adjust the amplitude so the analyzer marker amplitude reads +5 dBm ± 0.05 dB.

55. Set the power sensor cal factor (for frequency being measured) on the measuring receiver, then record the measuring receiver power reading in [Table 2-24](#).

56. Repeat [step 51](#) to [step 55](#) for frequencies of 1453 MHz, 1477 MHz, and 1501 MHz. Record the results in [Table 2-24](#).

Table 2-24 Frequency Response Attenuator 30 dB

Synthesized Sweeper Frequency (MHz)	Measuring Receiver		
	Min (dBm)	Reading (dBm)	Max (dBm)
1429	+4.4	_____	+5.6
1453	+4.4	_____	+5.6
1477	+4.4	_____	+5.6
1501	+4.4	_____	+5.6

27. Checking the Absolute Amplitude Accuracy for Option 051

Frequency Response Input Attenuator 40 dB

57. On the analyzer, press the following keys.

AMPLITUDE, ATTEN AUTO MAN, 40, dB

AMPLITUDE, 10, +dBm

58. Set the FREQUENCY of the analyzer to the measurement frequency shown in [Table 2-25](#).

59. On the synthesized sweeper, press CW, then set the frequency to the same measurement frequency as the analyzer is set in the previous step.

60. On the analyzer, press **PEAK SEARCH**.

61. On the synthesized sweeper, press POWER LEVEL and adjust the amplitude so the analyzer marker amplitude reads +5 dBm ± 0.05 dB.

62. Set the power sensor cal factor (for frequency being measured) on the measuring receiver, then record the measuring receiver power reading in [Table 2-25](#).

63. Repeat [step 58](#) to [step 62](#) for frequencies of 1477 MHz, 1453 MHz, and 1429 MHz. Record the results in [Table 2-25](#).

Table 2-25 Frequency Response Attenuator 40 dB

Synthesized Sweeper Frequency (MHz)	Measuring Receiver		
	Min (dBm)	Reading (dBm)	Max (dBm)
1501	+4.0	_____	+6.0
1477	+4.0	_____	+6.0
1453	+4.0	_____	+6.0
1429	+4.0	_____	+6.0

28. Correcting for Absolute Amplitude Accuracy for Option 051

This adjustment applies to:

All 8590 E-Series spectrum analyzers, Option 051

The frequency response of the analyzer is adjusted to optimize the amplitude accuracy for the frequency range 810 MHz to 956 MHz and 1429 MHz to 1501 MHz. The amplitude error from "Checking the Absolute Amplitude Accuracy for Option 051" is used to determine how much flatness correction is necessary. Normally, only a small amount of adjustment is needed to bring the absolute amplitude accuracy of 8590 E-Series spectrum analyzer equipped with an Option 051 into specification.

Frequency Range 810 MHz to 956 MHz

1. Looking at [Table 2-18](#), Frequency Response Attenuator 10 dB, calculate the error from the nominal value of -9 dB for each frequency. For example, if the measuring receiver reading at 810 MHz is -9.2 dB, then the error is -0.2 dB. Find the average error by adding the four errors for each frequency and then dividing the sum by four.

Average Error _____ dB

Note that if the average error is greater than 0.5 dB, there may be a hardware problem. Typically, front-end component problems are responsible for large amplitude errors. A defective First Mixer or a poor cable connection may cause a power hole near the analyzer Option 051 frequency band. In this case, performing a frequency response check will uncover this type of problem. Perform a functional check of the input attenuator if the errors for some attenuation settings are larger than others.

CAUTION

The next step disables the protection for the factory correction constants.

2. Press the following analyzer keys.

FREQUENCY, -2001, Hz

CAL, More 1 of 4, More 2 of 4

Service Cal

Flatness Data

EDIT FLATNESS

28. Correcting for Absolute Amplitude Accuracy for Option 051

3. Press \uparrow (step up key) until the ERROR readout for 804 MHz is displayed (*781 MHz for an 8591E spectrum analyzer or an 8591C cable TV analyzer*).
4. Read the amplitude error from the display and record it in [Table 2-26](#) for the 8593E, 8594E, 8595E, and 8596E spectrum analyzers. Use [Table 2-27](#) for 8591E spectrum analyzers or 8591C cable TV analyzers.

Table 2-26 Frequency Response Errors: 8593E, 8594E, 8595E, 8596E

Frequency	Amplitude ERROR	Corrected Flatness ERROR
804 MHz	_____	_____
876 MHz	_____	_____
948 MHz	_____	_____
1.02 GHz	_____	_____

Table 2-27 Frequency Response Errors: 8591C and 8591E

Frequency	Amplitude ERROR	Corrected Flatness ERROR
781 MHz	_____	_____
818 MHz	_____	_____
855 MHz	_____	_____
892 MHz	_____	_____

Repeat [step 3](#) to [step 4](#) for the next frequency indicated in [Table 2-26](#) or [Table 2-27](#) until all four points have been recorded.

5. Subtract the Average Error, calculated in [step 1](#), from each Amplitude ERROR from [Table 2-26](#) or [Table 2-27](#), then record column 3 as the Corrected Flatness ERROR.

Do not subtract more than 0.5 dB from the Amplitude ERROR. If the Average Error is more than 0.5 dB, it may not be possible to make corrections during the adjustment.

6. Using \downarrow (step down key), set the frequency displayed on the analyzer to 804 MHz (*781 MHz for 8591E spectrum analyzers or 8591C cable TV analyzers*).

28. Correcting for Absolute Amplitude Accuracy for Option 051

7. Enter the Corrected Flatness ERROR from [Table 2-26](#) or [Table 2-27](#) for the frequency displayed using the DATA keys. Terminate the entry with the **+dBm**.

After the new data is entered, the analyzer will automatically jump to the next frequency correction point. Enter the next Corrected Flatness ERROR from the table.

To confirm the entries, press ↓ (step down key) to the frequency of interest. Re-check the displayed error against the Corrected Flatness ERROR from column 3.

8. Press **More, EXIT** after all corrections are complete.

Frequency Range 1429 MHz to 1501 MHz

9. Looking at [Table 2-22](#), Frequency Response Attenuator 10 dB, calculate the error from the nominal value of -9 dB for each frequency. For example, if the measuring receiver reading at 1429 MHz is -9.2 dB, then the error is -0.2 dB. Find the average error by adding the four errors for each frequency and then dividing the sum by four.

Average Error _____ dB

CAUTION

The next step disables the protection for the factory correction constants.

10. Press the following analyzer keys.

PRESET (wait for completion)

FREQUENCY, -2001 , Hz

CAL, **More 1 of 4**, **More 2 of 4**

Service Cal

Flatness Data

EDIT FLATNESS

11. Press ↑ (step up key) until the ERROR readout for 1.380 GHz is displayed (*1.410 GHz for an 8591E spectrum analyzer or an 8591C cable TV analyzer*).

28. Correcting for Absolute Amplitude Accuracy for Option 051

12. Read the amplitude error from the display and record it in [Table 2-28](#) for the 8593E, 8594E, 8595E, and 8596E spectrum analyzers. Use [Table 2-29](#) for 8591E spectrum analyzers or 8591C cable TV analyzers.

Table 2-28 Frequency Response Errors: 8593E, 8594E, 8595E, 8596E

Frequency	Amplitude ERROR	Corrected Flatness ERROR
1.380 GHz	_____	_____
1.452 GHz	_____	_____
1.524 GHz	_____	_____
1.596 GHz	_____	_____

Table 2-29 Frequency Response Errors: 8591C and 8591E

Frequency	Amplitude ERROR	Corrected Flatness ERROR
1.410 GHz	_____	_____
1.447 GHz	_____	_____
1.484 GHz	_____	_____
1.521 GHz	_____	_____

Repeat [step 10](#) and [step 11](#) for the next frequency indicated in [Table 2-28](#) or [Table 2-29](#) until all four points have been recorded.

13. Subtract the Average Error, calculated in [step 9](#), from each Amplitude ERROR from [Table 2-28](#) or [Table 2-29](#), then record column 3 as the Corrected Flatness ERROR.

Do not subtract more than 0.5 dB from the Amplitude ERROR. If the Average Error is more than 0.5 dB, it may not be possible to make corrections during the adjustment.

14. Using ↓ (step down key), set the frequency displayed on the analyzer to 1.380 GHz (*1.410 GHz for 8591E spectrum analyzers or 8591C cable TV analyzers*).

28. Correcting for Absolute Amplitude Accuracy for Option 051

15. Enter the Corrected Flatness ERROR from [Table 2-28](#) or [Table 2-29](#) for the frequency displayed using the DATA keys. Terminate the entry with the **+dBm**.

After the new data is entered, the analyzer will automatically jump to the next frequency correction point. Enter the next Corrected Flatness ERROR from the table.

To confirm the entries, press ↓ (step down key) to the frequency of interest. Re-check the displayed error against the Corrected Flatness ERROR from column 3.

16. Press More, EXIT after all corrections are complete.
17. Perform the frequency response verification test from the calibration guide for your instrument. Only checking Band 0 is necessary.

Making Adjustments

28. Correcting for Absolute Amplitude Accuracy for Option 051

Before You Start

There are three things you should do before starting an adjustment procedure.

- Check that you are familiar with the safety symbols marked on the analyzer, and read the general safety considerations and the symbol definitions given in the front of this service guide.
- Check that the analyzer has been turned on and allowed to warm up for at least 30 minutes at room temperature before making any adjustments. The analyzer *must* be allowed to stand at room temperature at least 2 hours prior to the 30 minute warmup.
- Read the rest of this section.

6a. Cal Attenuator Error

This adjustment applies to:

All 8590 E-Series and L-Series spectrum analyzers
8591C cable TV analyzers
8594Q QAM analyzers

The A12 amplitude control assembly has one 10 dB and two 20 dB nonadjustable amplifiers. It also has 1 dB, 2 dB, 4 dB, 8 dB, and 16 dB attenuators which are correctable. The 16 dB step is not used at this time.

The attenuator error correction procedure involves determining the 1 dB step attenuator errors, disabling the attenuator correction constants, determining the attenuator step errors and entering the new correction constants into the analyzer memory.

Equipment Required

Synthesized Signal generator 8663A
1 dB step attenuator 8494G
Attenuator/switch driver (if programmable step attenuators are used) 11713A
Cable, Type-N 152 cm (60 in)
Cable, BNC, 122 cm (48 in)
Attenuator interconnect kit
Adapter, Type N (m) to BNC (f)

Additional Equipment for 75 Ω Input

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

6a. Cal Attenuator Error

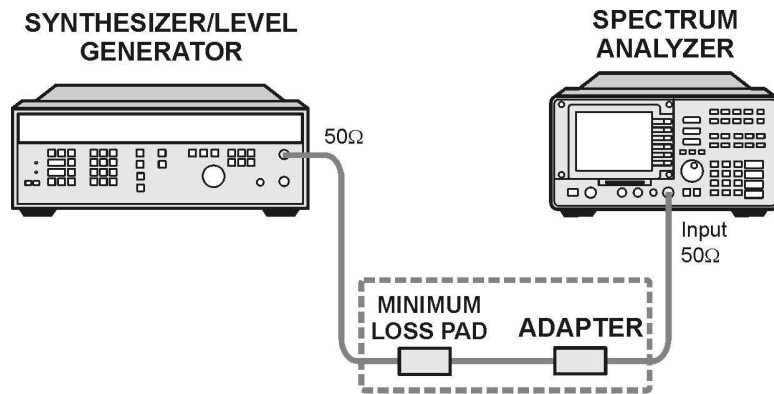
Calculate Actual Attenuation Errors

1. From the calibration data supplied with the 1 dB step attenuator, enter in column 2 of [Table 2a-1](#) the actual attenuation for the corresponding nominal attenuation settings in column 1.
2. Subtract column 1 from column 2 and enter these values in column 3.

Table 2a-1 Calculating Actual Attenuation Errors

Nominal 1 dB Step Attenuator Setting Column 1	Actual Attenuation Column 2	Attenuator Error (Column 2 - Column 1) Column 3
1 dB		
4 dB		
5 dB		
7 dB		
8 dB		
9 dB		

Figure 2a-1 Cal Attenuator Error Connection Setup



sq110

Procedure

The accuracy of the amplitude control attenuator is critical to the proper calibration of the instrument; therefore, this procedure must be carefully and accurately performed.

1. Connect the equipment as shown in [Figure 2a-1](#). The 75 Ω RF input requires an external pad as shown in [Figure 2a-1](#).
2. Set the frequency of the synthesized signal generator to 200 MHz and the amplitude to -10dBm.
3. Set the external 1 dB step attenuator to 9 dB.
4. To turn the cal attenuator corrections off, press the following analyzer keys.

PRESET

CAL, More 1 of 4

CORRECT ON OFF (OFF)

1 dB Step Check

5. To measure the 1 dB step correction, press the following analyzer keys.

FREQUENCY, 200, MHz

SPAN, 10, MHz

AMPLITUDE, 18, -dBm

SCALE LOG LIN (LIN), More 1 of 2

AMPTD UNITS, dBm

PEAK SEARCH

MKR FCTN, MK TRACK ON OFF (ON)

SPAN, 50, kHz

BW, 3, kHz

VID BW AUTO MAN, 300, Hz

75 Ω input: **AMPLITUDE, More 1 of 2, AMPTD UNITS, dBm**

6. Press the following analyzer keys.

PEAK SEARCH, MARKER DELTA

MKR FCTN, MK TRACK ON OFF (ON)

7. The MKR Δ amplitude reading should be 0.0 dB \pm 0.01 dB. If it is not, repeat [step 5](#).

6a. Cal Attenuator Error

8. Set the analyzer's reference level by pressing **AMPLITUDE**, 17, **-dBm**.
9. Set the 1 dB step attenuator to 8 dB.
10. The 1 dB attenuator step error is the MKR Δ reading minus the error in the 1 dB step attenuator when set to 9 dB and 8 dB in [Table 2a-1](#).

$$\begin{aligned} \text{1 dB atten step error} = \\ \text{Analyzer MKR } \Delta - (\text{9dB atten error} - \text{8 dB atten error}) \end{aligned}$$

11. Enter the 1 dB attenuator step error in [Table 2a-2](#).

2 dB Check

12. To measure the 2 dB step correction, press the following analyzer keys.

AMPLITUDE, 16, **-dBm**

13. Set the 1 dB step attenuator to 7 dB.

14. Press the following analyzer keys.

PEAK SEARCH, **MARKER DELTA**

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

15. The MKR Δ amplitude reading should be 0.0 dB \pm 0.01dB. If it is not, repeat [step 5](#).
 16. Set the analyzer's reference level by pressing **AMPLITUDE**, 14, **-dBm**.
 17. Set the 1 dB step attenuator to 5 dB.
 18. The 2 dB attenuator step error is the MKR Δ reading minus the error in the 1 dB step attenuator when set to 7 dB and 5 dB in [Table 2a-1](#).
- $$\begin{aligned} \text{2 dB attenuator step error} = \\ \text{Analyzer MKR } \Delta - (\text{7dB attenuator error} - \text{5 dB} \\ \text{attenuator error}) \end{aligned}$$
19. Enter the 2 dB attenuator step error in [Table 2a-2](#).

4 dB Step Check

20. To measure the 4 dB step correction, press the following analyzer keys.

AMPLITUDE, 17, -dBm

21. Set the 1 dB step attenuator to 8 dB.

22. Press the following analyzer keys.

PEAK SEARCH, MARKER DELTA

MKR FCTN, MK TRACK ON OFF (ON)

23. The MKR Δ amplitude reading should be 0.0 dB \pm 0.01dB. If it is not, repeat [step 5](#).

24. Set the analyzer's reference level by pressing **AMPLITUDE, 13, -dBm**.

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

26. The 4 dB attenuator step error is the MKR Δ reading minus the error in the 1 dB step attenuator when set to 8 dB and 4 dB in [Table 2a-1](#).

$$\begin{aligned} \text{4 dB attenuator step error} = \\ \text{Analyzer MKR } \Delta - (\text{8dB attenuator error} - \text{4 dB} \\ \text{attenuator error}) \end{aligned}$$

27. Enter the 4 dB attenuator step error in [Table 2a-2](#).

8 dB Step Check

28. To measure the 8 dB step correction, press the following analyzer keys.

AMPLITUDE, 18, -dBm

29. Set the 1 dB step attenuator to 9 dB.

30. Press the following analyzer keys.

PEAK SEARCH, MARKER DELTA

MKR FCTN, MK TRACK ON OFF (ON)

31. The MKR Δ amplitude reading should be 0.0 dB \pm 0.01dB. If it is not, repeat [step 5](#).

32. Set the analyzer's reference level by pressing **AMPLITUDE, 10, -dBm**.

33. Set the 1 dB step attenuator to 1dB.

6a. Cal Attenuator Error

34. The 8 dB attenuator step error is the MKR Δ reading minus the error in the 1 dB step attenuator when set to 9 dB and 1 dB in [Table 2a-1](#).

$$\text{8 dB atten step error} = \text{Analyzer MKR } \Delta - (\text{9dB atten error} - \text{1 dB atten error})$$

35. Enter the 8 dB attenuator step error in [Table 2a-2](#).

Table 2a-2 A12 Amplitude Control Assembly Attenuator Errors

1 dB Step Attenuator Setting (dB)		Reference Level Settings (dBm)		Attenuator Step (dB)	Error
OFF	ON	OFF	ON		
9	8	-18	-17	1	
7	5	-16	-14	2	
8	4	-17	-13	4	
9	1	-18	-10	8	

Entering Attenuator Error Correction Data

36. Press the following analyzer keys.

PRESET

75 Ω input only: **AMPLITUDE, More 1 of 2, AMPTD UNITS, dBm**

FREQUENCY, -2001, Hz

CAL, More 1 of 4, More 2 of 4

SERVICE CAL, SET ATTN ERROR

Note that the frequency of -2001 Hz is necessary to access the **SERVICE CAL** routines.

37. When the analyzer prompts you with the message ENTER CAL ATTN ERROR, enter the data from [Table 2a-2](#) and terminate with the reverse sign using the **dBm** or **-dBm** keys. For example, if the error recorded in [Table 2a-2](#) is 0.07, enter 0.07 and terminate with **-dBm**.

38. When the analyzer prompts you to enter the 16 dB step, enter 0 dBm. At the completion of entering the 16 dB error, the analyzer will reset.

39. To confirm that the correct data is stored, access the cal attenuator corrections by pressing the following analyzer keys.

CAL, More 1 of 4, More 2 of 4

SERVICE DIAG

DISPLAY CAL DATA

Note that the cal-attenuator corrections are the first five corrections located in the ERR column.

7a. Log and Linear Amplifier

This adjustment applies to:

- All 8590 E-Series and L-Series spectrum analyzers
- 8591C cable TV analyzers
- 8594Q QAM analyzers

A 21.4 MHz signal is injected into an IF test board that has been inserted in place of the first resolution bandwidth assembly, A11. The gain of the A14 log amplifier assembly is adjusted by observing the voltage at the AUX VIDEO OUT on the rear panel with a digital multimeter.

Equipment Required

- Synthesized signal generator
- Digital multimeter (DMM)
- IF test board
- Cable, BNC, 120 cm (48 in)
- Cable, BNC (f) to dual banana plug
- Test cable BNC (m) to SMB (f)
- Adapter tip FN (m) to BNC (f)
- 10 dB step attenuator (8496 A/G)
- Attenuator/switch driver (if programmable step attenuators are used)
- Attenuator interconnect kit

Procedure

1. Turn the analyzer **LINE** switch to OFF. Remove the instrument cover assembly.
2. Remove the first IF bandwidth filter assembly, A11. Install the IF test board into the A11 slot. Turn the analyzer **LINE** switch to ON.
3. Set the DMM to read dc volts.
4. Press the following analyzer keys.

PRESET

CAL, More 1 of 4

CORRECT ON OFF (OFF), More 2 of 4

SERVICE DIAG

STP GAIN ZERO

SPAN, 0, Hz

BW, 10, kHz

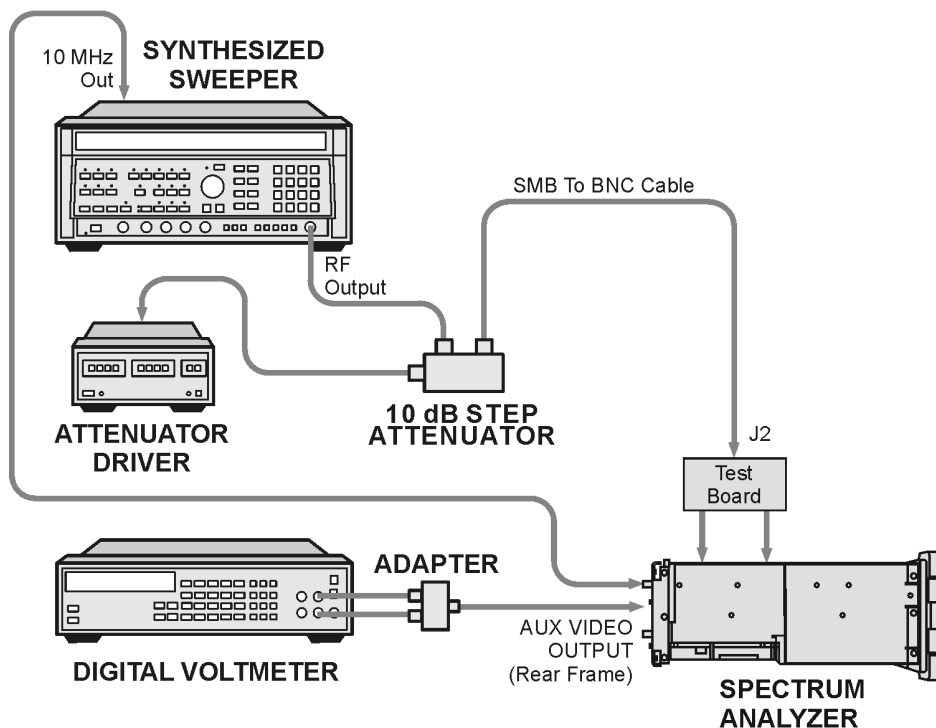
VID BW AUTO MAN, 300, Hz

AMPLITUDE, 10, -dBm

SCALE LOG LIN (LIN)

5. Set the synthesized signal generator as follows:
FREQUENCY 21.4 MHz
AMPLITUDE -6 dBm
6. Connect equipment as shown in [Figure 2a-2](#).

Figure 2a-2 Log and Linear Amplifier Adjustment Setup



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Log Fidelity Adjustment

7. With the frequency function active, adjust the INCR SET to 100 Hz. Press the \uparrow (step-up key) to maximize the signal level on screen. Adjust the synthesized signal generator amplitude as necessary to keep the signal on the display.

8. Adjust the synthesized signal generator output level for a DMM reading of 1000 mV \pm 7.0 mV. Record the synthesized sweeper amplitude readout for later reference:

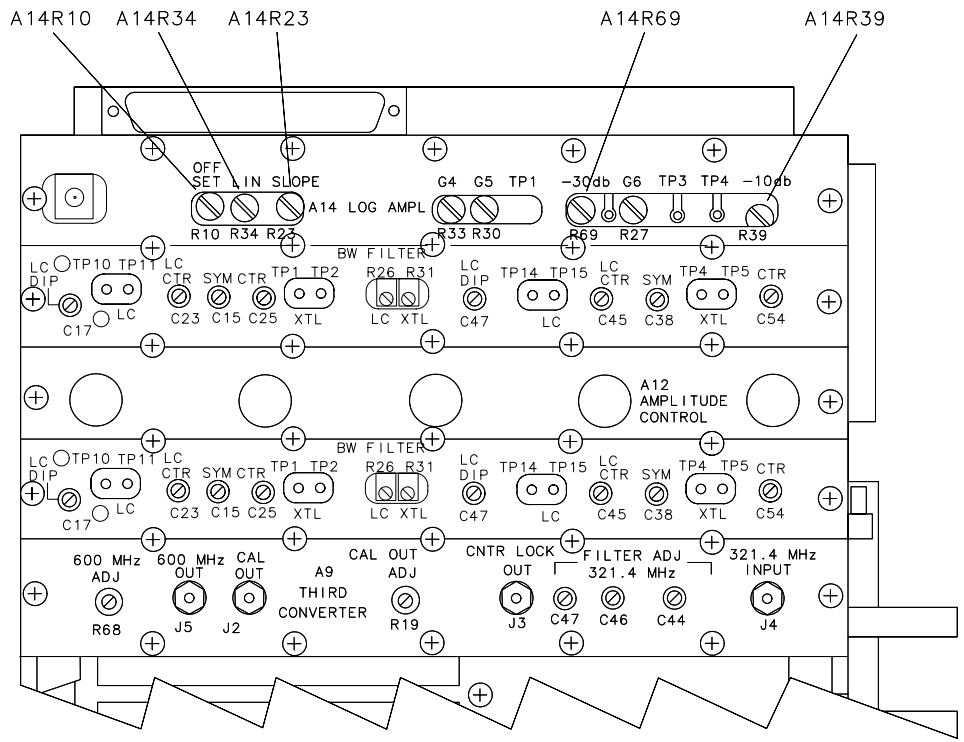
_____dBm

9. Press **SCALE** (LOG) on the analyzer.

10. Set the synthesized signal generator to the level recorded in [step 8](#) and adjust A14R23 SLOPE (refer to [Figure 2a-3](#)) for a DMM reading of 1000 mV \pm 1 mV.

From this point on, the power level will be controlled by the 8496G 10 dB step attenuator.

Figure 2a-3 Log and Linear Amplifier Adjustment Location



11. Set the 10 dB step attenuator to 60 dB. Adjust A14R10 OFFSET for the DMM reading of 250 mV \pm 2 mV.
12. Repeat [step 10](#) and [step 11](#) until no further adjustment is necessary.
13. Set the 10 dB step attenuator to 30 dB. Adjust the A14R23 SLOPE for a DMM reading of 625 mV \pm 2 mV.
14. Set the 10 dB step attenuator back to 0 dB. Adjust the A14R69 -30 dB for a DMM reading of 1000 mV \pm 1 mV.
15. Repeat [step 13](#) and [step 14](#) until no further adjustment is necessary.
16. Set the 10 dB step attenuator to 10 dB. Adjust the A14R23 SLOPE for a DMM reading of 875 mV \pm 2 mV.
17. Set the 10 dB step attenuator back to 0 dB. Adjust the A14R39 -10 dB for a DMM reading of 1000 mV \pm 2 mV.
18. Repeat [step 16](#) and [step 17](#) until no further adjustment is necessary.
19. Repeat [step 10](#) to [step 18](#) until the limits in [Table 2a-3](#) are met.

7a. Log and Linear Amplifier

Table 2a-3 Log Fidelity Check

Synthesized Sweeper Level	DMM Reading
Reference from step 8	1000 mV \pm 1 mV
Reference – 10 dB	875 mV \pm 3 mV
Reference – 20 dB	750 mV \pm 4 mV
Reference – 30 dB	625 mV \pm 4 mV
Reference – 40 dB	500 mV \pm 5 mV
Reference – 50 dB	375 mV \pm 6 mV
Reference – 60 dB	250 mV \pm 7 mV
Reference – 70 dB	125 mV \pm 8 mV

Linear Output and Step Gain Adjustments

20. Press the following analyzer keys.

AMPLITUDE, 50, –dBm

SCALE LOG LIN (LIN), **More 1 of 2**

AMPTD UNITS, dBm

21. Set the synthesized sweeper amplitude to the level recorded in [step 8](#) and adjust A14R34 LIN for a DMM reading of 1000 mV \pm 1 mV.

22. Make the adjustments indicated in [Table 2a-4](#).

Table 2a-4 Linear Gain Check

Adjust	Synthesized Sweeper Level	External Attenuator, 8496G (dB)	Analyzer Reference Level (dBm)	DMM Reading
A14R34	Reference from step 8	0 dB	–50	1000 mV \pm 1 mV
A14R33	Reference from step 8	10	–60	1000 mV \pm 5 mV
A14R30	Reference from step 8	20	–70	1000 mV \pm 5 mV
A14R27	Reference from step 8	30	–80	1000 mV \pm 5 mV
N/A	Reference from step 8	40	–90	1000 mV \pm 30 mV

15a. Frequency Response of the 8590L, 8591C, and 8591E

This adjustment applies to:

- 8590L spectrum analyzers
- 8591E spectrum analyzers
- 8591C cable TV analyzers

The frequency response (flatness) of the analyzer is measured with the corrections off. The source is adjusted to place the displayed signal at the analyzer center horizontal graticule line.

The flatness data is then entered into the analyzer using the **SERVICE CAL** functions. The error corrections are stored in battery backed RAM on the A16 processor/video assembly.

For analyzers equipped with 75 Ω inputs, the 50 Ω system is characterized before starting the "Frequency Response" adjustment procedure.

Equipment Required

- Synthesized signal generator
- Measuring receiver (*used as a power meter*)
- Frequency synthesizer
- Power sensor, 1 MHz to 1.8 GHz
- Power splitter
- Adapter, Type N (f) to APC 3.5 (m)
- 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 Inputs

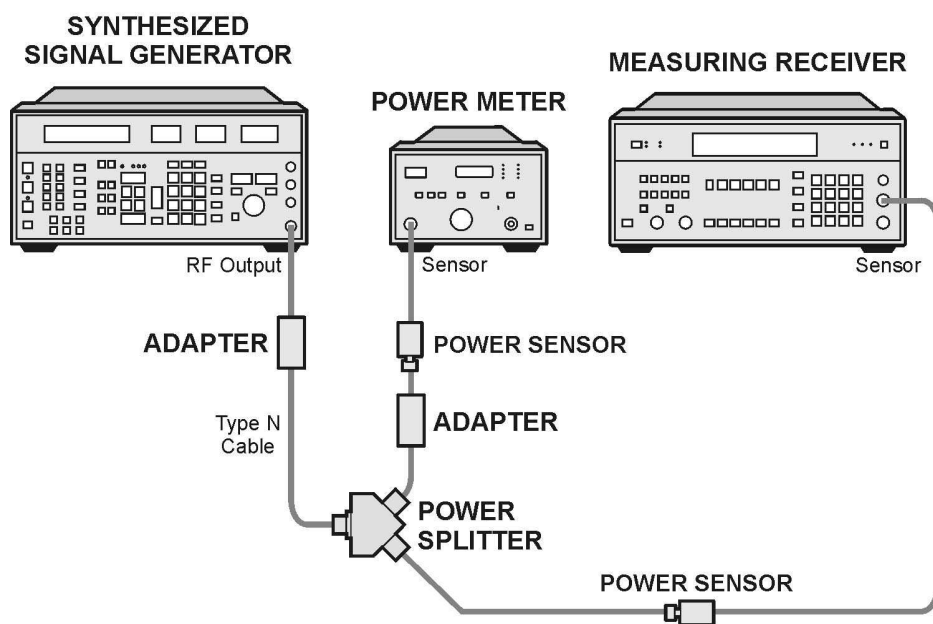
- Power meter
- Power sensor, 75 Ω
- Cable, BNC, 120 cm (48 in) 75 Ω
- Adapter, Type N (f) 75 Ω to Type N (m) 50 Ω
- Adapter, Type N (m) to BNC (m), 75 Ω

Procedure for System Characterization (75 Ω input)

1. Zero and calibrate the measuring receiver and 1 MHz to 1.8 GHz power sensor as described in the measuring receiver operation manual.
2. Zero and calibrate the power meter and the 75 Ω power sensor as described in the power meter operation manual.
3. Press INSTRUMENT PRESET on the synthesized signal generator. Set the synthesized signal generator controls as follows:

CW	41 MHz
FREQ STEP	37 MHz
POWER LEVEL	5 dBm
4. Connect the equipment as shown in [Figure 2a-4](#).

Figure 2a-4 System Characterization Test Setup for 75 Ω inputs



CAUTION

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

5. Adjust the synthesized signal generator POWER LEVEL for a 0 dBm reading on the measuring receiver.

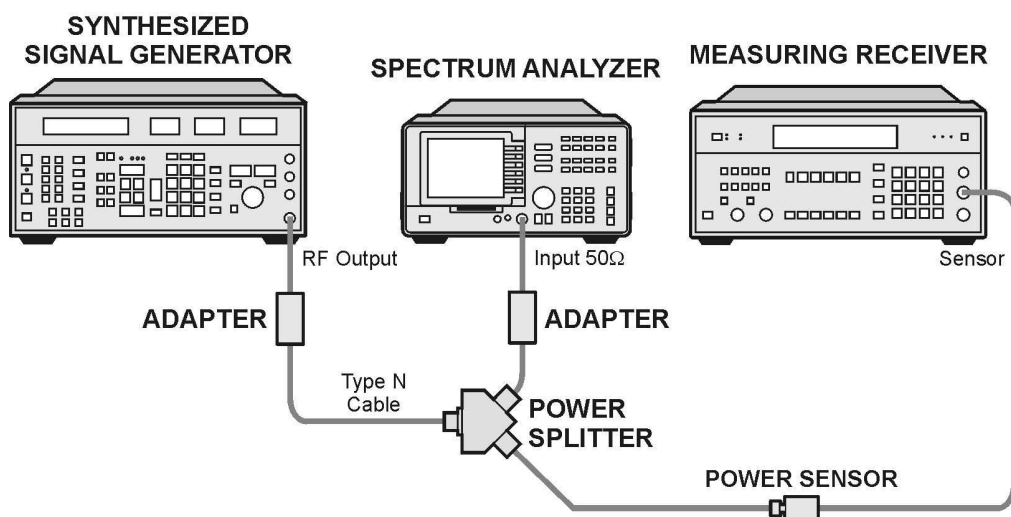
6. Record the power meter reading in Column 4 of [Table 2a-5](#), taking into account the cal factors of both power sensors.
7. On the synthesized signal generator, press CW and STEP UP, to step through the remaining frequencies listed in [Table 2a-5](#).

At each new frequency repeat [step 5](#) and [step 6](#), and enter each power sensor cal factor into the respective power meter.

Procedure

1. Zero and calibrate the measuring receiver and 1 MHz to 1.8 GHz power sensor in log mode as described in the measuring receiver operation manual.
2. Connect the equipment as shown in [Figure 2a-5](#).

Figure 2a-5 Frequency Response Setup



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CAUTION

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

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

CW	300 MHz
FREQ STEP	37 MHz
POWER LEVEL	-9 dBm

15a. Frequency Response of the 8590L, 8591C, and 8591E

4. On the analyzer, press the following keys.

PRESET

CAL, More 1 of 4

CORRECT ON OFF (OFF)

FREQUENCY, 300, MHz

CF STEP AUTO MAN, 37, MHz

SPAN, 12, MHz

75 Ω input: press **AMPLITUDE, More 1 of 2, AMPTD UNITS, dBm**

AMPLITUDE, 10, -dBm

SCALE LOG LIN (LOG), 1, dB

BW, 1, MHz

PEAK SEARCH

MKR FCTN, MK TRACK ON OFF (ON)

5. Adjust the synthesized signal generator POWER LEVEL for a MKR-TRK amplitude reading of $-14 \text{ dBm} \pm 0.1 \text{ dB}$.
6. Press RATIO mode on the measuring receiver.
7. Press the following analyzer keys.

FREQUENCY, 4, MHz

8. Set the synthesized signal generator CW to 4 MHz.
9. Adjust the synthesized signal generator POWER LEVEL for an analyzer MKR-TRK amplitude reading of $-14 \text{ dBm} \pm 0.1 \text{ dB}$.
10. Record the power ratio in Column 2 of [Table 2a-5](#) for 4 MHz.
11. Press the following analyzer keys.

FREQUENCY, 41, MHz

12. Set the synthesized signal generator CW to 41 MHz.
13. Adjust the synthesized signal generator POWER LEVEL for an analyzer MKR-TRK amplitude reading of $-14 \text{ dBm} \pm 0.1 \text{ dB}$.
14. Record the power ratio displayed on the measuring receiver in Column 2 of [Table 2a-5](#) for 41 MHz.
15. On the analyzer, press **FREQUENCY** and \uparrow (step up), to step through the remaining frequencies listed in Column 1 of [Table 2a-5](#). At each new frequency repeat [step 13](#) to [step 15](#), entering the power sensor Cal Factor into the measuring receiver as indicated in Column 3 of [Table 2a-5](#).

16. On the synthesized signal generator, press CW and STEP UP.

Entering Flatness Correction Data

17. Enter the pass code by pressing the following analyzer keys.

PRESET

FREQUENCY, -2001, Hz

75 Ω input: **AMPLITUDE, More 1 of 2, AMPTD UNITS, dBm**

18. To access the flatness correction menu, press the following analyzer keys.

CAL, More 1 of 4, More 2 of 4

SERVICE CAL

FLATNESS DATA

Perform the next step *only if* all the flatness correction data must be replaced in memory due to the repair or replacement of the A16 processor/video assembly.

19. To initialize the area of memory where the flatness correction data is stored, press the following keys.

INIT FLT

PRESET

FREQUENCY, -2001, Hz

75 Ω input: **AMPLITUDE, More 1 of 2, AMPTD UNITS, dBm**

CAL, More 1 of 4, More 2 of 4

SERVICE CAL

FLATNESS DATA

20. To enter flatness corrections, press **EDIT FLATNESS**.

21. The frequency of the first data point, 4.00 MHz, will be displayed in the active function block of the analyzer display.

22. Use the data keys on the analyzer to enter the amplitude value for 4 MHz from Column 2 of [Table 2a-5](#) (*75 Ω input:* Column 5), Frequency Response Errors. Terminate the entry with the **dB** key. When entering negative amplitude values, precede the numeric entry with the **-** and **dB** keys or the **-dB** key.

The **BK SP** (backspace) key may be used to correct any entry if the terminator, **dB** or **-dB** key has *not* been pressed. Re-enter the data if the terminator has been pressed.

15a. Frequency Response of the 8590L, 8591C, and 8591E

23. Press \uparrow (step up) and enter the data from [Table 2a-5](#), Column 2 ($75\ \Omega$ *input*: Column 5) for the next data point as described in [step 21](#).

24. Repeat [step 22](#) for the remaining flatness correction data points listed in [Table 2a-5](#).

At each point, verify that the frequency listed in the active function block corresponds to the frequency at which the data was taken. If these two frequencies do not correspond, press \uparrow (step up) or \downarrow (step down) until the proper frequency is displayed in the active function block.

If some data is incorrect after entering all of the data from [Table 2a-5](#), select the incorrect data point using \uparrow (step up) or \downarrow (step down) and re-enter the proper data.

25. After all corrections have been input, press the **STORE FLATNESS** softkey to store the correction data in nonvolatile memory. The instrument will automatically preset and display **CAL: DONE** in the active function block of the analyzer.

Table 2a-5 Frequency Response Errors

Column 1 Frequency (MHz)	Column 2 Error Relative to 300 MHz (dB)	Column 3 Sensor CAL FACTOR (GHz)	Column 4 (75 Ω inputs) System Error (dB)	Column 5 (75 Ω inputs) Corrected Error Relative to 300 MHz (dB)
4	_____	N/A	N/A	_____
41	_____	0.03	_____	_____
78	_____	0.1	_____	_____
115	_____	0.1	_____	_____
152	_____	0.1	_____	_____
189	_____	0.3	_____	_____
226	_____	0.3	_____	_____
263	_____	0.3	_____	_____
300	_____	0.3	_____	_____
337	_____	0.3	_____	_____
374	_____	0.3	_____	_____
411	_____	0.3	_____	_____
448	_____	0.3	_____	_____
485	_____	0.3	_____	_____
522	_____	0.3	_____	_____
559	_____	1.0	_____	_____
596	_____	1.0	_____	_____
633	_____	1.0	_____	_____
670	_____	1.0	_____	_____
707	_____	1.0	_____	_____
744	_____	1.0	_____	_____
781	_____	1.0	_____	_____
818	_____	1.0	_____	_____
855	_____	1.0	_____	_____
892	_____	1.0	_____	_____

Table 2a-5 Frequency Response Errors (Continued)

Column 1 Frequency (MHz)	Column 2 Error Relative to 300 MHz (dB)	Column 3 Sensor CAL FACTOR (GHz)	Column 4 (75 Ω inputs) System Error (dB)	Column 5 (75 Ω inputs) Corrected Error Relative to 300 MHz (dB)
929	_____	1.0	_____	_____
966	_____	1.0	_____	_____
1003	_____	1.0	_____	_____
1040	_____	1.0	_____	_____
1077	_____	1.0	_____	_____
1114	_____	1.0	_____	_____
1151	_____	1.0	_____	_____
1188	_____	1.0	_____	_____
1225	_____	1.0	_____	_____
1262	_____	1.0	_____	_____
1299	_____	1.0	_____	_____
1336	_____	1.0	_____	_____
1373	_____	1.0	_____	_____
1410	_____	1.0	_____	_____
1447	_____	1.0	_____	_____
1484	_____	1.0	_____	_____
1521	_____	1.0	_____	_____
1558	_____	2.0	_____	_____
1595	_____	2.0	_____	_____
1632	_____	2.0	_____	_____
1669	_____	2.0	_____	_____
1706	_____	2.0	_____	_____
1743	_____	2.0	_____	_____
1780	_____	2.0	_____	_____
1817	_____	2.0	_____	_____

Before You Start

Commands within parenthesis after a softkey, for example (LOG), are used throughout this chapter to indicate the part of a softkey which should be underlined when the key is pressed.

Refer to [Chapter 4](#) for information that is useful when first starting to troubleshoot an analyzer failure.

Before You Start

There are three things you must do *before* you begin troubleshooting an instrument failure.

- Familiarize yourself with the safety symbols marked on the analyzer, the general safety considerations, and the safety note definitions given in the front of this guide.
- Read the section entitled “[Protection from Electrostatic Discharge](#)” in [Chapter 15](#). The analyzer contains static-sensitive components.
- Become familiar with the organization of the troubleshooting information in this service guide and the information in this chapter.

WARNING

The analyzer contains potentially hazardous voltages. Refer to the safety symbols on the analyzer and the general safety considerations in this guide before operating the unit with the cover removed. Failure to heed the safety precautions can result in severe or fatal injury.

Backing Up Analyzer Correction Constants

This section describes how to retrieve the correction-constant data from the instrument memory and record the data as a backup copy. As long as the data remains valid, it can be used to recalibrate the instrument quickly after a memory loss. It is recommended that a copy of this data be maintained in the user's records. Procedures for restoring the correction constants to battery-backed RAM memory are also provided in this section.

Note that if the current correction constants are not valid, new correction constants must be generated. Refer to the following adjustment procedures in [Chapter 2](#) of this service guide.

- Adjusting the 10 MHz Reference.
- Adjusting the Frequency Response (*for your analyzer*).
- Adjusting the Cal Attenuator Error.
- Correcting the External ALC Error Correction (*for Option 010 and 011 only*).

The 8590 E-Series and L-Series spectrum analyzer, 8591C cable TV analyzer, and 8594Q QAM analyzer stores the following correction constants in RAM.

Flatness-correction constants. Used to correct frequency-response amplitude errors.

Step-attenuation correction constants. Used to correct A12 Amplitude Control step-attenuator errors and provide a relative amplitude reference for the CAL AMPTD self-calibration routine.

Timebase correction constant. Used by the DAC that tunes the RTXO (10 MHz timebase) on the A25 Counter Lock assembly. *Analyzers equipped with the precision frequency reference do not use this correction constant.*

CALGX slope and offset correction constants. Used to improve the performance of the external automatic level control (ALC). *Only analyzers equipped with Option 010 or 011 use these corrections.*

Retrieve the timebase and flatness-correction constants

1. Make a copy of the Correction Constant Backup-Data Record at the end of this chapter.
2. Record the date and instrument serial number.
Skip [Step 3](#) and [Step 4](#) if your instrument is equipped with a precision frequency reference or if testing an 8590L with Option 713.
3. Press the following keys.

PRESET

FREQUENCY, -37, Hz

CAL, More 1 of 4, More 2 of 4

4. Press **VERIFY TIMEBASE**, then record the number that is displayed in the active-function block in [Table 3-2](#).
5. Press the following keys.

SERVICE CAL, FLATNESS DATA, EDIT FLATNESS

6. The signal trace represents the frequency-response (flatness) correction-constant data. The active-function block displays the frequency response error.
7. Record the frequency-response error in the appropriate table for your analyzer. [Table 3-3](#) is for the 8590L and 8591E spectrum analyzers and 8591C cable TV analyzers. [Table 3-5](#) through [Table 3-12](#) are for all other 8590 E-Series and L-Series spectrum analyzers.
8. Press \uparrow , then record the next frequency-response error in the appropriate table.
9. Repeat the previous step until all frequency-response errors are recorded. Use \downarrow to view previous data points.
10. Press **EXIT** when all frequency-response errors have been recorded.

Retrieve the A12 step-gain and CALTGX correction constants

1. Press the following keys to view the current A12 step-attenuator correction constants.

CAL, More 1 of 4, More 2 of 4

SERVICE DIAG

DISPLAY CAL DATA

2. Look at the first five entries in the CA ATT ERR column; they are the amplitude errors for the 1 dB, 2 dB, 4 dB, 8 dB, and 16 dB step-attenuators.
3. Record the amplitude errors (correction constants) for the five step-attenuators in [Table 3-14](#).

[Step 4](#) is for analyzers equipped with Option 010 or 011 only. Skip this step for all other analyzers.

4. Record the CALTGX slope and offset correction constants in [Table 3-15](#). The correction constants are printed on a label that is located on the A7A1 Tracking Generator Control Board assembly.

File the completed copy of the Correction Constant Backup-Data Record for future reference.

Analyzer Initialization

This procedure is used to restore the factory/service correction constants to the processor/video board assembly, and to initialize the analyzer settings after a non-volatile memory loss. The loss of non-volatile memory may be caused by the following conditions.

- Installation of a new A16 Processor/Video board assembly
- Dead B1 battery

Firmware startup sequence

The firmware installed in the analyzer recognizes when the analyzer non-volatile memory is lost by comparing the contents of two RAM locations with known values. If there is a discrepancy, the startup routine is initiated.

The analyzer startup routine does the following:

- User memory is erased
- DLP editor memory is initialized
- Power-on state is set to PRESET
- Windows are initialized
- Video constants are initialized
- Display units are set to dBm
- Identifies which analyzer is present except for the following analyzers.

8591C
8590D
8595E
8592D

If the analyzer is either an 8595E or 8596E, the screen will prompt you to enter the correct analyzer model number. Enter 5 for an 8595E or a 6 for an 8596E spectrum analyzer.

After the startup routine is complete, the message USING DEFAULTS <n> is displayed on screen. The value of <n> is a key to what condition caused the startup sequence. This number was used in the development of the firmware and is of no value in troubleshooting.

In the case of an 8591C cable TV analyzer, the firmware is unable to identify this model number. After the loss of correction constants, an 8591C cable TV analyzer will actually identify as an 8591E spectrum analyzer.

If the analyzer is an 8591C, the analyzer's startup routine will identify it as an 8591E. Use this procedure to change the identity back to an 8591C.

Press the following keys.

PRESET (wait until preset is complete)

DISPLAY, Change Title

Use the softkeys to type in the following remote command. Don't forget to include the semicolon (;).

```
FACTSET 11023,1;
```

NOTE

A remote controller may be used in place of the execute title function.

DISPLAY, Hold

Press the following keys.

CAL, More 1 of 4, More 2 of 4, Service Cal, EXECUTE TITLE

PRESET (wait until preset is complete)

CONFIG, More 1 of 3, SHOW OPTIONS

Confirm that the correct analyzer model number is displayed.

Set the default configuration

Set the default configuration by pressing the following analyzer keys.

CONFIG, More 1 of 3, DEFAULT CONFIG, DEFAULT CONFIG

Reset the power-on units

Set the power-on units by pressing the following analyzer keys.

PRESET

FREQUENCY, -2001, Hz

AMPLITUDE, More 1 of 2

INPUT Z 50 75 (so that 50 is underlined)

75 Ω input only: Press **INPUT Z 50 75**, so that 75 is underlined.

AMPLITUDE, SCALE LOG LIN (LOG), More 1 of 2

Amptd Units dBm

75 Ω input only: Press **dBmV**.

AMPLITUDE, SCALE LOG LIN (LIN), More 1 of 2

Amptd Units Volts

CAL, More 1 of 4, More 2 of 4, Service Cal, STOR PWR ON UNITS

Reloading the Correction Constants

This procedure assumes that you have valid correction constant data from a previous backup. Without backup data, new correction constants must be generated by performing the adjustments in [Chapter 2](#).

Reload the timebase-correction constant

Skip this step for instruments equipped with a precision frequency reference.

Reload the timebase correction constant by pressing the following analyzer keys.

PRESET

FREQUENCY, -2001, Hz

CAL, More 1 of 4, More 2 of 4

Service Cal, **CAL TIMEBASE**

Type the value from the Table (corr backup) using the DATA Keys, then press **ENTER**.

Reload the flatness-correction constants

1. Reload the flatness-correction constants by pressing the following analyzer keys.

Press **FREQUENCY**

Enter -2001, Hz

Press **CAL**, More 1 of 4, More 2 of 4

Press **Service Cal**

Flatness Data

INT FLAT For Option 026: Press **INIT FLT 26.5 GHz**

EDIT FLATNESS

2. Enter each correction constant listed in the Correction Constant Backup-Data Record, then terminate the entry with the **+dBm** or **-dBm** key, as appropriate. Each entry is displayed briefly before the data-entry routine steps to the next correction data point.

Use the **↑** and **↓** keys to edit previously entered correction data.

3. When all flatness-correction constants are entered, press **STORE FLATNESS**, More, **EXIT**.

Reload the A12 step-gain-correction constants

1. Reload the A12 step-gain-correction constants by pressing the following keys.

PRESET

FREQUENCY, -2001, Hz

CAL, More 1 of 4, More 2 of 4

Service Cal, SET ATTN ERROR

REF LVL OFFSET is displayed in the active-function block above the prompt ENTER CAL ATTN ERROR 1.

2. At the prompt, enter the five step-attenuator correction constants (resolution to 0.01 dB) listed in the Correction Constant Backup-Data Record, then terminate each entry with either **+dBm** or **-dBm**, as appropriate. Typically 1 and 2 dB step errors are negative. The 4 and 8 dB steps are positive. The 16 dB step is always 0 dB.

Each entry is displayed to the left of the graticule as an amplitude offset, but only with 0.1 dB resolution. A PRESET occurs after the 16 dB step-attenuator error is entered.

Reload the differential phase calibration constant

This step is for instruments equipped with Option 107 only.

1. Install 85721A Cable TV Measurements Personality.

Refer to your cable TV measurements user's guide for the procedure to load this personality.

Press **FREQUENCY**

Enter **-2001, Hz**

Press **CAL, More 1 of 4, More 2 of 4**

Press **Service Cal, Flatness Data**

Press **Store DP CAL**

Enter **-7373, Hz**

Instrument Calibration after Reloading the Correction Constants

It is necessary to calibrate the analyzer after reloading correction constants. Refer to [Chapter 2](#) in this service guide to perform the following adjustments.

- Performing the CAL FREQ Adjustment Routine (*for all 8590 E-Series and L-Series spectrum analyzers, 8591C cable TV analyzers and 8594Q QAM analyzers*)
- Performing the CAL AMPTD Adjustment Routine (*for all 8590 E-Series and L-Series spectrum analyzers, 8591C cable TV analyzers and 8594Q QAM analyzers*)
- Performing the CAL YTF Adjustment Routine (*for the 8592L, 8593E, 8595E or 8596E spectrum analyzers only*)
- Performing the CAL MXR Adjustment Routine (*for the 8592L, 8593E, 8595E or 8596E spectrum analyzers only*)
- Adjusting the Display (*for all 8590 E- and L-Series spectrum analyzers, 8591C cable TV analyzers and 8594Q QAM analyzers*)
- Adjusting the Time and Date (*for all 8590 E-Series and L-Series spectrum analyzers, 8591C cable TV analyzers and 8594Q QAM analyzers*)

The analyzer should now be fully restored to its previous state.

NOTE

Instrument firmware expects the cal output signal to be 300 MHz \pm 2 MHz. Sometimes the instrument default data is not able to tune the cal signal within this range and a “cal signal not found” message may appear on screen. Perform a cal output bypass check by pressing **Frequency, -37, Hz, Cal, Cal Freq**. This will bypass the cal check and start by calibrating the sweep ramp.

Backing Up and Reloading Correction Constants
Instrument Calibration after Reloading the Correction Constants

Table 3-1 Correction Constant Backup-Data Record

Agilent Technologies	Analyzer Model: _____
Serial No.: _____	Date: _____

**Table 3-2 RTXO Timebase Correction Constant
(Instruments without precision frequency reference)**

Timebase	_____
----------	-------

Table 3-3 Frequency Response Correction Constants for the 8590L, 8591C, or 8591E

Frequency (MHz)	Error (dB)*	Frequency (MHz)	Error (dB)*	Frequency (MHz)	Error (dB)*	Frequency (MHz)	Error (dB)*
4	_____	485	_____	966	_____	1447	_____
41	_____	522	_____	1003	_____	1484	_____
78	_____	559	_____	1040	_____	1521	_____
115	_____	596	_____	1077	_____	1558	_____
152	_____	633	_____	1114	_____	1595	_____
189	_____	670	_____	1151	_____	1632	_____
226	_____	707	_____	1188	_____	1669	_____
263	_____	744	_____	1225	_____	1706	_____
300	_____	781	_____	1262	_____	1743	_____
337	_____	818	_____	1299	_____	1780	_____
374	_____	855	_____	1336	_____	1817	_____
411	_____	892	_____	1373	_____		_____
448	_____	929	_____	1410	_____		_____

* Instruments equipped with 75 Ω Input Impedance, display dBmV.

Table 3-4 Correction Constant Backup-Data Record

Agilent Technologies	Analyzer Model: _____
Serial No.: _____	Date: _____

Table 3-5 Frequency-Response Correction Constants for 8592L, 8593E, 8594E, 8594L, 8594Q, 8595E, or 8596E Band 0

Frequency (GHz)	Error (dB)	Frequency (GHz)	Error (dB)	Frequency (GHz)	Error (dB)	Frequency (GHz)	Error (dB)
0.012	_____	0.804	_____	1.596	_____	2.388	_____
0.084	_____	0.876	_____	1.668	_____	2.460	_____
0.156	_____	0.948	_____	1.740	_____	2.532	_____
0.228	_____	1.020	_____	1.812	_____	2.604	_____
0.300	_____	1.092	_____	1.884	_____	2.676	_____
0.372	_____	1.164	_____	1.956	_____	2.748	_____
0.444	_____	1.236	_____	2.028	_____	2.820	_____
0.516	_____	1.308	_____	2.100	_____	2.892	_____
0.588	_____	1.380	_____	2.172	_____		_____
0.660	_____	1.452	_____	2.244	_____		_____
0.732	_____	1.524	_____	2.316	_____		_____

Table 3-6 Frequency-Response Correction Constants for 8592L, 8593E, 8595E, or 8596E Band 1

Frequency (GHz)	Error (dB)	Frequency (GHz)	Error (dB)	Frequency (GHz)	Error (dB)	Frequency (GHz)	Error (dB)
2.7500	_____	3.9245	_____	5.0990	_____	6.235	_____
2.9849	_____	4.1594	_____	5.3339	_____	6.5084	_____
3.2198	_____	4.3943	_____	5.5688	_____		_____
3.4547	_____	4.6292	_____	5.8037	_____		_____
3.6896	_____	4.8641	_____	6.0386	_____		_____

Backing Up and Reloading Correction Constants
Instrument Calibration after Reloading the Correction Constants

Table 3-7 Correction Constant Backup-Data Record

Agilent Technologies	Analyzer Model: _____
Serial No.: _____	Date: _____

Table 3-8 Frequency-Response Correction Constants for 8592L, 8593E, or 8596E Band 2

Frequency (GHz)	Error (dB)	Frequency (GHz)	Error (dB)	Frequency (GHz)	Error (dB)	Frequency (GHz)	Error (dB)
6.100	_____	7.940	_____	9.780	_____	11.620	_____
6.284	_____	8.124	_____	9.964	_____	11.804	_____
6.468	_____	8.308	_____	10.148	_____	11.988	_____
6.652	_____	8.492	_____	10.332	_____	12.172	_____
6.836	_____	8.676	_____	10.516	_____	12.356	_____
7.020	_____	8.860	_____	10.700	_____	12.540	_____
7.204	_____	9.044	_____	10.884	_____	12.724	_____
7.388	_____	9.228	_____	11.068	_____		
7.572	_____	9.412	_____	11.252	_____		
7.756	_____	9.596	_____	11.436	_____		

Table 3-9 Frequency-Response Correction Constants for 8592L or 8593E Band 3

Frequency (GHz)	Error (dB)	Frequency (GHz)	Error (dB)	Frequency (GHz)	Error (dB)	Frequency (GHz)	Error (dB)
12.450	_____	14.290	_____	16.130	_____	17.970	_____
12.680	_____	14.520	_____	16.360	_____	18.200	_____
12.910	_____	14.750	_____	16.590	_____	18.430	_____
13.140	_____	14.980	_____	16.820	_____	18.660	_____
13.370	_____	15.210	_____	17.050	_____	18.890	_____
13.600	_____	15.440	_____	17.280	_____	19.120	_____
13.830	_____	15.670	_____	17.510	_____	19.350	_____
14.060	_____	15.900	_____	17.740	_____		

Table 3-10 Correction Constant Backup-Data Record

Agilent Technologies	Analyzer Model: _____
Serial No.: _____	Date: _____

Table 3-11 Frequency-Response Correction Constants for 8592L or 8593E Band 4

Frequency (GHz)	Error (dB)	Frequency (GHz)	Error (dB)	Frequency (GHz)	Error (dB)	Frequency (GHz)	Error (dB)
19.150	_____	19.900	_____	20.650	_____	21.400	_____
19.300	_____	20.050	_____	20.800	_____	21.550	_____
19.450	_____	20.200	_____	20.950	_____	21.700	_____
19.600	_____	20.350	_____	21.100	_____	21.850	_____
19.750	_____	20.500	_____	21.250	_____	22.000	_____

Table 3-12 Frequency-Response Correction Constants for 8592L or 8593E Band 4 (Option 026)

Frequency (GHz)	Error (dB)	Frequency (GHz)	Error (dB)	Frequency (GHz)	Error (dB)	Frequency (GHz)	Error (dB)
19.100	_____	21.024	_____	22.948	_____	24.872	_____
19.248	_____	21.172	_____	23.096	_____	25.020	_____
19.396	_____	21.320	_____	23.244	_____	25.168	_____
19.544	_____	21.468	_____	23.392	_____	25.316	_____
19.692	_____	21.616	_____	23.540	_____	25.464	_____
19.840	_____	21.764	_____	23.688	_____	25.612	_____
19.988	_____	21.912	_____	23.836	_____	25.760	_____
20.136	_____	22.060	_____	23.984	_____	25.908	_____
20.284	_____	22.208	_____	24.132	_____	26.056	_____
20.432	_____	22.356	_____	24.280	_____	26.204	_____
20.580	_____	22.504	_____	24.428	_____	26.352	_____
20.728	_____	22.652	_____	24.576	_____	26.500	_____
20.876	_____	22.800	_____	24.724	_____		_____

Table 3-13 Correction Constant Backup-Data Record

Agilent Technologies	Analyzer Model: _____
Serial No.: _____	Date: _____

Table 3-14 A12 Step-Attenuator Correction Constants

Attenuator Step	ERR (dB)	Attenuator Step	ERR (dB)
1 dB	_____	4dB	_____
2dB	_____	8dB	_____
		16dB	_____

Table 3-15 CALTGX Correction Constants (Options 010 and 011)

Slope	_____
Offset	_____

4 Troubleshooting the Analyzer

This chapter provides information that is useful when starting to troubleshoot an analyzer failure. It provides procedures for troubleshooting common failures and isolating problems in the analyzer.

Additional troubleshooting details for specific assemblies are available in [Chapter 5](#) and [Chapter 6](#) of this service guide. Assembly descriptions are located in [Chapter 9](#).

Component-level information for the 8590 E-Series and L-Series spectrum analyzers, 8591C cable TV analyzers, 8594Q QAM analyzers is provided in the *8590 Series Analyzers Component-Level Repair Service Guide* binder. Refer to [Chapter 12](#) for a list of available component-level service information.

Before You Start

There are four things you should do before starting to troubleshoot a failure.

- Check that you are familiar with the safety symbols marked on the instrument, and read the general safety considerations and the safety note definitions given in the front of the this guide.
- The analyzer contains static sensitive components. Read the section entitled “Protection From Electrostatic Discharge” in step 1.
- Become familiar with the organization of the troubleshooting information in this chapter and the chapters that follow.
- Read the rest of this section.

WARNING

The analyzer contains potentially hazardous voltages. Refer to the safety symbols on the analyzer and the general safety considerations at the beginning of this service guide before operating the unit with the cover removed. Failure to heed the safety precautions can result in severe or fatal injury.

Service equipment you will need

Refer to in Table 1-7, “Recommended Test Equipment,” in Chapter 1 of the *8590 Series Analyzers Calibration Guide* for a list of the recommended test equipment needed to troubleshoot and repair the analyzer. Although Agilent Technologies equipment is recommended, any equipment that meets the critical specifications given in the table can be substituted for the recommended model.

Refer to [Chapter 15](#) of this guide for a list of required service and hand tools needed to troubleshoot and repair the analyzer.

Replacement assemblies

Some of the 8590 E-Series and L-Series spectrum analyzers, 8591C cable TV analyzer, and 8594Q QAM analyzer assemblies are not repairable to the component level. The following assemblies are not repairable to the component level and must be replaced as an assembly.

- A2 display
- A3 input attenuator (8590L, 8591E, and 8591C only)
- A3A2 RF switch (8592L, 8593E, 8595E, and 8596E only)
- A3A3 2.9 GHz low-pass filter (8592L, 8593E, 8594E, 8594L, 8594Q, 8595E, and 8596E only)
- A3A4 second converter (8592L, 8593E, 8594E, 8594L, 8594Q, 8595E, and 8596E only)
- A3A5 input attenuator (8592L, 8593E, 8594E, 8594L, 8594Q, 8595E, and 8596E only)
- A3A6 dual mixer (8592L, 8593E, 8595E, and 8596E only)
- A3A6 low band mixer (8594E, 8594L, and 8594Q only)
- A3A7 YTO (8592L, 8593E, 8594E, 8594L, 8594Q, 8595E, and 8596E only)
- A3A8 YTF (8592L and 8593E only)
- A3A8 switched YTF (8595E, and 8596E only)
- A3A9 321.4 MHz bandpass filter (8592L, 8593E, 8594E, 8594L, 8594Q, 8595E, and 8596E only)
- A3A14 first LO distribution amplifier (Option 009, 010 only)
- A3A15 tracking generator (Option 010 only)
- A4 first converter (8590L, 8591E, and 8591C only)
- A6 YTO (8590L, 8591E, and 8591C only)
- A8 power supply
- A22 10 MHz precision frequency reference

Troubleshooting the Analyzer

Before You Start

- A25A1 sampler
- A26 TV tuner module (Option 107) *Qualified Service Center Only*
- A130 narrow bandwidth (Option 030 only)

Refer to [Chapter 12](#) when ordering replacement assemblies.

After an analyzer repair

If one or more analyzer assemblies have been repaired or replaced, perform the related adjustments and performance verification tests. Refer to [Chapter 2](#) for a table of the related adjustments and performance verification tests required for each assembly.

Problems at Instrument Power-Up

This section describes symptoms that can occur when the analyzer is first powered on.

CAUTION

Immediately unplug the analyzer from the ac power line if the unit shows any of the following symptoms.

- Smoke, arcing, or unusual noise from inside the unit.
- No response of any kind when unit is plugged into ac power mains and turned on.
- The analyzer ac power fuse blows.
- A circuit breaker or fuse on the main ac power line opens.

These potentially serious faults must be corrected before proceeding. Refer to [“Troubleshooting an Inoperative Analyzer.”](#)

Note that analyzers equipped with the AM/FM speaker (Options 102, 103, or 110) normally emit noise from the speaker at power-up. This is not a problem, adjust the volume control as desired.

Table 4-1 lists symptoms that can occur when the instrument is first powered on. Refer to this table for an overview of symptoms at power-up and their possible cause.

Table 4-1 Instrument Failure Symptoms at Power-On

Line LED	A8 LED -15 V	A8 LED +15 V	A8 LED +5 V	A8 LED +12 V	B1 Fan	A2 Display	Possible Cause
ON	ON	ON	ON	ON	ON	ON	Normal Operation*
OFF	ON	ON	ON	ON	ON	ON	W1 wiring to Line LED, or Line LED
OFF	OFF	OFF	OFF	OFF	OFF	OFF	Line fuse, A8 primary circuit failure
ON	M	M	M	M	M	X	A8 primary overload
ON	OFF	ON	ON	ON	ON	X	-15 V supply failure
ON	OFF	M	M	M	M	X	-15 V supply overload
ON	ON	OFF	ON	ON	ON	X	+15 V supply failure
ON	M	OFF	M	M	M	X	+15 V supply overload
ON	M	M	OFF	M	M	X	+5 V supply failure or supply overload
ON	ON	ON	ON	OFF	OFF	OFF	+12 V supply failure
ON	M	M	M	OFF	OFF	OFF	+12 V supply overload
ON	ON	ON	ON	ON	OFF	ON	Fan failure or open along +12 V supply line to fan
ON	ON	ON	ON	ON	ON	OFF	NoWRUP signal
ON	ON	ON	ON	ON	ON	X	A16 assembly failure
ON	ON	ON	ON	ON	ON	OFF	Display failure, intensity-control failure, or A16 memory failure
ON	ON	ON	ON	ON	ON	M	Intensity control failure, or A16 memory failure

M = LED or assembly is momentarily on, then goes off.
 X = Status of LED or assembly does not matter.

* DS13 remains on after **PRESET** is pressed.

Troubleshooting an Inoperative Analyzer

When an analyzer appears to be inoperative, there is often little evidence that points directly to the cause. This section provides steps and solutions to typical failure modes relating to an inoperative analyzer.

Before troubleshooting an analyzer, ensure that it has been set up correctly and the power supply is functioning properly by performing step 1 and step 2 below.

Step 1. Check the Analyzer Setup

- Check that the voltage-selector switch on the rear of the A8 power supply is correct for the ac power line in use.
- Check that the ac line-power voltage is present and that the instrument line cord is in good condition.
- Check the line fuse. If it has blown, perhaps a nonstandard fuse with too low a current rating was installed. If the line fuse still blows, continue with the section entitled “[If the line fuse has blown.](#)”

WARNING

For continued protection against fire hazard, replace fuse only with same type and ratings, (type 5A/250V). Failure to use the proper fuse specified for the analyzer can cause substantial instrument damage. The use of other fuses or materials is prohibited.

Step 2. Check the Power Supply

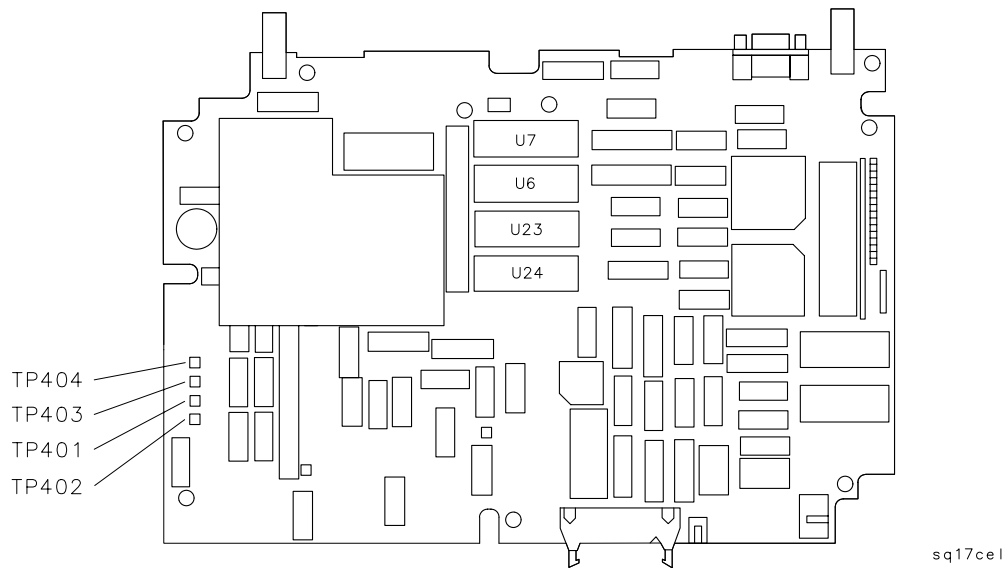
The power supply voltages are checked using a digital voltmeter.

1. Turn the analyzer **LINE** switch to OFF. Remove the instrument cover assembly.
2. Connect the DMM test leads from the chassis (ground) to A16TP403. See [Figure 4-1](#).

WARNING

The analyzer contains potentially hazardous voltages. Refer to the safety symbols provided on the analyzer, and in the general safety instructions in this guide, before operating the unit with the cover removed. Ensure that safety instructions are strictly followed. Failure to do so can result in severe or fatal injury.

Figure 4-1 A16 Power Supply Test Point Location



3. Turn the analyzer **LINE** switch to ON.
4. Locate the power supply test point using [Figure 4-1](#). Check the supply voltages as indicated in [Table 4-2](#). Be sure the voltage readings are within the limits shown in [Table 4-2](#).
5. Repeat [step 4](#) for each power supply listed in [Table 4-2](#).

Table 4-2 Power Supply Tolerances

Power Supply	Test Point	Specification
+5.1 V	A16TP403	+5.0 to +5.25 Vdc
+12.0 V	A16TP404	+11.1 to +12.8 Vdc
+15.0 V	A16TP401	+14.7 to +15.25 Vdc
-15.0 V	A16TP402	-14.7 to -15.25 Vdc

If the line fuse has blown

If the instrument was set up correctly, and the line fuse still blows, suspect that the power supply is defective.

CAUTION

The A8 power supply assembly is a switching power-supply and does not operate normally without a load on the dc power-supply outputs. Do not attempt to operate the power supply out of the instrument. Damage to the power supply may occur.

If the fan is not operating

CAUTION

The A8 power supply may be hot if the instrument has been operating without the fan running. Allow the instrument to cool down before troubleshooting.

The B1 Fan receives +12 Vdc from the A8 power supply after the power supply receives the start-up signal, low-power-on (LPWRON) from the front-panel LINE switch. First check the +12 Vdc supply to the fan at the Rear Frame.

1. Disconnect the line-power cord from the analyzer.
2. Look through the fan grill. If the cables routed near the fan are jammed in the fan, remove the fan from the rear frame, reroute the cables, and remount the fan.
3. Remove the fan from the rear frame and disconnect its wiring connector from A15J19.
4. Reconnect line power to the analyzer and turn it on.
5. Refer to “A15 Motherboard Assembly” in [Chapter 5](#) for the pin identification of the fan-supply connector, A15J19, and the A8 power-supply connector, A8J1.
6. Check that pin 2 on A15J19 is connected to digital common-ground (DCOM). If the ground connection is open, suspect the A15 Motherboard.
7. Check pin 1 on A15J19 for +12 Vdc.

If the +12 Vdc is present, check for a defective B1 fan assembly by connecting the fan to an external DC supply.

If the +12 Vdc is absent, do the following:

- Disconnect the analyzer from the line power.
- Remove the A8 power supply.
- Check the continuity of the A15 motherboard from pin 1 on A15J19 to pin 8 on A15J13.
- If the continuity of the motherboard is correct, suspect a bad connection on the D sub-connector (between pin 8 on A15J13 and pin 8 on A8J1) or a defective power supply.

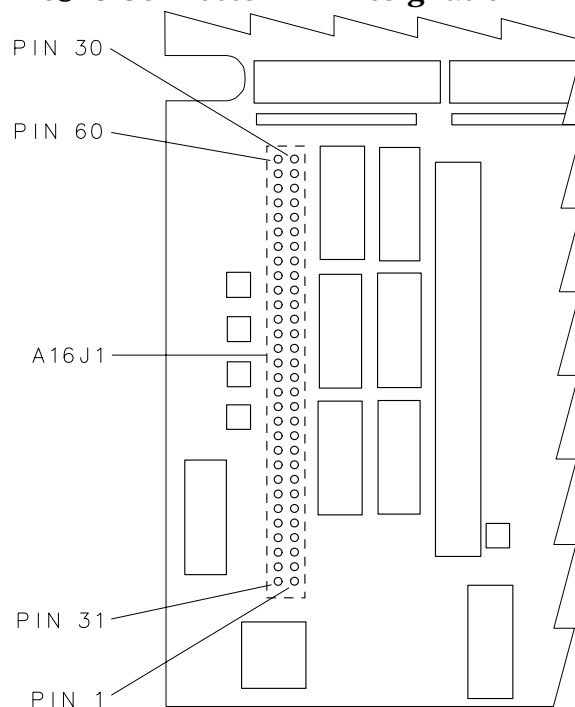
If all the A8 power-supply LEDs are off

If all the power-supply LEDs remain off, the low-power-on (LPWRON) control line must be checked from the front-panel line switch, through the A16 processor/video assembly and A15 Motherboard, to the A8 power supply.

1. Disconnect the analyzer line-power cord, remove the instrument cover, and turn the instrument so its bottom side faces up.
2. Check that the line switch provides the correct LPWRON signal at pin 2 on A16J9.
 - LPWRON becomes TTL low when the line switch is on. The closed switch connects A16J9 pin 2 to the digital common-ground (DCOM) through the W1 wiring harness.
 - LPWRON is pulled TTL high by the power supply when the line switch is in STANDBY.
3. Check the continuity of the LPWRON signal trace from pin 2 on A16J9 to pin 19 on A15J13. Refer to [Figure 4-2](#) for the pin designations of the A15J13 connector.
4. Refer to “A15 Motherboard Assembly” in [Chapter 5](#) for the connector-pin designations of the A16 and A15 assemblies.
5. If the LPWRON signal path from the previous step is correct, suspect a bad connection on the D sub-connector (between pin 19 on A15J13 and pin 19 on A8J1) or a defective power supply. Isolate the failure to the power supply by substituting another power supply assembly into the analyzer.

Figure 4-2

A15J13 Connector-Pin Designation



sh235e

If individual A8 power-supply LEDs are off

If one or more of the A8 power-supply LEDs remain off, determine whether the power supply is defective or circuitry on the dc power-supply distribution network is loading the power supply down by substituting another power supply assembly.

If all the A8 power-supply LEDs are on

If all the A8 power-supply LEDs are on, check the dc power-supply voltages on the A16 processor/video assembly. Check each voltage at the A16 assembly test points, TP401 through TP404. Refer to Foldout 11-1 for the dc-voltage assignment of each test point.

If a dc voltage is missing, suspect an open connection in the dc power-supply distribution network. Refer to “A15 Motherboard Assembly” in [Chapter 5](#) for the connector-pin designation of each assembly connected to the missing dc voltage supply.

If Using Defaults <N> is displayed

A dead BT101 battery will cause the loss of all correction-factor and correction-constant data. When the data stored in memory is lost, the analyzer substitutes the default-correction data stored in ROM and performs the instrument-preset routine. The message

Using Defaults <N> will appear on the analyzer display (where N is an integer that represents a code that was used during the development of the analyzer firmware).

If the battery is dead, replace the battery as described in [Chapter 7](#) then reload the correction constants as described in [Chapter 3](#) of this service guide.

Troubleshooting the A2 Display Assembly

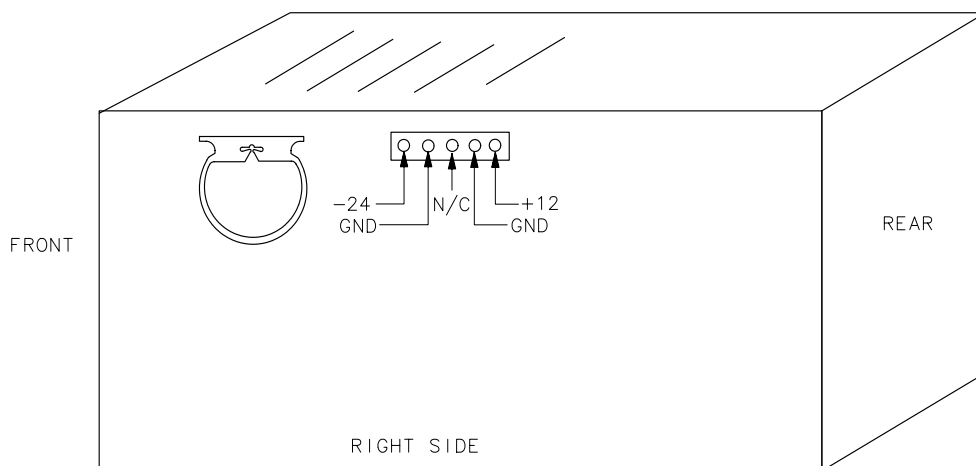
Use this section when the A8 power supply is functioning but there appears to be a defective A2 display assembly. Check the following conditions before proceeding with the A2 display troubleshooting procedures.

- ❑ Check that the B1 Fan is running and the green LED above the **LINE** switch is on when the analyzer is on. If they are not operating, refer to the appropriate section of “[Troubleshooting an Inoperative Analyzer.](#)”
- ❑ Check the five LEDs on the A8 power supply assembly. If they are not on, refer to the appropriate section of “[Troubleshooting an Inoperative Analyzer.](#)”

Note that the A8 power supply draws current whenever ac line power is applied, even when the LINE switch is in the STANDBY position. However, no voltages are distributed outside the A8 power supply assembly when the LINE switch is in the STANDBY position, except for a TTL high on LPWRON.

- ❑ Check the dc power supplied to the A2 display. There is a separate 12 V supply for the display assembly. This supply can be checked at the output connector, A8J6, located on the right side of the A8 power supply. Refer to [Figure 4-3](#). If there is a failure, check the continuity of the cable assembly W51 supplying the display, and the integrity of the power supply using the procedures in this chapter.

Figure 4-3 Detail of Power Supply Connector, A8J6



sh281e

WARNING

High voltage is present within the A2 display and remains for some time after it has been disconnected. Be careful while troubleshooting the display outside of its enclosure.

If an A2 display assembly failure is suspected, the display must be removed from its enclosure for further troubleshooting. Refer to the A2 display assembly removal procedure in [Chapter 3](#) before checking the continuity of the W2 and W3 wire harnesses. If both W2 and W3 are good, suspect the A2 display.

The A2 display is not field-repairable, and must be replaced as an assembly. Refer to [Chapter 10](#) for part number information.

After replacement, adjust the new display, refer to [step 2](#).

If the display has an intensity problem

CAUTION

The A1R1 potentiometer leads are easily broken. Do not twist the W3 wire harness where it attaches to A1R1.

1. Disconnect W3 from the A1R1 intensity control potentiometer on the front frame.
2. Check the continuity and resistance range (0 to 100 k Ω) of the inner potentiometer on A1R1.
3. Reconnect W3 to A1R1.

If the display is blank

1. Verify the MONITOR OUTPUT, located on the analyzer rear frame, by performing the following:
 - Attach an external monitor to the MONITOR OUTPUT connector. The MONITOR OUTPUT is a NTSC composite video with horizontal at 15.75 kHz and a vertical rate of 60 Hz.
 - Adjust the horizontal hold on the external monitor, if necessary.

If a normal instrument display is present, the display failure is limited to the A2 display and its related circuitry.
2. Verify the output of the drive circuitry from the A16 processor/video assembly to the A2 display by performing the following steps.
 - Position the analyzer with the bottom side facing up.

CAUTION

Do not short any two of the A16J8 pins together. Damage to the output buffer amplifiers located on the processor/video assembly may occur.

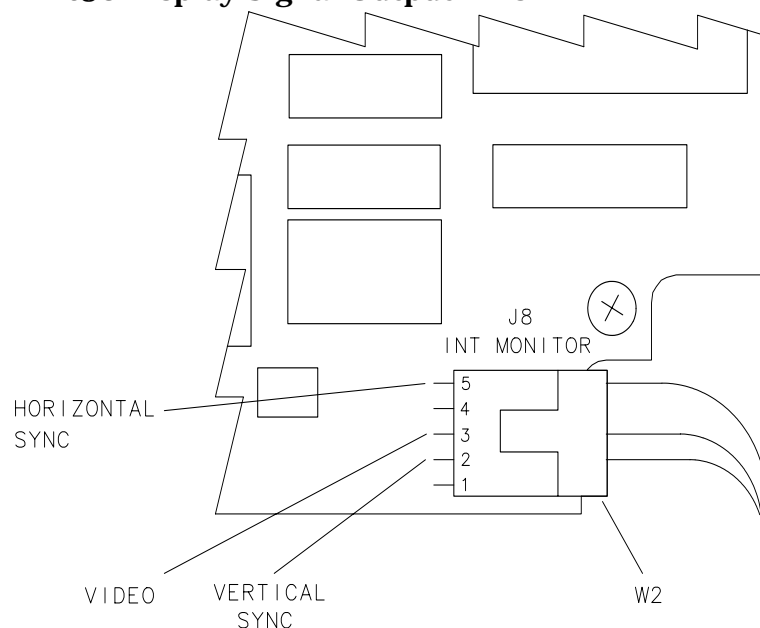
- Disconnect the W2 wire harness.

- Refer to [Figure 4-4](#) for the location of the test points and check the following signals at A16J8 pins, using an oscilloscope.
 - ❑ Check for a 60 Hz TTL signal with a pulse width of approximately 0.2 ms and a repetition rate of approximately 18 ms at pin 2, vertical sync signal.
 - ❑ Check for an approximately 2.5 V pk-pk video signal at pin 3, video signal.
 - ❑ Check for a 15.75 kHz TTL signal with a pulse width of approximately 10 μ s and a repetition rate of approximately 64 μ s at pin 5, horizontal sync signal.

If the video, horizontal, and vertical signals are missing, but the +12 V supply voltage is present, continue with [step 3](#).

3. Check the +12 Vdc power supplied to the A2 display. There is a separate 12 V supply for the display assembly. This supply can be checked at the output connector, A8J6, located on the right side of the A8 power supply. Refer to [Figure 4-3](#). If there is a failure, check the continuity of the cable assembly W51 supplying the display, and the integrity of the power supply using the procedures in this chapter.

Figure 4-4 A16J8 Display Signal Output Pins



4. Verify the High-Power-Up signal from the A8 power supply by checking for the +5 V TTL WRUP signal at pin 54 on the A16J1. The A16J1 connector is on the trace side of the A16 processor/video assembly. Refer to [Figure 4-5](#) for the numbering order of A16J1 connector-pins accessible from the component side of the A16 processor/video assembly.

Note that the A8 power supply assembly sends the high-power-up (WRUP) signal to the A16 processor/video assembly after it receives the low-power-on (LPWRON) signal and the +5 V supply has stabilized. If WRUP is low, the display remains blank and the A16 failure LEDs (DS1 through DS16) will not come on during power-up.

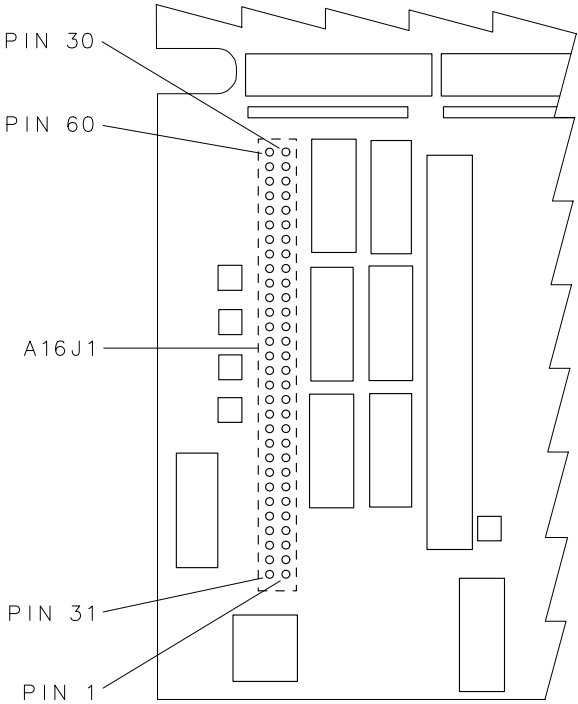
- If the WRUP signal is missing, trace the signal back through the A15 motherboard to the A8 power supply assembly, pin 37 on A8J1. Refer to “A15 Motherboard Assembly” in [Chapter 5](#) for the connector-pin designation of the WRUP signal path.

Note that if your analyzer is an 8590 E-Series, 8591C, or 8594Q QAM analyzer, the WRUP signal can be measured on pin 55 of each card-cage slot on the A15 motherboard. Refer to [Figure 4-6](#) for the numbering order of the connector pins on A15J3 through A15J6.

- If the WRUP signal is present, yet one or more of the A16 processor/video assembly outputs is incorrect, suspect a defective A16 processor/video assembly. Before replacing the A16 processor/video assembly, refer to [Chapter 3](#) in this service guide.
- If all the A16 display outputs are correct, suspect a defective A2 display.

Figure 4-5

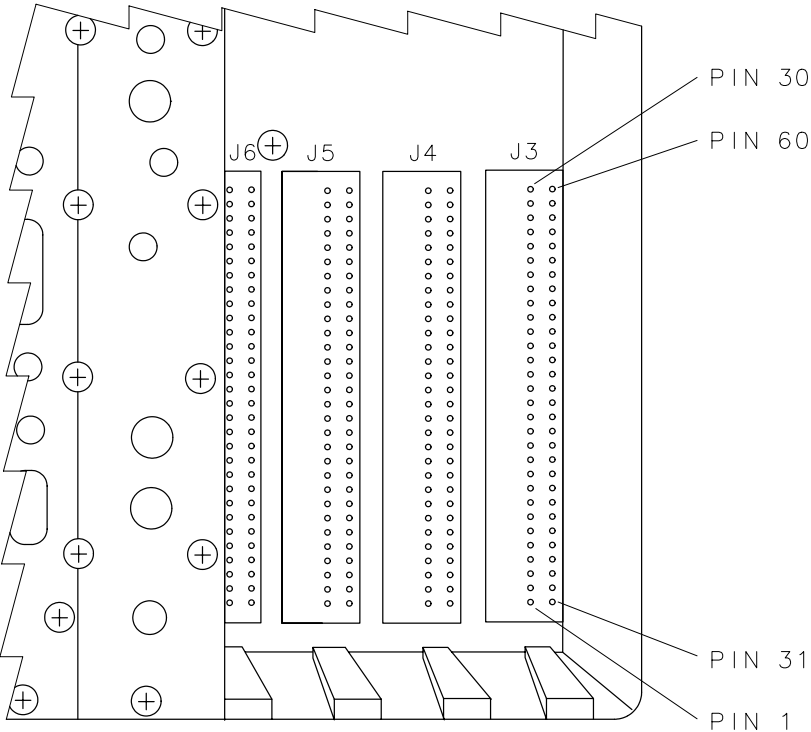
A16J1 Connector-Pin Orientation



sh238e

Figure 4-6

Card-Cage Connector-Pin Orientation



sh239e

Isolating an RF, LO, IF, or Video Problem

This section provides techniques for isolating amplitude failures along the signal path from the analyzer input to the A16 processor/video assembly. These troubleshooting methods isolate the failure to one of four functional sections in the analyzer.

- The RF section. This section includes the assemblies from the analyzer input to the input of the A9 third converter assembly.
- The LO section. This section involves the assemblies that provide a local oscillator output to the RF section. The A25 counterlock assembly is one of the assemblies involved (for counterlocked analyzers only).
- The IF section. This section includes the assemblies from the input of the A9 third converter to the output of the A14 log amplifier assembly.
- The video section. This includes the circuitry from the output of the A14 log amplifier assembly to the ADC section on the A16 processor/video. This section of the analyzer processes the detected 21.4 MHz IF signal from the IF section.

Procedure for Isolating an RF, LO, IF, or Video Failure

Perform the following procedure to isolate an RF, LO, IF, or Video problem.

1. With the failure symptoms present, switch the analyzer from positive-peak detector to sample-detector mode.
 - If the analyzer returns to normal operation, the positive-peak detector is defective.
 - If the failure symptoms remain, continue with the next step.
2. Verify the 2 V reference detector and the ground reference detector are operating properly by performing the internal service-diagnostic routines in this chapter.
 - If either the 2 V or ground reference detectors are not operating properly, suspect the ADC circuitry on the A16 processor/video board assembly.
 - If the 2 V or ground reference detectors are functioning properly, continue with the next step.
3. Use the display calibration data to find the DAC value used to adjust the gain at the output of the A9 third converter assembly. The DAC value is in the REF LVL CAL DAC block. Refer to the internal service-diagnostic routines in this chapter.

The DAC value is unique for each analyzer. The **CAL AMPTD** self-calibration routine adjusts this value based on the amplitude of the digitized video signal on the processor/video board assembly. The calibration routine makes this adjustment while calibrating the reference level at top screen.

After running the **CAL AMPTD** calibration routine, the REF LVL CAL DAC has a typical value of 165 with a range of 130 to 185. The higher the DAC value, the greater the output from the A9 third converter assembly.

4. Check the signal path from the analyzer input to the output of the A14 log amplifier assembly. Refer to “[IF Power-Level Measurement](#)” located in [Chapter 5](#) of this guide.
5. Measure the 321.4 MHz input to the A9 third converter assembly by connecting the CAL OUT to the INPUT 50 Ω with a BNC cable.

75 Ω input only: Connect the CAL OUT to the INPUT 75 Ω with the 75 Ω BNC cable.

Then, disconnect the W9 cable assembly from the third converter and measure at the cable output.

The 321.4 MHz input typically measures between –36 and –39 dBm with zero input attenuation.

- If the REF LVL CAL DAC value is 255 and the input to the A9 third converter assembly is above the test limit, suspect a low gain problem in the IF section. Continue with the troubleshooting procedures in “[IF Power-Level Measurement](#).”
 - If the REF LVL CAL DAC value is 0 and the input to the A9 third converter assembly is nominal, suspect a high gain problem in the IF section. Continue with the troubleshooting procedures in “[IF Power-Level Measurement](#).”
 - If the REF LVL CAL DAC value is 255 and the input to the A9 third converter is below the test limit, suspect a low gain problem in the RF/LO sections. Continue with the next step.
 - If the REF LVL CAL DAC value is 0 and the input to the A9 third converter is above the test limit, suspect a high gain problem in the RF section. Continue with the next step.
6. Set up the analyzer as shown in “Instrument Settings for RF Power-Level Measurement” in this chapter.
 7. Isolate the failure to an RF or LO assembly by performing the RF Power-Level Measurements procedure in [Chapter 6](#) of this guide.

Once the problem has been isolated to one of the four sections, use standard troubleshooting methods to locate the source of the failure.

The following failure symptoms are examples to help isolate a failure to either the RF, LO, IF, or Video sections.

If there is only a horizontal trace with no signal or noise floor present

1. Check for a peak-detector failure by switching between the positive-peak detector and sample detector modes.
2. Perform the 2 V reference detector and ground reference detector diagnostic routines. Refer to “[Using the Internal Service-Diagnostic Routines](#)” in this chapter.
3. Check the signal path from the analyzer input to the output of the A14 log amplifier assembly. Refer to “[IF Power-Level Measurement](#)” located in [Chapter 5](#) of this service guide.

If the analyzer displays a low signal level

A low signal level can cause the **CAL AMPTD** self-calibration routine to stop if the REF LVL CAL DAC reaches 255. The routine does not store the correction factors from an incomplete calibration; however, the corrections from the incomplete calibration are temporarily retained and can be viewed by displaying the calibration data (**DISPLAY CAL DATA**) as described in “[Using the Internal Service-Diagnostic Routines.](#)” Refer to [Chapter 14](#) for a description of the displayed error message.

Perform the following steps to help isolate the problem.

1. Check the amplitude of the CAL OUT signal and ensure that the CAL OUT signal is properly connected to the analyzer input. (The self-calibration routines perform an initial setup check. If the signal level is below -40 dBm, the routine fails.)
2. Use **DEFAULT CAL DATA** to set the REF LVL CAL DAC to a default value of 200 by pressing the following analyzer keys.
FREQUENCY, – 2001, Hz
CAL, More 1 of 4, More 2 of 4
DEFAULT CAL DATA
3. Check the signal path from the analyzer input to the output of the A14 log amplifier assembly. Refer to “[IF Power-Level Measurement](#)” located in [Chapter 5](#) of this service guide.

If the analyzer displays a high noise floor

This problem can be due to low gain somewhere along the RF or IF signal path.

The **CAL AMPTD** self-calibration routine compensates for the low gain by increasing the gain of the A9 Third Converter assembly using the REF LVL CAL DAC. The excessive gain may cause the high noise floor by amplifying the noise level from the RF section, or over-driving a stage in the IF section.

The analyzer may also fail the displayed average noise performance verification test.

1. Check the REF LVL CAL DAC value using **DISPLAY CAL DATA** as described in [“Using the Internal Service-Diagnostic Routines.”](#) This type of problem causes the DAC value to be close to the 255 maximum.
2. Measure the 321.4 MHz input to the A9 third converter assembly by connecting the CAL OUT to the INPUT 50Ω with a BNC cable.
75 Ω input only: Connect the CAL OUT to the INPUT 75Ω with the 75 Ω BNC cable.
Then, disconnect the W9 cable assembly from the third converter and measure at the cable output.
The 321.4 MHz input typically measures between –36 and –39 dBm with zero input attenuation.
3. Check the signal path from the analyzer input to the output of the A14 log amplifier assembly. Refer to [“IF Power-Level Measurement”](#) located in [Chapter 5](#) of this service guide.

If the displayed signal amplitude appears too high

This problem is caused by high gain somewhere along the RF or IF signal path. The displayed CAL OUT signal appears to have an amplitude greater than –20 dBm. The excessive gain causes a calibration error that makes the CAL OUT signal appear higher than normal.

The **CAL AMPTD** self-calibration routine may not fail.

- Check for a REF LVL CAL DAC value of 0 using **DISPLAY CAL DATA** as described in [“Using the Internal Service-Diagnostic Routines.”](#) The values in the ERR column are 0.00 or have a negative value.
- Measure the 321.4 MHz input to the A9 third converter assembly by connecting the CAL OUT to the INPUT 50Ω with a BNC cable.
75 Ω input only: Connect the CAL OUT to the INPUT 75Ω with the 75 Ω BNC cable.
Then, disconnect the W9 cable assembly from the third converter and measure at the cable output.
The 321.4 MHz input typically measures between –36 and –39 dBm with zero input attenuation.
- Check the signal path from the analyzer input to the output of the A14 log amplifier assembly. Refer to [“IF Power-Level Measurement”](#) located in [Chapter 5](#) of this service guide.

If the displayed signal is distorted

This failure may result in the displayed signal having distinct lobes on each side. A high noise floor may also be present.

Note that an intermittent hardware failure during the **CAL AMPTD** self-calibration routine can cause this type of amplitude failure. The erroneous calibration data causes the failure symptoms even while the hardware is operating normally.

1. If the signal looks normal when **CORRECT ON OFF** is off, check the values in the RFATN and SGAIN columns using **DISPLAY CAL DATA** as described in [“Using the Internal Service-Diagnostic Routines.”](#)

If a correction factor in either column is greater than two, there may be a failure on the input attenuator or the A12 amplitude control assembly.

Refer to [Chapter 13](#) for the description of the corrections that are disabled when **CORRECT ON OFF** is off.

2. Troubleshoot the input attenuator or step gain symptoms with **CORRECT ON OFF** turned off.
3. Measure the 321.4 MHz input to the A9 third converter assembly by connecting the CAL OUT to the INPUT 50Ω with a BNC cable.

75 Ω input only: Connect the CAL OUT to the INPUT 75Ω with the 75 Ω BNC cable.

Then, disconnect the W9 cable assembly from the third converter and measure at the cable output.

The 321.4 MHz input typically measures between –36 and –39 dBm with zero input attenuation.

4. Check the signal path from the analyzer input to the output of the A14 log amplifier assembly. Refer to [“IF Power-Level Measurement”](#) located in [Chapter 5](#) of this service guide.

Recalibration of the analyzer is necessary after the adjustment or replacement of each suspect assembly. A functioning analyzer may still appear to be defective if calibration data from before the repair is used.

If the signal is off frequency

This failure may result in the **CAL FREQ** self-calibration routine failing.

Perform all of the internal service-diagnostic routines.

Refer to [“Using the Internal Service-Diagnostic Routines”](#) in this chapter.

If the signal is off frequency in spans <10 MHz only

1. Perform all of the internal service-diagnostic routines. Refer to [“Using the Internal Service-Diagnostic Routines”](#) in this chapter.
2. *For analyzers equipped with an A25 counterlock assembly only:* Disconnect the A25 counterlock assembly, perform the **FREQ CAL** calibration routine, then operate the analyzer as an unlock instrument.

If the analyzer is corrected, suspect the A25 counterlock assembly.

If the signal displays in low band only

This symptom only applies to the 8592L, 8593E, 8594E, 8594L, 8594Q, 8595E, and 8596E spectrum analyzers.

Perform all of the internal service-diagnostic routines. Refer to [“Using the Internal Service-Diagnostic Routines”](#) in this chapter.

If the A7 Analog Interface board assembly appears to be functioning properly, see the appropriate section of [Chapter 6](#) for your analyzer.

Using the Internal Service-Diagnostic Routines

The 8590 E-Series and L-Series spectrum analyzers, 8591C cable TV analyzers, and 8594Q QAM analyzers have an internal service-diagnostics routine menu available within the calibration menus.

Reference voltages and ramps are routed through a MUX located on the A7 analog interface board assembly. These voltages and ramps can be displayed on the analyzer or on an oscilloscope by connecting a probe to A7TP2 when a service-diagnostic routine is performed. The only exception is the 2VREF and GNDREF, these reference voltages originate on the A16 processor/video board assembly.

The service-diagnostic routines included in this section are the most useful routines used to help isolate problems with the A7 analog interface and A16 processor/video board assemblies. Illustrations are included with each procedure to show the expected displayed results.

Access the service-diagnostic routine softkeys by pressing the following analyzer keys.

**CAL, More 1 of 4, More 2 of 4
SERV DIAG**

Note that whenever an analyzer setting has been changed while in a service-diagnostic routine, you must return to the service-diagnostic routine softkey menu by pressing the key sequence listed above.

If a flat line appears at midscreen

When a service-diagnostic routine is selected and only a flat line appears at midscreen, connect an oscilloscope to A7TP2. If the expected signal is there, then the ANA_TEST line is either shorted or open. This can be caused by bent pins or solder bridges on either the A7, A16, or A15 board assemblies. This condition will cause the frequency calibration routine to fail, as it uses this line to set up the sweep ramp at the beginning of the calibration routine.

If a service-diagnostic routine fails

When a service-diagnostic routine fails, it is recommended to continue verifying the rest of the service-diagnostic routines to isolate a failure for further troubleshooting. For example, the main coil driver is dependent on the sweep ramp and the -10 V reference to function properly.

Verify the displayed calibration data

1. Press the following analyzer keys.

CAL, More 1 of 4, More 2 of 4
SERV DIAG
DISPLAY CAL DATA

2. Verify that the digital correction values are within their limits. Refer to [Chapter 14](#) for typical examples of the calibration data displays.
 - If default values are being used, all digital corrections should be zero.
 - If corrections are being used, make sure that all digital corrections are present. Typical values should be below 1.00.
3. Return to the diagnostics menu by pressing the following analyzer keys.

PRESET
FREQUENCY, BAND LOCK, 0-2.9 GHz BAND 0 (except 8590L,
8591E, and 8594E)
CAL, More 1 of 4, More 2 of 4
SERV DIAG, More 1

Verify the 2 V reference detector

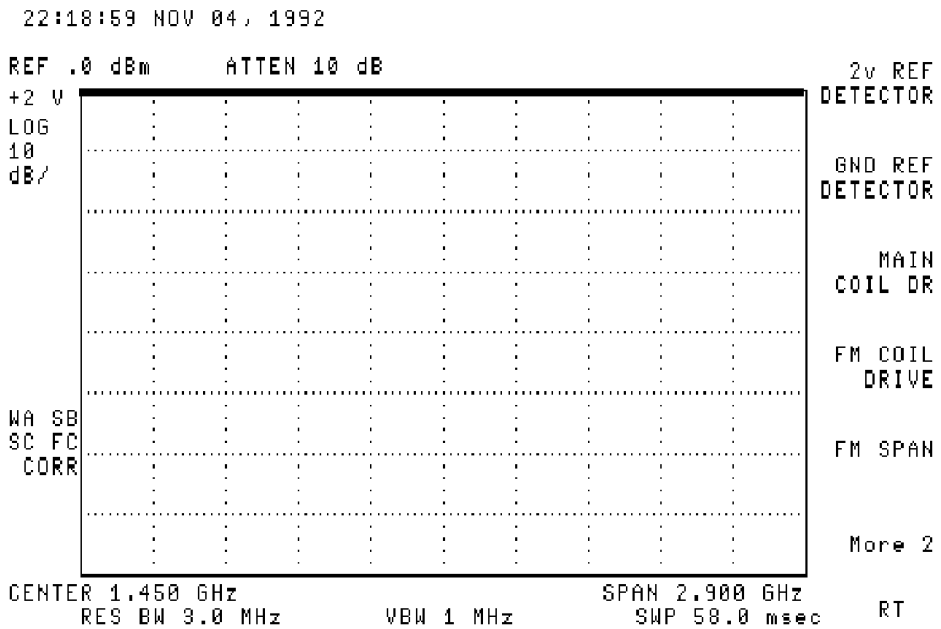
This service-diagnostic routine verifies the 2 V reference circuitry on the A16 processor/video board.

Verify the 2 V reference by pressing **2V REF DETECTOR**.

- If the signal trace is at the top of the display, the 2 V reference is functioning properly. See [Figure 4-7](#).
- If the signal is not at the top of the display, the problem is isolated to the A16 processor/video board assembly. Refer to [“Troubleshooting the A16 Processor/Video Board Assembly”](#) located in this chapter for further troubleshooting.

Figure 4-7

2 V Reference Detector



Verify the ground reference detector

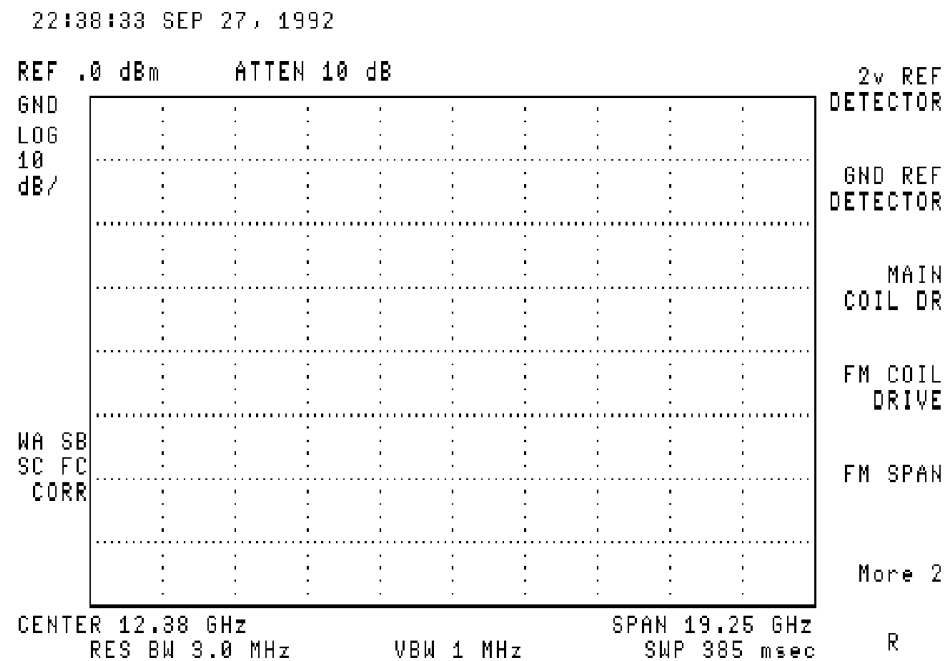
This service-diagnostic routine verifies the ground reference circuitry on the A16 processor/video board.

Verify the ground reference by pressing **GND REF**.

- If the signal trace is at the bottom of the display, the ground reference is functioning properly. See [Figure 4-8](#).
- If the signal is not at the bottom of the display, the problem is isolated to the A16 processor/video board assembly. Refer to [“Troubleshooting the A16 Processor/Video Board Assembly”](#) located in this chapter for further troubleshooting.

Figure 4-8

Ground Reference Detector



Verify the main coil driver

This service-diagnostic routine verifies that the ramp is driving the YTO.

1. Select a single band (if more than one band is available on your analyzer).

Note that any band is acceptable unless the problem is isolated to a specific band. In that case, choose the appropriate band. Figure 4-9 uses Band 0 as an example.

2. Return to the diagnostics menu by pressing the following analyzer keys.

FREQUENCY, BAND LOCK, 0-2.9 GHz BAND 0

CAL, More 1 of 4, More 2 of 4

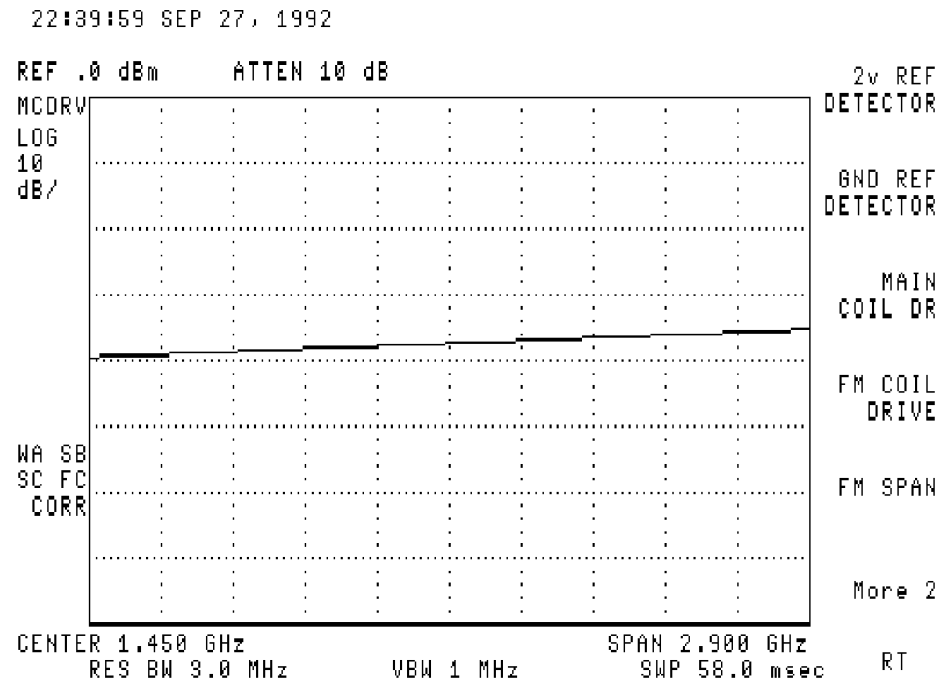
SERV DIAG, More 1

3. Verify the main coil driver by pressing MAIN COIL DRIVE.

- If the signal trace is similar to Figure 4-9, the main coil driver is functioning properly.
- If the signal is not similar, suspect the A7 analog interface assembly.

Figure 4-9

Main Coil Driver Typical Display



Verify the FM coil driver

It is only necessary to perform this service-diagnostic routine if the failure appears in narrow spans (10 MHz and below).

1. Set the analyzer span to 10 MHz.

Be sure to set the span before performing the service-diagnostic routine. For example, if the span is not set first, the trace will appear at the top of the display instead of the expected ramp.

2. Return to the diagnostics menu by pressing the following analyzer keys.

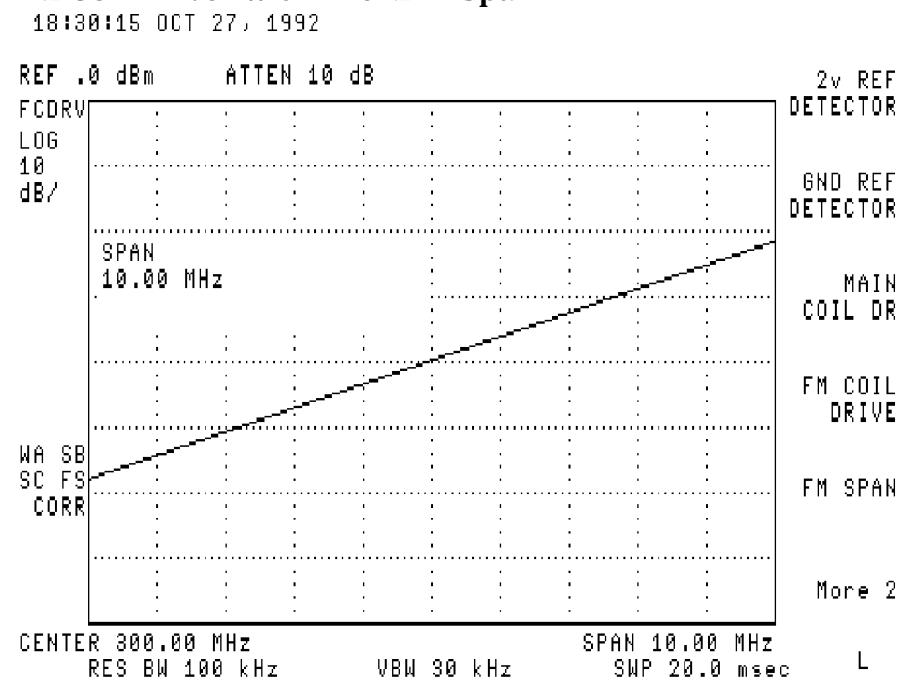
CAL, More 1 of 4, More 2 of 4
SERV DIAG, More 1

3. Verify the FM coil driver by pressing **FM COIL DRIVE**.

- If the signal trace is similar to [Figure 4-10](#), the FM coil driver is functioning properly.
- If the signal is not similar, suspect the A7 analog interface board assembly.
- *For analyzers equipped with an A25 counterlock assembly only:* If all other service-diagnostic routines operate properly, disconnect the A25 counterlock assembly, perform the **FREQ CAL** calibration routine, then operate the analyzer as an unlock instrument.
If the analyzer is corrected, suspect the A25 counterlock assembly.

Figure 4-10

FM Coil Driver with ≤ 10 MHz Span



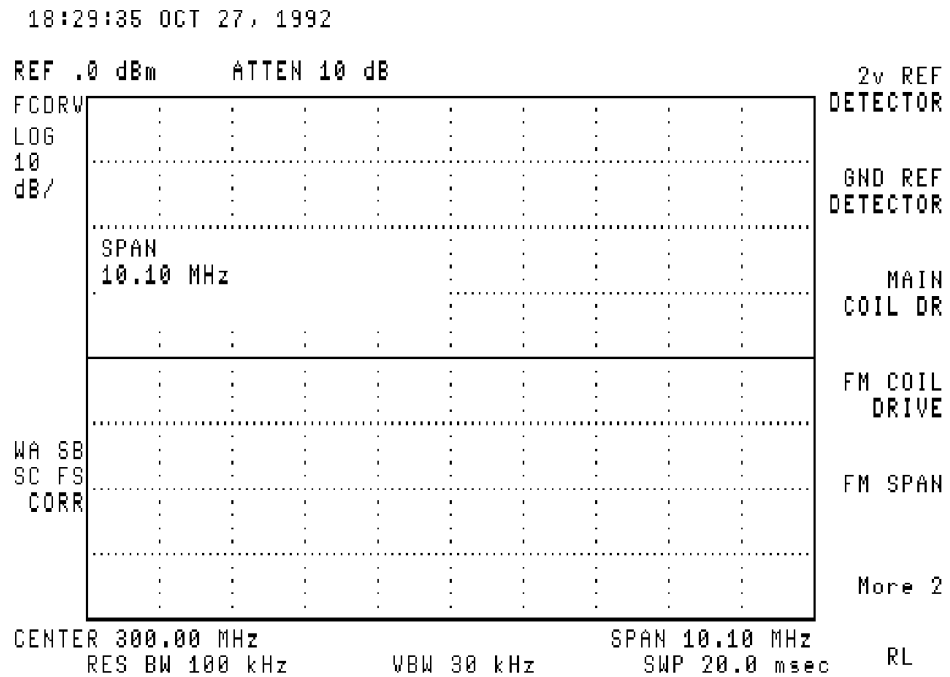
Verify the FM coil driver for spans >10 MHz

It is only necessary to perform this service-diagnostic routine if the failure appears in spans wider than 10 MHz.

1. Set the analyzer span to 11 MHz.
2. Return to the diagnostics menu by pressing:
 - CAL, More 1 of 4, More 2 of 4**
 - SERV DIAG, More 1**
3. Verify the FM coil driver by pressing **FM COIL DRIVE**.
 - If the signal trace is similar to [Figure 4-11](#) the FM coil driver is functioning properly.
 - If the signal is not similar continue with the next service-diagnostic routine.

Figure 4-11

FM Coil Driver with >10 MHz Span



Verify the sweep ramp

1. Verify the sweep ramp by pressing:

**SPAN, 10, MHz, CAL, More 1 of 4, More 2 of 4,
SERV DIAG, More 1, More 2, SWEEP RAMP**

- If the signal trace is similar to [Figure 4-12](#) the sweep ramp is functioning properly.

NOTE

Before a successful frequency calibration is performed, the ramp will not be corner to corner, but will have some overshoot or undershoot.

- If the signal is not similar suspect the A7 analog interface board assembly. Refer to [Chapter 6](#) for further information about troubleshooting the A7 board assembly.

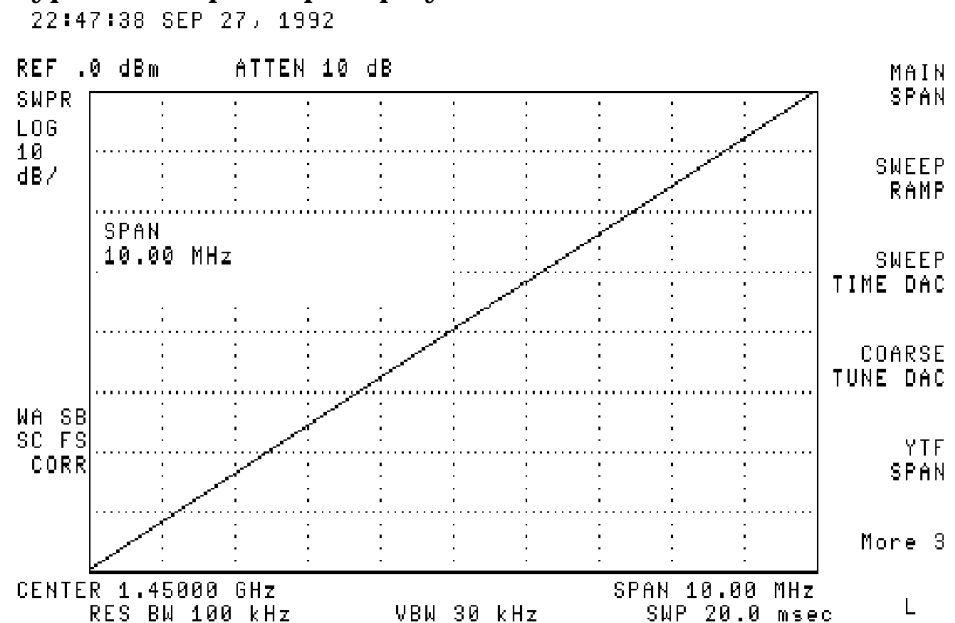
2. Change the analyzer sweep time.

NOTE

It is recommended that all sweep times be checked due to the A7 analog interface board assembly operating differently for the different RC combinations. This can result in the analyzer appearing to operate properly in one sweep time and not in another.

Figure 4-12

Typical Sweep Ramp Display

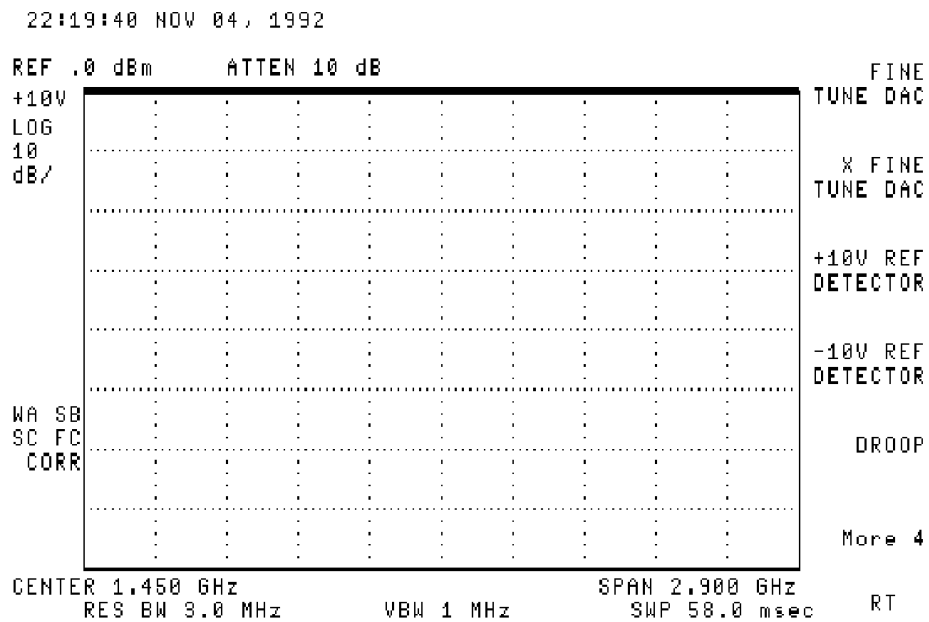


Verify the 10 V reference detector

This service-diagnostic routine verifies the 10 V reference. +10 V is used as a reference for the DACs and originates on the A7 analog interface board assembly. Frequency and amplitude errors will occur if this voltage is incorrect.

- Return to the diagnostics menu by pressing the following analyzer keys.
CAL, More 1 of 4, More 2 of 4
SERV DIAG, More 1, More 2, More 3
- Verify the 10 V reference detector by pressing **10V REF DETECTOR**.
 - If the signal trace is at the top of the display, the 10 V reference detector is functioning properly. See [Figure 4-13](#).
 - If the signal is not at the top of the display, the problem is isolated to the A7 analog interface board assembly. Refer to [Chapter 6](#) for further troubleshooting.

Figure 4-13 10 V Reference Detector



Verify the -10 V reference detector

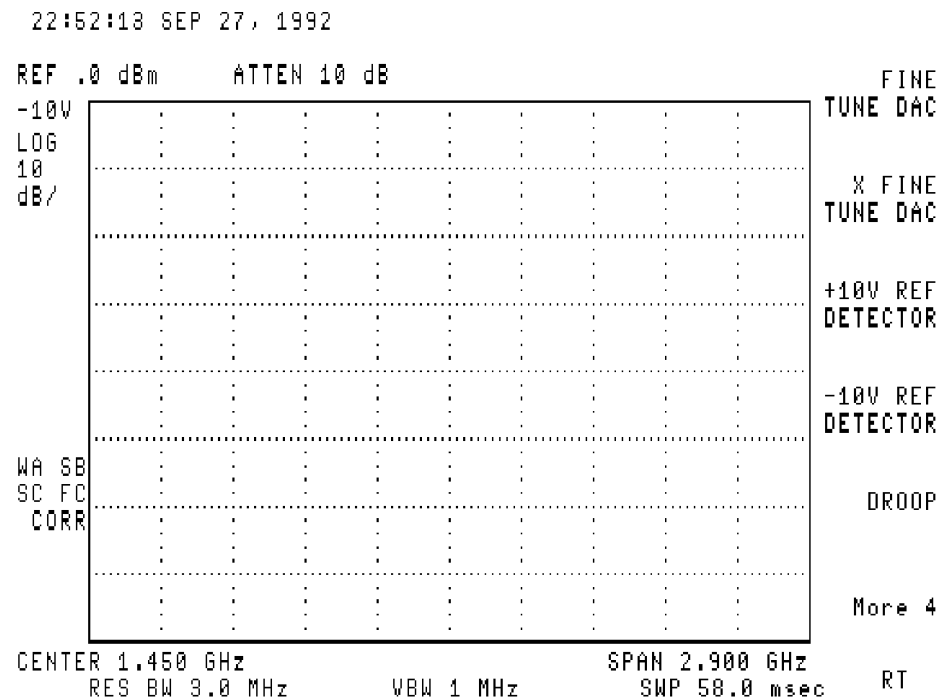
This service-diagnostic routine verifies the -10 V reference. -10 V is summed with the tuning voltages and used in the main coil driver and originates on the A7 analog interface board assembly. Frequency and amplitude errors will occur if this voltage is incorrect.

Verify the -10 V reference detector by pressing **-10V REF DETECTOR**.

- If the signal trace is at the bottom of the display, the -10 V reference detector is functioning properly. See [Figure 4-14](#).
- If the signal is not at the bottom of the display, the problem is isolated to the A7 analog interface board assembly. Refer to [Chapter 6](#) for further troubleshooting.

Figure 4-14

-10 V Reference Detector



Verify the YTF driver

This service-diagnostic routine applies only to the 8592L, 8593E, 8595E, and 8596E spectrum analyzers with high band problems. This routine verifies the YTF driver. The YTF is a sensitive device and the minimum of ramp voltage error can result in the YTF being out of specification.

1. Enter band 1 by pressing the following analyzer keys.

FREQUENCY, BAND LOCK, 2.75 - 6.5 BAND 1

Note that any band, other than band 0, is acceptable.

2. Verify the YTF driver by pressing:

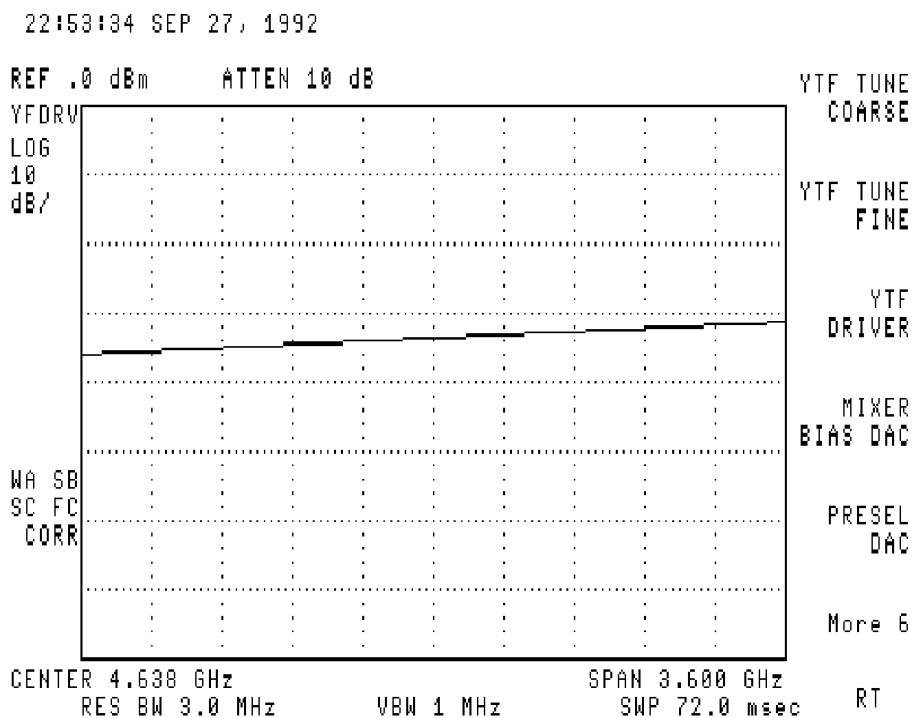
CAL, More 1 of 4, More 2 of 4,

SERV DIAG, More 1, More 2, More 3, More 4, More 5,

YTF DRIVER

- Bands 2, 3, and 4 will have a similar display at different positions on the display.
- If the signal trace is similar to [Figure 4-15](#), the YTF driver is functioning properly.
- If the signal is not similar, suspect the A7 analog interface board assembly. Refer to [Chapter 6](#) for further information about troubleshooting the A7 board assembly.

Figure 4-15 YTF Driver



Troubleshooting the A16 Processor/Video Board Assembly

After you have determined that the problem is caused by the A16 processor/video assembly, use the following procedures. The *8590 Series Analyzers Component-Level Repair Service Guide* is required to assist with these procedures. Refer to [Chapter 13](#) for a list of available component-level service information.

If a signal cannot be displayed

If a signal cannot be displayed, and it has been determined that a top-screen signal of two volts is present at VIDEO_IF, the problem may be on the A16 processor/video board assembly.

1. Put 0 V into the video circuit, simulating a bottom-screen signal level condition by setting the diagnostic to the ground reference detector. Refer to [“Verify the ground reference detector”](#) located in this chapter.

Use an oscilloscope to check for the following conditions. Refer to Sheet 2 of 4 of the A16 processor/video board assembly component-level information.

- Check for 0 V throughout the signal path through U201, U61, U45, and U46.
- Check the offset by measuring the inverting and noninverting pins on U201, U61, U45, and U46. The difference between both measured values should not exceed 5 mV.

2. Replace any components with excess offset voltage.
3. Put 2 V into the video circuit, simulating a top-screen signal level condition by setting the diagnostic to the 2 V reference detector. Refer to [“Verify the 2 V reference detector”](#) located in this chapter.

Use an oscilloscope to check for the following conditions. Refer to Sheet 2 of 4 of the A16 processor/video board assembly component-level information.

- Check for 2 V throughout the signal path through U201, U61, U45, and U46.
- Check the offset by measuring the inverting and noninverting pins on U201, U61, U45, and U46. The difference between both measured values should not exceed 5 mV.

4. Replace any components with excess offset voltage.

5. Switch between POS PEAK and SAMPLE detector modes. If the signal appears when in the SAMPLE detector, suspect something in the positive-peak detector circuit.

If the analyzer does not respond (locked up)

If the analyzer is not responding or is continuously doing instrument presets, and cycling power does not correct the problem, perform the following steps.

1. Check for a defective Down Loadable Program (DLP) that has been installed into the analyzer.
2. Clear the user memory by performing the step, for your analyzer, listed below.

If the analyzer is equipped with Option 023 (RS-232 remote interface), connect it to a computer. Execute the Break command, and press the following analyzer keys.

CONFIG, More 1 of 3, More 2 of 3

DISPOSE USER MEM

DISPOSE USER MEM

If the analyzer is equipped with Option 021 (IB remote interface), connect it to a controller. Execute the following remote program line to erase user memory and clear the problem.

```
SEND 7;UNL MTA LISTEN 18 CMD 12
```

Perform a free-run check

This procedure allows you to set the microprocessor to a known state so that certain basic functions can be checked. A MOVEQ instruction is read from the system data bus. The MOVEQ instruction may be thought of as a no operation (NOP) for this procedure. The microprocessor will increment the address lines A1 through A23, then continue to read data on the system data bus.

1. Turn the analyzer power off.
2. Remove A16U25 (16 pin DIP jumper pack.)
3. Connect a clip lead from A16TP1 pin 7 to ground.
4. Turn the analyzer power on.

CAUTION

While measuring pins on the microprocessor chip, exerting too much pressure on a pin may cause one of the data lines to open. This may result in factory correction constants to be erased.

5. Check A16U12 for the conditions described in Table 4-3 while in the free-run mode. Refer to the component-level information for the A16 processor/video board assembly.

Figure 4-16 A16U12 Pin Location

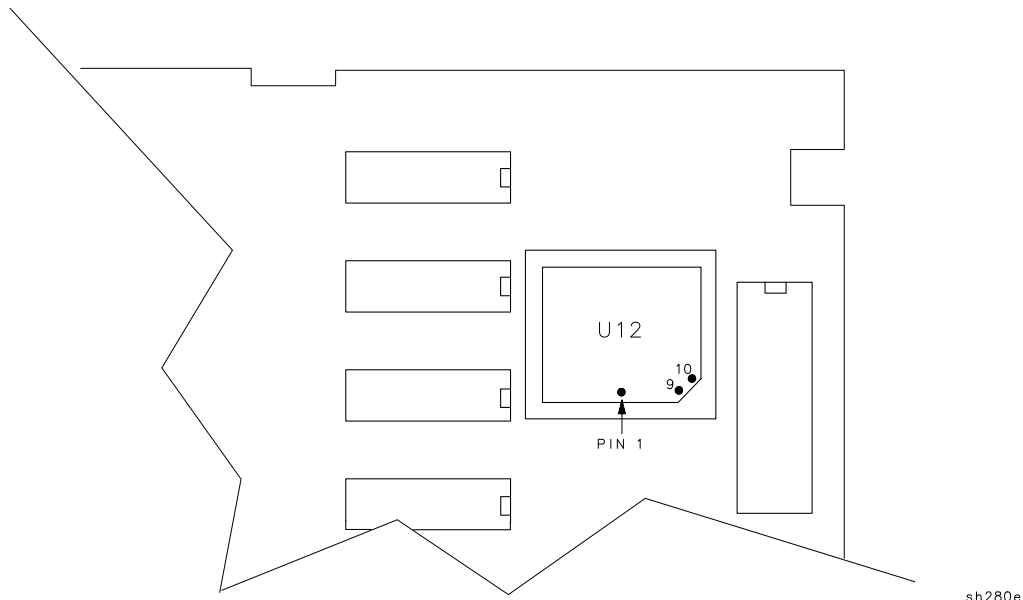


Table 4-3 Free-Run Mode Test Points on A16

A16U12 Pin Location	A16U12 Free-Run Mode Condition
6	AS is toggling
7	UDS is toggling
8	LDS is toggling
9	R/W is logical one
32-55	Address lines A1 through A23 are counting in binary where: A1 (pin 32) = LSB

6. Check for +5 V at pin 1 of ROM's U6, U7, U23, and U24.
 The Free-Run Check is now complete.
7. Turn the analyzer power off.
8. Remove the clip lead from A16TP1 pin 7 and ground.
9. Replace A16U25 (16 pin DIP jumper pack).
10. Turn the analyzer power on.

Troubleshooting the Analyzer
Troubleshooting the A16 Processor/Video Board Assembly

5

Troubleshooting the IF Section

This chapter provides troubleshooting information for the IF section of the 8590 E-Series and L-Series spectrum analyzers and 8591C cable TV analyzers and 8594Q QAM analyzers. Troubleshooting information for tracing signals on the A15 motherboard assembly is also provided.

Refer to [Chapter 4, “Troubleshooting the Analyzer”](#) for procedures that are useful when first starting to troubleshoot an analyzer failure.

Before You Start

There are four things you should do before starting to troubleshoot an analyzer failure.

- Check that you are familiar with the safety symbols marked on the analyzer, and read the general safety instructions and the symbol definitions given in the front of this guide.
- The analyzer contains static sensitive components. Read the section entitled “Protection from Electrostatic Discharge” in.
- Become familiar with the organization of the troubleshooting information in this service guide.
- Read the rest of this section.

WARNING

The analyzer contains potentially hazardous voltages. Refer to the safety symbols on the analyzer and the general safety considerations in the front of this guide before operating the unit with the cover removed. Failure to heed the safety precautions can result in severe or fatal injury.

Service Equipment You Will Need

Refer to the table entitled, “Recommended Test Equipment,” in Chapter 1 of the *8590 Series Analyzers Calibration Guide* for a list of the recommended test equipment needed to troubleshoot and repair the analyzer. Although Agilent Technologies equipment is recommended, any equipment that meets the critical specifications given in the table can be substituted for the recommended model.

Refer to [Chapter 15, “Service Equipment and Tools”](#) of this guide for a list of recommended service tools and required hand tools needed to troubleshoot and repair the analyzer.

After an Analyzer Repair

If one or more analyzer assemblies have been repaired or replaced, perform the related adjustments and performance verification tests. Refer to [Chapter 2, “Making Adjustments”](#) for a table of Adjustments and Tests for Replaced or Repaired Assemblies, for the related adjustments and performance verification tests required for each assembly.

IF Section Information

This section provides the control details for the assemblies in the IF section. The control-line outputs are valid when the instrument settings provided with each table are used.

For many IF functions, the A7 analog interface assembly converts the digital control signals from the A16 processor/video assembly to analog control signals. Some analyzer functions are performed directly by the A16 assembly. The A16 assembly also makes amplitude error corrections to improve instrument performance. The analyzer-setting changes and error-correction functions performed on the A16 assembly are a combined mathematical offset of the digitized video signal.

For more information about the A15 motherboard assembly and the tracing of specific signals in the IF section, refer to “A15 motherboard assembly” in this chapter.

IF Power-Level Measurement

The following measurement procedures are used for troubleshooting along the 21.4 MHz IF signal path from the A9 third converter assembly, through the IF section, to output of the A14 log amplifier assembly.

To calibrate the reference level of the analyzer, the CAL AMPTD self-calibration routine adjusts the gain of the 21.4 MHz IF variable amplifier on the A9 assembly and mathematically offsets the digitized video signal on the A16 processor/video assembly. Due to component variations it is unlikely that any two analyzers will have the same 21.4 MHz IF signal level for the same instrument settings. Furthermore, a defective analyzer may produce misleading IF signal levels if the CAL AMPTD routine has been run.

An IF test board is used in the following procedures to simplify troubleshooting. The test board is used to isolate the RF section from the IF section and allows the testing of individual IF assemblies. Refer to [Chapter 15, "Service Equipment and Tools"](#) for the part number of the IF test board.

To set up the instrument for an IF power-level measurement

The power levels provided with the measurement procedures in this section are accurate when the following steps are followed.

1. Ensure that the CAL OUT amplitude is within specification. Refer to the calibrator amplitude performance test in the *8590 E-Series and L-Series Spectrum Analyzers User's Guide* or *8591C Cable TV Analyzer User's Guide, Spectrum Analyzer Reference*.
2. Connect the CAL OUT signal to the RF input using the CAL cable.
3. Press **PRESET** on the analyzer, then wait for the preset routine to finish. Set the analyzer by pressing the following keys.

FREQUENCY, 300, MHz

SPAN, 0, Hz

To check the gains for the IF assemblies

The overall gain of individual assemblies in the IF section are listed below. The gain level provided for the A12 assembly is correct only when the analyzer is set as provided in step three, above.

- The A11 bandwidth filter assembly produces 10 dB of gain.
- The A12 amplitude control assembly produces 5 dB of gain.
- The A13 bandwidth filter assembly produces 10 dB of gain.
- A +10 dBm signal at the input of the A14 log amplifier assembly produces a 2 volt signal (VIDEO_IF) that is equivalent to a top-screen display.

Refer to “IF Section Information” in [Chapter 4, “Troubleshooting the Analyzer”](#) for the changes in gain output when the instrument settings are changed from the settings used in this section.

To measure the IF signal from the A9 third converter

Measure the 21.4 MHz IF output from the A9 assembly with the following procedure. Refer to the IF/Control Overall Block Diagram, while performing this procedure.

1. Remove the A11 bandwidth filter assembly.
2. Insert the IF test board in the A11 assembly slot.
3. Measure the 21.4 MHz IF output at J1 on the IF test board using an active probe, with an analyzer attached. (Use of a 50 Ω analyzer will cause erroneous power-level measurements.)
4. The test limit for the 21.4 MHz IF signal is $-45 \text{ dBm} \pm 2 \text{ dB}$. The test board receives the signal at measurement point A on the block diagram.

Note that the variable IF amplifier at the output of the A9 assembly has a gain range of -15 to $+2 \text{ dB}$. This level is dependent on the output from the reference level DAC, located on the A7 analog interface assembly, that is adjusted during the **CAL AMPTD** self-calibration routine.

To inject a signal at the output of the A11 bandwidth filter assembly

Inject a 21.4 MHz signal at the output of the A11 bandwidth filter assembly with the following procedure. Refer to [Figure 9-1](#) while performing this procedure.

1. Remove the A11 bandwidth filter assembly.
2. Insert the IF test board in the A11 assembly slot.
3. Connect a synthesizer/level generator to the J2 input connector on the IF test board. The test board injects the signal at A15J8 pin 22.
4. Set the signal source for 21.4 MHz at +4 dBm. This signal level provides +10 dBm at the input to the A14 log amplifier assembly and simulates a top-screen signal.
5. Check for the following nominal signal outputs.

- A -10 dBm at the AUX IF OUTPUT connector on the rear panel. Refer to measurement point C on [Figure 9-1](#).

Use an active probe to make the measurement. If a 50 Ω analyzer is used, an additional 6 dB drop in signal level results. (The AUX IF OUTPUT has a 50 Ω output impedance.)

- One volt at the AUX VIDEO OUTPUT connector on the rear panel (measurement point B). A voltage divider on the A15 motherboard reduces the uncorrected 2 volt video signal (AUX_VIDEO) to a 1 volt output.
- A signal at the top graticule line and a marker reading of approximately 0 dBm.

Use **CORRECT ON OFF** to observe the magnitude of video offsets that the A16 assembly is currently using to correct the signal position at top-screen. Refer to [Chapter 13, "Softkey Descriptions"](#) for more information about **CORRECT ON OFF**.

To inject a signal at the output of the A13 bandwidth filter assembly

Inject a 21.4 MHz signal at the output of the A13 bandwidth filter assembly with the following procedure. Refer to [Figure 9-1](#) while performing this procedure.

1. Remove the A13 bandwidth filter assembly.
2. Insert the IF test board in the A13 assembly slot.
3. Connect a synthesizer/level generator to the J2 input connector on the IF test board. The test board injects the signal at A15J11 pin 22.
4. Set the signal source for 21.4 MHz at +13 dBm. This signal level provides +10 dBm at the input to the A14 log amplifier assembly and simulates a signal at top-screen. The output impedance of the IF test board interacts with circuitry on the A15 assembly to cause a 3 dB signal loss.
5. Check for the following nominal signal outputs.

- A -10 dBm at the AUX IF OUTPUT connector on the rear panel. Refer to measurement point C on [Figure 9-1](#).

Use an active probe to make the measurement. If a 50 Ω analyzer is used, an additional 6 dB drop in signal level results. (The AUX IF OUTPUT has a 50 Ω output impedance.)

- One Volt at the AUX VIDEO OUTPUT connector on the rear panel (measurement point B). A voltage divider on the A15 Motherboard reduces the uncorrected 2 V video signal (AUX_VIDEO) to a 1 V output.
- A signal at the top graticule line and a marker reading of approximately 0 dBm.

Use **CORRECT ON OFF** to observe the magnitude of video offsets that the A16 assembly is currently using to correct the signal position at top-screen. Refer to [Chapter 13, "Softkey Descriptions"](#) for more information about **CORRECT ON OFF**.

To check bandwidth control lines for the A11/A13 bandwidth filter assemblies

Table 5-1 provides nominal bandwidth control voltages sent to the A11 and A13 bandwidth filter assemblies from the A7 analog interface assembly. A calibrated analyzer produces control voltages similar to the values in Table 5-1. (The values in Table 5-1 were measured while default calibration data was in use.)

- Use the difference in control voltage between bandwidths from the table as a guide for normal bandwidth operation.
- Use an extender board to measure the bandwidth control voltages at the motherboard connector for the A7 assembly or the A11/A13 filter assemblies.
- Refer to “[Troubleshooting the A15 Motherboard Assembly](#)” for the location of the control lines for each assembly.

Table 5-1 Nominal Resolution Bandwidth Control Line Voltages

Resolution Bandwidth	BW5	BW6	BW7
3 dB			
5 MHz	+14.0	-9.90	+4.4
3 MHz	+14.0	-9.90	+6.4
1 MHz	+14.0	-9.90	+8.5
0.3 MHz	+14.0	-9.90	+9.4
0.1 MHz	+14.0	-9.90	+9.7
30 kHz	-1.0	+9.25	+9.7
10 kHz	-1.0	+8.96	+9.7
3 kHz	-1.0	+8.51	+9.7
1 kHz	-1.0	+7.50	+9.7
0.3 kHz	-1.0	+6.00	+9.7
6 dB EMI			
9 kHz	-1.0	+8.81	+9.7
120 kHz	+14.0	-9.90	+9.6

To check IF section gain control

[Table 5-2](#) lists the changes in IF Section gain that alter the displayed signal position when the reference level is changed in increments as small as 1 dB. The control voltages from the A7 analog interface assembly that change the gain of specific IF assemblies are provided in [Table 5-3](#), [Table 5-4](#), and [Table 5-5](#).

When the reference level is changed, the A16 assembly performs two step-gain functions that change the position of the displayed signal. Refer to [Table 5-2](#) for the reference levels where the A16 assembly changes the signal position in increments of 10 dB. When a reference-level change of less than 1 dB is required, the A16 assembly makes a corresponding change in the signal position. These changes in signal position are made by mathematically offsetting the digitized video signal on the A16 assembly.

The A16 assembly also makes amplitude error corrections to improve instrument performance. The reference-level changes and error-correction functions are a combined mathematical offset of the digitized video signal. This makes it difficult to distinguish which offset is contributing to a change in displayed signal level when the reference level is changed. Disable the error corrections by setting **CORRECT ON OFF** to OFF.

Refer to “[Troubleshooting the A15 Motherboard Assembly](#)” in this chapter when tracing control lines in the IF section

The entries in [Table 5-2](#) are valid after pressing the following keys.

PRESET

CAL

More 1 of 3

CORRECT ON OFF (OFF)

Be sure that the input attenuator setting remains at 10 dB.

Table 5-2 IF Section Gain Table in dB

Reference Level (dBm) *	A12 Calibration Attenuator (Log/Linear Mode)	A12 Step Gain † (Log/Linear Mode)	A14 Gain (Linear Mode)	A16 Video Offset (Log Mode) ‡	A16 Video Offset (Linear Mode) ‡
0	10	0	0	0	0
-1	9	0	0	0	0
-2	8	0	0	0	0
-3	7	0	0	0	0
-4	6	0	0	0	0
-5	5	0	0	0	0
-6	4	0	0	0	0
-7	3	0	0	0	0
-8	2	0	0	0	0
-9	1	0	0	0	0
-10	10	10	0	0	0
-20	10	20	0	0	0
-30	10	30	0	0	0
-40	10	40	0	0	0
-50	10	50	0	0	0
-60	10	50	10	10	0
-70	10	50	20	20	0
-80	10	50	30	30	0
-90	10	50	40	40	0
-100	10	50	40	50	10
-110	10	50	40	60	20
-120	10	50	40	70	30
-130	10	50	40	80	40
-131	9	50	40	80	40
-132	8	50	40	80	40
-133	7	50	40	80	40
-134	6	50	40	80	40
-135	5	50	40	80	40
-136	4	50	40	80	40
-137	3	50	40	80	40
-138	2	50	40	80	40
-139	1	50	40	80	40

* For instruments with 75 Ω Input Impedance, change the display units to dBmV.
 † The gain of the 10 dB step-gain stage is 15 dB when enabled and 5 dB when disabled.
 ‡ Turn CORRECT ON OFF off to remove the amplitude error corrections generated by CAL AMPTD.

Control lines for the A12 amplitude control assembly

Table 5-3 and Table 5-4 provide the control line output from the A7 analog interface assembly that change the gain of the A12 assembly when the reference level is changed. The calibration attenuator settings in Table 5-4 provide reference-level changes in 1 dB increments for the full reference-level range of the analyzer.

Refer to “Troubleshooting the A15 Motherboard Assembly” in this chapter when tracing control lines in the IF section. The entries in Table 5-3 and Table 5-4 are valid after pressing the following keys.

PRESET

CAL

More 1 of 3

CORRECT ON OFF (OFF)

Be sure that the input attenuator setting remains at 10 dB.

Table 5-3

10 dB Step-Gain Control Lines

Reference Level (dBm)	10 dB Step Gains	IFG1 (10 dB Step) A12J2-14	IFG2 (20-1 dB Step) A12J2-13	IFG3 (20-2 dB Step) A12J2-12
0	0	L	L	L
-10	10	H	L	L
-20	20	L	H	L
-30	30	H	H	L
-40	40	L	H	H
-50	50	H	H	H

H = >2.5 V (TTL High)
 L = <0.8 V (TTL Low)

For each reference level in Table 5-3, the Calibration Attenuator control lines are set to 10 dB of attenuation as shown in the first entry of Table 5-4. The control line settings from Table 5-4 repeat, starting with each reference level in Table 5-3 to produce reference-level changes in 1 dB increments.

Troubleshooting the IF Section
IF Power-Level Measurement

Table 5-4 Calibration-Attenuator Control Lines

Reference Level (dBm)	Calibration Attenuator	IFA1 (1 dB) A12J2-4	IFA2 (2 dB) A12J2-3	IFA3 (4 dB) A12J2-2	IFA4 (8 dB) A12J2-1	IFA5 (16 dB) A12J2-11
0	10	L	H	L	H	L
-1	9	H	L	L	H	L
-2	8	L	L	L	H	L
-3	7	H	H	H	L	L
-4	6	L	H	H	L	L
-5	5	H	L	H	L	L
-6	4	L	L	H	L	L
-7	3	H	H	L	L	L
-8	2	L	H	L	L	L
-9	1	H	L	L	L	L

H = >2.5 V (TTL High)
L = <0.8 V (TTL Low)

To check linear gain control lines for the A14 log amplifier

Table 5-5 provides the control line voltages from the A7 analog interface assembly to the A14 log amplifier assembly. When the analyzer is in linear mode, the seven A14 log amplifier stages are biased to operate as linear amplifiers. Four of the seven stages are also used to provide 40 dB of gain in 10 dB increments. The linear gains are enabled for the reference levels indicated in Table 5-2 and Table 5-5. Two of the four stages operate as one 20 dB amplifier and are controlled by the same control line, IFG6.

Refer to “Troubleshooting the A15 Motherboard Assembly” in this chapter when tracing control lines in the IF section.

When enabled, each control line has a –7.6 Vdc output. This voltage is supplied by the –8 VT temperature-compensated power supply located on the A14 assembly.

The entries in Table 5-5 are valid when the instrument is set up as follows:

- PRESET**
- SCALE LOG LIN, LIN**
- AMPTD UNITS, dBm**
- CAL**
- More 1 of 3**
- CORRECT ON OFF (OFF)**

Table 5-5 Linear Gain Control Lines on the A14 Assembly

Reference Level (dBm)	A14 Gain in Linear Mode (dB)	IFG4 (10-1 dB Step) A14P1-38	IFG5 (10-2 dB Step) A14P1-39	IFG6 (20 dB Step) A14P1-40
–50	0	H	H	H
–60	10	L	H	H
–70	20	L	L	H
–80	30	L	H	L
–90	40	L	L	L

H = +14.3 Vdc (disabled)
 L = –7.6 Vdc (enabled)

Troubleshooting the A15 Motherboard Assembly

Use this section to identify and locate all the signals and voltages that pass through the A15 motherboard assembly. The location of active components on the motherboard are also provided.

The following information is provided in this section.

- [Figure 5-1](#), A15 Motherboard Connector Designation. Shows the location and reference designator for each connector on the motherboard.
- [Figure 5-2](#) and [Figure 5-2](#) A15 Connectors with Additional Associated Circuitry. Provides a simplified circuit diagram for the components on the motherboard. To help locate the components, the motherboard connector-pin that is connected to each component is shown.
- [Figure 5-3](#), A15J13 Connector-Pin Designation. Provides the pin numbering sequence for the connector that connects the A8 power supply to the motherboard.
- [Figure 5-4](#), Card-Cage Connector Pin Designation. Provides the pin-numbering sequence for the four motherboard connectors in the card cage. The motherboard connector for the A7 analog interface assembly (not shown) has the same pin-numbering sequence, but is installed in a position that is reversed when compared to the card-cage connectors.
- [Table 5-6](#), A15 Motherboard Mnemonic Descriptions. Provides the mnemonic, full name, and functional description for each signal and voltage on the motherboard.
- [Table 5-7](#), A15 Motherboard Pin Designations. Identifies the signal or voltage distribution for each signal and voltage on the motherboard.

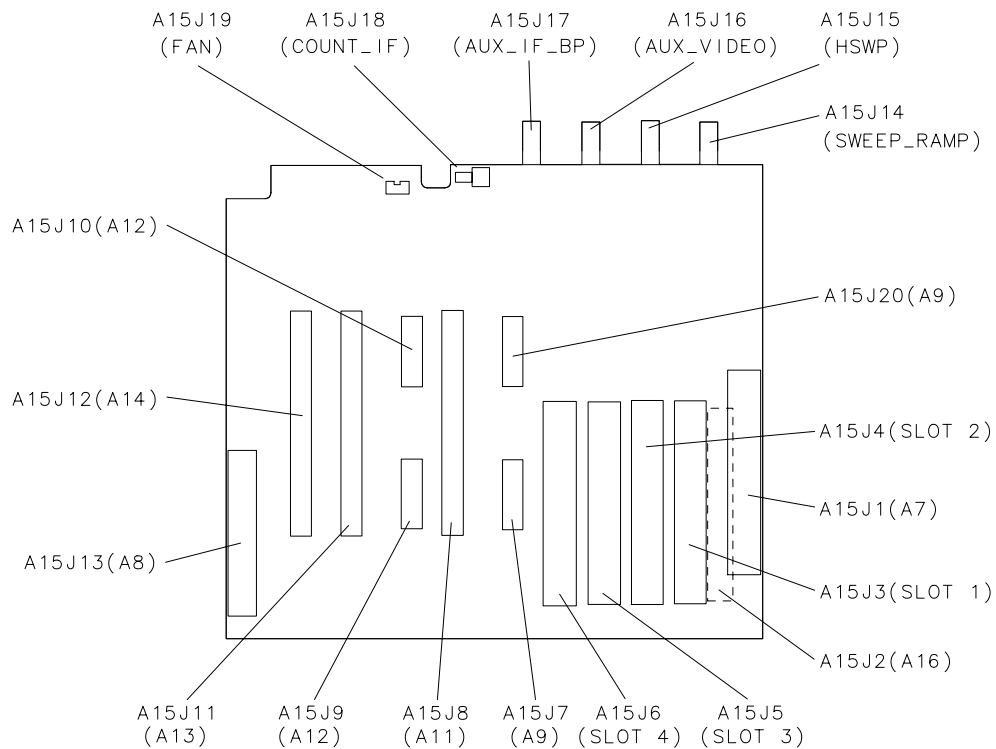
Each column identifies the instrument assembly that is connected to the A15 motherboard. The associated motherboard reference designator for each assembly is also supplied.

The mnemonics from [Table 5-7](#) are arranged alphabetically by row on the left-hand side of the table.

For a given mnemonic, read across the row to find all the assemblies that the signal or voltage is connected to. The A15 connector pin numbers in each box indicate the A15 connector pins where the signal or voltage appear.

Be sure to read the footnotes at the bottom of [Table 5-7](#).

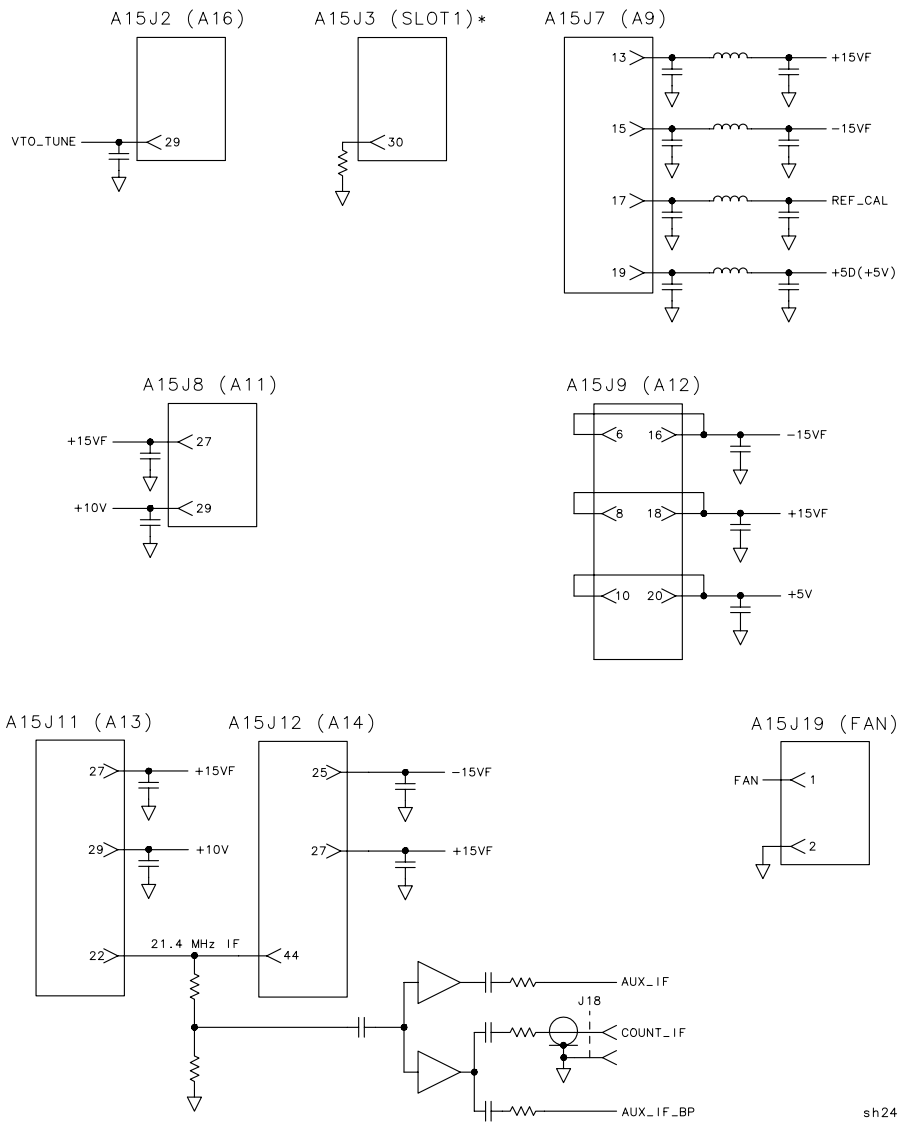
Figure 5-1 A15 Motherboard Connector Designation



sh247e

- All connector pins on A9J20 are tied to ground (ACOM).
- The A15J1 connector for the A7 analog interface assembly is installed in a position that is reversed when compared to card-cage connectors A15J3, A15J4, A15J5, and A15J6; therefore, the pin-numbering order is also reversed for A15J1 when compared to the card-cage connectors.

Figure 5-2 A15 Connectors with Additional Associated Circuitry (1 of 2)



sh248e

Figure 5-2 A15 Connectors with Additional Associated Circuitry (2 of 2)

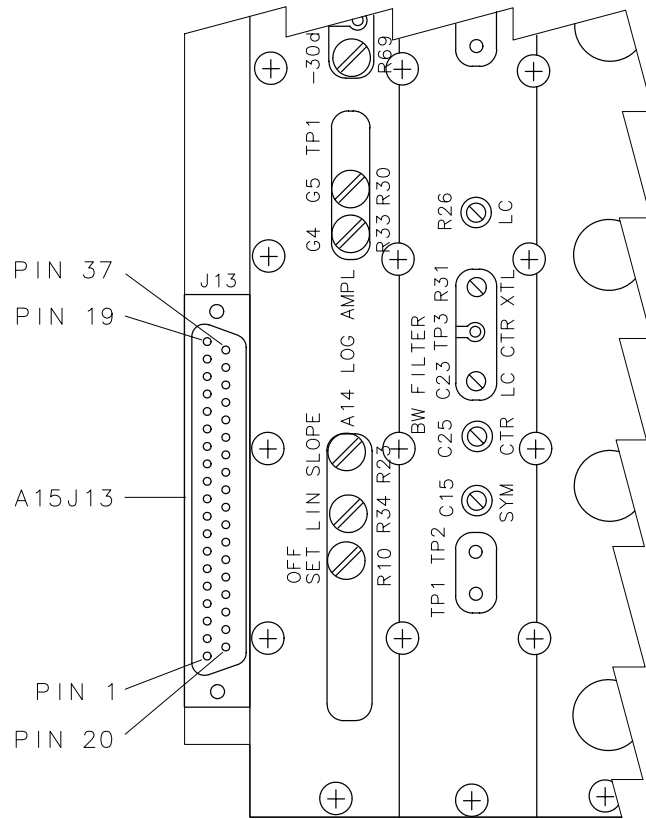
REAR FRAME CONNECTORS



sh249e

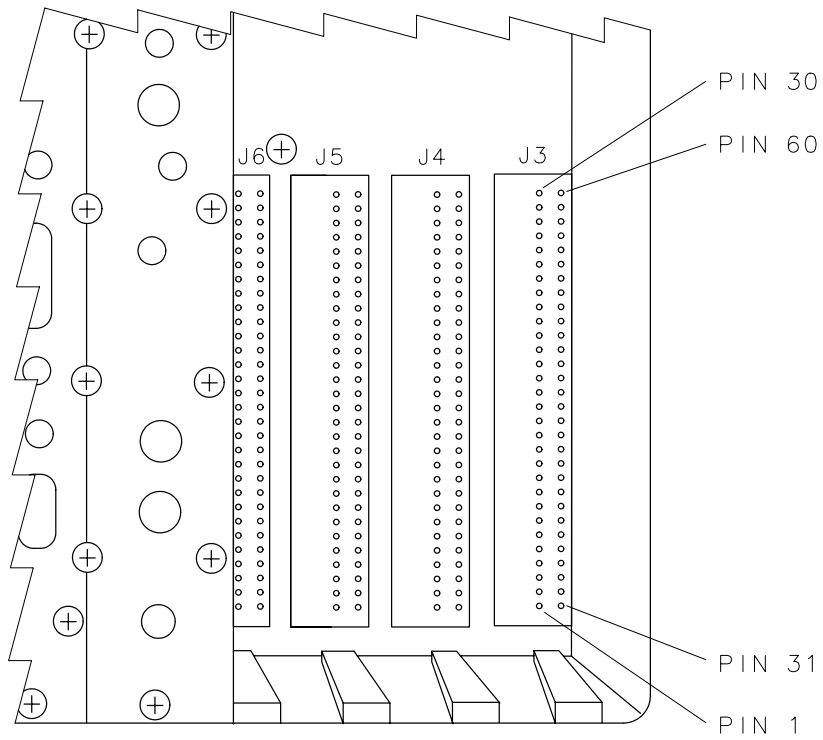
- The A15 motherboard pin designation for the 21.4 MHz IF signal path is provided in [Table 5-7](#).
- All the connector pins with the same number are connected in parallel for the card-cage connectors A15J3, A15J4, A15J5, and A15J6.

Figure 5-3 A15J13 Connector-Pin Designation



sh250e

Figure 5-4 Card-Cage Connector Pin Designation



sh268e

Table 5-6 A15 Motherboard Mnemonic Descriptions

Mnemonic	Full Name	Description
21.4 MHz IF	21.4 MHz IF	The 21.4 MHz IF signal between the A9 Third Converter assembly and the detector on the A14 Log Amplifier assembly.
+10V	+10 V Supply	The A7 Analog assembly provides a +10 V bias supply for the LC bandwidth filters on the A11/A13 bandwidth filter assemblies.
+12V	+12 V Supply	+12 V supply for the A2 Display and the RS-232 option, referenced to DCOM.
+15VF	+15 V Supply	+15 V power supply, referenced to ACOM.
+5V	+5 V Supply	+5 V power supply, referenced to DCOM.
-15V	-15 V Supply	-15 V power supply, referenced to ACOM.
-8VT	-8 V Temperature Compensated Supply	Provides -8 V from the temperature-compensated (TC) power supply on the A14 Log Amplifier assembly to the A7 Analog Interface assembly. The A7 provides temperature-compensation for the IFG4-IFG6 and the Log/Lin control lines using the -8 VT as a TC reference.
ACOM	Analog Common	A common ground for all analog circuitry.
ADC_SYNC	A/D Conversion Synchronization	A positive-going signal that indicates when the main ADC on the A16 Video/Processor assembly has started an A/D conversion. ADC_SYNC resets the peak detectors located on assemblies installed in the 8590L, 8591C, 8591E, 8593E, 8594E, 8595E, 8596E, and 8594Q card cage.
ADR0-ADR4	Address 0-4	Input/Output (IO) address lines.
ANA_TEST	Analog Test	Provides a series of test signals from A7 Analog Interface assembly to A16 Processor/Video assembly during instrument calibration and troubleshooting. (Refer to the A7 Overview Section)
AUX_IF	Auxiliary IF	An uncorrected, buffered 21.4 MHz IF signal from the output of the A13 bandwidth filter assembly to the four card-cage slots.
AUX_IF_BP	Auxiliary IF Back Panel	An uncorrected, buffered 21.4 MHz IF signal from the output of the A13 bandwidth filter assembly to J17, AUX IF OUTPUT.

Table 5-6 A15 Motherboard Mnemonic Descriptions (Continued)

Mnemonic	Full Name	Description
AUX_VIDEO	Auxiliary Video	A detected video signal (0 — 2 V) that has passed through the video filters. No amplitude corrections have been applied to this signal. A voltage divider at J16, AUX VIDEO OUTPUT, reduces the signal amplitude to 0 — 1 V.
BW5	Bandwidth 5	A bias voltage that activates either the LC or crystal bandwidth-filter mode.
BW6	Bandwidth 6	Controls the crystal-filter bandwidth.
BW7	Bandwidth 7	Controls the LC filter bandwidth.
COUNT_IF	Counterlock IF	A buffered 21.4 MHz IF signal from the output of the A13 bandwidth filter assembly to A25 Counter-Lock assembly.
CRD_ANLG_1	Card Cage Analog 1	An analog signal from assemblies installed in the card cage to the A16 input multiplexer. When it is selected, the signal passes through the A16 video-filter and peak-detector sections. It is available on AUX_VIDEO after it passes through the video filter.
CRD_ANLG_2	Card Cage Analog 2	An analog signal from assemblies installed in the card cage. The signal goes directly to A16 A/D conversion section, bypassing both the video-filter and peak-detector sections.
DCOM	Digital Common	A common ground for all digital circuitry.
DISCRIM or DISCRIMINAT OR	Discriminator	For Spans ≤ 10 MHz, the A25 Counter-Lock assembly sends a dc tuning voltage through the A16 Processor/Video assembly to the A7 Analog Interface assembly. The A7 assembly then adjusts the YTO to reduce residual FM.
EXT_HSWP	External High Sweep	EXT_HSWP performs two functions: 1) It provides external control of high sweep on the A16 Processor/Video when an external signal is connected to J15, HIGH SWEEP INPUT/OUTPUT. 2) It provides the HSWP signal as a rear-panel output at J15, HIGH SWEEP INPUT/OUTPUT. <i>This is an open-collector signal. It should never be driven high.</i>
FAN	FAN	+12 V power supply for the B1 fan.
WRUP	High Power Up	Enables the initial start-up sequence for the CPU on the A16 Processor/Video assembly when the analyzer is first turned on. This occurs prior to the start-up of other related assemblies.

Table 5-6 A15 Motherboard Mnemonic Descriptions (Continued)

Mnemonic	Full Name	Description
HSWP	High Sweep	Provides control for the analyzer display sweep and retrace. A TTL high starts a sweep and a TTL low initiates a retrace. <i>This is an open-collector signal. It should never be driven high.</i>
IFA1	IF Attenuation 1	Control line for 1dB step attenuator on the A12 Amplitude Control assembly.
IFA2	IF Attenuation 2	Control line for the 2 dB step attenuator on the A12 Amplitude Control assembly.
IFA3	IF Attenuation 3	Control line for the 4 dB step attenuator on the A12 Amplitude Control assembly.
IFA4	IF Attenuation 4	Control line for the 8 dB step attenuator on the A12 Amplitude Control assembly.
IFA5	IF Attenuation 5	Control line for the 16 dB step attenuator on the A12 Amplitude Control assembly.
IFG1	IF Gain 1	Control line for the 10 dB step gain on the A12 Amplitude Control assembly.
IFG2	IF Gain 2	Control line for the first 20 dB step gain on the A12 Amplitude Control assembly.
IFG3	IF Gain 3	Control line for the second 20 dB step gain on the A12 Amplitude Control assembly.
IFG4	IF Gain 4	Temperature-compensated control line for the 10 dB linear gain on the A14 Log Amplifier assembly.
IFG5	IF Gain 5	Temperature-compensated control line for the 10 dB linear gain on the A14 Log Amplifier assembly.
IFG6	IF Gain 6	Temperature-compensated control line for the 20 dB linear gain on the A14 Log Amplifier assembly.
INTERBUS	Interbus	A communication line between the four slots in the card cage. It coordinates functions between options when more than one option is installed in the card cage.
IOB0-IOB15	Input/Output Bus 0- Input/Output Bus 15	Input/Output (IO) data lines used between the A16 Processor/Video assembly and related assemblies.
LBIO	Low Bottom-box Input/Output	Strobe line for Input/Output (IO) data transfers.
LINE_TRIG	Line Trigger	Provides a TTL signal at the power-line frequency rate. It enables the line-trigger mode on the A16 Processor/Video assembly.

Table 5-6 A15 Motherboard Mnemonic Descriptions (Continued)

Mnemonic	Full Name	Description
LOG_LIN	Log Linear	Controls switching between log and linear modes on the A14 Log Amplifier assembly.
LPWRON	Low Power On	The front-panel line switch provides a TTL low when the switch is depressed. This initiates start-up of the A8 Power Supply and A16 Processor/Video assemblies.
LTIO	Low Top-box Input/Output	Strobe line for Input/Output (I/O) data transfers.
REF_CAL	Reference Cal	A DAC on the A7 Analog Interface assembly adjusts the gain of the A9 Third Converter assembly through REF_CAL.
SWEEP_RAMP	Sweep Ramp	A 0 to +10 V ramp signal that corresponds to signal sweep across the display. The signal is sent to J14, SWEEP OUTPUT, on the rear frame.
VIDEO_IF	Video IF	The detected 21.4 MHz IF signal from the detector on the A14 Log Amplifier assembly to the input multiplexer on the A16 Processor/Video assembly.
VTO_TUNE	Voltage-Tuned Oscillator Tune	A tuning voltage from the A25 Counter-Lock assembly to A9 Third Converter assembly. It locks the 600 MHz oscillator on the A9 assembly to the frequency reference.

Table 5-7 A15 Motherboard Pin Designations

Mnemonic	Instrument Assemblies									Card Cages ^a
	A7	A8	A9	A11	A12		A13	A14	A16	Slots 1, 2, 3, 4
	A15J1	A15J13	A15J7	A15J8	A15J9	A15J10	A15J11	A15J12	A15J2	A15J3, 4, 5, 6
21.4 MHz IF			9	22, 23	1	20	22, 23 ^b	44 ^b		
+10 V	22 ^c			29			29 ^b			
+12 V		13, 32							27, 57	
+15 V	3, 33	1, 2, 3, 20, 21, 22 ^c	b	27 ^b	8, 18		27 ^b	27 ^b	8, 38	9, 39
+5 V	19, 49	9, 10, 11, 12, 28, 29, 30, 31 ^c	b		10, 20				25, 26, 55, 56	26, 56
-15 V	4, 34	4, 5, 6, 23, 24, 25 ^c	b		6, 16 ^b			25 ^b	9, 39	10, 40
-8 VT	23							8 ^c		
ACOM	2, 32	7, 26, 27	1-8, 10, 12, 14, 16, 18, 20	1-21, 24-26, 28, 33-44	2-5, 7, 9, 11-15, 17, 19	5-10, 15-19	1-21, 24-26, 28, 33-44	1, 3-7, 9-24, 26, 28-30, 32-37, 41-43	2, 4, 6, 32-37	2, 4, 6, 8, 29, 31-38, 59, 60
ADC_SYNC									30 ^c	27
ADR0	6								11 ^c	12
ADR1	36								41 ^c	42
ADR2	7								12 ^c	13

Table 5-7 A15 Motherboard Pin Designations (Continued)

Mnemonic	Instrument Assemblies									Card Cages ^a
	A7	A8	A9	A11	A12		A13	A14	A16	Slots 1, 2, 3, 4
	A15J1	A15J13	A15J7	A15J8	A15J9	A15J10	A15J11	A15J12	A15J2	A15J3, 4, 5, 6
ADR3	37								42 ^c	43
ADR4	8								13 ^c	14
ANA_TEST	31								31 ^c	
AUX_IF							22 ^{b, c}			30
AUX_IF_BP							22 ^{b, c}			
AUX_VIDEO ^b									7 ^c	7
BW5	24 ^c			30			30			
BW6	54 ^c			31			31			
BW7	25 ^c			32			32			
COUNT_IF ^b										
CRD_ANLG_1									3 ^c	3
CRD_ANLG_2									5 ^c	5
DCOM	11, 16, 35, 38, 43, 48	14-17, 33-36							16, 21, 40, 43, 48, 53	17, 22, 41, 44, 49, 54
DISCRIMINATOR	21								28 ^c	
EXT_HSWP ^b										
FAN ^b		8 ^c								
WRUP	50	37 ^c							54	55
HSWP ^b									58 ^c	57
IFA1	58 ^c					4				
IFA2	29 ^c					3				

Table 5-7 A15 Motherboard Pin Designations (Continued)

Mnemonic	Instrument Assemblies									Card Cages ^a
	A7	A8	A9	A11	A12		A13	A14	A16	Slots 1, 2, 3, 4
	A15J1	A15J13	A15J7	A15J8	A15J9	A15J10	A15J11	A15J12	A15J2	A15J3, 4, 5, 6
IFA3	59 ^c					2				
IFA4	30 ^c					1				
IFA5	60 ^c					11				
IFG1	55 ^c					14				
IFG2	26 ^c					13				
IFG3	56 ^c					12				
IFG4	27 ^c							38		
IFG5	57 ^c							39		
IFG6	28 ^c							40		
INTERBUS										58 ^b
IOB0	9								14	15
IOB1	39								44	45
IOB2	10								5	16
IOB3	40								45	46
IOB4	41								46	47
IOB5	12								17	18
IOB6	42								47	48
IOB7	13								18	19
IOB8	14								19	20
IOB9	44								49	50
IOB10	15								20	21
IOB11	45								50	51
IOB12	46								51	52
IOB13	17								22	23

Table 5-7 A15 Motherboard Pin Designations (Continued)

Mnemonic	Instrument Assemblies									Card Cages ^a
	A7	A8	A9	A11	A12		A13	A14	A16	Slots 1, 2, 3, 4
	A15J1	A15J13	A15J7	A15J8	A15J9	A15J10	A15J11	A15J12	A15J2	A15J3, 4, 5, 6
IOB14	47								52	53
IOB15	18								23	24
LBIO	5								10 ^c	11
LINE_TRIG		18 ^c							60	
LOG_LIN	52 ^c							31		
LPWRON		19							59 ^c	
LTIO									24 ^c	25
REF_CAL	53 ^c		b							
SWEEP_RAMP ^b	51 ^c									28
VIDEO_IF								2 ^c	1	1
VTO_TUNE			11						29 ^{b,c}	

a. 8590 E-Series, 8591C and 8594Q only.

b. Refer to the figure, “A15 Connectors with Additional Associated Circuitry” in this section.

c. Pin numbers indicate assembly where signal or voltage originates.

Troubleshooting the IF Section
Troubleshooting the A15 Motherboard Assembly

6 Troubleshooting the RF Section

This chapter provides troubleshooting information for the RF section of the 8590 E-Series and L-Series spectrum analyzers, 8591C cable TV analyzers, and 8594Q QAM analyzers. This chapter is divided into two sections.

Before You Start

Section 6a, “8590L, 8591C, and 8591E,” describes troubleshooting information for the 8590L and 8591E spectrum analyzers and 8591C cable TV analyzers.

Section 6b, “8592L/94L, 8594Q, and 8593E/94E/95E/96E,” describes troubleshooting information for the 8592L, 8593E, 8594E, 8594L, 8595E, and 8596E spectrum analyzers and 8594Q QAM analyzer.

Refer to [Chapter 4, “Troubleshooting the Analyzer,”](#) for troubleshooting procedures that are useful when first starting to troubleshoot an analyzer failure.

Before You Start

There are four things you should do before starting to troubleshoot an analyzer failure:

- Check that you are familiar with the safety symbols marked on the analyzer, and read the general safety considerations and the safety note definitions given in the front of this guide.
- The analyzer contains static-sensitive components. Read the section entitled, “[Section Protection from Electrostatic Discharge](#)” in [Chapter 15](#).
- Become familiar with the organization of the troubleshooting information in this service guide.
- Read the rest of this section.

WARNING

The analyzer contains potentially hazardous voltages. Refer to the safety symbols on the analyzer and the general safety considerations in this manual before operating the unit with the cover removed. Failure to heed the safety precautions can result in severe or fatal injury.

Service Equipment You Will Need

Refer to the table entitled, “Recommended Test Equipment,” in Chapter 1 of the *8590 Series Analyzers Calibration Guide* for a list of the recommended test equipment needed to troubleshoot and repair the analyzer. Although Agilent Technologies equipment is recommended, any equipment that meets the critical specifications given in the table can be substituted for the recommended model.

Refer to [Chapter 13, “Softkey Descriptions,”](#) of this guide for a list of recommended service tools and required hand tools needed to troubleshoot and repair the analyzer.

After an Analyzer Repair

If one or more analyzer assemblies have been repaired or replaced, perform the related adjustments and performance verification tests. Refer to [Chapter 2, “Making Adjustments,”](#) for a table of Adjustments and Tests for Replaced or Repaired Assemblies, for the related adjustments and performance verification tests required for each assembly.

6a. 8590L, 8591C, and 8591E

This section describes the RF section troubleshooting process for the 8590L and 8591E spectrum analyzers and 8591C cable TV analyzers.

Making RF Power-Level Measurements

The power level ranges listed for measurements A through G in Table 6-1 apply after performing the following steps:

1. Connect the CAL OUT to the RF INPUT using the CAL cable.
 Ensure that the CAL OUT amplitude is within specification. (Refer to the calibrator amplitude performance test in the calibration guide.)
2. Perform the frequency and amplitude calibration routines.
3. Press **PRESET**, then wait for the analyzer to complete the preset routine.
4. Press the following instrument keys:

FREQUENCY, 300, MHz
SPAN, 0, Hz

Table 6-1 Power Levels at Measurement Points

Measurement Point	Measurement Frequency	Power Level Range * (dBm)	
		50 Ω	75 Ω
A	300 MHz	-29 to -31	-35 to -37
B	2.1214 GHz	-39 to -43	-46 to -49
C	2.1214 GHz	-39 to -44	-46 to -50
D	321.4 MHz	-42 to -46	-51 to -55
E	2.4214 GHz	+6 to +12	Same as 50 Ω
F	2.4214 GHz	-10 to -20	Same as 50 Ω
G	1.8 GHz	-17 to -23	Same as 50 Ω

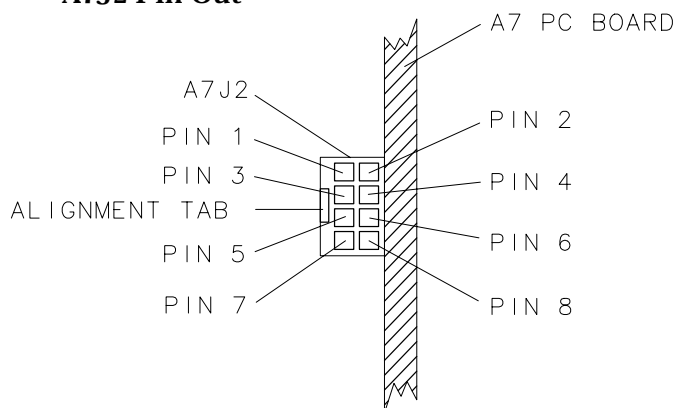
* A frequency-selective measuring device, such as another analyzer, is recommended for making these measurements. Broadband measuring devices, such as power meters, give erroneous results due to the presence of other, higher-amplitude signals.

Connector Pin-Out Information

The RF section receives control voltages for the A3 attenuator from the A7 analog interface assembly. It also receives power-supply voltages for the A3 attenuator and A5 second converter assemblies from the A7 analog interface assembly. The W13 wire harness connects the attenuator and second converter to the A7J2 connector on the A7 assembly. Table 6-2 identifies the signals that are supplied to the two RF assemblies and Figure 6-1 shows the pin number location on A7J2.

Figure 6-1

A7J2 Pin-Out



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Table 6-2

A7J2 Connector Pin Designation (Top-Side View)

A7J2 Pin Number	W13 Wire Color	Signal Description
1	Brown	+8 VF power supply for A5 Second Converter
2	Black	Analog ground for A5 Second Converter
3	Orange	+15 VF power supply for A3 Attenuator
4	N/C	
5	Green	Control line for 20 dB step on A3 Input Attenuator
6	Blue	Control line for 10 dB step on A3 Input Attenuator
7	N/C	
8	Grey	Control line for 30 dB step on A3 Input Attenuator

To check control of the A3 input attenuator

The A7 analog interface assembly controls the three attenuator steps in the A3 input attenuator. Each attenuator step requires one control line, as shown in Table 6-3. The W13 wire harness connects the attenuator to A7J2 on the A7 assembly. W13 also supplies the +15 V power supply for the attenuator. Locate W13 using the top view of the analyzer in Chapter 11, "Major Assembly and Cable Locations."

Use a digital multimeter (DMM) and the values from Table 6-3 to check the control voltages for each attenuator step. Refer to Figure 6-1 for the location of the connector pins on A7J2. Measure the voltages at the A7J2 pins on the trace side of the A7 assembly.

Table 6-3 Input Attenuator Control Output at A7J2

Attenuator Setting (dB)	10 dB Step (A7J2 Pin 6)	20 dB Step (A7J2 Pin 5)	30 dB Step (A7J2 Pin 8)
0	L	L	L
10	H	L	L
20	L	H	L
30	H	H	L
40	H	L	H
50	L	H	H
60	H	H	H

H = +15 V (A high output indicates that the attenuator step is in the signal path.)
 L = +0.8 V
 These control voltages are valid only if the A3 Input Attenuator is connected to A7J2.

6b. 8592L/94L, 8594Q, and 8593E/94E/95E/96E

This section describes the RF section troubleshooting process for the 8592L, 8593E, 8594E, 8594L, 8595E, and 8596E spectrum analyzers, and 8594Q QAM analyzers.

Making RF Power-Level Measurements

The power level ranges listed for measurements A through E in Table 6-4 apply after performing the following steps:

1. Ensure that the CAL OUT amplitude is within specification. (Refer to the calibrator amplitude performance test in the calibration guide.)
2. Select the appropriate input signal for the desired frequency band:

Band 0 300 MHz at -20 dBm (CAL OUT signal)

Band 15 GHz at 0 dBm

Band 2 10 GHz at 0 dBm

Band 3 15 GHz at 0 dBm

Band 4 20 GHz at 0 dBm

3. Press **PRESET**, then wait for the analyzer to complete the preset routine.
4. Press the following instrument keys:

FREQUENCY (same as input signal)

SPAN, 0, Hz

AMPLITUDE, 0, dBm

ATTEN, 10, dB

BW, 3, MHz

SWEEP

SWEPTIME, 20, ms

Table 6-4 Power Levels at Measurement Points

Measurement Point	Measurement Frequency	Power Level Range *				
		Band 0 92L, 93E, 94E, 94L, 94Q, 95E, 96E	Band 1 92L, 93E, 95E, 96E	Band 2 92L, 93E, 96E	Band 3 92L, 93E	Band 4 92L,93E
A	Same as input frequency	-30 to -33 dBm	—	—	—	—
B	Same as input frequency	—	-14 to -19 dBm	-14 to -19 dBm	-14 to -20 dBm	-15 to -23 dBm
C	321.4 MHz	—	10 to 16 dB below B †	18 to 26 dB below B †	21 to 31 dB below B †	25 to 35 dB below B †
D	3.9214 GHz	8 to 12 dB below A †	—	—	—	—
E	321.4 MHz	5 to 11 dB below D †	1 to 6 dB below C †	1 to 6 dB below C †	1 to 6 dB below C †	1 to 6 dB below C †
<p>* A frequency-selective measuring device, such as another analyzer, is recommended for making these measurements. Broadband measuring devices, such as power meters, will give erroneous results due to the presence of other, higher-amplitude signals.</p> <p>† The power-level range is relative to the actual measurement taken at the measurement point indicated.</p>						

Connector Pin-Out Information

The RF section receives control voltages from the A7 analog interface assembly. It also receives power-supply voltages for the attenuator and second converter assemblies from the A7 analog interface assembly. Table 6-8 and Table 6-9 identify the signals that are supplied to the two RF assemblies for both the standard and option 026 spectrum analyzers.

Table 6-5

A7J2 Connector Pin Designation for 8592L, 8593E, 8596E

A7J2 Pin Number	W13 Wire Color	Signal Description
1	Black	Normally Open
2	Grey	Normally Closed
3	Orange	ACOM
4	Yellow	+15 VF
5	Green	POS_MXR_BIAS
6	Blue	PIN_Switch
7	Violet	COMB
8	N/C	
9	White and Red	+15 VF
10	N/C	-15 VF

Table 6-6

A7J2 Connector Pin Designation for Option 026 for 8595E

A7J2 Pin Number	W13 Wire Color	Signal Description
1	Brown	Normally Open
2	Red	Normally Closed
3	N/C	ACOM
4	N/C	+15 VF
5	Green	POS_MXR_BIAS
6	Blue	PIN_Switch
7	N/C	COMB
8	N/C	
9	N/C	+15 VF
10	N/C	-15 VF

Table 6-7 A7J4 2nd Converter Drive Pin Designation for 8592L, 8593E, 8594E, 8594L, 8594Q, 8595E, 8596E

A7J4 Pin Number	Signal Description
1	2nd Mixer Bias
2	+5 A
3	ACOM
4	+10 VF
5	PIN_SW
6	KEY
7	N/C
8	N/C
9	N/C
10	N/C

Table 6-8 A7J301 YTF Driver Pin Designation for 8592L, 8593E, 8595E, 8596E

A7J301 Pin Number	W34 Wire Color	Signal Description
1	Brown	YIG_FLT+
2	Orange	YIG_FLT-
3	Green	-15 VF
4	Violet	+15 VF

Table 6-9 A10J1 Tracking Generator Control Pin Designation for 8593E, 8594E, 8594L, 8594Q, 8595E, 8596E

A10J1 Pin Number	Signal Description
1	+15 VF
2	ACOM
3	-15 VF
4	OSC_PWR
5	TUNE
6	ALC_MON
7	KEY
8	PWR_LVL
9	+5 VF1
10	ALC_EXT

To check control of the A3A5 input attenuator

The A7 analog interface assembly controls the three attenuator steps and blocking capacitor in the A3A5 input attenuator using eight control lines. Refer to the RF section block diagram for your analyzer at the end of [Chapter](#) , “[Assembly Descriptions and Block Diagrams.](#)” Each attenuator step requires two control lines, as shown in Table 6-10 and Table 6-11. The attenuator is connected to A7J5 on the A7 assembly with the ribbon cable, W36. Locate W36 using the top view of the analyzer in [Chapter 11](#), “[Major Assembly and Cable Locations.](#)”

Use a digital multimeter (DMM) and the values from Table 6-10 to check the control voltages. Measure the voltages at the A7J5 pins on the trace side of the A7 assembly.

Table 6-10 **Input Attenuator Control Output at A7J5 for 8592L and 8593E**

Attenuator Setting (dB)	10 dB Step		1st 20 dB Step		2nd 20 dB Step		3rd 20 dB Step	
	Pin 2	Pin 1	Pin 9	Pin 4	Pin 8	Pin 5	Pin 7	Pin 6
0	H	L	H	L	H	L	H	L
10	L	H	H	L	H	L	H	L
20	H	L	H	L	L	H	H	L
30	L	H	H	L	L	H	H	L
40	H	L	L	H	H	L	L	H
50	L	H	L	H	H	L	L	H
60	H	L	L	H	L	H	L	H
70	L	H	L	H	L	H	L	H

H = -10 V (with the attenuator connected at A7J5)
 H = 0 V (A floating output if the attenuator is disconnected.)
 L = -15 V (A low at pin 2, 9, 8, or 7 indicates that the attenuator step is in the signal path.)

Table 6-11 **Input Attenuator Control Output at A7J5 for 8594E, 8594L, 8594Q, 8595E, 8596E**

Attenuator Setting (dB)	10 dB Step		40 dB Step		20 dB Step		Blocking Capacitor	
	Pin 2	Pin 1	Pin 9	Pin 4	Pin 8	Pin 5	Pin 7	Pin 6
0	H	L	H	L	H	L	—	—
10	L	H	H	L	H	L	—	—
20	H	L	H	L	L	H	—	—
30	L	H	H	L	L	H	—	—
40	H	L	L	H	H	L	—	—
50	L	H	L	H	H	L	—	—
60	H	L	L	H	L	H	—	—
70	L	H	L	H	L	H	—	—
Blocking Capacitor In	—	—	—	—	—	—	L	H
Blocking Capacitor Out	—	—	—	—	—	—	H	L

H = -10 V (with the attenuator connected at A7J5)
H = 0 V (A floating output if the attenuator is disconnected.)
L = -15 V (A low at pin 2, 9, or 8 indicates that the attenuator step is in the signal path. A low at pin 7 indicates the blocking capacitor is the signal path.)

7 **Replacing Major Assemblies**

The procedures in this chapter describe the removal and replacement of major assemblies in the 8590L, 8591C, 8591E, 8592L, 8593E, 8594E, 8594L, 8594Q, 8595E, and 8596E analyzers.

The words “right” and “left” are used throughout these procedures to indicate the sides of the analyzer as normally viewed from the front of the instrument. Numbers in parentheses, for example **(1)**, indicate numerical callouts on the figures.

Before You Start

There are four things you should do before starting to troubleshoot an analyzer failure:

- Check that you are familiar with the safety symbols marked on the analyzer, and read the general safety considerations and the safety note definitions given in the front of this service guide.
- The analyzer contains static sensitive components. Read the section entitled “[Protection from Electrostatic Discharge.](#)” in [Chapter 15](#).
- Become familiar with the organization of the troubleshooting information in this service guide.
- Read the rest of this section.

WARNING

The analyzer contains potentially hazardous voltages. Refer to the safety symbols on the analyzer and the general safety considerations in this guide before operating the unit with the cover removed. Failure to heed the safety precautions can result in severe or fatal injury.

Service Equipment You Will Need

Refer to Chapter 1 of the *8590 Series Analyzers Calibration Guide* for a list of the recommended test equipment needed to troubleshoot and repair the analyzer. Although Agilent Technologies equipment is recommended, any equipment that meets the critical specifications given in the table can be substituted for the recommended model.

Refer to [Chapter 15](#) of this guide for a list of required service and hand tools needed to troubleshoot and repair the analyzer.

After an Analyzer Repair

If one or more analyzer assemblies have been repaired or replaced, perform the related adjustments and performance verification tests. Refer to [Chapter 2](#) for a table of Adjustments and Tests for Replaced or Repaired Assemblies, for the related adjustments and performance verification tests required for each assembly.

Removal and Replacement Procedures in this Chapter

- Instrument Cover
- A1 Front-Frame Assembly
- A1A1 Keyboard/Front Panel Keys
- A2 Display
- RF Assembly
- A3 Front-End Assembly
- A7 Analog Assembly
- A8 Power Supply
- A15 Motherboard and IF Extrusion
- A16 Processor/Video Board and Firmware
- A16A1 Memory Board
- A16A1BT1 Battery
- A17 Memory Card Reader
- A25 Counter-Lock Assembly
- B1 Fan
- Rear Frame

Instrument Cover

This procedure applies to:

- 8590 E-Series and L-Series spectrum analyzers
- 8591C cable TV analyzers
- 8594Q QAM analyzers

Removal

1. Disconnect the analyzer from ac power.

CAUTION

To prevent damage to the front frame, use a soft cloth or towel between the work surface and the front frame.

2. Carefully place the analyzer on the work surface with the front frame facing down.
3. Remove the four screws and washers attaching the instrument cover to the rear frame.
4. Unscrew, but do not remove, the four rear-feet screws, using a 4 mm hex wrench.
5. Pull the instrument cover off towards the rear of the instrument.

Replacement

1. Disconnect the analyzer from ac power.

CAUTION

To prevent damage when replacing the instrument cover, remember the following:

- Place a soft cloth or towel between the work surface and the front frame.
- Ensure that cables do not bind between the instrument cover and its internal assemblies.

-
2. Carefully place the analyzer on the work surface with the front frame facing down.
 3. Replace the instrument cover assembly by matching the seam on the cover with the bottom of the instrument.
 4. Fit the leading edge of the cover completely into the slot on the back of the front-frame assembly. The cover should fit snugly against the EMI gasket in the slot.
 5. Tighten the four rear-foot screws with a 4-mm hex wrench.
 6. Replace the four screws and washers attaching the instrument cover assembly to the rear frame.

A1 Front-Frame Assembly

This procedure applies to:

- 8590 E-Series and L-Series spectrum analyzers
- 8591C cable TV analyzers
- 8594Q QAM analyzers

CAUTION

Use ESD precautions when performing this replacement procedure.

Removal

1. Remove the instrument cover assembly. Refer to the “[Instrument Cover](#).” removal procedure.
2. Place the analyzer with the bottom side facing up on the work surface.
3. If the instrument came equipped with the A17 Memory Card Reader, remove it. Refer to the “[A17 Memory Card Reader Assembly](#).” removal procedure.
4. On 8592L, 8593E, and 8596E spectrum analyzers, remove the cable tie **(2)** that secures the A3A11 and A3A12 assemblies to the W10 semi-rigid cable. See [Figure 7-1](#).
5. On 8592L, 8593E, and 8596E spectrum analyzers, disconnect the W37 semi-rigid cable **(3)** from the 100 MHz COMB OUT connector on the front-frame assembly.
6. Remove the two screws **(1)** that secure the front frame to the main chassis.
7. If the instrument came equipped with a tracking generator, disconnect the tracking generator output semi-rigid cable **(5)** from the RF OUT connector on the front-frame assembly.
8. Disconnect the W10 semi-rigid cable **(4)** from the INPUT connector.
9. Disconnect W3 **(6)** from A1R1, the front-panel INTEN control. It may be necessary to remove the speaker bracket from LS1 as well as A22 10 MHz reference in order to get to W3.
10. If the instrument came equipped with an A102 AM/FM Speaker and TV Synch Trigger (Option 102) or A103 Quasi Peak Detector (Option 103), disconnect W102 from the VOL control wiring connector **(8)** at A1R1.

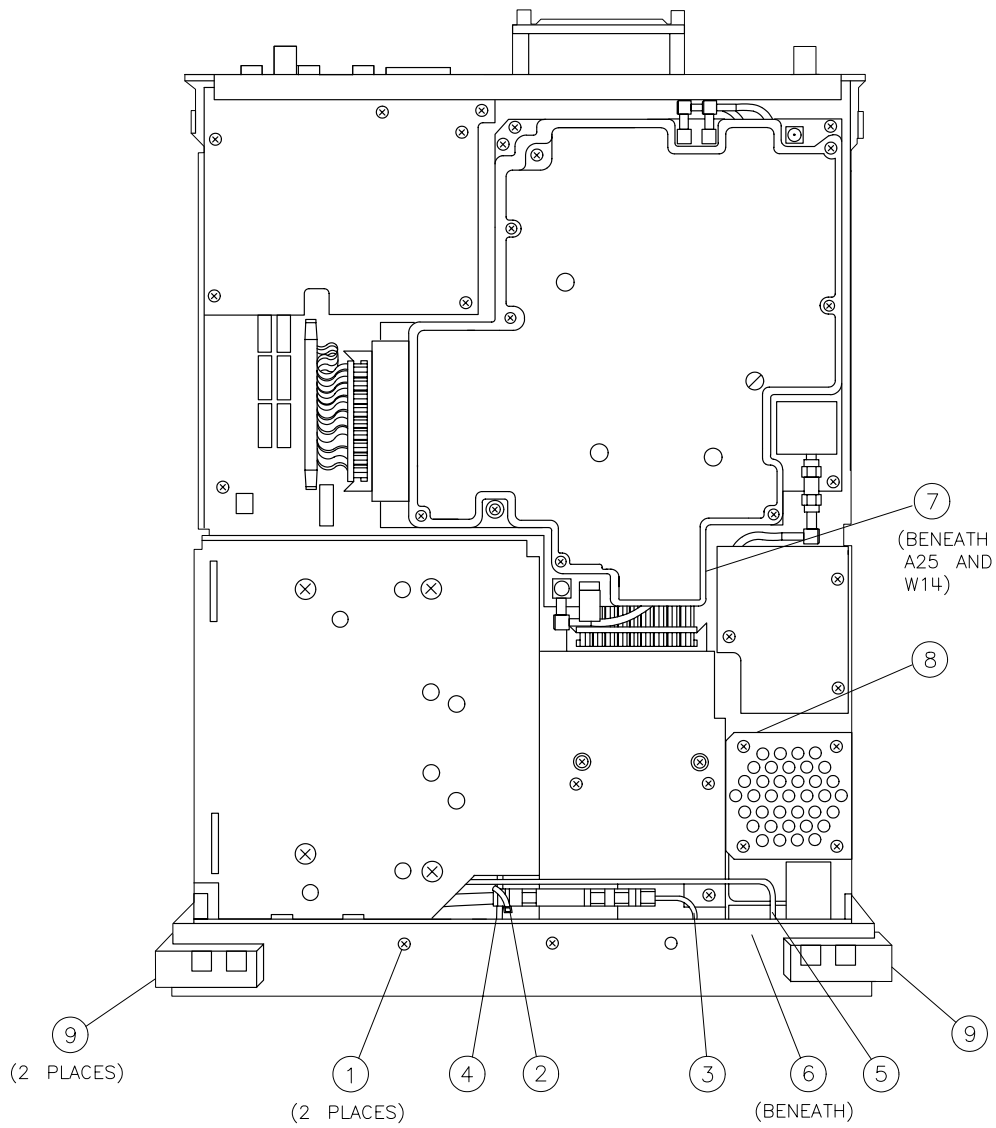
11. Disconnect W1 (7) from A16J9.
12. Place the analyzer with the front frame forward and the top side facing up on the work surface.
13. Disconnect W7 from A9J2.
14. Remove the five screws (9) that secure the front frame to the main chassis sides. There are three screws on the right and two screws on the left.

CAUTION

To prevent damage to the semi-rigid cables, make sure they are completely disconnected from the front panel connectors *before* removing the front frame.

15. Separate the front frame from the main chassis and disconnect the W4 ribbon cable from the A1A1 Keyboard assembly.
16. Remove the front-frame assembly.

Figure 7-1 **A1 Front-Frame Replacement**



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