Adjustment Software

Adjustment Software

TOP

1 Adjustment Software

Introduction NEXT

What You Will Find in This Chapter

This chapter is divided into three sections. The first, "Introduction" is a brief description of adjustments. The second, "Getting Started" describes how to begin using the adjustment software and the equipment you will need to complete the tests. The third, "Adjustment Descriptions" describes the various adjustments and their implementation.

Introduction NEXT

TOP

Introduction

Test Environment

Agilent Test Management Environment is the new high performance, 32 bit, component-based calibration platform from Agilent Technologies. Agilent Test Management Environment can be expanded by purchasing test packages to test additional Agilent instruments. Agilent Test Management Environment reduces the cost of instrument maintenance by providing quick and accurate automated tests--reducing instrument downtime--and providing a "common look and feel"--reducing operator training. Agilent Test Management Environment feature highlights:

Runs on Microsoft Windows 95/98/2000 or NT 4.0.

Provides fast automated testing.

Provides easy customizing of test sequences.

Provides ANSI Z540 compliant test reports.

It is Y2K compliant.

Runs from a graphic user interface.

Provides test standard tracking.

Provides administration security to control the test standards used.

Provides comprehensive on-line help.

Adjustments

Adjustments, sometimes incorrectly referred to as *calibrations*, are procedures designed to reset various circuit parameters. In addition, some of the adjustments reset or calculate correction values associated with some measurements. The adjustments are supplied in an automated test software package accessory. The software is designed to adjust an instrument operating within the operational temperature range defined by the instrument specifications.

Never perform adjustments as routine maintenance. Adjustments should be performed only after a repair or a performance test failure.

PREVIOUS What You Will Find in This Chapter

Getting Started NEXT

TOP

Getting Started

NOTE Refer to the online help documentation for complete information on using the adjustment software.

Before You Start

You must do the following *before* starting adjustments:

1. Ensure you have a compatible controller (IBM compatible computer), refer to the table 9-1.
2. Install the adjustment software on the computer.
3. Ensure you have the proper test equipment, refer to tables 9-1 through 9-5 for a list of test equipment.
4. Switch the unit under test (UUT) on and let it warm up in accordance with warm-up requirements in the instrument specifications.

Software Installation and Configuration

Refer to the instructions on the Adjustment Software CD-ROM packaging for installation instructions.

After installation, refer to the online help instructions for configuring the software for performing test and adjustments.

Test Equipment

Table 9-1 through 9-5, list the equipment required to run the adjustments (they will be identified as an "A" in the Use column). The tables list the equipment type, critical specifications, and the recommended model number. The "Recommended Model" is the preferred equipment. The critical specifications in this table are the most restrictive specifications for all of the tests.

Not all of the listed test equipment needs to be connected to perform an individual test. To run a test, only the equipment specified for that test needs to be connected.

NOTE The validity of the adjustment program measurements depends in part on required test equipment measurement accuracy. Verify proper calibration of test equipment before running tests with this software.

Warmup Time

Test Equipment Warmup

Allow sufficient warmup time for the test equipment. Refer to individual operating and service manuals for warmup specifications.

UUT Warmup

The UUT must be stored at a constant temperature, within the specified operating temperature range, for a minimum of two hours prior to running the adjustments. Switch on the instrument and let it warm up in accordance with warm-up requirements in the instrument specifications.

NOTE Analyzers equipped with the High-Stability Frequency Reference, Option 1D5, require a minimum of 24 hours warm-up time before performing the "10 MHz Reference Adjustment".

Equipment Connections

GPIB Cables

All test equipment controlled by GPIB should be connected to the GPIB connector of the controller. If the controller has only one GPIB connector, connect the UUT to it as well. If the controller has dual GPIB connectors, connect the UUT to the second GPIB interface.

Test Setups

Abbreviated test setup illustrations for each test are included with the test located in the section titled "Adjustment Descriptions" on page 6, and complete detailed illustrations are located in the online help supplied with the test software. The program prompts the operator to make appropriate equipment connections.

Table 1 Required Controller and Accessories

Equipment	Critical Specifications	Recommended Model Number	Alternative Model Number
Controller			
Computer	IBM compatible PC Intel Pentium 90 MHz or greater MS Windows 95/98/2000 or NT 4.0 At least 32 MB RAM At least 200 MB of free hard disk space CD-ROM Drive 800x600 Minimum monitor resolution Web browser[1]		
IEEE 488 Interface Card	High-performance GPIB with: Agilent -VISA 1.2[2] or greater or NI -VISA 1.2[3] or greater	National part number AT-GPIB/TNT	
Software	Performance verification and Adjustment software for ESA-Series Specrum Analyzers	E4401-90416	

Table 2 Recommended Test Equipment

Equipment	Critical Specifications for Equipment Substitution	Recommended Model	Use [4]
Digital Multimeter	Input Resistance: >10 Mohm Accuracy: ± 10 mV on 100 V range	Agilent 3458A	P,A,T
DVM Test Leads	For use with 3458A Digital Multimeter	Agilent 34118B	T
Universal Counter	Time Interval Range: 25 ms to 100 ms Single Operation Range: +2.5 Vdc to -2.5 Vdc	Agilent 53132A	P,A,T
Frequency Standard	Frequency: 10 MHz Timebase Accuracy (Aging): $<1 \times 10^{-9}$/day	Agilent 5071A	P,A
Oscilloscope	Bandwidth: >10 MHz Functions: Area, Vp-p, Pulse Width Vertical Scale Factor of 0.5 V to 5 V/Div	Agilent 54820A	P, T

Power Meter	Compatible with 8480 series power sensors. dB relative mode. Resolution: 0.01 dB Reference Accuracy: 1.2% Dual Channel	Agilent E4419B/A	P,A,T
RF Power Sensor (2 required)	Frequency Range: 100 kHz to 3 GHz Maximum SWR: 1.60 (100 kHz to 300 kHz) 1.20 (300 kHz to 1 MHz) 1.1 (1 MHz to 2.0 GHz) 1.18 (2.0 GHz to 3.0 GHz) Amplitude range: -25 dBm to +10 dBm	Agilent 8482A	P,A,T
Microwave Power Sensor	Frequency Range: 50 MHz to 26.5 GHz Maximum SWR: 1.15 (50 MHz to 100 MHz) 1.10 (100 MHz to 2 GHz) 1.15 (2 GHz to 12.4 GHz) 1.20 (12.4 GHz to 18 GHz) 1.25 (18 GHz to 26.5 GHz) Amplitude range: -25 dBm to 0 dBm	Agilent 8485A	P,A,T
75 ohm Power Sensor (Option 1DP)	Frequency Range: 1 MHz to 1500 MHz Maximum SWR: 1.18 (600 kHz to 1500 MHz) Impedance: 75 ohm Amplitude Range: -30 dBm to +20 dBm	Agilent 8483A	P,A,T
Power Sensor, Low Power	Frequency Range: 50 MHz to 3.0 GHz Amplitude Range: -20 dBm to -70 dBm Maximum SWR: 1.4 (10 MHz to 30 MHz) 1.15 (30 MHz to 3.0 GHz)	Agilent 8481D	P,A,T
Spectrum Analyzer, Microwave (required for Option 1DN or 1DQ)	Frequency Range: 100 kHz to 7 GHz Relative Amplitude Accuracy: 100 kHz to 3.0 GHz: < 1.8 dB Frequency Accuracy: < 10 kHz @ 7 GHz	Agilent 8563E	P,T
Synthesized Signal Generator	Frequency Range: 100 kHz to 2500 MHz Amplitude Range: -35 to +16 dBm SSB Noise: <-120 dBc/Hz at 20 kHz offset	Agilent 8663A	P,A

Synthesized Signal Generator Not Required for E4401B/E7401A/E4411B/E4403B or E4408B	Frequency: 1 GHz non-option 120 Phase Noise at 1 GHz: < -131 dBc/Hz @ 100 kHz offset < -137 dBc/Hz @ 1 MHz offset < -139 dBc/Hz @ 5 MHz offset < -143 dBc/Hz @ 10 MHz offset option 120 Phase Noise at 1 GHz: < -131 dBc/Hz @ 100 kHz offset < -145 dBc/Hz @ 1 MHz offset < -147 dBc/Hz @ 5 MHz offset < -149 dBc/Hz @ 10 MHz offset	Agilent 8665B/64A/64B	P
Synthesized Sweeper *(2 required for all but E4401B and E4411B)*	Frequency Range: E4407B or E4408B: 10 MHz to 26.5 GHz All others: 10 MHz to 13.2 GHz Frequency Accuracy (CW): ±0.02% Leveling Modes: Internal and External Modulation Modes: AM Power Level Range: -35 to +16 dBm	Agilent 83630/40/50B 83620/30/40/50B	P,A,T
Function Generator	Frequency Range: 0.1 Hz to 20 MHz Frequency Accuracy: 0.02% Waveform: Triangle, Square	Agilent 33120A	P,A,T
RF Signal Generator Required for options BAC, BAH	(Options IE5 and UN8)	E4433B	P
Pulse Generator Required for EMC models only	Mainframe with 81103A and 81106A 10V/2nS Output Channel and External PLL/Clock	8110A	P
Switch/Pulse Modulator Required for EMC models only		0955-0533 or SC35B	P

Attenuator/Switch Driver	Compatible with 8494G and Agilent 8496G Programmable step attenuators	Agilent 11713A	P
Attenuator, 1 dB Step	Attenuation Range: 0 to 11 dB Frequency Range: 4 GHz Connectors: Type-N female Calibrated at 50 MHz with accuracy of 1 to 11 dB attenuation: 0.010 dB.	Agilent 8494A/G	P
Attenuator, 10 dB Step	Attenuation Range: 0 to 110 dB Frequency Range: 4 GHz Connectors: Type-N female Calibrated at 50 MHz with accuracy of: 0 to 40 dB attenuation: ±0.020 dB 50 to 100 dB attenuation: ±0.065 dB 110 dB attenuation: ±0.075 dB	Agilent 8496A/G	P
Attenuator, 20 dB Fixed (Option 1DS)	Nominal attenuation: 20 dB Frequency Range: dc to 3.0 GHz Connectors: Type N (m) and Type N (f) Maximum SWR: <1.2 (dc to 3 GHz)	Agilent 8491A Option 020	P, A
Attenuator, 10 dB Fixed	Nominal attenuation: 10 dB Frequency Range: dc to 12.4 GHz Connectors: Type-N (m) and Type-N (f)	Agilent 8491A Option 010	P
Attenuator, 6 dB Fixed	Nominal attenuation: 6 dB Frequency Range: dc to 12.4 GHz Connectors: Type-N (m) and Type-N (f) Maximum SWR: <1.15 at 50 MHz	Agilent 8491A Option 010 and H47	P
Attenuator Interconnect Kit	Mechanically and electrically connects 8494A/G and 8496A/G	Agilent 11716 Series	

Table 3 Recommended Accessories

Equipment	Critical Specifications for Accessory Substitution	Recommended Model	Use [5]

6 GHz Directional Bridge	Frequency Range: 5 MHz to 3.0 GHz Directivity: >40 dB Coupling factor: 16 dB nominal Insertion Loss: 2 dB maximum	Agilent 86205A	P
Power Splitter E4401B/02B/ 03B/04B/05B/11B)	Frequency Range: 9 kHz to 13.2 GHz Insertion Loss: 6 dB nominal Output Tracking: <0.25 dB Equivalent Output SWR: <1.22:1	Agilent 11667A	P,A
Power Splitter (E4407B/08B)	Frequency Range: 9 kHz to 26.5 GHz Insertion Loss: 6 dB nominal Output Tracking: <0.25 dB Equivalent Output SWR: <1.22:1	Agilent 11667B	
Directional Coupler	Frequency Range: 2 GHz to 8 GHz Directivity >20 dB Max.VSWR: 1.35:1 Transmission Arm Loss: < 1 dB nominal Coupled Arm Loss: ~ 16 dB nominal	Agilent 0995-0098	
Directional Coupler	Frequency Range: 2 GHz to 15 GHz Directivity >14 dB Max.VSWR: 1.35:1 Transmission Arm Loss: < 1.5 dB nominal Coupled Arm Loss: ~ 10 dB nominal	Agilent 87300B	
Termination, 50 ohm (E4401B/02B/ 03B/04B/05B/11B) (2 required for Option 1DN)	Impedance: 50 ohm nominal Connector: Type-N (m)	Agilent 909A (Option 012)	P,T
Termination, 50 ohm (E4407B/ 08B)	Impedance: 50 ohm nominal Connector: APC 3.5 (f)	Agilent 909D (Option 011)	P,T
Termination, 50 ohm	Impedance: 50 ohm nominal Connector: BNC (m)	Agilent 11593A	P,A
Termination, 75 ohm (Option 1DQ and 1DP)	Impedance: 75 ohm nominal *(2 required for Option 1DQ) (1 required for Option 1DP)*	Agilent 909E (Option 201)	P,T
Filter, 50 MHz Low Pass	Cutoff frequency: 50 MHz Rejection at 65 MHz: >40 dB Rejection at 75 MHz: >60 dB	Agilent 0955-0306	P
Filter, 300 MHz Low Pass	Cutoff frequency: 300 MHz Rejection at >43 MHz: >45 dB	Agilent 0955-0455	P

Filter, 1 GHz Low Pass	Cutoff frequency: 1 GHz Rejection at 2 GHz: >60 dB	Agilent 0955-0487	P
Filter, 1.8 GHz Low Pass (2 required) (E4404B/ 05B/ 07B/ 08B)	Cutoff frequency: 1.8 GHz Rejection at >3 GHz: >45 dB	Agilent 0955-0491	P
Filter, 4.4 GHz Low Pass (2 required) (E4404B/ 05B/ 07B/ 08B)	Cutoff frequency: 4.4 GHz Rejection at >5.5 GHz: >42 dB	Agilent 9135-0005 or 360D	P

Table 4 Recommended Adapters

Critical Specifications for Adapter Substitution	Recommended Model	Use [6]
BNC (m) to BNC (m)	Agilent 1250-0216	P,T
BNC tee (f,m,f)	Agilent 1250-0781	A,T
Type-N (f) to APC-3.5 (f)	Agilent 1250-1745	P,A,T
Type-N (f) to BNC (m)	Agilent 1250-1477	P,T
Type-N (f) to BNC (m), 75 ohm *(2 required for* Option 1DQ) *(1 required for* Option 1DP)	Agilent 1250-1534	P,A,T
Type-N (m) to BNC (f) *(4 required)*	Agilent 1250-1476	P,A,T
Type-N (m) to BNC (m) *(2 required)*	Agilent 1250-1473	P,T
Type-N (m) to BNC (m), 75 ohm (Option 1DP)	Agilent 1250-1533	P,A,T
Type-N (f) to Type-N (f)	Agilent 1250-1472	P,T
Type-N (m) to Type-N (m)	Agilent 1250-1475	P,A,T
Type-N (f) to Type-N (f), 75 ohm (Option 1DP)	Agilent 1250-1529	P,A,T
Type-N (f), 75 ohm to Type-N (m), 50 ohm (Option 1DP)	Agilent 1250-0597	P,A,T

Type-N (m) to SMA (m)	Agilent 1250-1636	P
BNC (m) to SMA (f)	Agilent 1250-2015	P
50 ohm to 75 ohm Minimum Loss Pad Frequency Range: dc to 1.5 GHz Insertion Loss: 5.7 dB (Option 1DP)	Agilent 11852B	P,A,T
Type-N (f) to Type-N (f)	Agilent 1250-0777	
Type-N (f) to BNC (f), 75 ohm (Option 1DP)	Agilent 1250-1535	
Type-N (m) to APC-3.5 (f) *(3 required)*	Agilent 1250-1744	
APC-3.5 (f) to APC-3.5 (f)	Agilent 1250-1749	
Dual Banana to BNC (f)	Agilent 1251-2277	P,A,T
Type-N (m) to BNC (f) *(2 required)*	Agilent 1250-0780	

Table 5 Recommended Cables

Critical Specifications for Cable Substitution	Recommended Model	Use [7]
Frequency Range: dc to 1 GHz Length: >122 cm (48 in) Connectors: BNC (m) (2) *(4 required)*	Agilent 10503A	P,A,T
Frequency Range: dc to 310 MHz Length: 23 cm (9 in) Connectors: BNC (m) (2)	Agilent 10502A	P,T
BNC, 75 ohm, 30 cm (12 in) (option 1DP)	Agilent 5062-6452	P,A,T
Type-N, Precision 62 cm (24 in)	Agilent 11500C	P,A,T
Type-N, Precision 152 cm (60 in) *(2 required)*	Agilent 11500D	P,A,T
APC-3.5 Cable Frequency: 9 kHz to 26.5 GHz Connectors: APC-3.5 (m) (2) Length: >92 cm (36 in) *(2 required)*	Agilent 8120-4921	
Cable, Test Length: >91 cm (36 in) Connectors: SMB (f) to BNC (m) *(2 required)*	Agilent 85680-60093	T

Footnotes

1 Microsoft Internet Explorer 4.0 or greater or Netscape 4.0 or greater.
2 Agilent -VISA is available at http://www.agilent.com.
3 National Instruments NI-VISA is available at http://www.ni.com/gpib/gpib_dl.htm.
4 P = Performance Test, A = Adjustment, T = Troubleshooting
5 P = Performance Test, A = Adjustment, T = Troubleshooting
6 P = Performance Test, A = Adjustment, T = Troubleshooting
7 P = Performance Test, A = Adjustment, T = Troubleshooting

(Number takes you back)

PREVIOUS Introduction

Adjustment Descriptions NEXT

TOP

Adjustment Descriptions

Each of the following test descriptions include the related specification, the related adjustment, a description of what it does (or what it measures), a list of equipment required for the execution, an abbreviated illustration of the equipment setup, related measurement data, and additional important information that may be necessary to understand the test. They are designed to be run on an instrument operating within a temperature range of 20° C to 30° C.

The following is a list of the adjustments included in this section:

Frequency Response Low Band Adjustment
Frequency Response High Band Adjustment
YTF Adjustment
LO Power Adjustment
IF Amplitude Adjustment
50 MHz Amplitude Reference Adjustment
10 MHz Reference Adjustment
Tracking Generator ALC Adjustment
Tracking Generator Frequency Slope Adjustment
IF Input Adjustment
Processor Initialization
RF Assembly Initialization
Flatness Initialization

Frequency Response Low Band Adjustment

Related Performance Tests

Frequency Response

Adjustment Description

This test has three major parts: Uncorrected Flatness, Uncorrected Flatness (Preamp On), and Corrected Flatness. This adjustment only covers frequencies up to 3GHz.

In the Uncorrected Flatness part, the test measures the ESA's amplitude error with flatness corrections off as a function of frequency. At each frequency >= 100 kHz, the output of a source is fed through a power splitter to a power sensor and the spectrum analyzer. The source's power level is adjusted to place the displayed signal at the ESA's center horizontal graticule line. The power meter amplitude (absolute reading) is recorded and stored in an array.

To measure frequencies below 100 kHz, a DVM with a 50 ohm load replaces the power sensor and a function generator is used as the source.

For improved amplitude accuracy below 3 GHz, the power splitter is characterized using a second power sensor (the "reference" sensor) connected to one power splitter output port. The other power splitter output port connects to the "buried" sensor; it is not removed from the power splitter. Once the characterization is done, the reference sensor is removed and replaced by the ESA.

ESAs with 75 ohm inputs are tested only down to 1 MHz.

In the Uncorrected Flatness (Preamp On) part, the uncorrected flatness is measured similarly as was done in the Uncorrected Flatness part, but uses a lower power level. Only frequencies <= 3 GHz are measured. A 20 dB fixed attenuator is used to provide the lower power level. The flatness of the 20 dB attenuator, source, and power splitter are characterized as was done in the Uncorrected Flatness part.

In the Corrected Flatness part, the data stored in the Uncorrected Flatness part of the test is manipulated to generate Reference, Offset, and Interaction amplitude correction datasets. These datasets are then downloaded into the analyzer's EEROM.

The values for flatness temperature compensation are also stored in the analyzer's EEPROM.

Required Test Equipment

The following table lists the test equipment required for the test. The list includes any miscellaneous devices.

Instrument	Recommended Model	For Model
Signal Sources		
Synthesized Signal Generator	8663A	E4401B, E4411B, E7401A
Function Generator	33120A	All
Synthesized Sweeper	83620A/B, 83630A/B, 83640A/B, or 83650A/B	E4402B, E4403B, E4404B, E4405B E7402A/03A/04A/05A
	83630A/B, 83640A/B, or 83650A/B	E4407B, E4408B, E7405A
Meters		
Voltmeter	3458	
Power Meter	E4419A	All
75 ohm Power Sensor (Option 1DP only)	8483A	E4401B, E4411B, E7401A
RF Power Sensor Non-Option 1DP Option 1DP	8482A (2 required) 8482A	All E4401B, E4411B
Microwave Power Sensor	8485A	E4404B, E4405B, E4407B, E4408B E7403A/04A/05A
Terminations		
Termination	11593A	
Miscellaneous Devices		
Power Splitter	11667A 11667B	All E4407B, E4408B, E7405
Minimum Loss Pad (Option 1DP only)	11852B	E4401B, E4411B

Test Setups Illustrations

The following figures illustrate the equipment setups for the adjustment.

Figure 1 **Source/Splitter Characterization Setup**

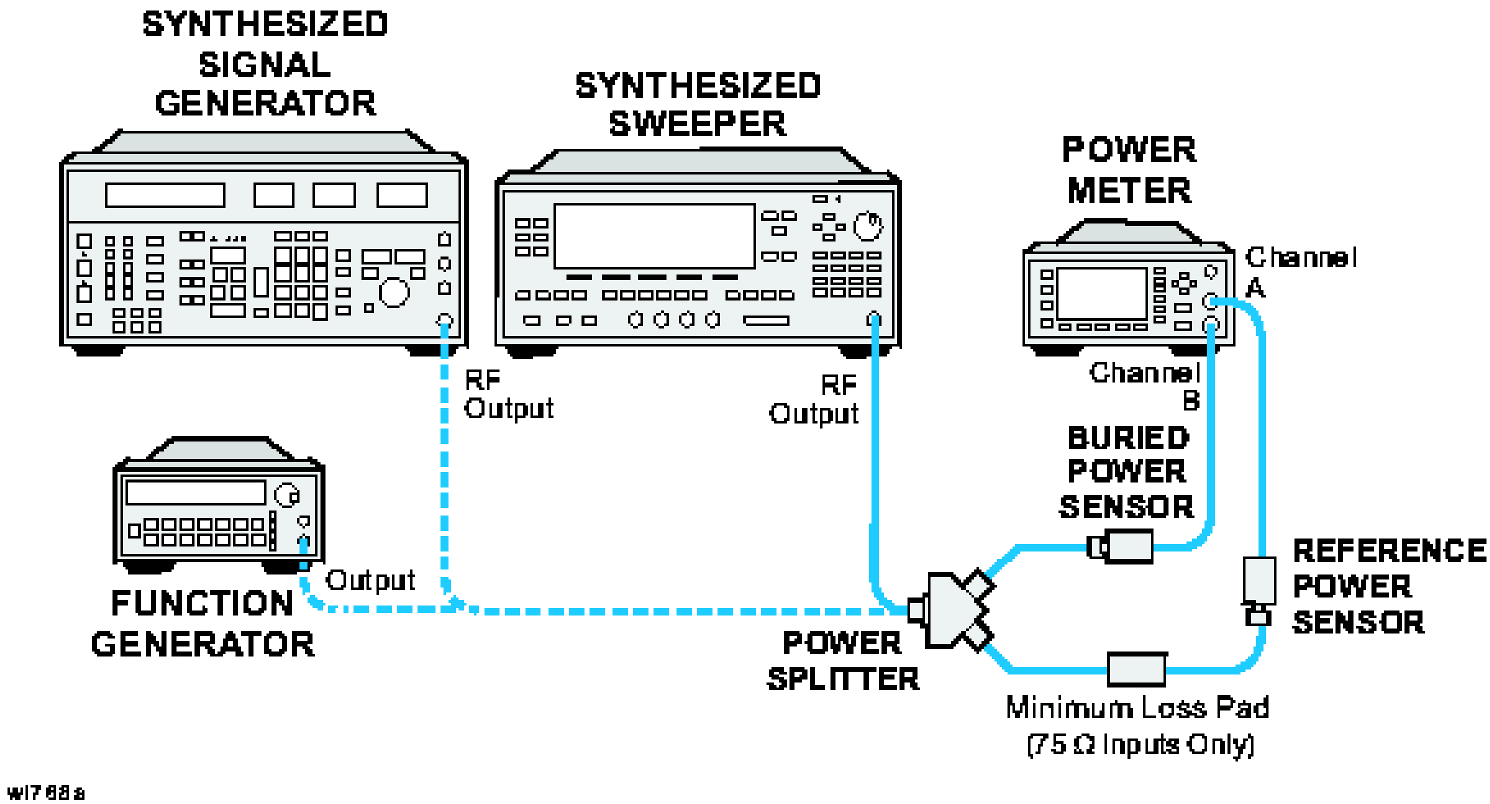
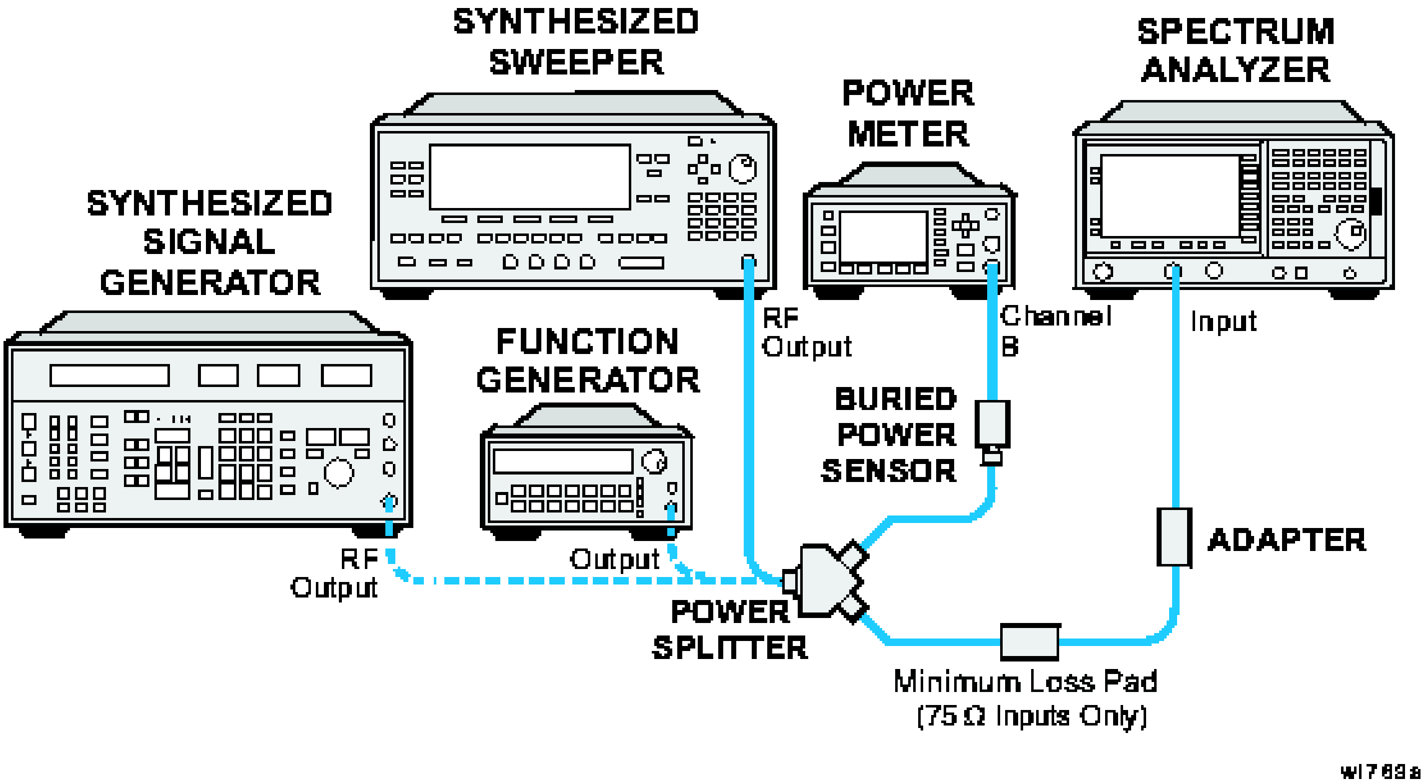


Figure 2 **Frequency Response Test Setup, 100 kHz to 1.5 GHz/3.0 GHz**



Important Information

Splitter Tracking Error

The splitter tracking error ($Track_{Error}$) is determined by measuring the source amplitude of the first arm of the splitter on power meter channel A (ChA) and the source amplitude of the second arm of the splitter on power meter channel B (ChB). The splitter tracking error is then calculated by subtracting the channel B reading from the channel A reading. Tracking errors are calculated for the same frequencies at which flatness is measured.

When measuring frequency response with the preamp on, the splitter tracking errors will be nominally 20 dB due to the presence of the 20 dB fixed attenuator connected to one splitter output port.

$$Track_{Error} = ChA - ChB$$

Flatness Error

The flatness error ($Flat_{Error}$) is determined by using the UUT to measure the source amplitude out of the first arm of the splitter ($Meas_{Amp}$) and using power meter channel B to measure the source amplitude of the second arm of the splitter (ChB_{Amp}). The flatness error ($Flat_{Error}$) is then calculated by subtracting the channel B reading and the tracking error from the UUT reading.

$$Flat_{Error} = Meas_{Amp} - ChB_{Amp} - Track_{Error}$$

Then the flatness error is normalized to 50 MHz for all measured frequencies.

PREVIOUS Adjustment Descriptions

Frequency Response High Band Adjustment NEXT

TOP

Frequency Response High Band Adjustment

Related Performance Tests

Frequency Response High Band

Adjustment Description

This test has three major parts: Uncorrected Flatness, Uncorrected Flatness (Preamp On), and Corrected Flatness. This adjustment only covers frequencies above 3GHz.

In the Uncorrected Flatness part, the test measures the ESA's amplitude error with flatness corrections off as a function of frequency. At each frequency >= 3 GHz, the output of a source is fed through a power splitter to a power sensor and the spectrum analyzer. The source's power level is adjusted to place the displayed signal at the ESA's center horizontal graticule line. The power meter amplitude (absolute reading) is recorded and stored in an array.

In the Corrected Flatness part, the data stored in the Uncorrected Flatness part of the test is manipulated to generate Reference, Offset, and Interaction amplitude correction datasets. These datasets are then downloaded into the analyzer's EEROM.

The values for flatness temperature compensation are also stored in the analyzer's EEPROM.

Required Test Equipment

The following table lists the test equipment required for the test. The list includes any miscellaneous devices.

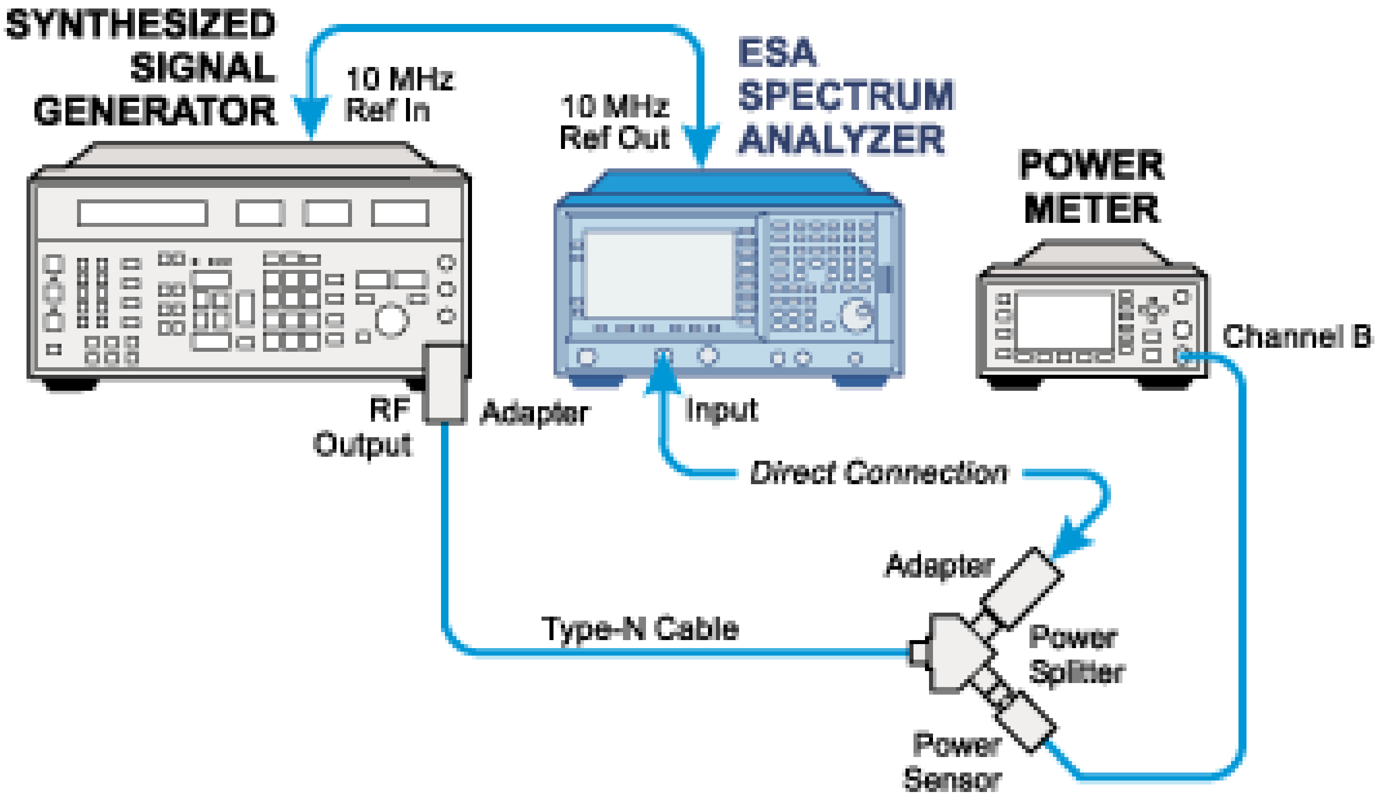
Instrument	Recommended Model	For Model
Signal Sources		

Synthesized Sweeper	83620A/B, 83630A/B, 83640A/B, or 83650A/B	E4404B, E4405B E7403A/04A
	83630A/B, 83640A/B, or 83650A/B	E4407B, E4408B E7405A
Meters		
Power Meter	E4419A	All
Microwave Power Sensor	8485A	E4404B, E4405B, E4407B, E4408B E7403A/04A/05A
Miscellaneous Devices		
Power Splitter	11667B 11667A	E4407B, E4408B, E7405A E4404B, E4405B E7403A/04A

Test Setups Illustrations

The following figures illustrate the equipment setups for the adjustment.

Figure 1 Frequency Response Test Setup



Flatness Error

The flatness error ($Flat_{Error}$) is determined by using the UUT to measure the source amplitude out of the first arm of the splitter ($Meas_{Amp}$) and using power meter channel B to measure the source amplitude of the second arm of the splitter (ChB_{Amp}). The flatness error ($Flat_{Error}$) is then calculated by subtracting the channel B reading and the tracking error from the UUT reading.
Then the flatness error is normalized to 50 MHz for all measured frequencies.

PREVIOUS [Frequency Response Low Band Adjustment](#) [YTF Adjustment](#) NEXT

TOP

YTF Adjustment

Related Performance Tests

Frequency Response

Other Input Related Spurious Responses

Spurious Responses (SHD)

Description

This adjustment should be performed if either the A8A6 YIG-Tuned Filter/Mixer (aka YTF or "RYTHM") or the A7A4 Frequency Extension Assembly (FEA) is repaired or replaced. All EEROM data specific to the front-end hardware, for frequencies >= 3 GHz, such as RYTHM and LOIS resides on the FEA.

Before any measurements are made, the default constants for YTF Delay Offset and YTF Delay Slope are downloaded into the FEA's EEROM. Then a coarse YTF alignment is performed (optional for ESA 6.7 GHz and ESA 13.2 GHz) and four YTF tuning coefficients are downloaded into the FEA's EEROM. A fine alignment, very similar to the coarse alignment is performed next, and again four YTF tuning coefficients are downloaded into the FEA's EEROM. Finally, the frequency error with the YTF properly aligned is measured.

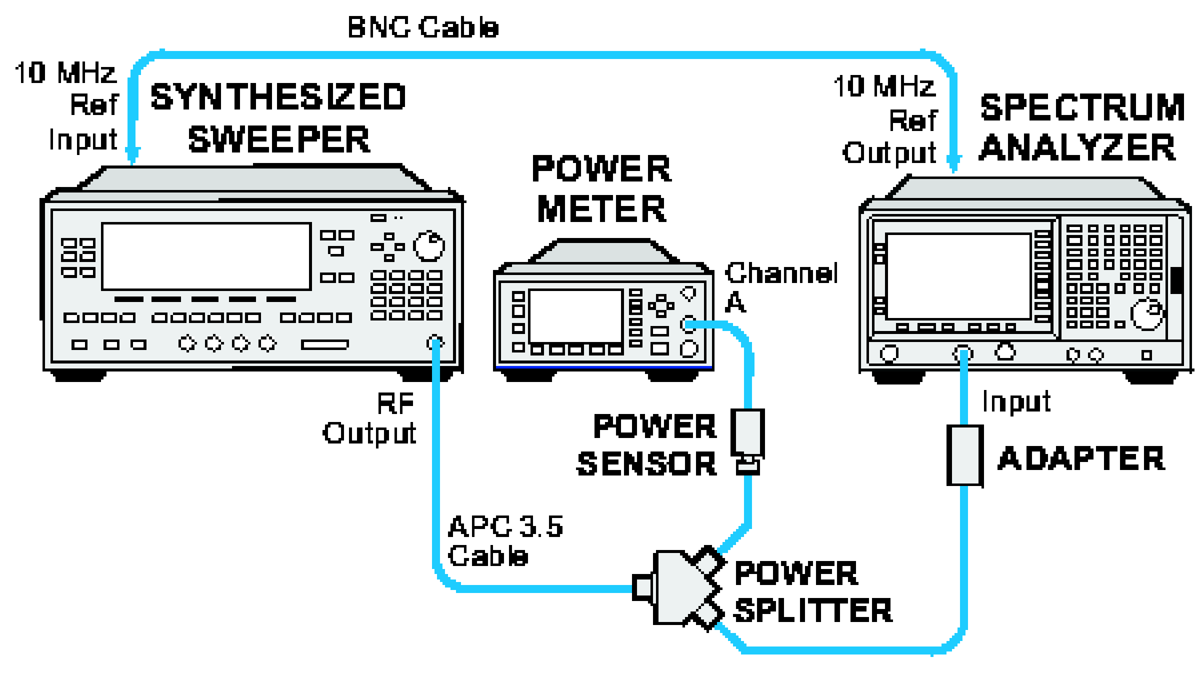
Required Test Equipment

The following table lists the test equipment required for the test. The list includes any miscellaneous devices.

Instrument	Recommended Model	For Model
Signal Sources		

Synthesized Sweeper	83620A/B, 83630A/B, 83640A/B, or 83650A/B 83630A/B, 83640A/B, or 83650A/B	E4404B, 4405B, E7404A, E7405A E4407B, E4408B, E7405A
Meters		
Power Meter	E4419A	All
Power Sensor	8485A	All
Miscellaneous Devices		
Power Splitter	11667A 11667B	E4404B, 4405B, E7404A, E7405A E4407B, E4408B, E7405A

Figure 3 YTF Adjustment Test Setup



PREVIOUS [Frequency Response High Band Adjustment](#) [LO Power Adjustment](#) NEXT

TOP

LO Power Adjustment

Related Performance Tests

Frequency Response

Frequency Response (Preamp On)

1st LO OUTPUT Amplitude Accuracy (Option AYZ only)

Tracking Generator Level Flatness

Adjustment Description

This procedure adjusts the LO power on LOIS (LO Amp / IF Switch), on the 3.0 GHz Tracking Generator (if present), and on the 3 GHz RF Assembly. The LO Power level values for LOIS are downloaded into the instrument from the information provided on the LOIS label which is affixed to LOIS. Alternately, the procedure also provides a method to adjust the LO power level on LOIS with a power meter if the label values are not available. This procedure also provides the method of adjusting the LO power levels for the 3.0 GHz Tracking Generator and the 3 GHz RF Assembly using a power meter.

For instruments with Option AYZ, the amplitude at the front-panel LO OUTPUT is also adjusted.

The LOIS adjustments apply only to the E4404B, E4405B, E4407B, E4408B, E7403, E7404A, E7405A.

Required Test Equipment

The following table lists the test equipment required for the test. The list includes any miscellaneous devices.

Table 8

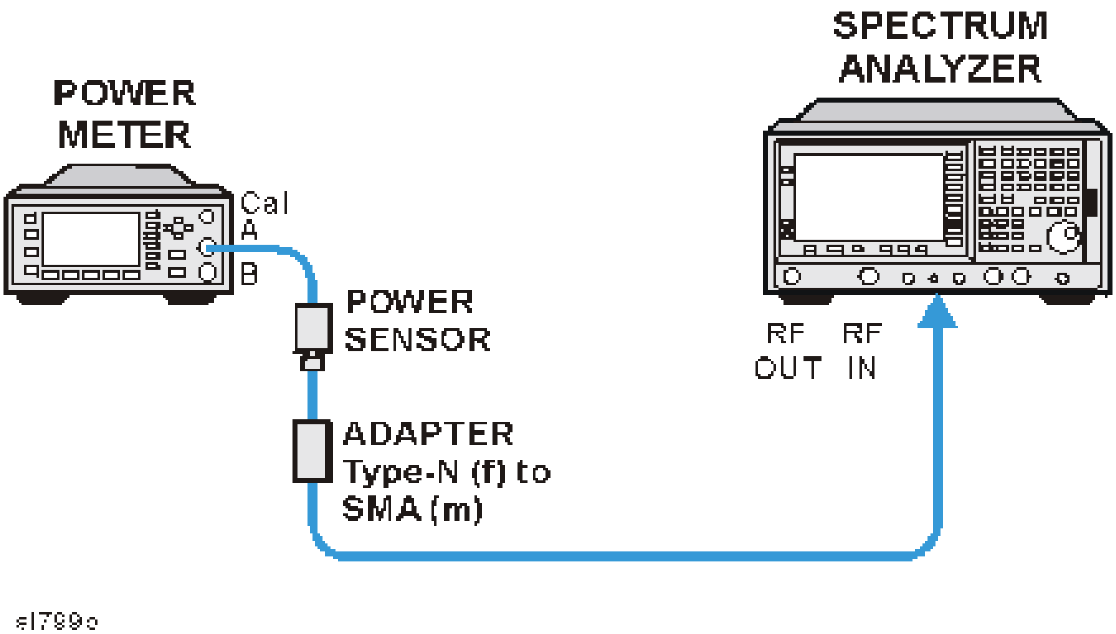
Instrument	Recommended Model	For Model

Meters		
Power Meter	E4419A	All
Power Sensor	8485A	All

Test Setups Illustrations

The following figures illustrate the equipment setups for the adjustment.

Figure 4 LO Power Adjustment Setup



PREVIOUS YTF Adjustment

IF Amplitude Adjustment NEXT

TOP

IF Amplitude Adjustment

Related Performance Tests

Absolute Amplitude Accuracy (Reference Settings)

Overall Amplitude Accuracy

Adjustment Description

This procedure adjusts the 21.4 MHz IF alignment signal. The 21.4 MHz IF alignment signal is generated from the A8 RF assembly and is switched in during various background alignment sequences to align the A3 IF assembly. A power sensor is connected to the 21.4 MHz IF alignment signal and the signal level is measured. The measured amplitude is then stored on the RF assembly. The measurement of the 21.4 MHz IF alignment signal requires the removal of the outer case. The IF coaxial cable is removed from the IF assembly and the adapter is used to connect the power sensor to the IF coaxial cable SMB connector.

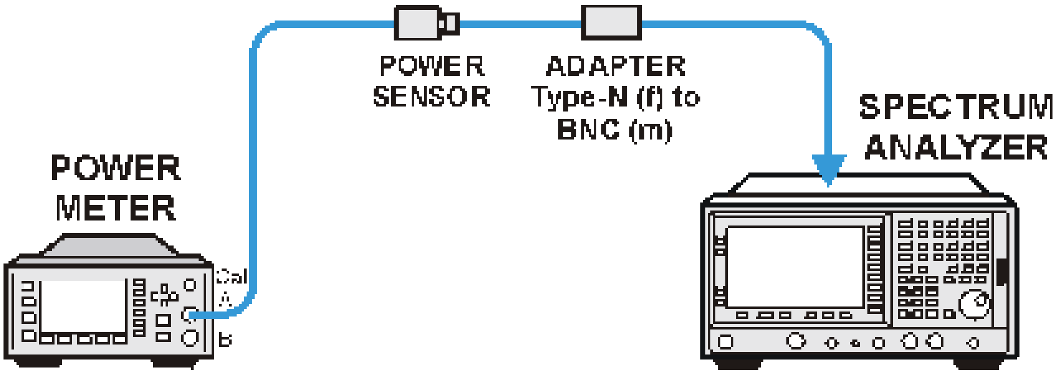
Required Test Equipment

The following table lists the test equipment required for the test. The list includes any miscellaneous devices.

Table 9

Instrument	Recommended Model	For Model
Meters		
Power Meter	E4419A	All
Low-Power Power Sensor	8481D	All
Adapters		
Adapters, Type-N(f) to SMB(f)		All

Figure 5 **21.4 MHz IF Calibrator Adjustment**



50 MHz Amplitude Reference Adjustment

Related Performance Tests

Absolute Amplitude Accuracy (Reference Settings)

Overall Amplitude Accuracy

Adjustment Description

This procedure adjusts the 50 MHz Amplitude Reference signal. For the E4401B, E4411B and E7401A, the amplitude of the 50 MHz Amplitude Reference signal is determined by measuring a substituted external 50 MHz signal. The analyzer's 50 MHz Amplitude Reference signal is first turned on and the on-screen level is noted. The analyzer's 50 MHz Amplitude Reference signal is then turned off, and the external 50 MHz signal is turned on. The external source amplitude is adjusted to match the level of the internal signal. A power meter is then connected to the cable to measure the amplitude of the external 50 MHz signal at the analyzer input. This level is stored in the analyzer.

For the >1.5 GHz models the procedure to adjust the 50 MHz AMPTD REF OUT signal is slightly different. Since the AMPTD REF OUT signal is accessible, a power meter is connected to the signal and it is measured. The amplitude is then adjusted via DACs to bring the AMPTD REF OUT signal to within specifications. The final measured power level is also stored in EEROM.

Required Test Equipment

The following table lists the test equipment required for the test. The list includes any miscellaneous devices.

Table 10

Instrument	Recommended Model	For Model
Synthesized Sweeper	83630B / 83650B	E4401B, E4411B, E7401A
Power Meter	E4419A	
RF Power Sensor	8482A	All except Option 1DP
75 ohm Power Sensor	8483A	E4401B, E4411B, with Option 1DP
Fixed Attenuator, 20 dB	8491A, Option 020	E4401B, E4411B, E7401A

Test Setups Illustrations

The following figures illustrate the equipment setups for the adjustment.

Figure 6 Internal 50 MHz Amplitude Reference Adjustment

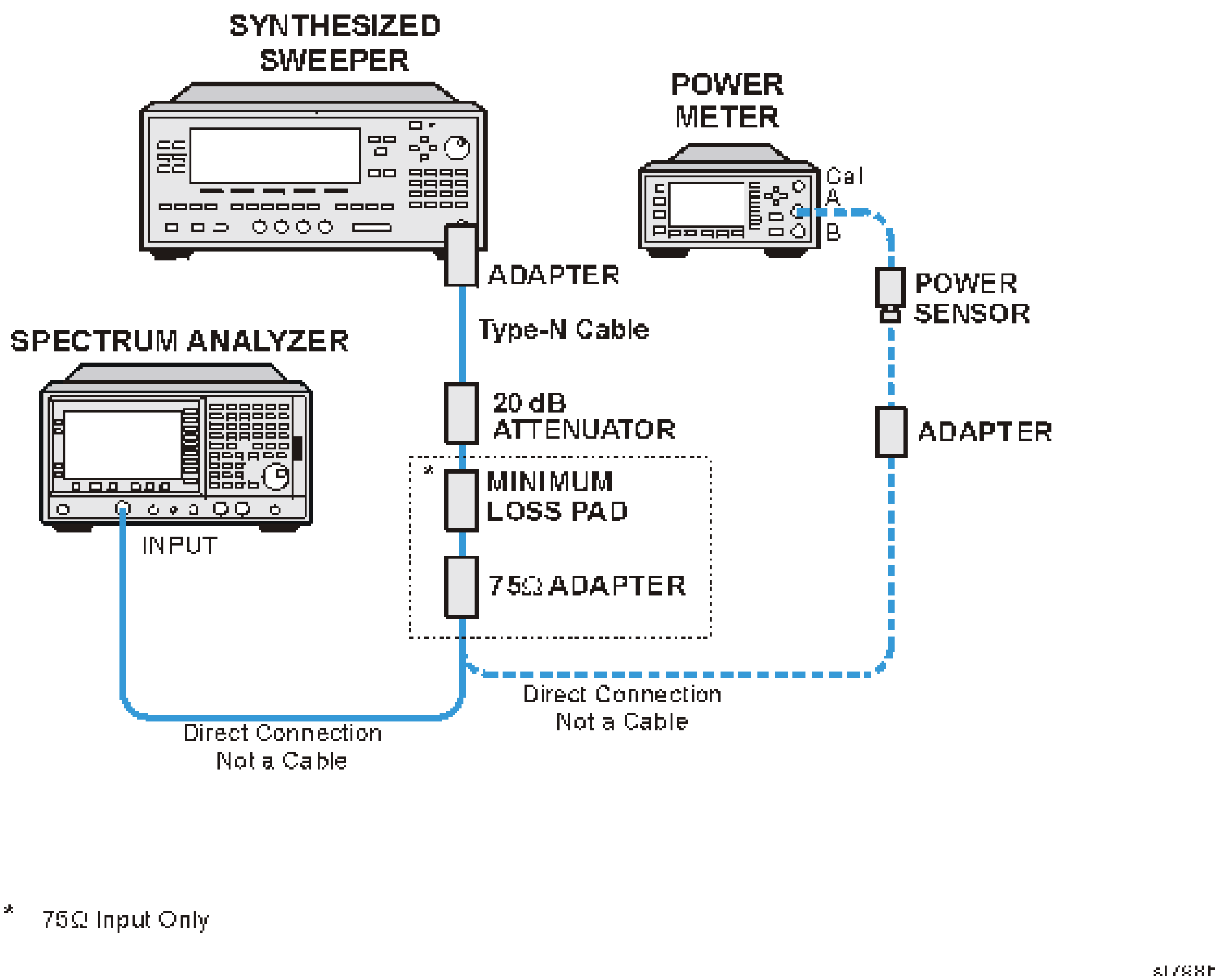
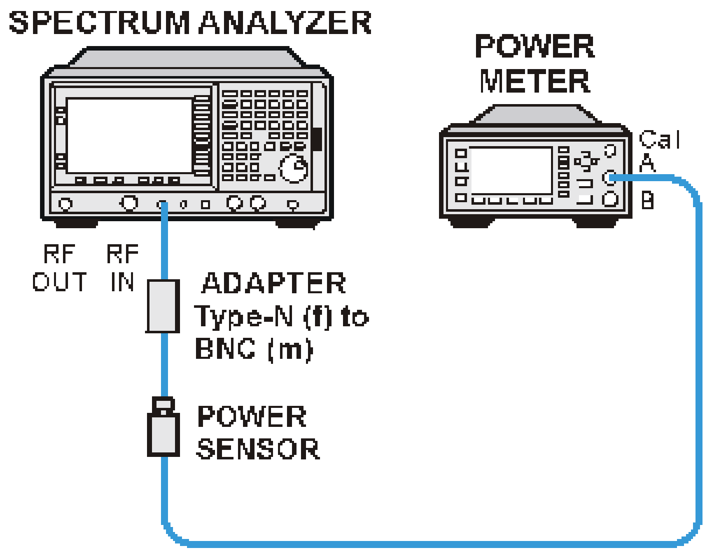


Figure 7 50 MHz Amplitude Reference Output Adjustment


SPECTRUM ANALYZER
POWER METER
Cal
A
B
RF OUT
RF IN
ADAPTER Type-N (f) to BNC (m)
POWER SENSOR

---

10 MHz Reference Adjustment

Specification

Settability:

± 5 x 10^{-7} (Non-Option 1D5)

± 1 x 10^{-8} (Option 1D5)

Adjustment Description

This adjustment should be performed only after the ESA has been allowed to warmup for at least one hour (if Non-Option 1D5 or "VCXO") or 24 hours (if Option 1D5, High-Stability Frequency Reference or "OCXO"), with the ESA in internal reference mode and in a 20° to 30° environment during the entire warmup period. The 10 MHz reference output is connected to the frequency counter's Channel A input. A cesium beam frequency standard, or some other 10 MHz "house standard" provides the frequency reference for the frequency counter.

If the ESA is equipped with an OCXO the ESA's coarse timebase DAC is adjusted to yield a frequency counter reading of 10 MHz 0.1 Hz. Otherwise, the coarse timebase DAC is adjusted for the closest value to 10 MHz. The status of the frequency reference PLL is checked at each setting of the coarse timebase DAC to ensure that it is locked.

The fine timebase DAC is adjusted to yield a frequency counter reading of 10 MHz ± 0.01 Hz if the OCXO is installed or 10 MHz ± 2 Hz if the VCXO is installed.

The final reference frequency and the values of the coarse and the fine timebase DAC setting are reported.

Required Test Equipment

The following table lists the test equipment required for the test. The list includes any miscellaneous devices.

Table 11

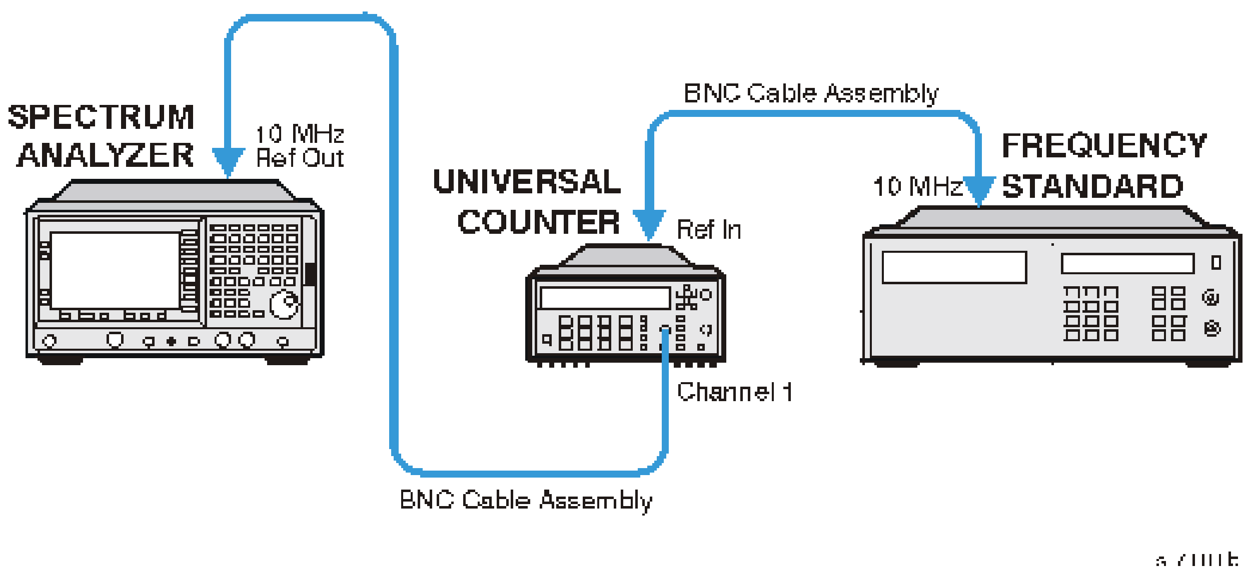
Instrument	Recommended Model	For Model

Universal Counter	53132A	All
Frequency Standard	5071A	All
Cable, BNC (2 required)	10503A	All

Test Setups Illustrations

The following figures illustrate the equipment setups for the adjustment.

Figure 8 10 MHz Reference Adjustment Setup



PREVIOUS 50 MHz Amplitude Reference Adjustment
Tracking Generator ALC Calibration NEXT

TOP

Tracking Generator ALC Calibration

Related Performance Test

Tracking Generator Absolute Amplitude and Vernier Accuracy

Adjustment Description

The tracking generator automatic level control (ALC) adjustment sets the values for three DACs. The ALC high-band offset DAC is the level DAC value which gives 0 dBm at 50 MHz. The ALC slope/gain amplitude DAC is a correction factor for the ALC level DAC. The ALC low-band offset DAC is also set.

For a complete tracking generator adjustment, complete this adjustment first, then perform the tracking generator frequency slope adjustment which follows.

NOTE This adjustment applies only to the 1.5 GHz tracking generator (TG) in the E4401B, E4411B and E7401A.

Required Test Equipment

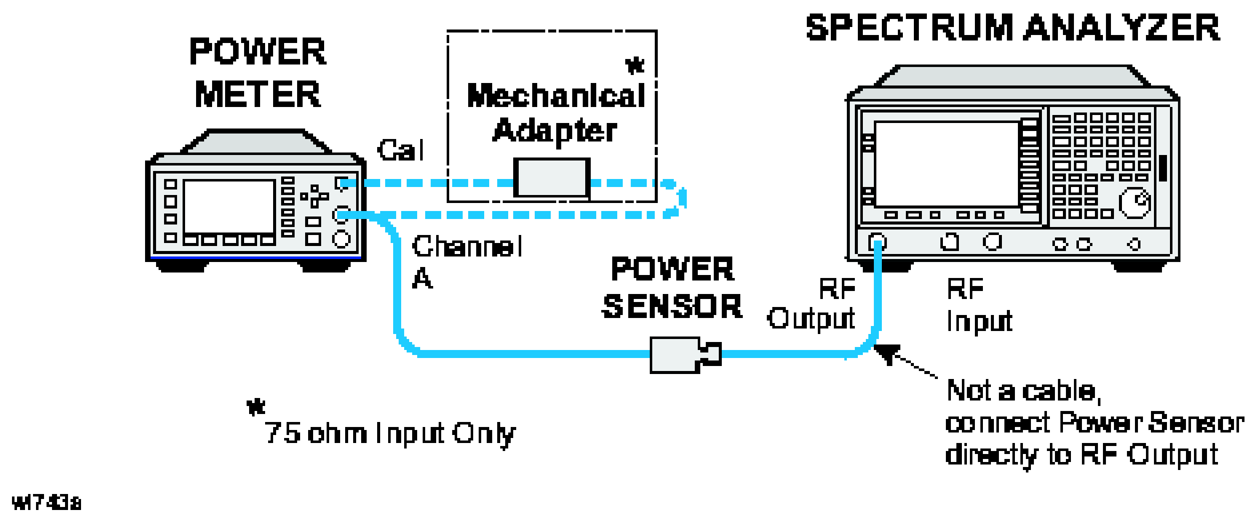
The following table lists the test equipment required for the test. The list includes any miscellaneous devices.

Table 12

Instrument	Recommended Model	For Model

Meters		
Power Meter	E4419A	All
Power Sensor Option 1DN Option 1DQ	 8482A 8483A	 All E4401B, E4411B

Figure 9 Tracking Generator ALC Adjustment Setup



PREVIOUS [10 MHz Reference Adjustment](#)

[Tracking Generator Frequency Slope Adjustment](#) NEXT

TOP

Tracking Generator Frequency Slope Adjustment

Related Performance Test

Tracking Generator Level Flatness

Adjustment Description

NOTE The Tracking Generator ALC Adjustment must be performed before performing this adjustment.

This adjustment applies only to the 1.5 GHz tracking generator (TG) . There is no equivalent adjustment for the 3.0 GHz TG.

The tracking generator frequency slope adjustment is performed after the ALC adjustment is completed. In this adjustment the slope DAC is initially set to 0 (no slope correction). The output flatness is measured from 50 MHz to 1500 MHz and the optimum slope DAC setting is calculated and set. The output flatness is measured again to verify the slope DAC setting.

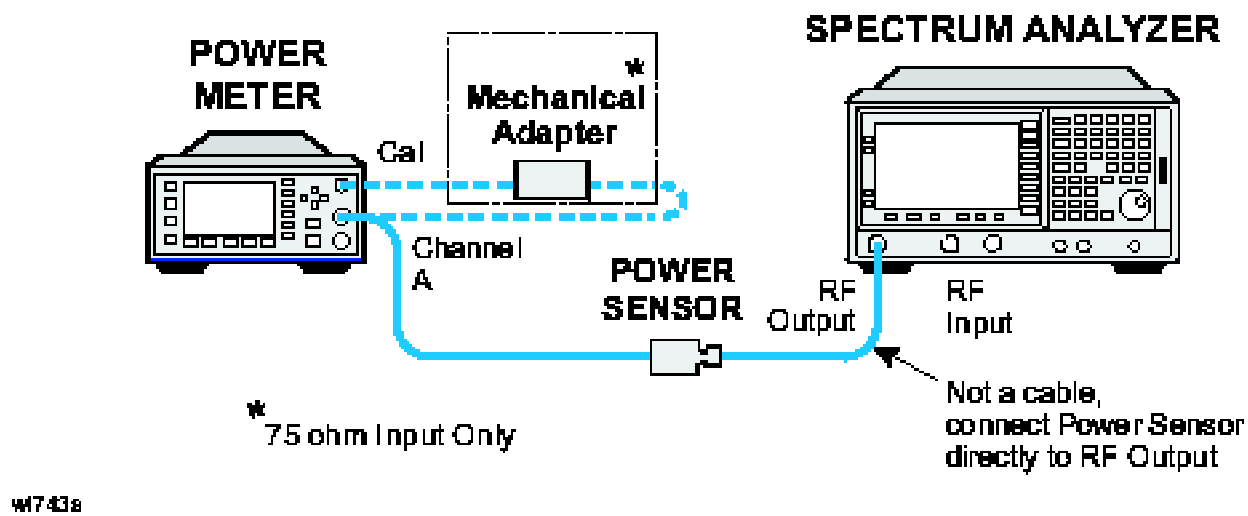
Required Test Equipment

The following table lists the test equipment required for the test. The list includes any miscellaneous devices.

Table 13

Instrument	Recommended Model	For Model
Meters		
Power Meter	E4419A	
Power Sensor Option 1DN Option 1DQ	 8482A 8483A	

Figure 10 Tracking Generator Frequency Slope Adjustment Setup



IF INPUT Adjustment

Related Performance Test:

IF INPUT Accuracy

Description:

This adjustment only applies to analyzers equipped with external mixing, Option AYZ.

This adjustment measures the accuracy of the IF INPUT and computes an amplitude correction. A nominally –30 dBm, 321.4 MHz signal is applied to a power sensor and the power level is recorded. The actual frequency must be offset slightly to compensate for the IF centering error of the 1 kHz resolution bandwidth. This frequency offset is measured using the AMPTD REF OUT signal applied to the INPUT 50 ohm connector. The signal is measured with frequency corrections on and off. The difference between these two measurements is the IF centering error. The 321.4 MHz signal is then offset by the negative of the IF centering error.

This signal is then applied to the analyzer's IF INPUT with the analyzer set to external mixing mode in A band (26.5 GHz to 40 GHz). Amplitude corrections are set to 0 dB and flatness corrections are disabled. The amplitude is measured by the analyzer and recorded. The difference between the two measurements is the amplitude correction. The amplitude correction is then stored in EEROM.

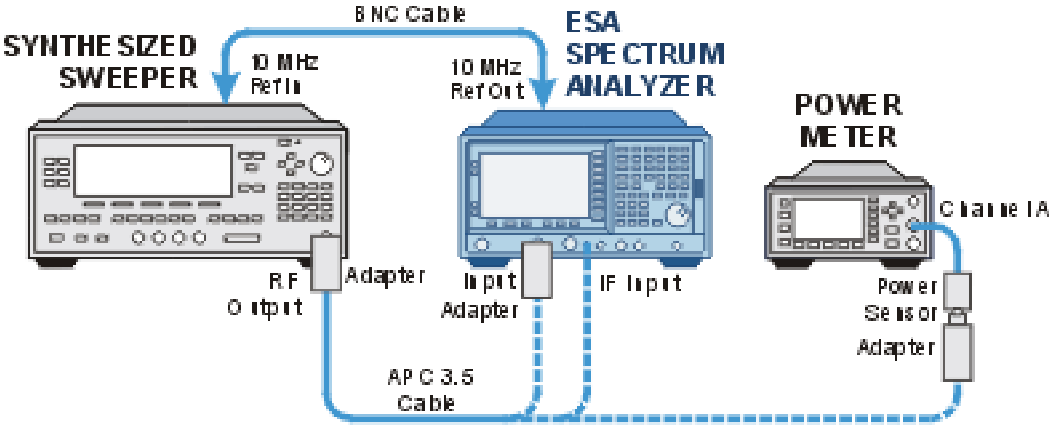
The analyzer will be automatically rebooted twice during this adjustment. The first reboot occurs after the default IF gain correction is stored in EEROM and the second reboot occurs after the measured IF gain correction is stored in EEROM.

Required Test Equipment:

The following table lists the test equipment required for the test. The list includes any miscellaneous devices.

Instrument	Recommended Model	For Model
Signal Sources		
Synthesized Sweeper	83620A/B, 83630A/B, 83640A/B, 83650A/B	All with Option AYZ
Meters		
Power Meter	E4419A	All with Option AYZ
Low-power Power Sensor	8484A or 8481D	All with Option AYZ
Miscellaneous Devices		
30 dB Reference Attenuator	11708A	All with Option AYZ
Cables		
Cable, BNC	10503A	All with Option AYZ
Cable, APC 3.5	8120-4921	All with Option AYZ
Adapters		
Type N(m) to APC 3.5(f) (not required for Option BAB)	1250-1744	All with Option AYZ
APC 3.5(f) to APC 3.5(f) (not required for Option BAB)	1250-1749	All with Option AYZ
Type N(f) to APC 3.5(f)	1250-1745	All with Option AYZ

Figure 11 IF INPUT Correction Adjustment Setup



mi778b

PREVIOUS Tracking Generator Frequency Slope Adjustment

RF Assembly Initialization NEXT

TOP

RF Assembly Initialization

Related Performance Test:

None

Description:

Several parameters stored in the EEROM on the A8 1.5 GHz RF Assembly (E4401B or E4411B) or A8A1 3.0 GHz RF Assembly (E4402B, E4403B, E4404B, E4405B, E4407B, and E4408B) are initialized to default values by this procedure. It will be necessary to perform the following adjustments after initializing the RF assembly:

IF Amplitude

50 MHz Amplitude Reference

10 MHz Reference

LO Amplitude (except E4401B and E4411B)

Frequency Response

YTF (E4404B, E4405B, E4407B, and E4408B)

This procedure should only be necessary if the 1.5 GHz or 3.0 GHz RF Assembly has been repaired; replacement assemblies are already initialized.

Required Test Equipment:

None Required.

Important Information

The following data is initialized in this procedure

Parameter	Default Value

21.4 MHz IF Alignment Signal Amplitude	-57 dBm
50 MHz Amplitude Reference Signal Amplitude	-27 dBm (E4401B, E44011B)-20 dBm (E4402B, E4403B, E4404B, E4405B, E4407B, E4408B)
Coarse Timebase DAC	128
Fine Timebase DAC	128
LO Level DAC	Product number dependent
YTF Tuning Constants	Product number dependent
Temperature Compensation Constants	Product number dependent
External Mixing Amplitude Offset	0 dB

PREVIOUS IF Input Adjustment

Processor Initialization NEXT

TOP

Processor Initialization

Related Performance Test:

None

Required Test Equipment:

None Required

Description:

This procedure must be used whenever a new A4 Processor Assembly is installed. The analyzer's product number, and serial number are first downloaded into the analyzer's EEROM.

NOTE This procedure can be used to change the analyzer's serial number only from the default serial number stored on replacement A4 Processor Assemblies. It does not allow the serial number to be changed if a valid serial number is already stored in EEROM.

Several parameters are initialized based upon the frequency range of the analyzer and whether the analyzer is an E-Series or L-Series product. The time, date, and amplitude units (for both log and linear scales) are then set. Default values for parameters such as the date mode, printer control language, print orientation, GPIB address (Option A4H only), baud rate (Option 1AX only), and viewing angle are stored. Lastly, amplitude correction and limitline data is initialized. The analyzer is preset once all this data has been stored in EEROM.

Important Information

The following data is initialized in this procedure:

Parameter	Default Value
Product Number	For example, E4401B
Serial Number	For example, US39010218
L-Series versus E-Series	L-Series if E4403B, E4408B, or E4411B; Otherwise, E-Series
Upper Frequency Limit (E4404B, E4405B, E4407B, and E4408B only)	6.7 GHz (E4404B only)13.2 GHz (E4405B only)26.5 GHz (E4407B or E4408B only)
APC 3.5 Connector	True if Option BAB
Time	Current time
Date	Current date
Log Scale Amplitude Units	dBm if non-Option 1DP; dBmV if Option 1DP
Linear Scale Amplitude Units	Volts
Power-On Mode	IP (Preset)
DTR Control	On
RTS Control	Input Buffer Full mode
Receive Pacing	None
Transmit Pacing	None
Color Palette	Default
Date Mode	Month-Day-Year
Time and Date Display	On
Print Mode	Screen
Printer	None
Printer Control Language	PCL3
Color Capable?	No
Color Printing	Off
Prints per Page	1

GPIB Address (Option A4H only)	18
Baud Rate (Option 1AX only)	9600
Viewing Angle	5
Volume	0

PREVIOUS RF Assembly Initialization

Flatness Initialization NEXT

TOP

PREVIOUS Processor Initialization

Flatness Initialization

Related Performance Test:

None

Description:

Default flatness data for the entire analyzer frequency range are stored in EEROM. For the E4401B and E4411B, all the flatness data is stored on the EEROM on the A8 1.5 GHz RF Assembly. For the E4402B and E4403B, all the flatness data is stored on the EEROM on the A8A1A2 Front End/LO Assembly. For the E4404B, E4405B, E4407B, and E4408B, the flatness data for frequencies <= 3 GHz (Band 0) are stored on the EEROM on A8A1A2, and the flatness data for frequencies > 3 GHz (Bands 1, 2, 3, and 4) are stored on the A7A4 Frequency Extension Assembly.It will be necessary to perform the Frequency Response adjustment after initializing the flatness data.

Required Test Equipment:

None Required

Important Information

The following table indicates the assemblies into which the default flatness data is stored for each product number:

Product	A8 1.5 GHz RF Assembly	A8A1 3.0 GHz RF Assembly	A7A4 Frequency Extension Assembly
E4401B	X		
E4402B		X	
E4403B		X	
E4404B		X	X

E4405B		X	X
E4407B		X	X
E4408B		X	X
E4411B	X		

PREVIOUS Processor Initialization

TOP

Index

A B C E F G H I L O P R S T W Y 0-9

A

B

C

E

Adjustment Software

Index