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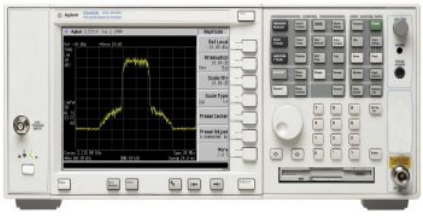
Agilent Technologies
PSA Series Spectrum Analyzers
Test and Adjustment Software



Test System Overview

The Agilent Technologies test system is designed to verify the performance of the PSA series spectrum analyzers and ensure that they meet published specifications. Follow the links below to view a listing of the test system requirements, test equipment required, a full description of each performance test, a full description of each adjustment, the associated troubleshooting procedures should any of the tests fail, and the Test Management Environment (TME) software help.

Getting Started -- steps for installing and running the test software

Required Equipment -- test equipment, ESD precautions

Performance Tests -- a list of all performance tests

Adjustments -- a list of all adjustments

Troubleshooting -- troubleshooting performance test failures

Memory Initialization Utilities -- utilities to write serial number information, and to reset instrument statistical data

Test Management Environment (TME) help -- information on setting up and using the

TME software

NOTE: If your analyzer has firmware revision A.03.xx, click here for information about possible conflicts between Option 266 and Basic Mode.

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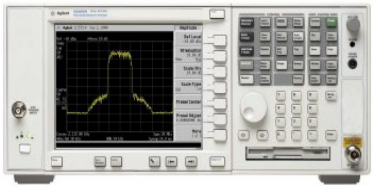

Before You Start

Check the following before starting the performance test software.

1. Ensure minimum requirements of the PC:

   ### Controller Requirements

   - 200 MHz Pentium processor or higher
   - 64 MB RAM or more
   - 200 MB available hard drive
   - Operating system: Windows 2000, service pack 3, or Windows NT, service pack 6A. (Windows XP is not supported at this time)
   - A standalone PC to GPIB controller with IEEE 488.2 protocol
   - A VISA communications interface
   - IE 4.0 or higher
2. Ensure computer has a GPIB Interface Card installed in it before running the software installation. The recommended card is Agilent model part number 82350A. You may also use a National Instruments model part number AT-GPIB/TNT or PCI-GPIB.
3. Ensure you have the proper test equipment. Let all the test equipment and PSA warm up in accordance to instrument specifications.

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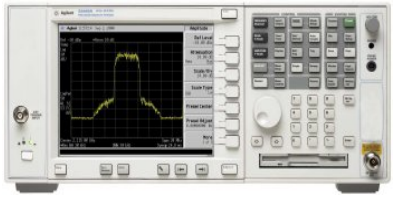

Test Equipment

Instrument	Critical Specifications	Recommended Agilent Model Number	Alternative Agilent Model Number	Use[1]
Signal Sources				
Synthesized Signal Generator	Frequency: 1 MHz to 2.5 GHz Spectral purity: 7 MHz to 1321 MHz Spurious (non-harmonic): at 50 MHz ≤-90 dBc ≤ 2.56 GHz, < -78 dBc Harmonics: < -30 dBc ≤ +13 dBm SSB Phase Noise: ≤ -106 dBc/Hz at 1 kHz offset (or residual FM ≤ 0.5 Hz, 300 Hz to 3 kHz integration BW). VSWR: < 1.5:1	8663A		A, P, T
Synthesized Signal Generator	Frequency: 100 kHz to 6.0 GHz Spectral Purity: SSB Phase Noise @ 1 GHz, 20 kHz offset = -134 dBc/Hz Harmonics: -30 dBc @ ≤ +10 dBm output	8665B (Option 004)		P
Sweep Signal Generator *(2 required, only 1 needs to be Option 008)*	Frequency: 10 MHz to 26.5 GHz Frequency Resolution: 1 Hz Harmonic level: < -40 dBc Amplitude range: -20dBm to +13 Amplitude resolution: 0.02 Harmonic level: < 2 GHz, < -30 dBc ≥ 2 GHz & < 26.5 GHz, < -50 dBc VSWR: < 20 GHz, 1.6:1 ≤ 31 GHz, 1.8:1	83630B (Option 008)	83630A (Option 008), 83640A/B (Option 008), 83650A/B (Option 008)	A, P, T

Sweep Signal Generator *(Needed for E4446A, E4448A)*	Frequency: 10 MHz to 50 GHz Frequency Resolution: 1 Hz Harmonic level: < -40 dBc Amplitude range: -20dBm to +13 Amplitude resolution: 0.02 Harmonic level: < 2 GHz, < -30 dBc ≥ 2 GHz & < 26.5 GHz, < -50 dBc ≥ 26.5 GHz, < -40 dBc VSWR: < 20 GHz, 1.6:1 ≤ 40 GHz, 1.8:1 ≤ 50 GHz, 2.0:1	83650B (Option 008)	83650A	A, P, T
Digital Signal Generator	Ability to create 64 tones across a 5 MHz span synchronously, 5 MHz to 10 MHz Resolution: 0.02	E4433B (Option UND)	E4437B (Option UND FW datecode: ≥ B.02.24)	P
Function Generator	Frequency: 1 Hz to 15 MHz Amplitude Resolution: 0.1 mv Harmonic Distortion: -35 dBc	33120A (Option 001)	33120A	A, P
Counters				
Universal Counter	Frequency: 10 MHz Gate time: 10 to 100 seconds Must be capable of measuring signal at +7 dBm (0.5 Vrms)	53132A		P, T
Meters				
Digital Voltmeter	AC Accuracy (SETACV SYNC mode): ± 4% of reading	3458A		A, T
Power Meter	Dual Channel Absolute Accuracy: ± 0.5% Resolution: 0.01 dB Reference Accuracy: 1.2% Power Reference Accuracy: ± 0.9% Compatible with Agilent 8480 series power sensors dB relative mode	E4419B	E4419A	A, P
Power Sensor *(2 required)*	Frequency Range: 100 kHz to 4.2 GHz. VSWR: at 50 MHz: £ 1.05 1 MHz to 4 GHz: £ 1.30:1 Type-N (m) Option H84 Cal Factor: Characterized by standards lab to: ± 0.6%[2]	8482A (Option H84)	8482A STD (Will increase measurement uncertainty)	A, P
Power Sensor	Frequency Range: 50 MHz to 8 GHz. VSWR: at 50 MHz: ≤ 1.05:1 700 MHz to 3 GHz: ≤ 1.22:1 Option H84 Cal Factor: Characterized by standards lab to: ± 0.6%	8481A (Option H84)	8481A STD, 8485A STD (Will increase measurement uncertainty)	P
Power Sensor *(Needed for E4440A, E4443A, E4445A)*	Frequency Range: 50 MHz to 26.5 GHz Amplitude Range: -20 to +10 dB VSWR: 50 MHz to 100 MHz: 1.15:1 100 MHz to 2 GHz: 1.10:1 2 GHz to 12.4 GHz: 1.15:1 12.4 GHz to 18 GHz: 1.20:1 18 GHz to 26.5 GHz: 1.25:1 RF Connector: 2.4 mm (M)	8485A	8487A	A, P

Power Sensor *(Needed for E4446A, E4448A)*	Frequency Range: 50 MHz to 50 GHz Amplitude Range: -20 to +20 dB VSWR: 50 MHz to 100 MHz: 1.15:1 100 MHz to 2 GHz: 1.10:1 2 GHz to 12.4 GHz: 1.15:1 12.4 GHz to 18 GHz: 1.20:1 18 GHz to 26.5 GHz: 1.25:1 26.5 GHz to 40 GHz: 1.30:1 40 GHz to 50 GHz: 1.50:1 RF Connector: 2.4 mm coaxial (M)	8487A		A, P
Standards				
Frequency Standard	Frequency: 10 MHz Accuracy: < ± 1e10 $^{-10}$	5071A	5061B	A, P
50 MHz, -25 dBm Calibrator	Frequency Drift: < 2.5 kHz Typical VSWR: 1.06:1 Output Power Variation: ± .004 dB Total Harmonic Content: -45 dBc	Z5602A Opt H51 Opt H35 for BAB Opt H24 for E4446A, E4448A		A
Attenuators				
10 dB Step Attenuator	Range: 0 to 110 dB Accuracy: Characterized by standards lab to: ± 0.005 + 0.0052/10 dB step[3] Calibrated at 50 MHz VSWR: at 50 MHz: ≤1.05:1	8496G	8496H	P
1 dB Step Attenuator	Range: 0 to 11 dB Accuracy: Characterized by standards lab to: ± 0.01 dB[3] Calibrated at 50 MHz VSWR: at 50 MHz: ≤1.05:1	8494G	8494H	P
Attenuator Interconnect Kit	Type N connector kit to connect the 8496G to the 8494G	11716A		P
Attenuator Driver	Compatible with the 8496G and 8494G step attenuators.	11713A		P
6 dB Fixed Attenuator	6 dB Type N (m, f) VSWR: at 50 MHz: ≤ 1.1	8491A (Options 006 & H47)		P
20 dB Fixed Attenuator	20 dB Type N (m, f) Accuracy: ± 0.5 dB VSWR: DC to 8 GHz: 1.20:1	8491A (Option 020)		A
20 dB Fixed Attenuator	20 dB 3.5 mm (m, f) Accuracy: ± 0.5 dB VSWR: DC to 8 GHz: 1.20:1	8493C (Option 020)		A
Terminations				
Type N (m)	50 W Frequency: 1 MHz to 4 GHz VSWR: 4 GHz: ≤ 1.05:1	909A (Option 012)		P, T
3.5 mm (m)	50 ohm VSWR: ≤ 26.5 GHz: ≤ 1.12:1	909D		P
2.4 mm (f) (*Needed for E4446A, E4448A)*	50 ohm Frequency: DC to 50 GHz	85138B		P
BNC	50 ohm	1250-0207		P
Miscellaneous Devices				
Power Splitter	Frequency: 9 kHz to 3 GHz Type N (f) VSWR: ≤ 1.10:1	11667A		P

Power Splitter	Frequency: DC to 26.5 GHz 3.5 mm (f) VSWR: DC to 3 GHz: < 1.06:1 3 GHz to 26.5 GHz: <1.22:1 Insertion Loss: DC to 8 GHz: 6.5 dB (*Typical)* 8 to 18 GHz: 7.0 dB 18 to 26.5 GHz: 7.3 dB	11667B (Option H30)	11667B (std)	P
Power Splitter (*Needed for E4446A, E4448A)*	Frequency: DC to 50 GHz 2.4 mm (f) VSWR: ≤ 18 GHz:: < 1.29:1 18 GHz to 26.5 GHz: <1.20:1 ≤ 40 GHz:: < 1.50:1 ≤ 50 GHz:: < 1.65:1 Insertion Loss: DC to 18 GHz: 6.0 dB (*Typical)* 18 to 26.5 GHz: 7.0 dB 26.5 to 40 GHz: 8.0 dB 40 to 50 GHz: 8.5 dB	11667C		P
Directional Bridge	Frequency Range: 5 MHz to 3 GHz Directivity: ≤ 5 MHz: 30 dB 5 MHz to 2 GHz: 40 dB 2 GHz to 3 GHz: 30 dB, VSWR: ≤ 2 GHz: ≤1.15:1 ≤ 3 GHz: ≤ 1.22:1 Insertion Loss: ≤ 1.5, +0.1 dB/GHz Coupling (nominal): 16 dB Type N (f)	86205A		P
Directional Coupler (*2 required)*	2 GHz to 20 GHz SMA (f) Directivity >16 dB Transmission arm loss: <1.5dB (nominal) Coupled Arm Loss: ~10dB (nominal) VSWR: ≤ 1.35:1	87300B		P
DC Probe		11002A	11003A	A
High Frequency Probe	300 kHz to 3 GHz Input Resistance: 1 M ohm (nominal)	85024A		T
Negative Detector	0.01 to 26.5 GHz ± 0.6 dB to 18 GHz	33330C		A
Bias Adjustment Board		E4440-60041		A
Cables				
APC 3.5 mm (m) (m) (*2 required)*	Frequency: DC to 26.5 GHz Length: ≤ 92 cm (36 in) Insertion Loss: ~2 dB VSWR: DC to 18 GHz: ≤ 1.25:1 18 GHz to 26.5 GHz: ≤ 1.35:1	8120-4921		A, P
2.4 mm (f) (m) (*Needed for E4446A, E4448A)*	Frequency: DC to 50 GHz Length: ≤ 249 mm (9.8 in) Insertion Loss: ≤ 26 GHz, ~4 dB Insertion Loss: ≤ 40 GHz, ~5 dB Insertion Loss: ≤ 50 GHz, ~6 dB VSWR: ≤ 26.5 GHz: ≤ 1.30:1 ≤ 40 GHz: ≤ 1.40:1 ≤ 50 GHz: ≤ 1.55:1	8120-6164		A, P
Type-N *(2 required)*	Frequency: 10 MHz to 8 GHz Precision Type-N (m) 62 cm (24 in.) VSWR: ≤ 18 GHz: 1.4:1 Insertion Loss: 1.5 dB	11500C		A, P, T
BNC *(3 required)*	50 W Coax BNC (m) 120 cm (48 in.)	10503A		A, P, T

BNC (m) to SMC (f)		10020-61605	10503A BNC cable with 1250-0832 BNC to SMC adapter	A
Filters				
50 MHz Low Pass	Cutoff Frequency: 50 MHz Rejection at 65 MHz: > 40 dB Rejection at 75 MHz: > 60 dB Insertion Loss: ~1 dB VSWR: ≤1.5:1 BNC (m) to BNC (f)	0955-0306		P, T
300 MHz Low Pass *(2 Required)*	Cutoff Frequency: 300 MHz Rejection at > 435 MHz: > 45 dB VSWR: ≤1.5:1 BNC (m, f)	0955-0455		P
1.8 GHz Low Pass *(2 Required)*	Cutoff frequency: 1.8 GHz Rejection at > 3 GHz: > 45 dB Insertion Loss: ~0.25 dB VSWR: ≤1.35:1 SMA (f)	0955-0491		P
4.4 GHz Low Pass *(2 Required)*	Cutoff frequency: 4.4 GHz Rejection at > 5.5 GHz: > 42 dB	9135-0005	360D	P
Adapters				
Type-N (f) to Type-N (f)	Frequency: DC to 18 GHz VSWR: ≤ 1.13:1	1250-1472		P
Type-N (m) to Type-N (m)	Frequency: DC to 18 GHz VSWR: ≤ 1.13:1	1250-1475		P
Type-N (f) to BNC (m)	Frequency: DC to 1.3 GHz VSWR: 1.13:1	1250-1477		P, T
Type-N (m) to BNC (m)	Frequency: DC to 1.3 GHz VSWR: ≤ 1.13:1	1250-1473		P, T
Type-N (m) to APC 3.5 mm (m)	Frequency: DC to 18 GHz VSWR: ≤ 1.08:1	1250-1743		P
Type-N (m) to BNC (f)	Frequency: DC to 1.3 GHz VSWR: ≤ 1.13:1	1250-1476		P
APC 3.5 mm (f) to APC 3.5mm (f) *(2 Required)*	Frequency: DC to 26.5 GHz VSWR: ≤ 1.05:1	83059B	1250-1749	P
APC 3.5 mm (m) to APC 3.5 mm (m) *(2 Required)*	Frequency: DC to 26.5 GHz VSWR: ≤ 1.12:1	1250-1748		P
APC 3.5 mm (f) to APC 3.5mm (f)	Frequency: DC to 34 GHz VSWR: ≤ 1.15:1	1250-1749		P
2.4 mm (f) to APC 3.5 mm (m) *(Needed for E4446A, E4448A)*	Frequency: DC to 26.5 GHz VSWR: ≤ 1.05:1	11901D		A, P
APC 3.5 mm (f) to Type-N (f)	For 83630B Frequency: DC to 18 GHz VSWR: 1.08:1	1250-1745		A, P
APC 3.5 mm (f) to 2.4 mm (f) *(Needed for E4446A, E4448A)*	Frequency: DC to 26.5 GHz VSWR: 1.05:1	11901B		P

BNC (m) to SMA (f)	Frequency: DC to 1.3 GHz VSWR: ≤ 1.13:1	1250-1700		P
Type N (m) to APC 3.5 mm (f) *(2 Required, Opt. BAB 3 Required)*	Frequency: DC to 18 GHz VSWR: ≤ 1.08:1	1250-1744		P
Type N (f) to 2.4 mm (f)	Frequency: DC to 18 GHz VSWR: ≤ 1.08:1	11903B		A, P
Type N (m) to 2.4 mm (f) *(Needed for E4446A, E4448A)*	Frequency: DC to 18 GHz VSWR: 1.08:1	11903D		P
Type N (f) to APC 3.5 mm (m)	Frequency: DC to 18 GHz VSWR: ≤ 1.14:1	1250-1750		A, P
BNC Tee		1250-0781		A, P
SMB (f) to BNC (f)	Frequency: DC to 1.3 GHz	1250-1236		A, P
BNC (f) to SMA (m)	Frequency: DC to 1.3 GHz	1250-1200		A, P
BNC (f) to Dual Banana		1251-2277		A, P
Controller				
Computer	IBM compatible PC Intel Pentium 90 MHz or greater Windows 2000 ® or NT ® 4.0 at least 32 MB RAM At least 200 MB of available hard disk space CD-ROM Drive 800x600 Minimum monitor resolution Web browser[4]			A, P
Accessories				
IEEE 488 Interface Card	High-performance GPIB with: Agilent-VISA 1.2[5] or greater or NI-VISA 1.2[6] or greater	82341D	National p/n AT-GPIB/TNT or PCI-GPIB	A, P

[1] A = Adjustments, P = Performance Testing, T = Troubleshooting)

[2] The 8482A power sensor uses cal factors to compensate the power sensor for frequency response errors. Cal factors are stated in percentages. The 8482A factory cal factor uncertainty ranges from 2.2% to 3.1%. The cal factor uncertainty can be reduced to < 2.0% by using metrology grade calibration techniques. The power sensor cal factor uncertainty becomes one component of the Verification Test uncertainty analysis. Lower cal factor uncertainties will translate to wider test margins.

[3] The 8494G and 8496G step attenuators should be permanently joined via the 11716A Interconnect Kit. The step attenuator combination should have each step attenuation characterized by a metrology lab at 50 MHz. For the best test results the step attenuation should be characterized to the following uncertainty levels;

- 0 dB to 40 db Attenuation: ± .005 dB
- 41 dB to 80 dB Attenuation: ± .01 dB
- 81 dB to 120 dB Attenuation: ± .21 dB

[4] Microsoft ® Internet Explorer ® 4.0 or greater or Netscape ® 4.0 or greater.

[5] Agilent Technologies Agilent-VISA is available at http://www.agilent.com.

[6] National Instruments NI-VISA is available at http://www.natinst.com/gpib/gpib_dl.htm

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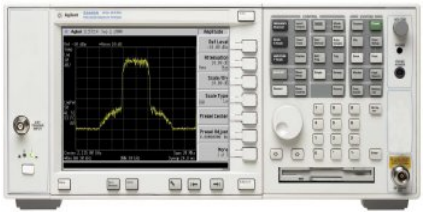

PSA Series Performance Tests

The Agilent PSA series test system uses the following performance tests to verify the specifications of the PSA series spectrum analyzers.

Important: Some of the performance tests require actual step attenuator calibration data to obtain valid results. Please refer to the Enter Equipment Calibration Data section in the TME help for details on how to enter this data.

1. Residual Responses
2. Displayed Average Noise Level
3. Frequency Reference Accuracy
4. Frequency Readout Accuracy
5. Count Accuracy
6. Spurious Responses
7. Third Order Intermodulation Distortion
8. Gain Compression
9. Second Harmonic Distortion
10. Power Bandwidth Accuracy

11. Resolution Bandwidth Switching Uncertainty
12. IF Amplitude Ripple (Option B7J)
13. IF Phase Ripple (Option B7J)
14. Display Scale Fidelity
15. Input Attenuation Switching Uncertainty
16. Absolute Amplitude Accuracy
17. Noise Sidebands < 50 kHz Offsets
18. Noise Sidebands > 50 kHz Offsets
19. Frequency Response (Option B7J)
20. Frequency Response 300 kHz to 3 GHz
21. Frequency Response Above 3 GHz
22. Frequency Response Below 300 kHz

Memory Initialization Utilities

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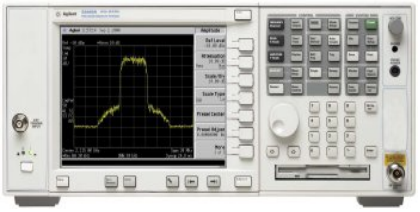


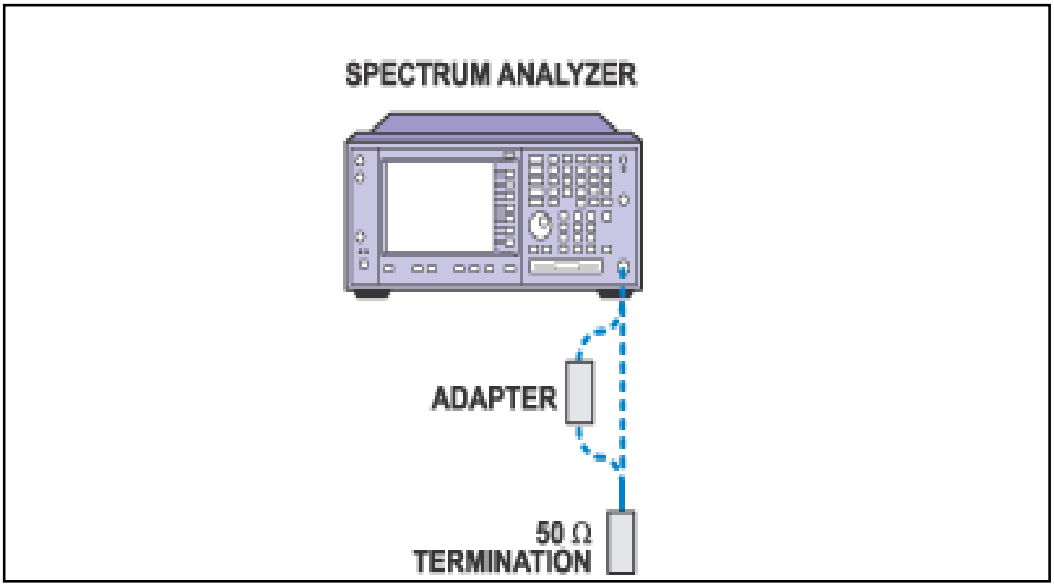
Residual Responses Performance Test

The PSA RF Input is terminated and the analyzer is swept from 200 kHz to 1 MHz. Then the analyzer is swept in incremental 10 MHz spans from 1 MHz to the upper frequency range. After each sweep, the Marker Peak function is used to measure the highest amplitude. The amplitude and frequency of any response above the specification are noted.

Required Test Equipment

Test Equipment	Model Number	E4440A E4443A, E4445A	E4446A E4448A
50 ohm Termination	909A, Option 012	X	
50 ohm Termination	85138B		X
3.5 mm (f) to Type N (f) adapter	1250-1745	(Option BAB)	

Residual Responses Test Setup



Troubleshooting

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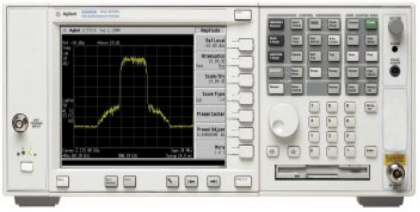


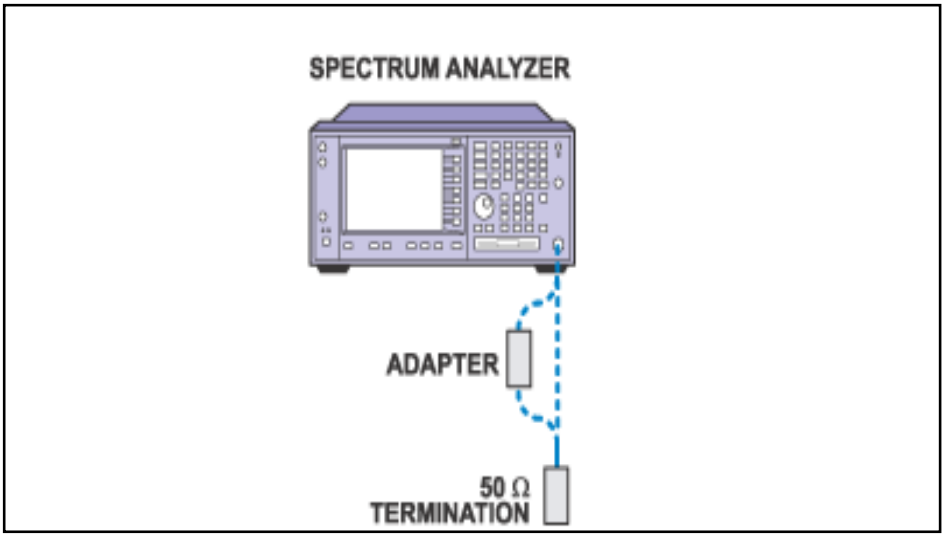
Displayed Average Noise Level Performance Test

The PSA's input is terminated with a 50 ohm load, and the displayed average noise level (DANL) is measured within the specified frequency ranges. If the PSA has the preamp option 1DS, additional testing is performed with the preamp on. All tests are performed in DC-Coupled mode.

Required Test Equipment

Test Equipment	Model Number	E4440A E4443A, E4445A	E4446A E4448A
50 ohm Termination	909A Option 012	X	
50 ohm Termination	85138B		X
3.5 mm (f) to Type N (f) adapter	1250-1745	(Option BAB)	

Displayed Average Noise Level Test Setup



Troubleshooting

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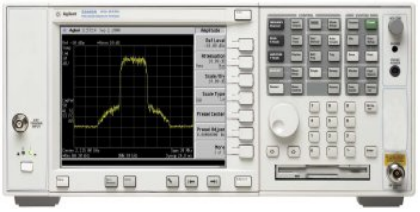


Frequency Reference Accuracy Performance Test

This test determines that the frequency reference is functional, provides a measured frequency value, suggests that an adjustment be made if the yearly allowable frequency offset value is exceeded.

The instrument is set to Internal Reference mode and is allowed a sufficient warm-up time of 24 hours while powered on (not in Standby mode). The frequency of the 10 MHz Reference is measured at its rear-panel port using a counter locked to a frequency standard. The measured value is compared to the allowable offset guideline, and is also printed on the Performance Test printout.

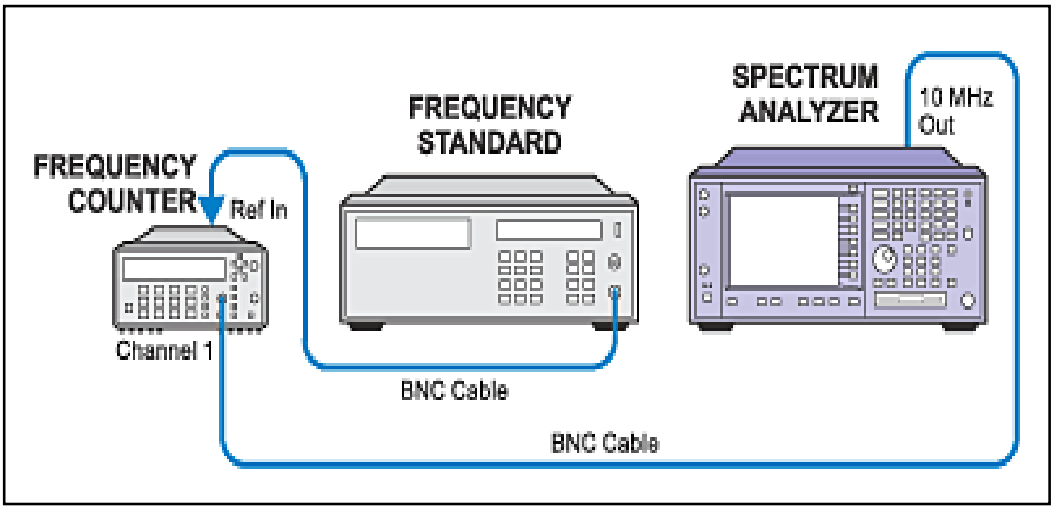
Placing the analyzer in Standby mode turns the frequency reference oscillator off, while continuing to provide power to the oven. While keeping the oscillator warm will reduce its stabilization time, it will not cause aging.

Required Test Equipment

Test Equipment	Model Number	E4440A E4443A, E4445A	E4446A E4448A
Universal Counter	53132A	X	X

Frequency Standard	5071A	X	X
BNC Cable (2 required)	10503A	X	X

Frequency Reference Accuracy Test Setup



Troubleshooting

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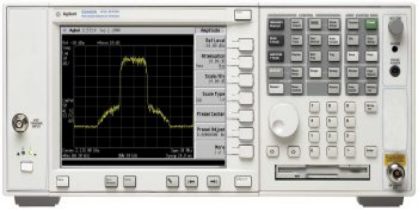


Frequency Readout Accuracy Performance Test

The test verifies the accuracy of a displayed frequency relative to either the start frequency or the center frequency of the sweep. It is not necessary that the start/center frequency be accurately known. It must, however, be the same as the frequency supplied by the external source. This is accomplished by locking the source and DUT references thus eliminating the Frequency Reference term.

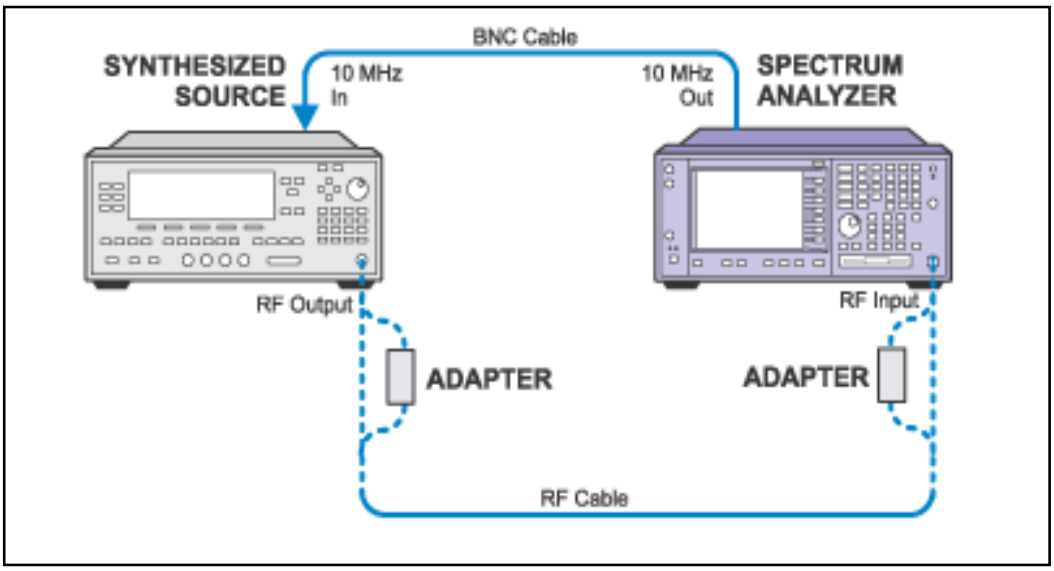
With the references locked, the test is done in several spans to check all modes of the synthesizer circuitry.

Required Test Equipment

Test Equipment	Model Number	E4440A E4443A, E4445A	E4446A E4448A
Synthesized Sweeper	83630A/B 83640A/B, 83650A/B	X	X
BNC Cable	10503A	X	X
APC 3.5 Cable	8120-4921	X	X
Type N (f) to 3.5 mm (f) adapter	1250-1745	X	
3.5 mm (f) to 3.5 mm (f) adapter	83059B	X	X
2.4 mm (f) to 3.5 mm (f) adapter	11901B	X	X

Type N (m) to 3.5 mm (f) adapter	1250-1744	X	

Frequency Readout Accuracy Test Setup



Troubleshooting

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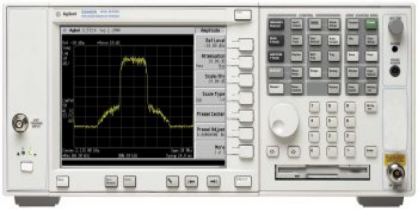


Count Accuracy Performance Test

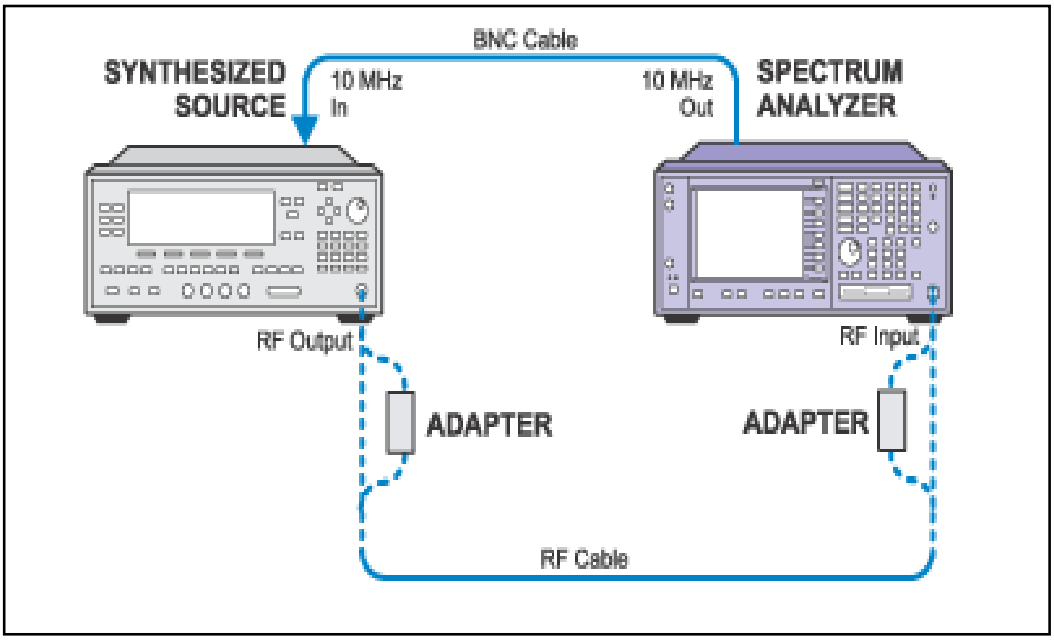
The test verifies the count accuracy of the built-in frequency counter. The PSA performs the Marker Count function by pausing between sweeps, tuning the center frequency to the marker frequency, setting the span to zero hertz, and then counting the frequency of the signal long enough to achieve a valid reading.

A synthesized source is used to supply the signal at a known frequency. The PSA 10 MHz frequency reference is connected to the source to lock it to the DUT.

Required Test Equipment

Test Equipment	Model Number	E4440A E4443A, E4445A	E4446A E4448A
Synthesized Sweeper	83630A/B 83640A/B, 83650A/B	X	X
BNC Cable	10503A	X	X
APC 3.5 Cable	8120-4921	X	X
Type N (f) to 3.5 mm (f) adapter	1250-1745	X	
3.5 mm (f) to 3.5 mm (f) adapter	83059B	X	X
2.4 mm (f) to 3.5 mm (f) adapter	11901B	X	X
Type N (m) to 3.5 mm (f) adapter	1250-1744	X	

Count Accuracy Test Setup



Troubleshooting

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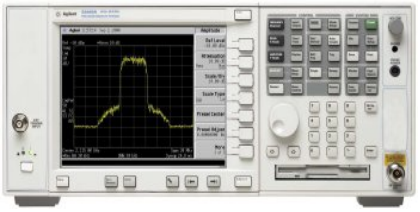


Spurious Responses Performance Test

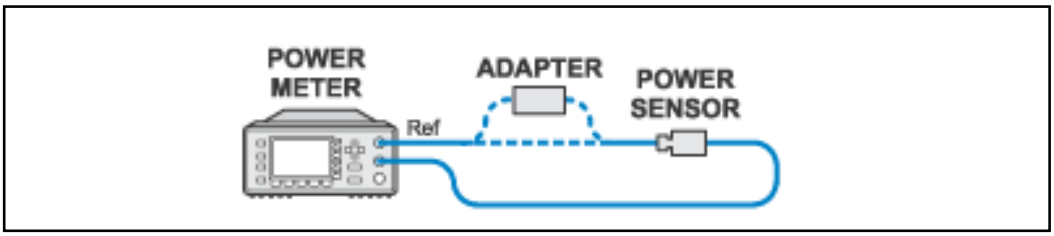
This test verifies that the PSA Series Spectrum Analyzer meets its specification for input related spurious responses. In this test, the source is connected to the RF Input and set for the spur frequency. The source amplitude is measured using a power meter. The source frequency is then moved to the frequency location that will create the spur. The amplitude of the source is kept the same by using the power meter. The PSA then measures the spurious response at the spur frequency.

Required Test Equipment

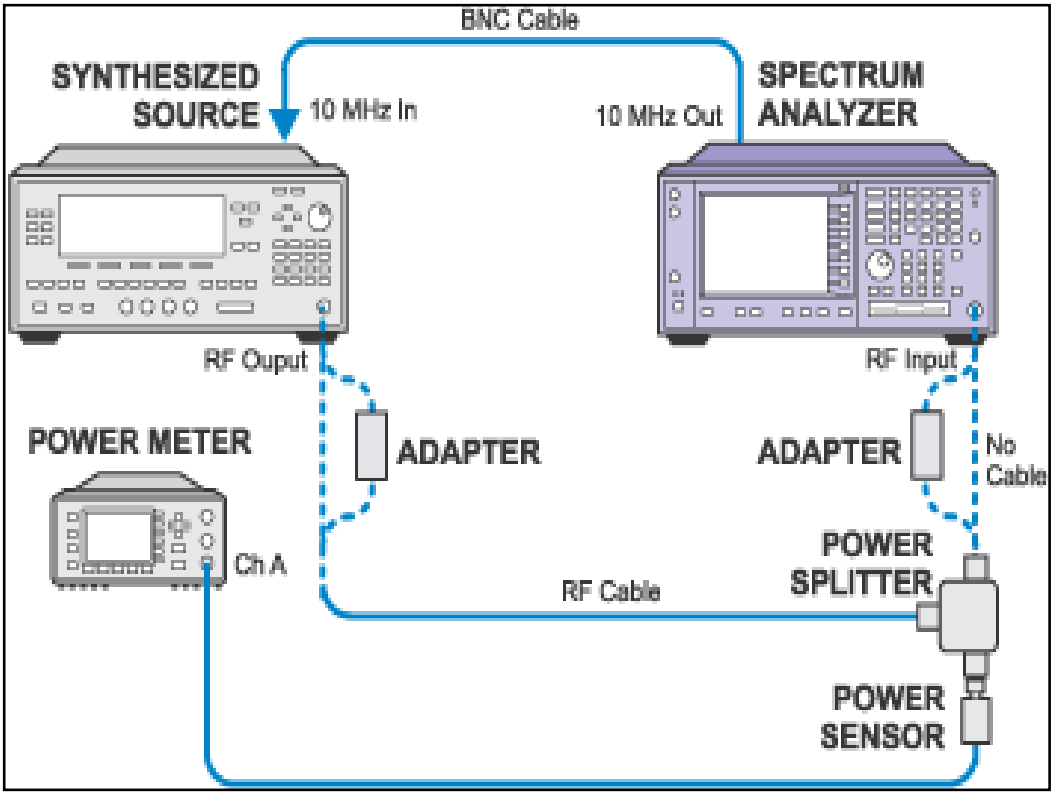
Test Equipment	Model Number	E4440A E4443A, E4445A	E4446A E4448A
Synthesized Sweeper	83630A/B, Option 008 83640A/B, 83650A/B, Option 008	X	
Synthesized Sweeper	83650A/B, Option 008		X
Power Meter	E4419A	X	X
Power Sensor	8485A	X	

Power Sensor	8487A		X
Power Splitter	11667B	X	
Power Splitter	11667C		X
APC 3.5 Cable	8120-4921	X	
2.4 mm Cable	8120-6164		X
BNC Cable	10503A	X	X
3.5 mm (f) to 3.5 mm (f) adapter	83059B	X	
3.5 mm (f) to 2.4 mm (f) adapter	11901B	X	

Power Meter Calibration



Spurious Responses Test Setup



Troubleshooting

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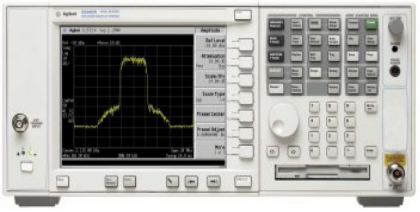


Third Order Intermodulation Distortion Performance Test

This test measures the Third-Order Intermodulation distortion produced by two discrete signals, and computes the Third Order Intercept (TOI) point.

Two signals separated by 100 kHz are combined in a directional bridge or directional coupler (for isolation) and are injected into the analyzer input. The spectrum analyzer measures the amplitude of the lower and upper distortion products. TOI is computed using the higher (worst case) of these two products.

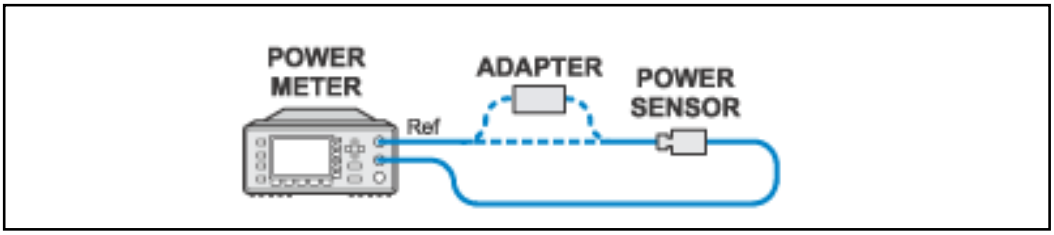
Testing begins by turning on one signal source and measuring the signal level at the directional bridge/coupler output port with a power meter. The bridge/coupler is then connected to the analyzer input, and the signal from the source is displayed on the analyzer. The second signal source is turned on and its amplitude is adjusted to match that of the first source.

In the 3 Hz to 3 GHz band, a filter is used to attenuate the second harmonic of the signal closest to the distortion product being measured. Above 3 GHz the analyzer provides internal preselection so the source does not require an external filter.

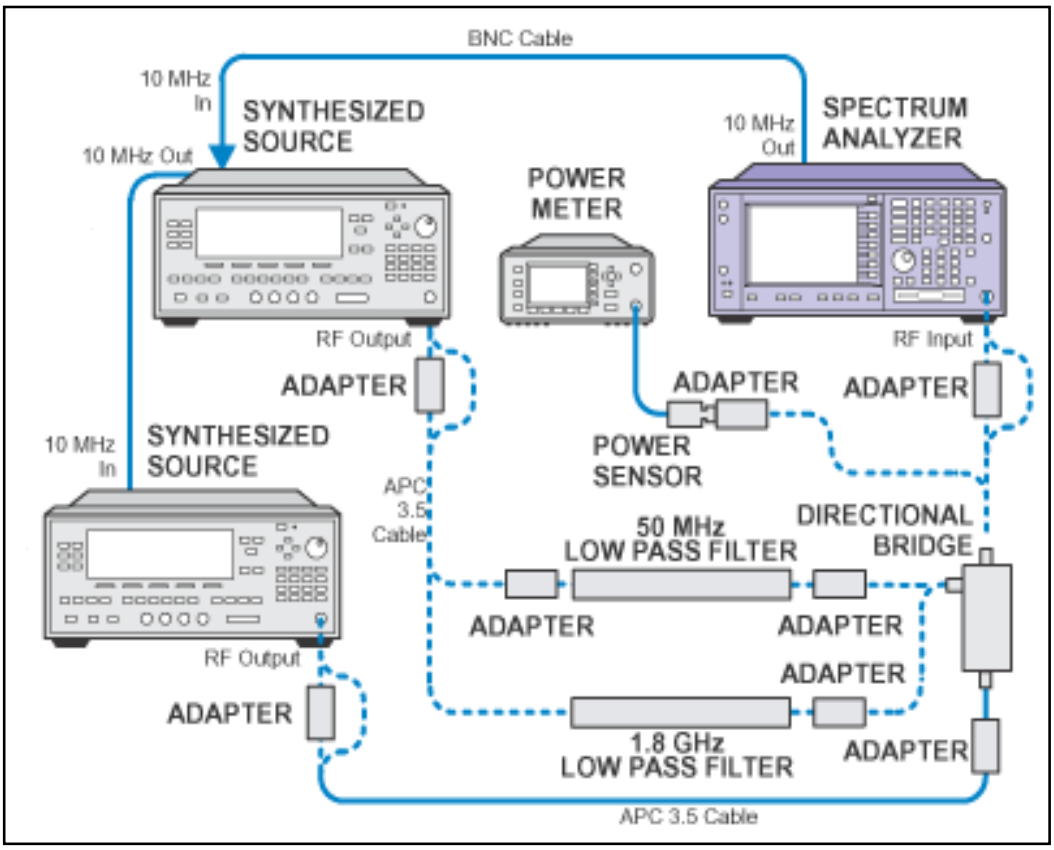
Required Test Equipment

Test Equipment	Model Number	E4440A E4443A, E4445A	E4446A E4448A
Synthesized Sweeper (2 required)	83630A/B 83640A/B, 83650A/B	X	X
Power Meter	E4419B	X	X
Power Sensor	8485A	X	X
Directional Bridge	86205A	X	X
Directional Coupler (2 required)	87300B	X	X
BNC Cable (2 required)	10503A	X	X
APC 3.5 Cable (2 required)	8120-4921	X	X
50 MHz Low Pass Filter	0955-0306	X	X
1.8 GHz Low Pass Filter	0955-0491	X	X
3.5 mm (f) to 3.5 mm (f) adapter (2 required)	83059B	X	X
BNC (m) to SMA (f) adapter	1250-1700	X	X
Type N (m) to Type N (m) adapter	1250-1475	X	X
Type N (m) to BNC (f) adapter	1250-1476	X	X
Type N (m) to 3.5 mm (m) adapter	1250-1743	X	X
Type N (m) to 3.5 mm (f) adapter (2 required, 3 required for Option BAB)	1250-1744	X	X
3.5 mm (m) to 3.5 mm (m) adapter (2 required)	1250-1748	X	X
3.5 mm 50 ohm Termination	909D	X	X
2.4 mm (f) to 3.5 mm (f) adapter	11901B	X	X
2.4 mm (f) to 3.5 mm (m) adapter	11901D		X

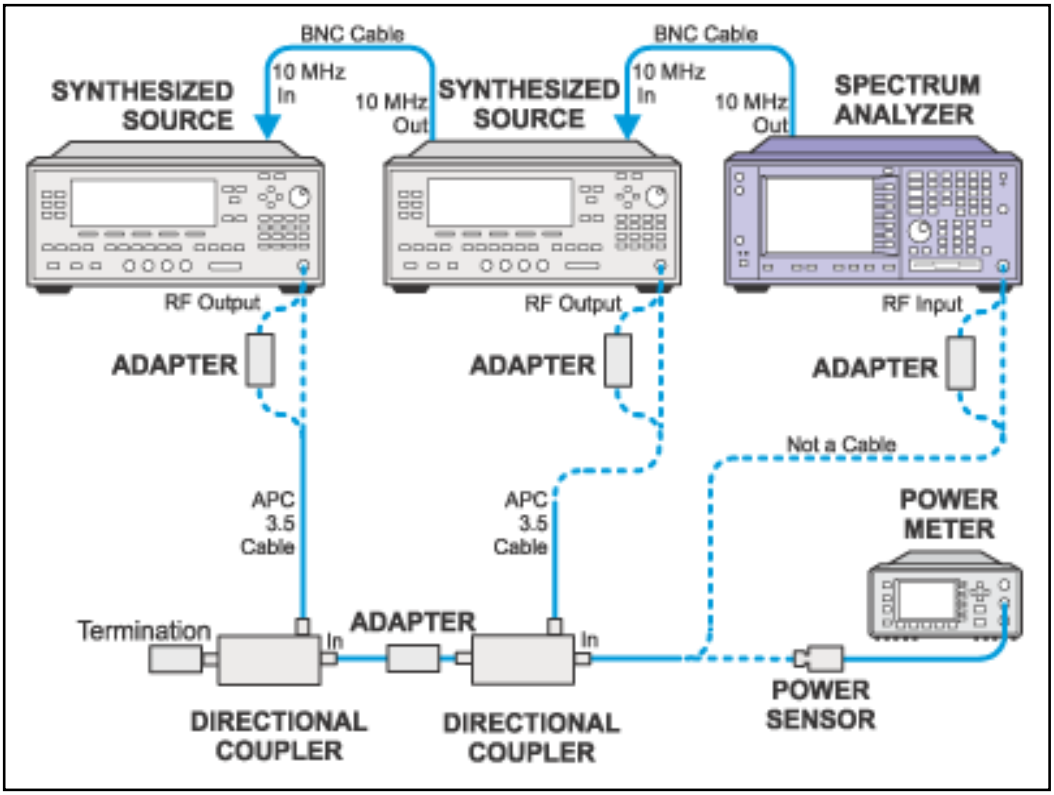
Power Meter Calibration



Third Order Intermodulation Distortion Low Band Test Setup



Third Order Intermodulation Distortion High Band Test Setup



Troubleshooting

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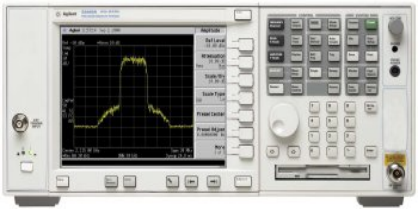


Gain Compression Performance Test

The test is performed at center frequencies of 50 MHz, 2 GHz and 7.6 GHz (excluding E4443A). The E444XA Reference Level is set to +10 dBm, the RBW is set to 30 kHz, and the tone spacing is 3 MHz. The E444XA input attenuator is set to 6 dB to provide acceptable input VSWR and yet to allow sufficient signal level at the input mixer without the need of an external amplifier. An input signal is set so that the mixer power is appropriate for the specification.

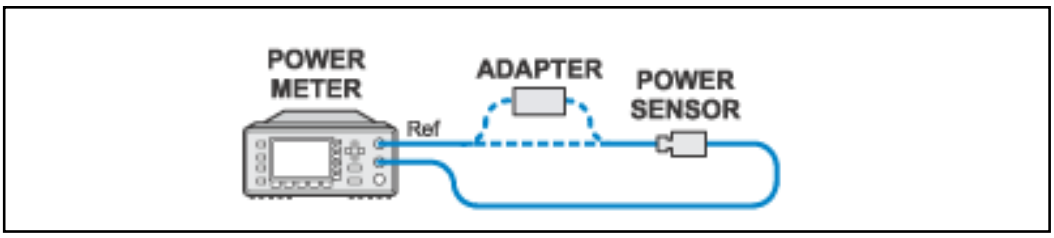
The signal amplitude is measured and a second tone is applied to bring the DUT into compression. The resulting amplitude drop of the first tone is measured. If the amplitude drop is greater than 1 dB the test result is "Fail". A directional coupler or bridge is used to combine the tones and provide sufficient source isolation.

Test Equipment

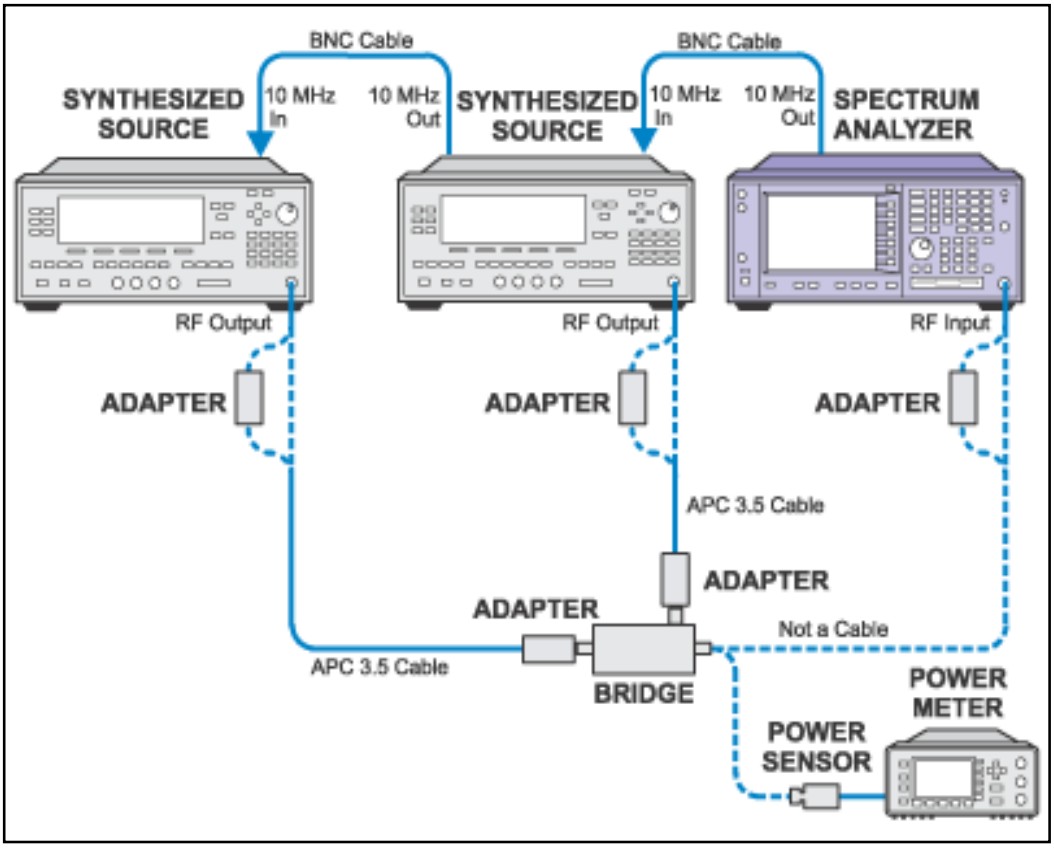
Test Equipment	Model Number	E4440A E4443A, E4445A	E4446A E4448A
Synthesized Sweeper (2 required)	83630A/B 83640A/B, 83650A/B	X	X
Power Meter	E4419A/B	X	X
Power Sensor	8481A	X	X
Directional Coupler	87300B	X	X

Directional Bridge	86205A	X	X
APC 3.5 Cable (2 required)	8120-4921	X	X
BNC Cable	10503A	X	X
2.4 mm (f) to 3.5 mm (f) adapter (2 required with 83640B)	11901B	X	X
3.5 mm (f) to 3.5 mm (f) adapter (2 required with 83630B)	83059B	X	X
Type N (m) to Type N (m) adapter	1250-1475	X	
Type N (f) to 3.5 mm (m) adapter	1250-1750	X	
Type N (m) to 3.5 mm (f) adapter (up to 3 required for Opt BAB)	1250-1744	X	
Type N (m) to 2.4 mm (f) adapter	11903D		X
BNC Tee	1250-0781	X	X

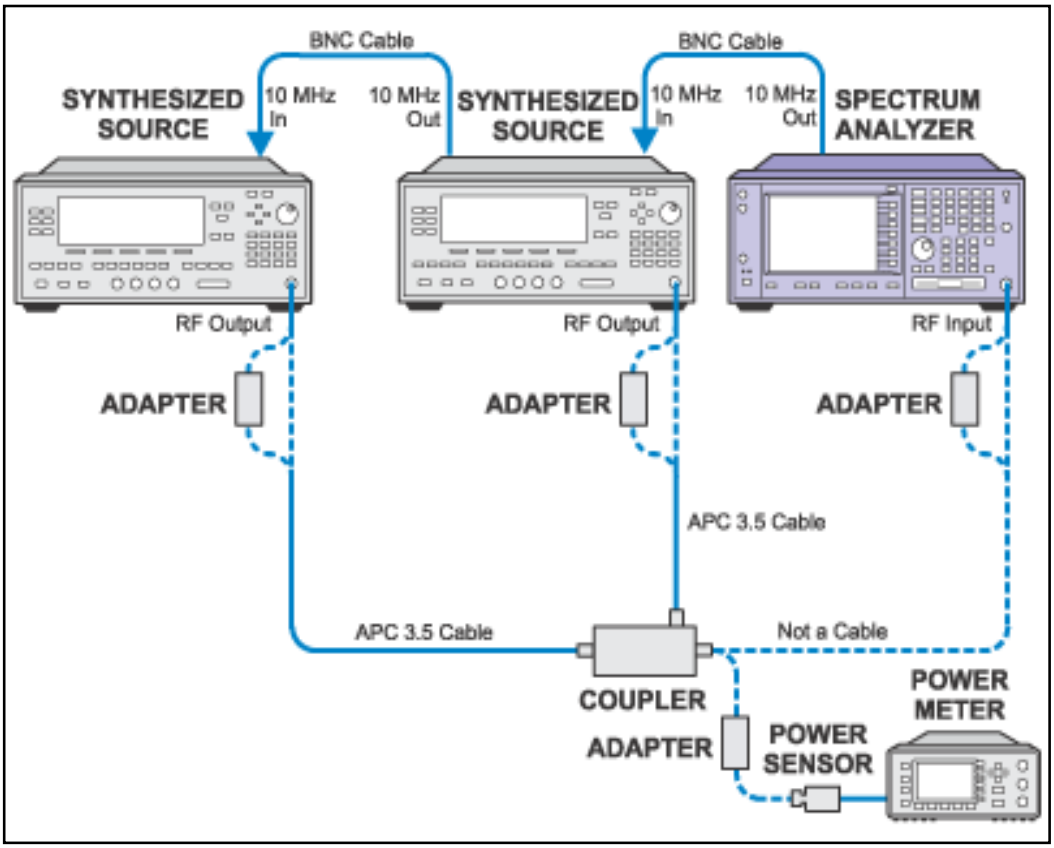
Power Meter Calibration



Gain Compression (50 MHz and 2 GHz) Setup



Gain Compression (7.6 GHz) Setup



Troubleshooting

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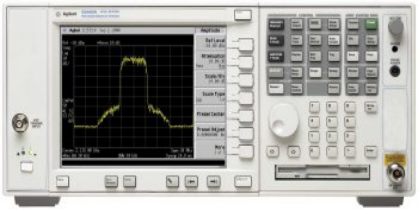


Second Harmonic Distortion Performance Test

At each test frequency, a signal is applied whose amplitude meets the requirement for the power at the first mixer. One or more low pass filters are inserted between the source and the PSA under test to prevent the second harmonic of the source from artificially raising the second harmonic product as it is displayed on the PSA. The Marker Amplitude function is used to measure the level of the distortion product and the theoretical Second Harmonic Intercept point (SHI) is calculated.

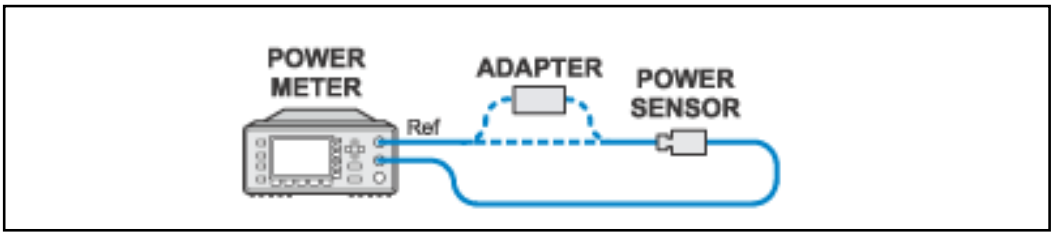
To reduce amplitude uncertainty due to flatness, a power meter is used to characterize the PSA at the fundamental and 2nd harmonic frequencies.

Required Test Equipment

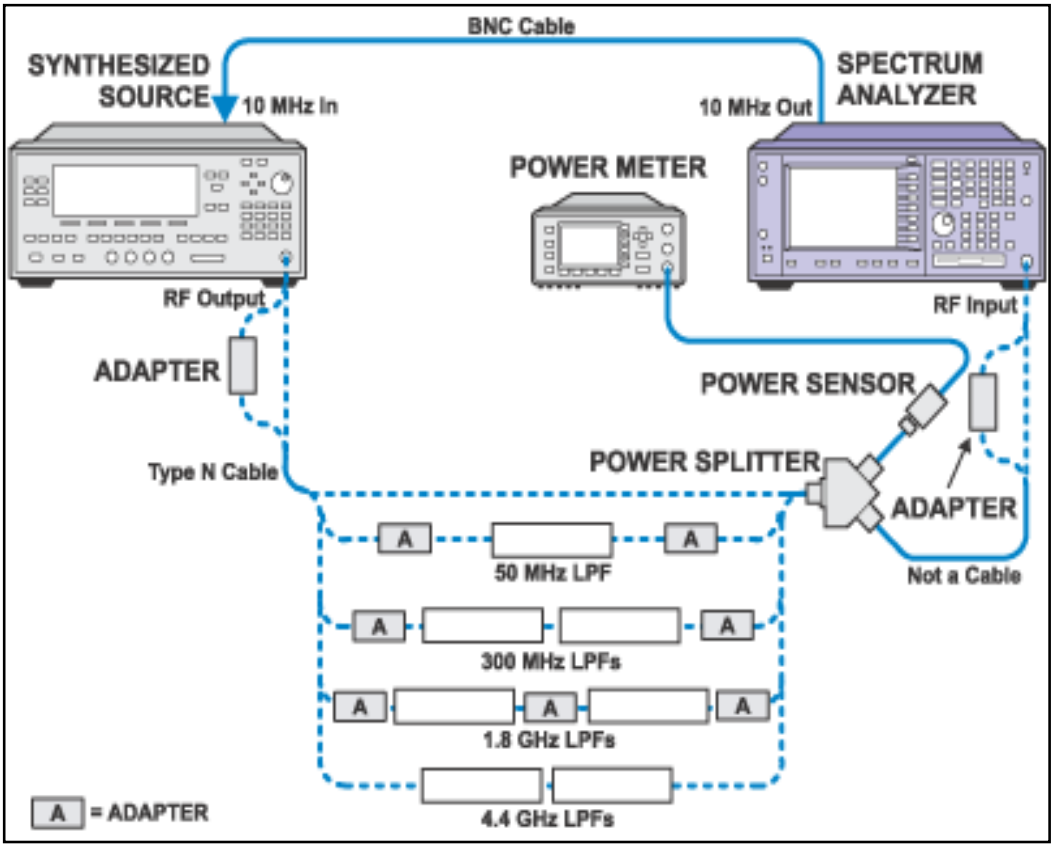
Test Equipment	Model Number	E4440A E4443A, E4445A	E4446A E4448A
Synthesized Sweeper	83630A/B 83640A/B, 83650A/B	X	X
Power Meter	E4419B	X	X

Power Sensor	8481A	X	X
Power Splitter	11667A	X	X
50 MHz Low Pass Filter	0955-0306	X	X
300 MHz Low Pass Filter (2 required)	0955-0455	X	X
1.8 GHz Low Pass Filter (2 required)	0955-0491	X	X
4.4 GHz Low Pass Filter (2 required)	9132-0005	X	X
BNC Cable	10503A	X	X
Type N Cable	11500C	X	X
Type N (m) to BNC (f) adapter	1250-1476	X	X
3.5 mm (m) to 3.5 mm (m) adapter	1250-1478	X	X
Type N (m) to Type N (m) adapter	1250-1475	X	
Type N (f) to 3.5 mm (f) adapter	1250-1745	X	
Type N (f) to BNC (m) adapter	1250-1477	X	X
Type N (m) to 3.5 mm (f) adapter (2 required for Option BAB; 1 for std.)	1250-1744	Opt BAB	
2.4 mm (f) to 3.5 mm (f) adapter	11901B		X
2.4 mm (f) to Type N (m) adapter	11903D		X
2.4 mm (f) to Type N (f) adapter	11903B	X	X
Type N (f) to 3.5 mm (m) adapter	1250-1750	X	X

Power Meter Calibration



Second Harmonic Distortion Test Setup



Troubleshooting

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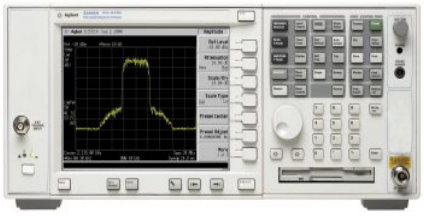

Power Bandwidth Accuracy Performance Test

In this test, the power bandwidth function is checked at a CW frequency of 50 MHz for resolution bandwidths from 1 Hz to 1.2 MHz in a 1, 3, 10 sequence. The signal source is the internal 50 MHz calibrator signal. The power bandwidth function reads the integrated power between a marker pair which enclose the CW signal.. This power is compared to the maximum power of the CW signal as read by the E444XA marker.

Required Test Equipment

None

Troubleshooting

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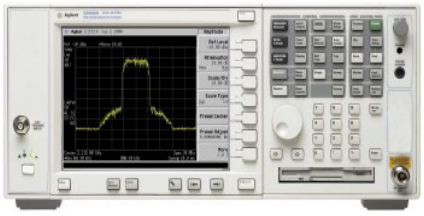

Resolution Bandwidth Switching Uncertainty Performance Test

Resolution bandwidth switching uncertainty is the relative amplitude error caused by the multiple filters that produce a specific RBW. To measure the resolution bandwidth switching uncertainty, an amplitude reference is taken with the resolution bandwidth set to 30 kHz using the marker delta function The resolution bandwidth is changed to settings between 300 Hz and 8 MHz, as applicable, and the relative amplitude variation is measured at each setting and compared to the specification.

Required Test Equipment

None

Troubleshooting

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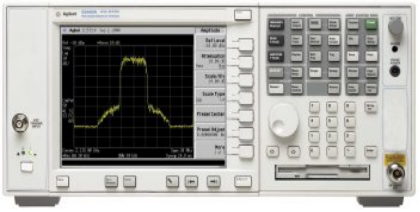


IF Amplitude Ripple (Option B7J) Performance Test

NOTE: This test is to be performed on PSA analyzers with **Option B7J only**.

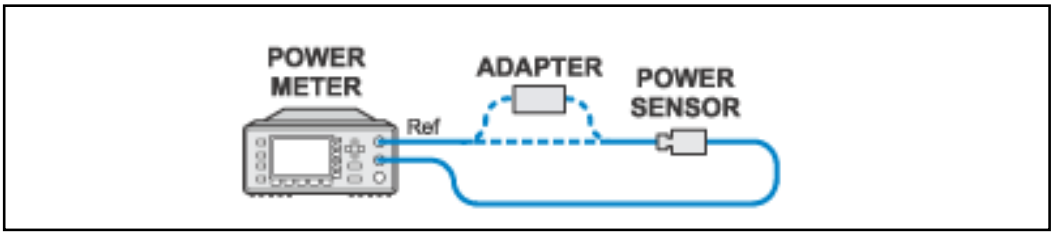
This test is a functional test. The IF Amplitude Ripple is measured in order to meet the EVM specification listed for various Digital Comms personalities. In this test, a CW signal of fixed amplitude is applied through a power splitter to the input of the PSA and to a power meter. With the PSA center frequency set to the CW value set by the source, the source amplitude is adjusted to a reference level, as indicated by the power meter.

The source frequency is then changed to a series of offset frequencies within the span of interest. At each offset frequency, the source amplitude is adjusted to maintain a constant reading from the power meter. The amplitude at each offset frequency is measured by the PSA. The difference between the amplitude at an offset frequency and the amplitude at the reference frequency is the IF Amplitude Ripple.

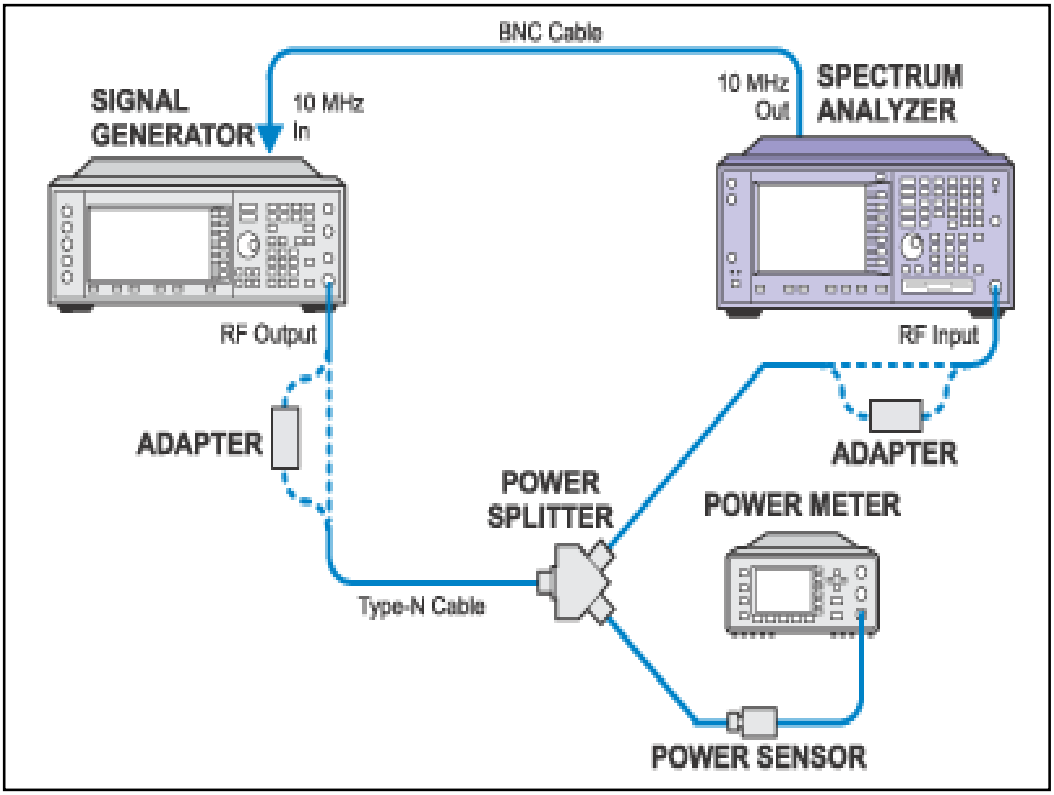
Required Test Equipment

Test Equipment	Model Number	E4440A E4443A, E4445A	E4446A E4448A
Signal Generator	E4433B	X	X
Power Meter	E4419A/B	X	X
Power Sensor	8481A Option H84	X	X
Power Splitter	11667A	X	X
Type N Cable	11500C	X	X
BNC Cable	10503A	X	X
Type N (m) to Type N (m) adapter	1250-1475	X	
Type N (m) to 3.5 mm (f) adapter	1250-1744	(Option BAB)	
2.4 mm (f) to Type N (m) adapter	11903D		X

Power Meter Calibration



IF Amplitude Ripple Test Setup



Troubleshooting

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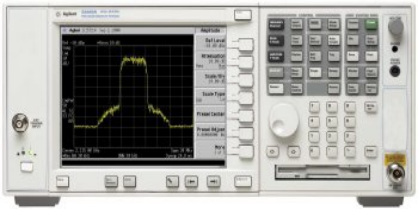


IF Phase Ripple (Option B7J) Performance Test

NOTE: This test is to be performed on PSA analyzers with **Option B7J only**.

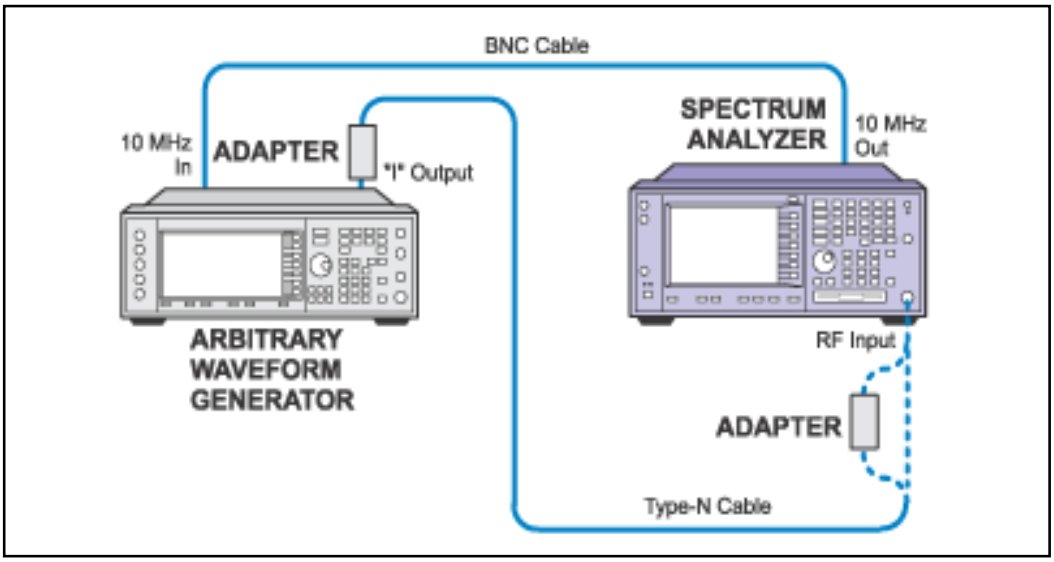
This test is a functional test. The IF Phase Ripple is measured in order to meet the EVM specification listed for various Digital Comms personalities. In this test the source is set to output 64 tones in groups of 8 tones which are generated synchronously. The tones are measured in groups to reduce error due to noise. An algorithm is applied to the measurement data to determine the relative phase between the tones.

Required Test Equipment

Test Equipment	Model Number	E4440A E4443A, E4445A	E4446A E4448A
Signal Generator	E4433B	X	X
Type N Cable	11500C	X	X
BNC Cable	10503A	X	X
Type N (f) to 3.5 mm (f) adapter	1250-1745	Option BAB	

Type N (f) to BNC (m) adapter	1250-1477	X	X
2.4 mm (f) to Type N (f) adapter	11903B		X

IF Phase Ripple Test Setup



Troubleshooting

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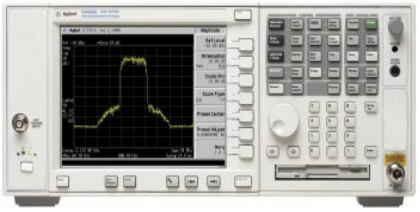


Display Scale Fidelity Performance Test

This test verifies that the PSA meets its amplitude accuracy specification for amplitude linearity. The input attenuator is set to 10 dB in zero span mode. The first part of the test sets the source to 5 dBm and external attenuators are set to 30 dB. The signal is then measured. The value measured is recorded as the reference level. The RF input is then varied between the specification intervals of 0 dBm and -17 dBm.

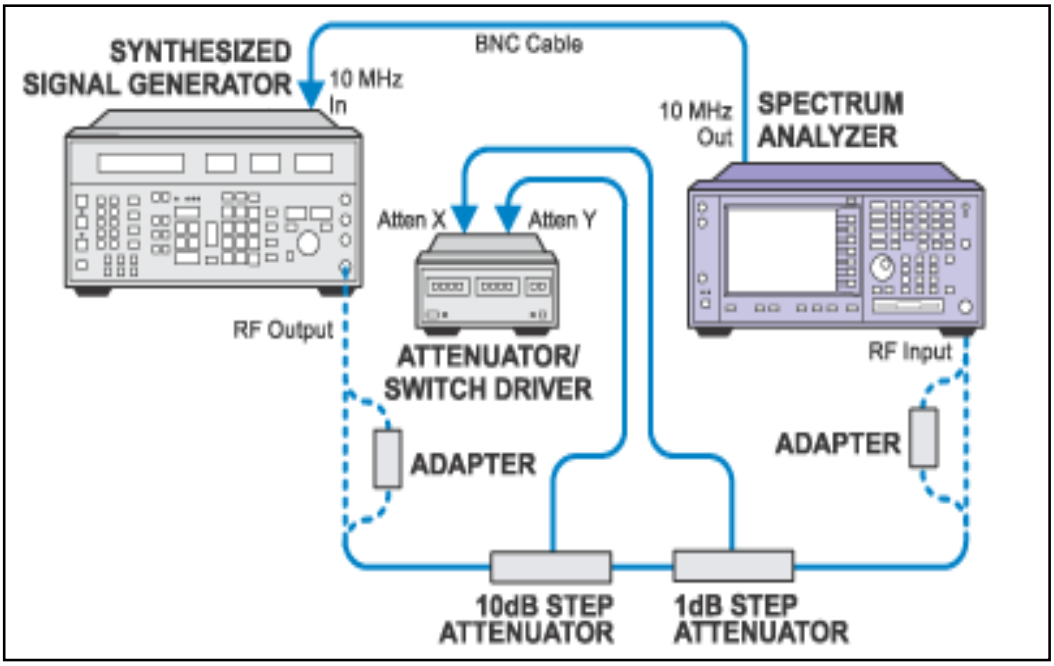
The second part of the test sets the source to -20 dBm and external attenuators are set to 5 dB. The signal is then measured. The value measured is recorded as the reference level. The RF input is then varied between the specification intervals of -25 dBm and -55 dBm. Signals below this level are guaranteed by design and are not measured.

NOTE: This test requires step attenuator calibration data to obtain valid results. Make sure you enter the calibration data for the step attenuators that you're using. Please refer to the Enter Equipment Calibration Data section in the TME help for details on how to enter this data. You must enter the data for the following columns to obtain valid results: Attn(dB), Uncert(dB) and ReflSize.

Required Test Equipment

Test Equipment	Model Number	E4440A E4443A, E4445A	E4446A E4448A
Digital Signal Generator	8663A	X	X
1 dB Step Attenuator	8494G	X	X
10 dB Step Attenuator	8496G	X	X
Attenuator Driver	11713A	X	X
Attenuator Interconnect Kit	11716A	X	X
Type N Cable	11500C	X	X
BNC Cable	10503A	X	X
3.5 mm (f) to Type N (f) adapter	1250-1745	Option BAB	
2.4 mm (f) to Type N (f) adapter	11903B		X

Display Scale Fidelity Test Setup



Troubleshooting

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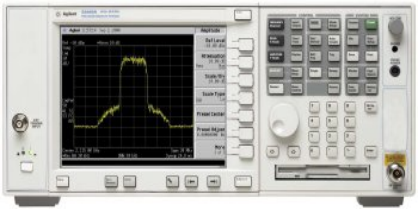


Input Attenuation Switching Uncertainty Performance Test

This test measures the step accuracy of the PSA input attenuator at 50 MHz. A signal source is connected to the PSA through the 10 dB and 1 dB precision step attenuators. The PSA input attenuator is varied from 0 dB to 70 dB while the external attenuator is switched from 70 dB to 0 dB. The step loss of the external attenuator is characterized to ± .03 dB, therefore the PSA Input Attenuator Switching Uncertainty can be calculated through RF substitution. The PSA mixer level is maintained at a constant level, thus eliminating scale fidelity error.

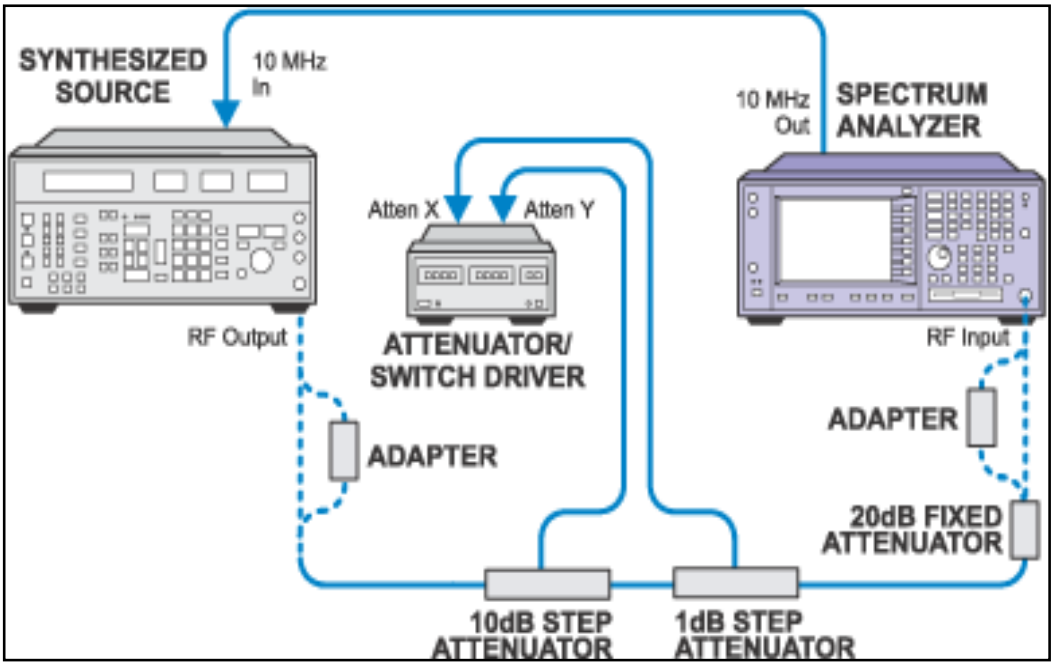
If the PSA is outfitted with Option B7J, Digital Demod Hardware, the test is performed once again on the internal Electronic Attenuator.

NOTE: This test requires step attenuator calibration data to obtain valid results. Make sure you enter the calibration data for the step attenuators that you're using. Please refer to the Enter Equipment Calibration Data section in the TME help for details on how to enter this data. You must enter the data for the following columns to obtain valid results: Attn(dB), Uncert(dB) and ReflSize.

Required Test Equipment

Test Equipment	Model Number	E4440A E4443A, E4445A	E4446A E4448A
Signal Generator	8663A	X	X
1 dB Step Attenuator	8494G	X	X
10 dB Step Attenuator	8496G	X	X
Attenuator Driver	11713A	X	X
Attenuator Interconnect Kit	11716A	X	X
20 dB Fixed Attenuator	8491A Option 020	X	X
BNC Cable	10503A	X	X
Type N Cable	11500C	X	X
Type N (f) to 3.5 mm (f) adapter	1250-1745	Opt BAB	
2.4 mm (f) to Type N (f) adapter	11903B		X

Input Attenuation Switching Uncertainty Test Setup



Troubleshooting

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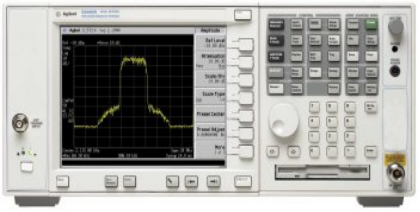
Test and Adjustment Software



Absolute Amplitude Accuracy Performance Test

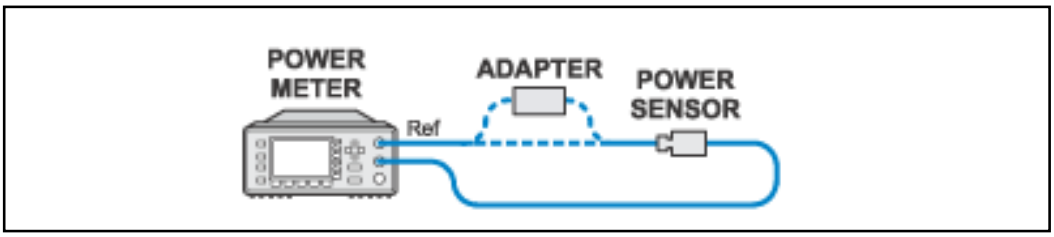
This test measures the absolute amplitude of the PSA at 50 MHz. A synthesized signal source and attenuators are used as the signal source to the analyzer. A power meter is used to measure this signal source. The value measured is recorded as the source amplitude. The PSA's input attenuator is fixed at 10 dB attenuation and the source amplitude is varied using the external attenuators.

NOTE: This test requires step attenuator calibration data to obtain valid results. Make sure you enter the calibration data for the step attenuators that you're using. Please refer to the Enter Equipment Calibration Data section in the TME help for details on how to enter this data. You must enter the data for the following columns to obtain valid results: Attn(dB), Uncert(dB) and ReflSize.

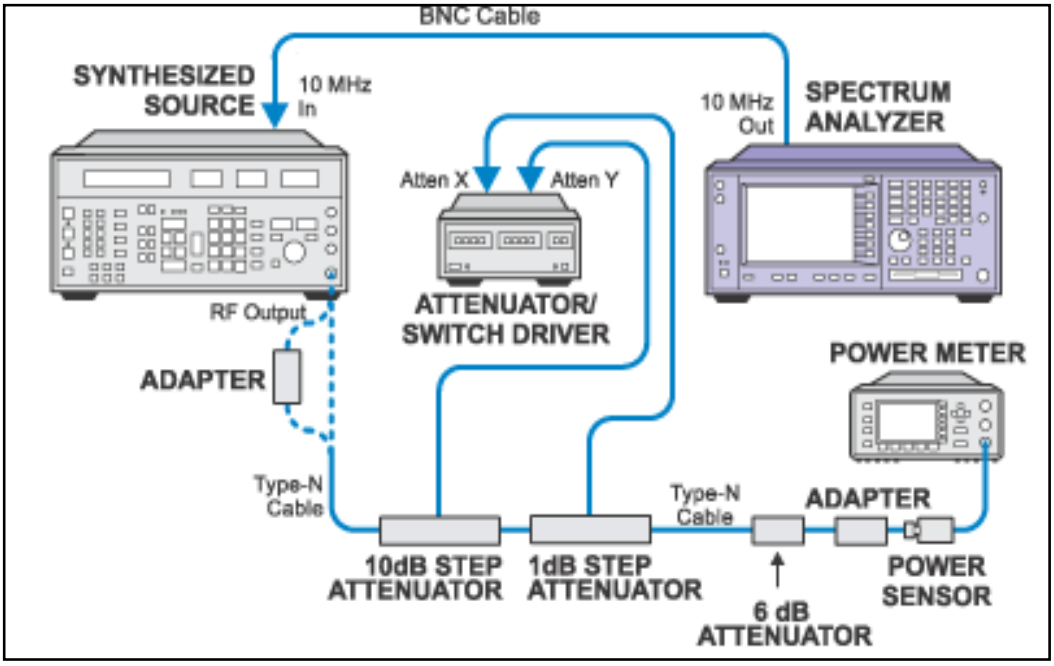
Required Test Equipment

Test Equipment	Model Number	E4440A E4443A, E4445A	E4446A E4448A
Signal Generator	8663A	X	X
Power Meter	E4419B	X	X
Power Sensor	8482A Option H84	X	X
6 dB Attenuator	8491A Options 006, H47	X	X
10 dB Step Attenuator	8496G	X	X
1 dB Step Attenuator	8494G	X	X
Attenuator Driver	11713A	X	X
Attenuator Interconnect Kit	11716A	X	X
Type N Cable (2 required)	11500C	X	X
BNC Cable	10503A	X	X
Type N (f) to Type N (f) adapter	1250-1472	X	
Type N (f) to 3.5 mm (f) adapter	1250-1745	X	
2.4 mm (f) to Type N (f) adapter	11903B		X

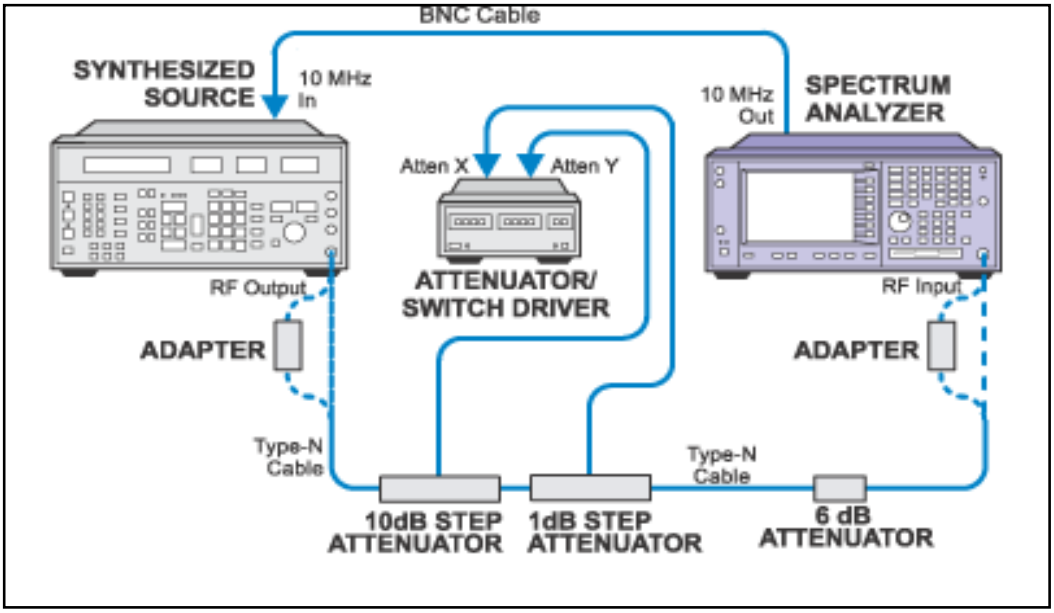
Power Meter Calibration



Measure Source Setup



Absolute Amplitude Accuracy Test Setup



Troubleshooting

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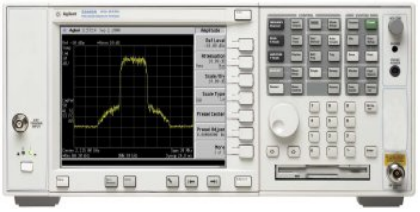


Noise Sidebands < 50 kHz Offsets Performance Test

This test verifies that the PSA meets it's noise sidebands specifications for offsets less than 50 kHz from the center frequency.

In this test, the source is connected to the RF Input and the noise level is measured at offsets of 100 Hz, 1 kHz, 10 kHz, and 30 kHz from the carrier. The sideband power is then subtracted from the carrier power to convert the measurement to dBc.

The resulting dBc measurement is normalized to 1 Hz RBW, and 2.25 dB of corrections are added. The 2.25 dB corrections account for:

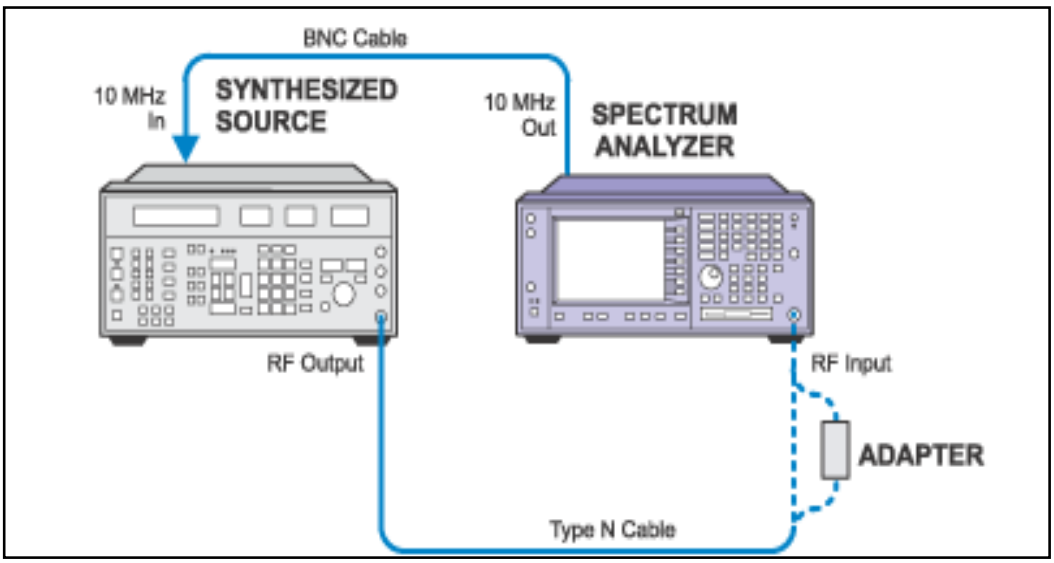
1. The Rayleigh Distribution of noise (1.05 dB).
2. The Log Response of the PSA (1.45 dB).
3. Equivalent Noise Bandwidth of the RBW filters (-.25 dB).

This test is performed in conjunction with the Noise Sidebands > 50 kHz Offsets test.

Required Test Equipment

Test Equipment	Model Number	E4440A E4443A, E4445A	E4446A E4448A
Signal Generator	8663A	X	X
BNC Cable	10503A	X	X
3.5 mm Cable	8120-4921	X	X
3.5 mm (f) to 3.5 mm (f) adapter	1250-1749	Opt BAB	
Type N (m) to 3.5 mm (f) adapter	1250-1744	X	
2.4 mm (f) to 3.5 mm (f) adapter	11901B		X

Noise Sidebands < 50 kHz Offsets Test Setup



Troubleshooting

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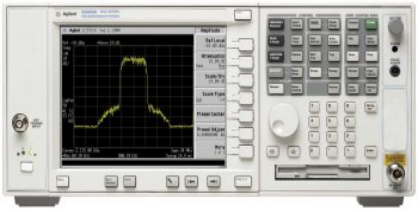


Noise Sidebands > 50 kHz Offsets Performance Test

This test verifies that the PSA meets it's Noise Sidebands specification for offsets greater than 50 kHz from the center frequency.

In this test, the source is connected to the RF Input and the noise level is measured at offsets of 100 kHz, 1 MHz, 6 MHz, and 10 MHz. In order to minimize the PSA DANL effects, near noise corrections are applied at each offset frequency. Near noise corrections involve measuring the noise sidebands with the RF signal On, and then measuring the DANL with the RF signal Off. Both measurements are then converted to power (in Watts), and the noise power is subtracted from the sideband power.

The resulting power is converted to dBm. The sideband power is then subtracted from the carrier power to convert the measurement to dBc. The resulting dBc measurement is normalized to 1 Hz RBW, and 2.25 dB of corrections are added. The 2.25 dB corrections account for:

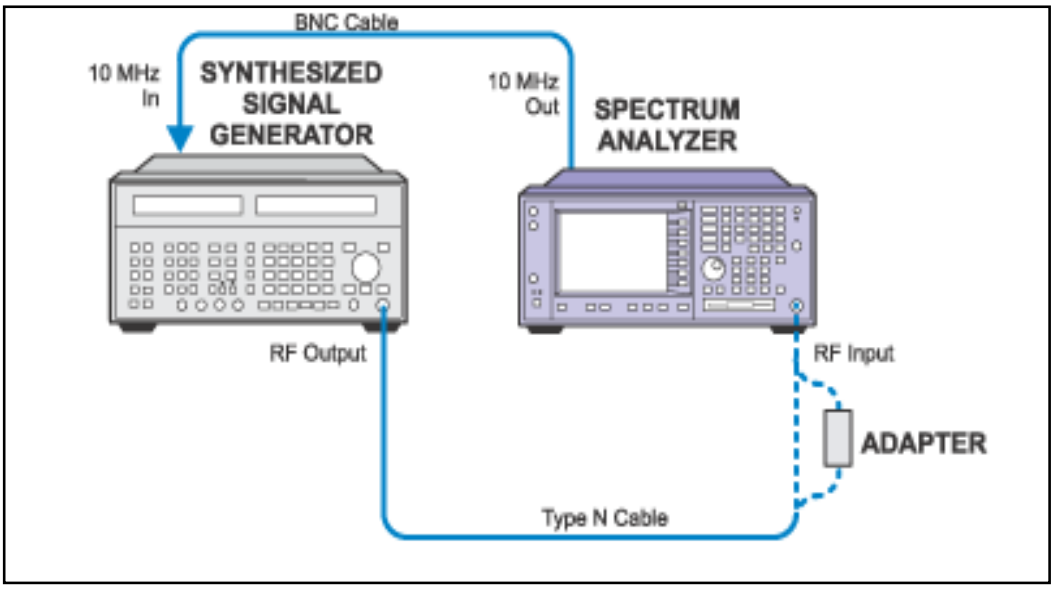
1. The Rayleigh Distribution of noise (1.05 dB).
2. The Log Response of the PSA (1.45 dB).
3. Equivalent Noise Bandwidth of the RBW filters (-.25 dB).

This test is performed in conjunction with the Noise Sidebands < 50 kHz Offsets test.

Required Test Equipment

Test Equipment	Model Number	E4440A E4443A, E4445A	E4446A E4448A
Signal Generator	8665B	X	X
BNC Cable	10503A	X	X
3.5 mm Cable	8120-4921	X	X
3.5 mm (f) to 3.5 mm (f) adapter	1250-1749	Opt BAB	
Type N (m) to 3.5 mm (f) adapter	1250-1744	X	
2.4 mm (f) to 3.5 mm (f) adapter	11901B		X

Noise Sidebands > 50 kHz Offsets Test Setup



Troubleshooting

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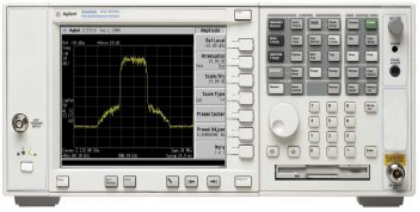


Frequency Response (Option B7J) Performance Test

NOTE: This test is to be performed on PSA analyzers with **Option B7J only**.

The PSA Option B7J is hardware which supports the Digital Comms options. An electronic attenuator is included in the option.

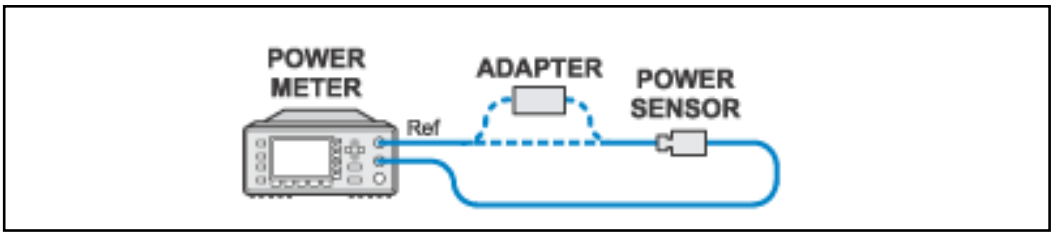
The attenuator realizes 40 dB of attenuation with 1, 2, 2, 5, 10, and 20 dB steps. The PSA Option B7J Flatness Test measures the flatness of each attenuator section relative to the reference frequency of 50 MHz. The test levels the signal source output by employing a power splitter and a power meter. Measurement uncertainties are kept to a minimum by using a reference sensor to calibrate a buried sensor. The buried sensor calibration calibrates out errors such as output tracking of the splitter.

Required Test Equipment

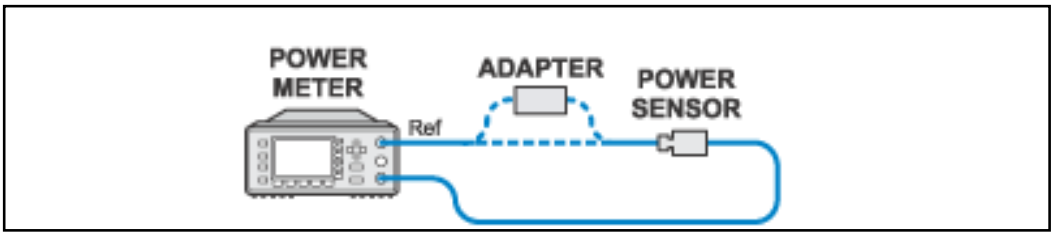
Test Equipment	Model Number	E4440A E4443A, E4445A	E4446A E4448A
Signal Generator	8665B	X	X

Power Meter	E4419A/B	X	X
Power Sensor (2 required)	8482A Option H84	X	X
Power Splitter	11667A	X	X
Type N Cable	11500C	X	X
Type N (m) to Type N (m) adapter	1250-1475	X	X
Type N (m) to 3.5 mm (f) adapter	1250-1744	X	
2.4 mm (f) to Type N (m) adapter	11903D		X

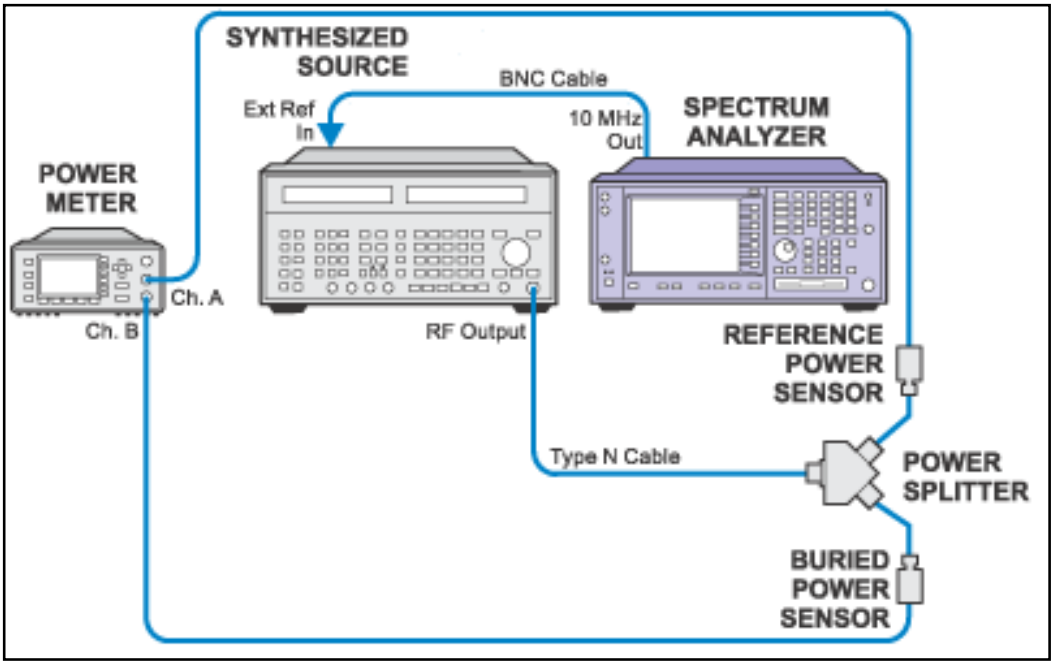
Power Meter Calibration (Channel A)



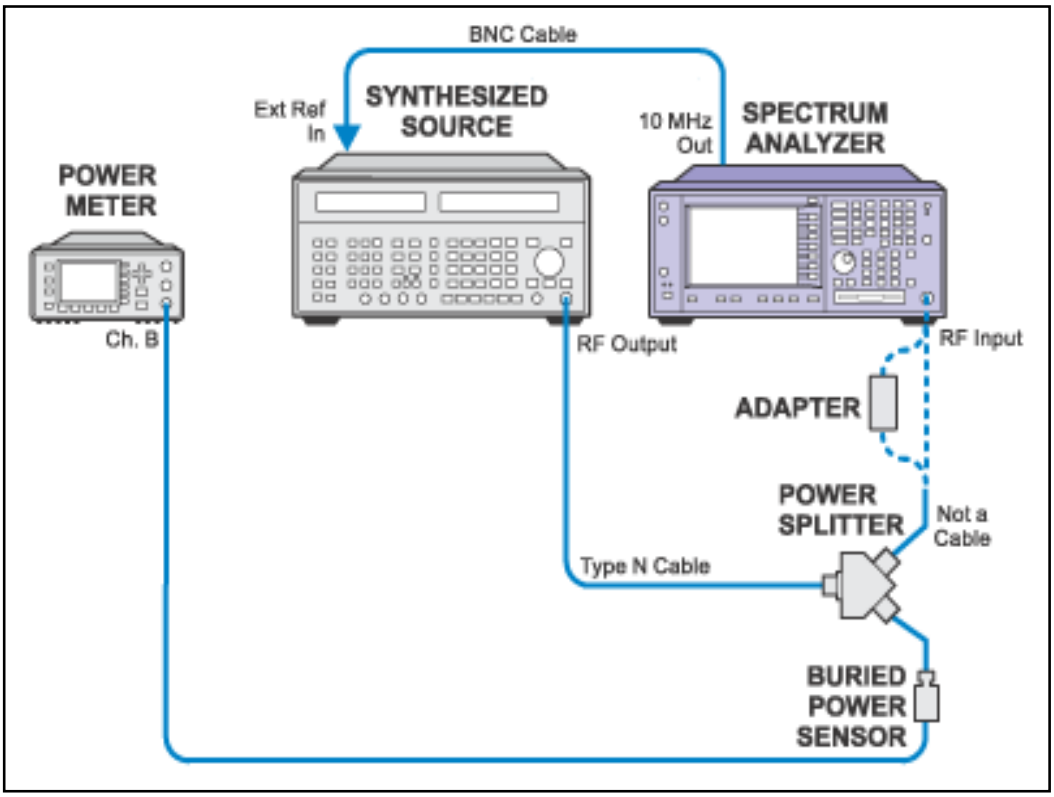
Power Meter Calibration (Channel B)



Buried Sensor Transfer Calibration



Frequency Response (Option B7J) Test Setup



Troubleshooting

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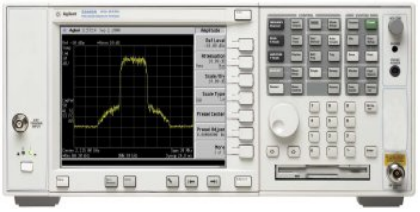


Frequency Response 300 kHz to 3 GHz Performance Test

Frequency Response (or flatness) is defined as the amplitude deviation from the reference value at 50 MHz. The complete E444XA Frequency Response is measured with three different tests;

- Frequency Response Below 300 kHz
- Frequency Response 300 kHz to 3 GHz
- Frequency Response Above 3 GHz

The Frequency Response Below 300 kHz test is used to verify flatness from 10 Hz to 300 kHz. The 300 kHz normalized error from the Frequency Response 300 kHz to 3 GHz test is used as the reference point for the Frequency Response Below 300 kHz test.

The Frequency Response Above 3 GHz test verifies flatness from 3.0 GHz up to 50 GHz, depending on your instrument frequency range.

This test measures Frequency Response 300 kHz to 3.0 GHz with the preamplifier (Option 1DS) off and on, in AC coupled mode, and with 10, 20, 30, and 40 dB of attenuation. For each test frequency, the amplitude error is normalized to 50 MHz, and the result is called Frequency Response.

This test has three sections. The first section measures the flatness from 300 kHz to 3 GHz

with the preamplifier turned off and 10 dB of RF attenuation. This section will characterize the tracking error of the 11667A power splitter in order to reduce measurement uncertainties.

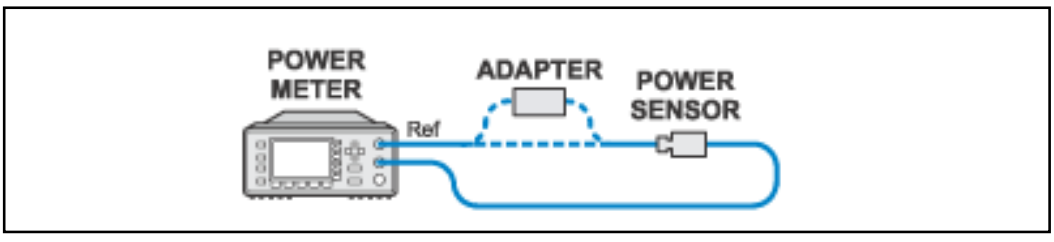
The second section measures flatness from 50 MHz to 3 GHz with 20, 30, and 40 dB of RF attenuation (preamplifier is off). This section is performed on instruments with Serial Number Prefixes greater than US4140, or MY4140. As with the first section, the splitter tracking will be characterized in an effort to reduce the measurement uncertainties.

The third section measures flatness from 300 kHz to 3 GHz with the preamplifier turned on. As with the first section, the splitter tracking will be characterized in an effort to reduce the measurement uncertainties.

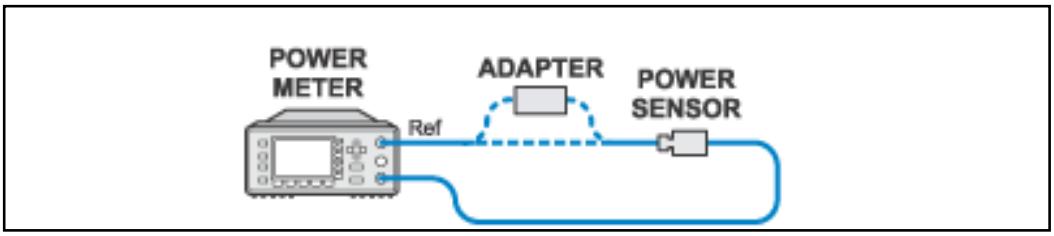
Required Test Equipment

Test Equipment	Model Number	E4440A E4443A, E4445A	E4446A E4448A
Signal Generator	8665B	X	X
Power Meter	E4419A/B	X	X
Power Sensor (2 required)	8482A Opt H84	X	X
20 dB Attenuator	8491A/B Opt 020	(Opt 1DS only)	(Opt 1DS only)
Power Splitter	11667A	X	X
Type N Cable	11500C	X	X
BNC Cable	10503A	X	X
Type N (m) to Type N (m) adapter	1250-1475	X	
Type N (m) to 3.5 mm (f) adapter	1250-1744	Opt BAB	
2.4 mm (f) to Type N (m) adapter	11903D		X

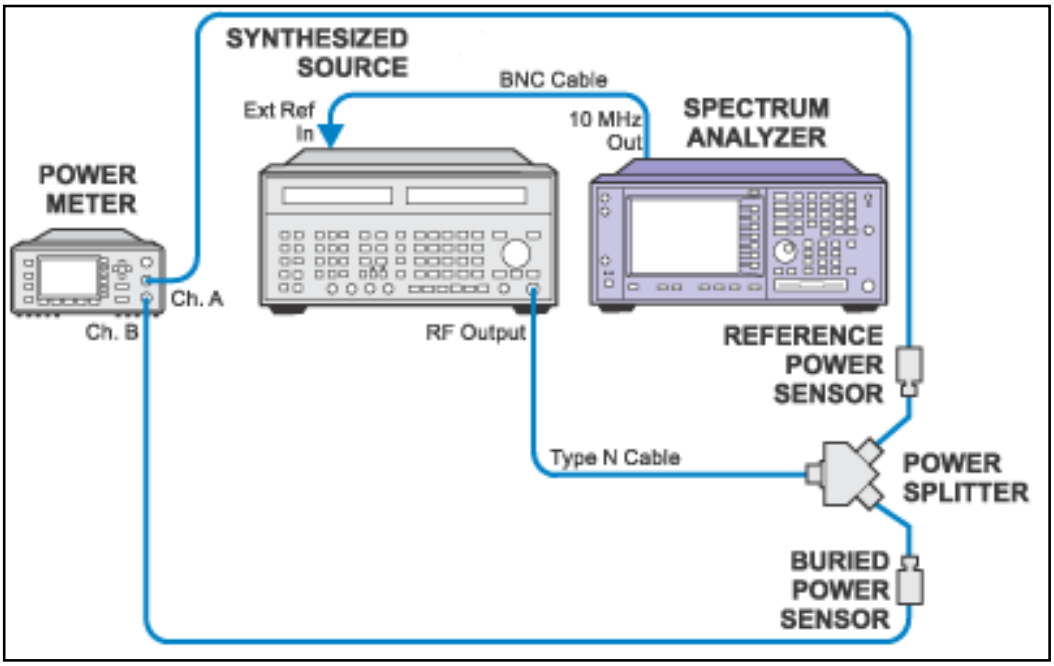
Power Meter Calibration (Channel A)



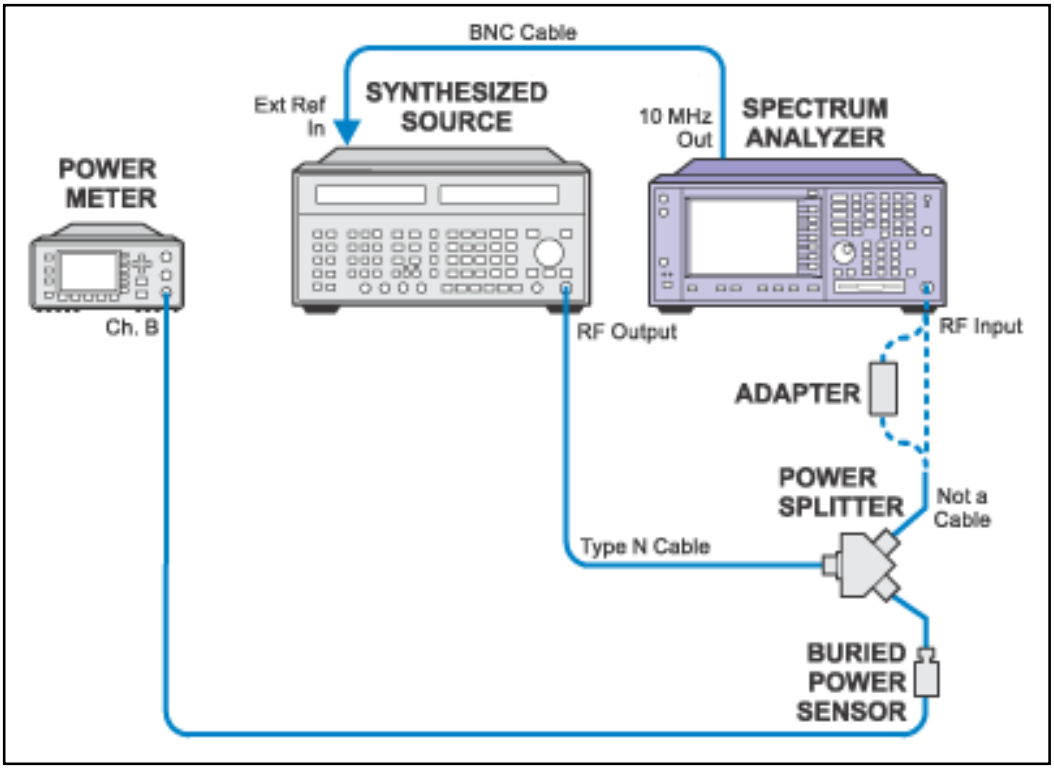
Power Meter Calibration (Channel B)



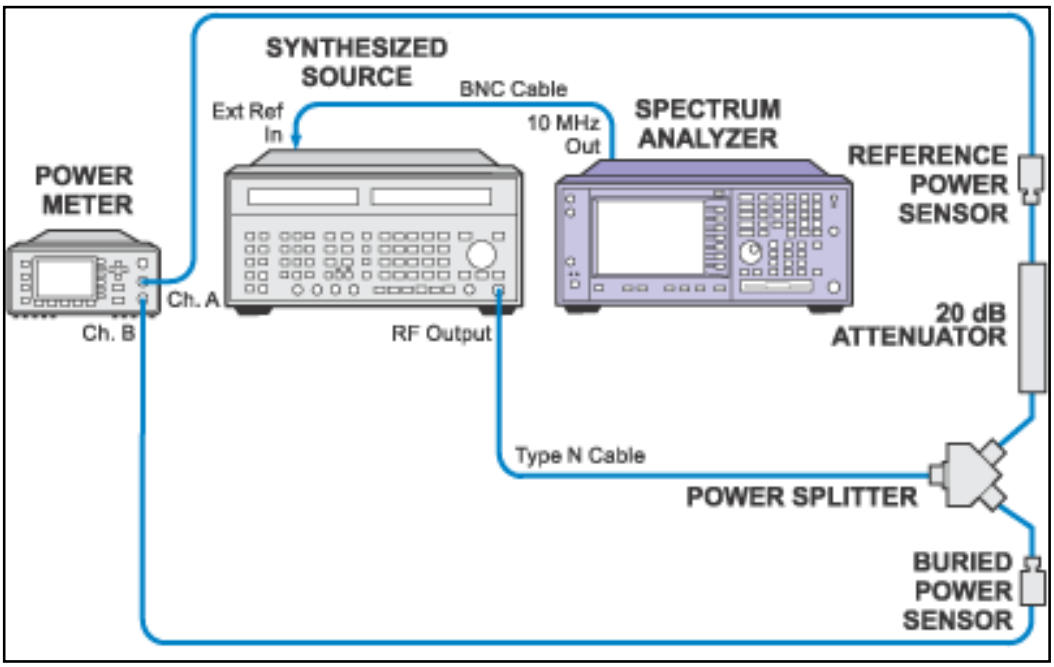
300 kHz to 3 GHz Splitter Calibration



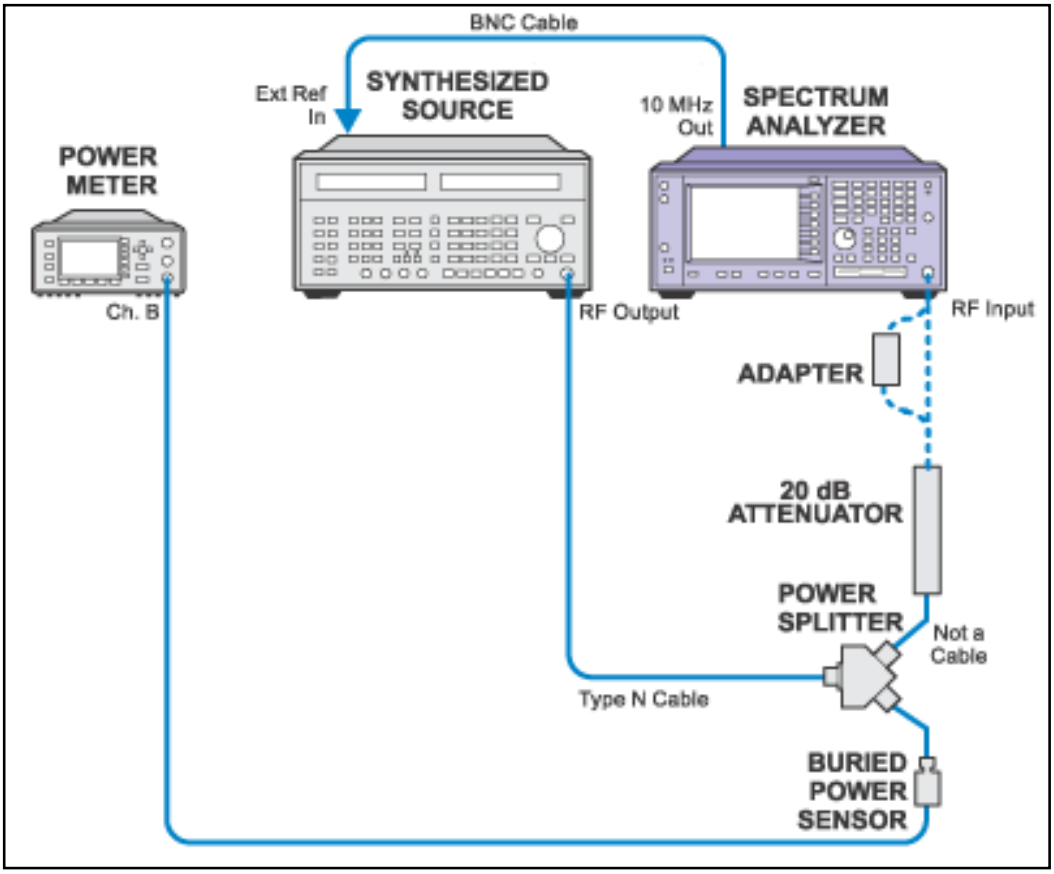
300 kHz to 3 GHz Flatness Test Setup



300 kHz to 3 GHz Splitter Calibration (Preamp on, Opt 1DS only)



300 kHz to 3 GHz Flatness Test Setup (Preamp on, Opt 1DS only)



Troubleshooting

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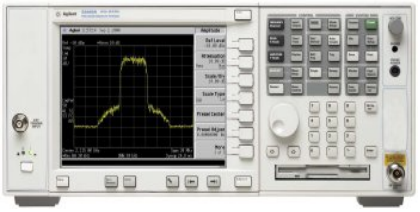


Frequency Response Above 3 GHz Performance Test

Frequency Response (or flatness) is defined as the amplitude deviation from the reference value at 50 MHz. The complete E444XA Frequency Response is measured with three different tests;

- Frequency Response Below 300 kHz
- Frequency Response 300 kHz to 3 GHz
- Frequency Response Above 3 GHz

The Frequency Response Below 300 kHz test is used to verify flatness from 10 Hz to 300 kHz. The 300 kHz normalized error from the Frequency Response 300 kHz to 3 GHz test is used as the reference point for the Frequency Response Below 300 kHz test.
The Frequency Response Above 3 GHz test verifies flatness from 3.0 GHz up to 50 GHz, depending on your instrument frequency range.

This test verifies the displayed amplitude vs. frequency over the frequency range from 3.0 GHz to 50 GHz. For each test frequency, the amplitude error is normalized to 50 MHz, and the result is called Frequency Response. Two sources, and two sets of power sensors are used to provide the needed frequency range.

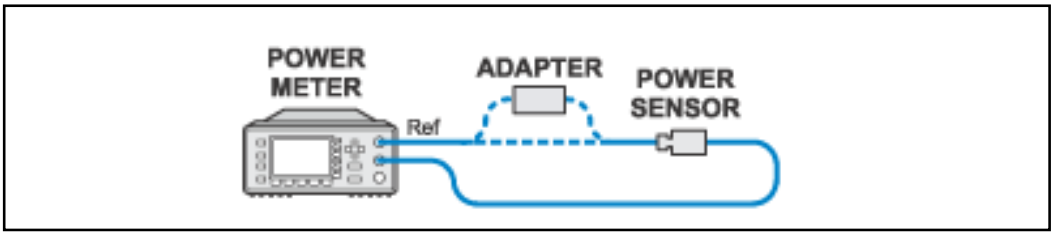
The E444XA flatness corrections are located every 100 MHz for frequencies above 3 GHz.

Above 3 GHz the flatness specification widens out such that higher uncertainties can be tolerated, therefore a splitter calibration is not necessary.

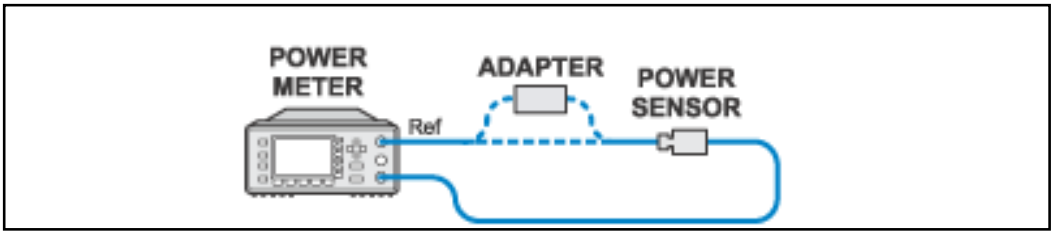
Required Test Equipment

Test Equipment	Model Number	E4440A E4443A, E4445A	E4446A E4448A
Synthesized Sweeper	83630A/B 83640A/B, 83650A/B	X	
Synthesized Sweeper	83640A/B, 83650A/B		X
Power Meter	E4419A/B	X	X
Power Sensor	8485A	X	
Power Sensor	8487A		X
Power Splitter	11667B	X	
Power Splitter	11667C		X
3.5 mm Cable	8120-4921	X	
BNC Cable	10503A	X	X
2.4 mm Cable	8120-6164		X
2.4 mm (f) to 3.5 mm (f) adapter	11901B	X	
Type N (m) to 3.5 mm (m) adapter	1250-1743	X	
3.5 mm (f) to 3.5 mm (f) adapter	83059B	X	
Type N (m) to 2.4 mm (f) adapter	11903D		X

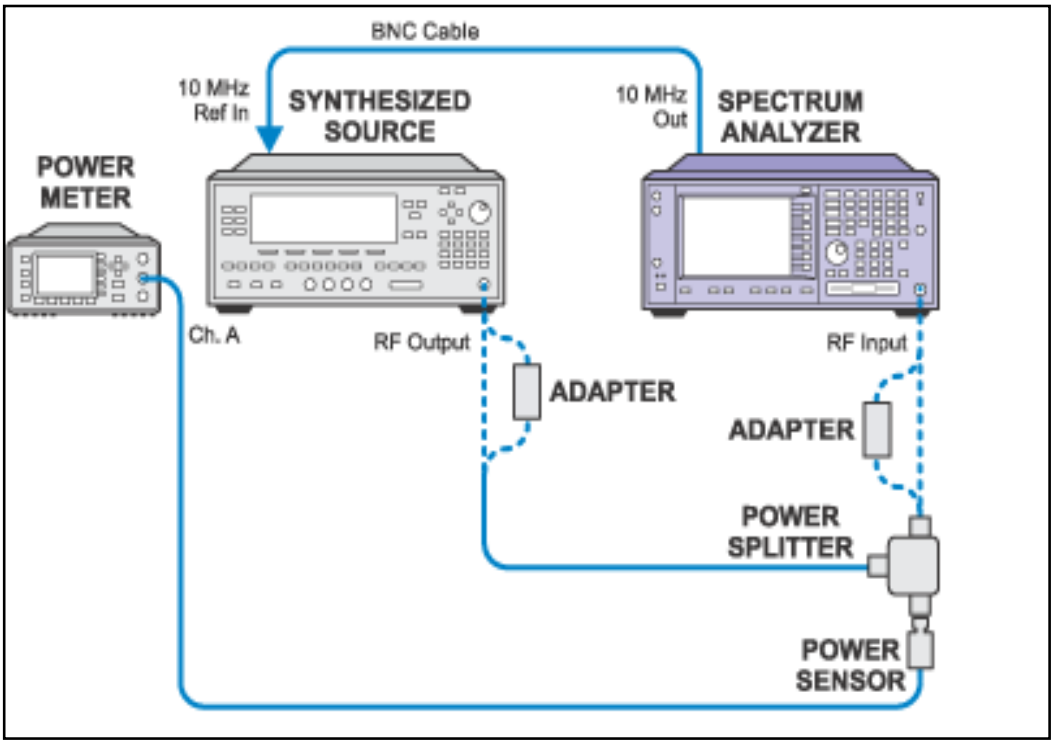
Power Meter Calibration (Channel A)



Power Meter Calibration (Channel B)



Frequency Response Above 3 GHz Test Setup



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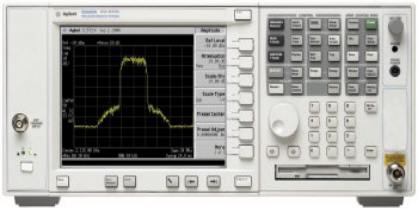


Frequency Response Below 300 kHz Performance Test

NOTE: The test **Frequency Response 300 kHz to 3 GHz** must be performed before performing this test.

Frequency Response (or flatness) is defined as the amplitude deviation from the reference value at 50 MHz. The complete E444XA Frequency Response is measured with three different tests;

- Frequency Response Below 300 kHz
- Frequency Response 300 kHz to 3 GHz
- Frequency Response Above 3 GHz

The Frequency Response Below 300 kHz test is used to verify flatness from 10 Hz to 300 kHz. The 300 kHz normalized error from the Frequency Response 300 kHz to 3 GHz test is used as the reference point for the Frequency Response Below 300 kHz test.
The Frequency Response Above 3 GHz test verifies flatness from 3.0 GHz up to 50 GHz, depending on your instrument frequency range.

This test measures the E444XA flatness over the frequency range from 10 Hz to 300 kHz,

relative to the amplitude at 300 kHz. This relative flatness is converted to an absolute flatness by adding the 300 kHz flatness error from the Frequency Response (300 kHz to 3 GHz) test.

A function generator, and a multimeter are used in the test. The function generator and DVM provide an accurate, flat CW level of 0.0707 V (RMS) (-10 dBm into 50 ohms) to the E444XA. This is the same input level that is used in the 300 kHz to 3 GHz test.

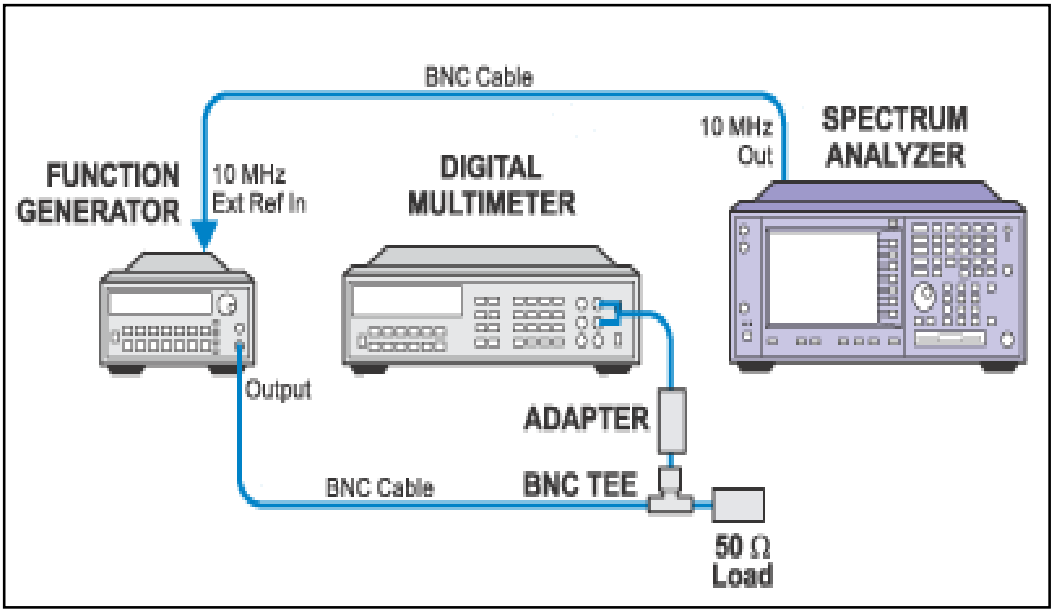
The E444XA measures the amplitude of the signal in dBm. Flatness (frequency response) is defined as the difference between the multimeter reading and the E444XA reading in dB.

The E444XA has three flatness correction points below 300 kHz. The correction points are 9 kHz, 50 kHz, and 200 kHz. The firmware applies the 9 kHz Flatness Correction as an offset to all points below 9 kHz.

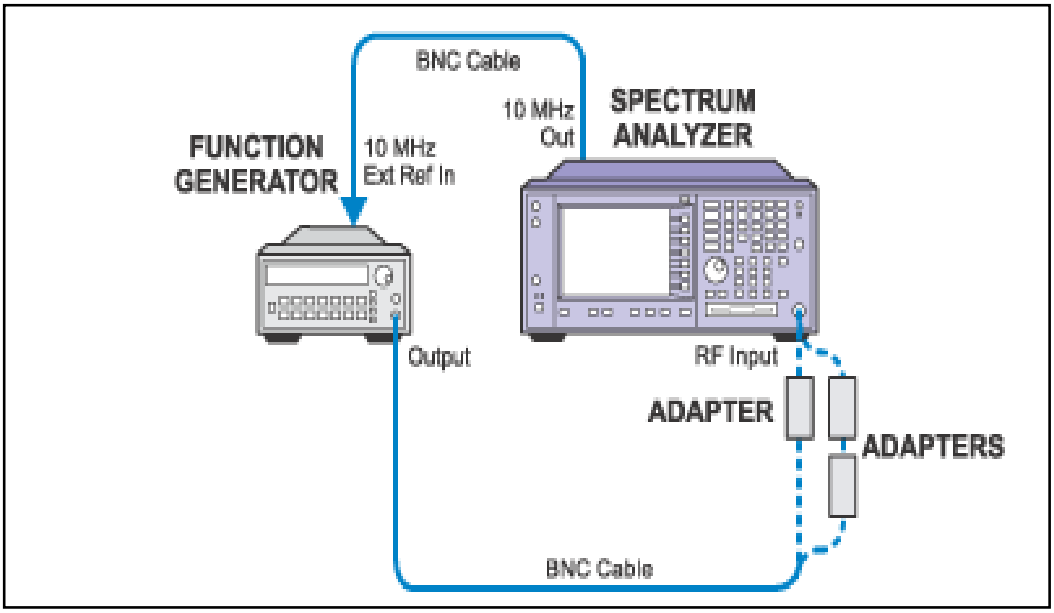
Required Test Equipment

Test Equipment	Model Number	E4440A E4443A, E4445A	E4446A E4448A
Function Generator	33120A	X	X
Multimeter	3458A	X	X
BNC Cable (2 required)	10503A	X	X
Type N (m) to BNC (f) adapter	1250-1476	X	X
BNC (f) to dual banana adapter	1251-2277	X	X
BNC Tee	1250-0781	X	X
Type N (f) to 3.5 mm (f) adapter	1250-1745	(Option BAB)	
Type N (f) to 2.4mm (f) adapter	11903B		X
BNC 50 ohm termination	1250-0207	X	X

Frequency Response Below 300 kHz System Calibration



Frequency Response Below 300 kHz Test Setup



Troubleshooting

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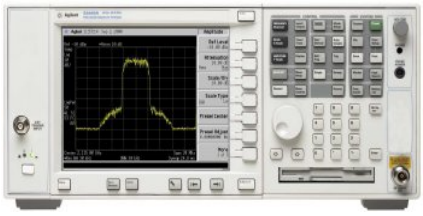

Memory Initialization Utilities

The PSA Memory Initialization Utilities encompass two functions. One utility resets the statistics (attenuator actuations, 50 MHz calibrator actuations, temperature ranges, hours of operation, etc.). The other writes the latest default calibration constants into the memory of a particular board assembly. This is needed since one part number board assembly is used in several model numbers, and certain model numbers require different default calibration constants.

Utilities are selected the same way as performance tests and adjustments.

Utility 1: Modification of Hardware Statistical Data

Utility 1 resets the statistical data (attenuator actuations, 50 MHz calibrator switches, hours of operation, etc.) on the A12 assembly. This statistical information is viewed on the analyzer screen when you press: **System**, **More**, **Show System**. It is to be used to reset one of the fields for troubleshooting, or due to an assembly replacement. For example, the number of preamplifier switch actuations will need to be reset to zero if the preamplifier is replaced.

When used: After replacing either of the attenuators or the preamp, or if you want to reset the temperature extremes the instrument encounters or the auto align Off time.

The utility will:

- Reset mechanical attenuator actuations when either the A14 or A15 Input Attenuators are replaced.
- Reset 50 MHz switch actuations when the A14 Input Attenuator is replaced.
- Reset AC/DC switch actuations when the A14 Input Attenuator is replaced.
- Reset Preamp switch actuations when the A22 Preamp is replaced.
- Reset the temperature extremes. You may wish to reset this counter when troubleshooting temperature related problems.
- Reset the Auto Align OFF time. You can turn the Auto align function off so an auto align will not occur during a critical test. This counter keeps track of the time in hours that auto align is turned off. Being able to reset this allows you to restart the clock if you wish.
- Reset Overload Events. You may wish to reset this when troubleshooting input power related problems.

Utility 2: Calibration Constant Memory Initialization

Utility 2 supports four board assemblies that can be configured via memory initialization to work in a particular instrument model. Eight variations are needed to initialize the memory on the current instruments.

The 3rd Converter, Analog IF, and LO/Synthesizer assemblies need to be configured either for the E4440A/E4443A/E4445A or for the E4446A/E4448A.

The Front End Driver assembly needs to be configured differently for either the E4446A or E4448A.

When used: After replacing the following board assemblies.

- A8 Analog IF
- A10 3rd Converter
- A12A1 Synthesizer Board or entire A12 Synthesizer Assembly
- A13 Front End Driver (E4446A or E4448A)

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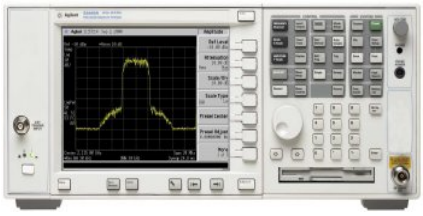
PSA Series Spectrum Analyzers
Test and Adjustment Software



PSA Series Adjustments

The following adjustments can be performed on the PSA series spectrum analyzers. These procedures are designed to reset various circuit parameters or recalculate correction values associated with some measurements. 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.

1. Lowband Mixer Bias Adjustment
2. SLODA Adjustment (E4440A, E4443A, E4445A)
3. FELOMA Adjustment (E4446A, E4448A)
4. Second LO Power Adjustment
5. Analog IF Input Detector Adjustment
6. Attenuator Slope Adjustment
7. 50 MHz Calibrator Amplitude Adjustment
8. Overload Detector DAC Adjustment
9. 10 MHz Internal Frequency Reference Adjustment
10. YTF Alignment Adjustment
11. Frequency Response Adjustment

12. Frequency Response Adjustment (Option B7J)

Memory Initialization Utilities

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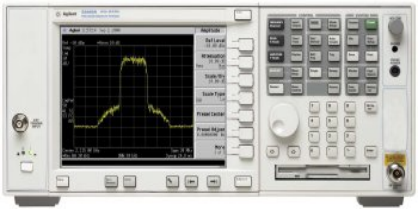
PSA Series Spectrum Analyzers
Test and Adjustment Software



Lowband Mixer Bias Adjustment

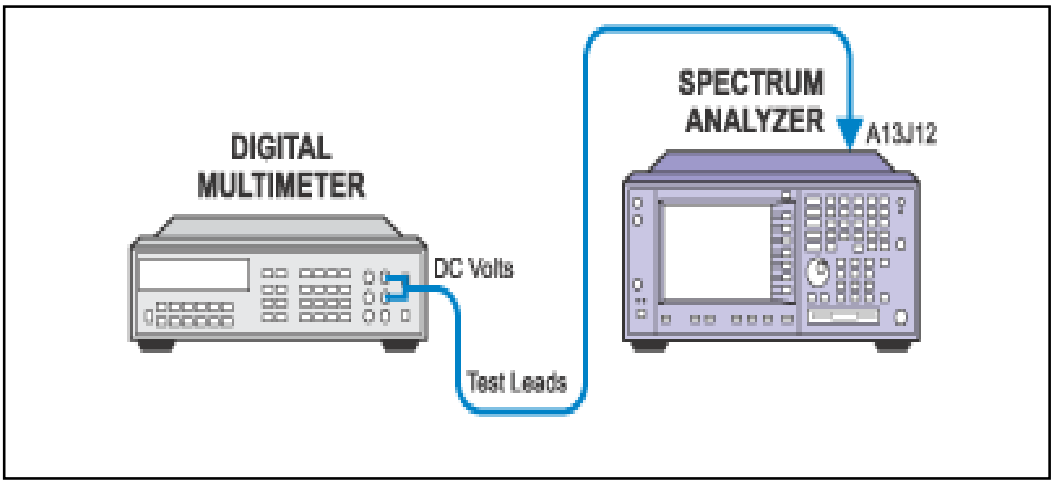
The bias currents for the A20 Lowband (1st and 2nd mixer) internal amplifiers are adjusted. These are for the 1st mixer LO amplifier and IF amplifier, and for the 2nd mixer LO amplifier. The currents are set by measuring voltage differences across 1 ohm sense resistors. Voltages are monitored on test points on the A13 Front End Driver with a DVM and are adjusted by supplying data to DACs on A13. The test points are accessible via a header on the top of A13, so placing A13 on an extender is not necessary. The instrument cover and top shield must be removed, however.

This adjustment should be performed after replacing the A20 and/or A13 assemblies.

Required Test Equipment

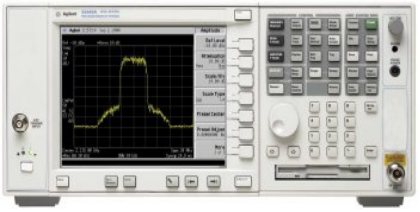
Test Equipment	Model Number	E4440A E4443A, E4445A	E4446A E4448A
Digital Voltmeter	3458A	X	X
E4440-60041	Bias Adjustment Board	X	X
DC Probe	11002A, 11003A	X	X

Lowband Mixer Bias Adjustment Setup


DIGITAL
MULTIMETER
DC Volts
Test Leads
SPECTRUM
ANALYZER
A13J12

Agilent Technologies

Agilent Technologies
PSA Series Spectrum Analyzers
Test and Adjustment Software



Switched LO Distribution Amplifier (SLODA) Adjustment (E4440A, E4443A, E4445A)

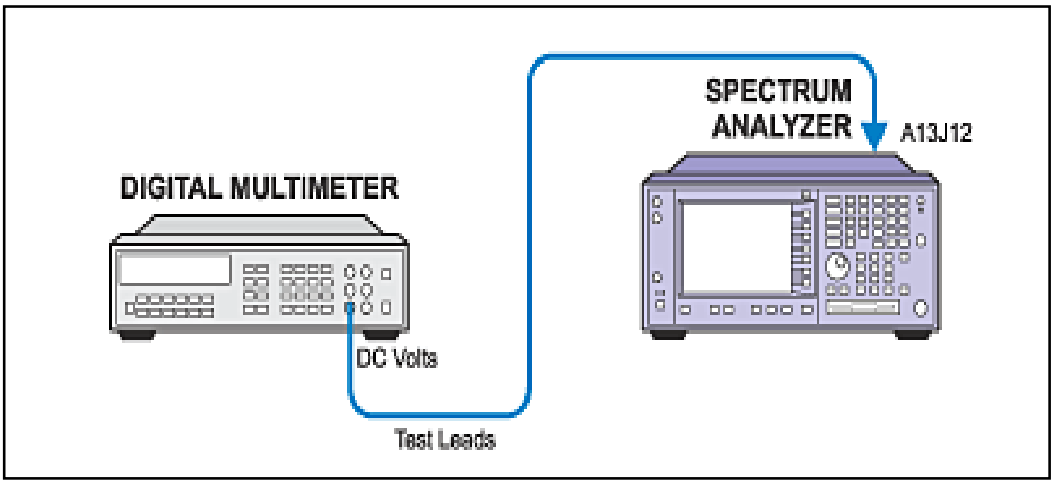
The Switched LO Distribution Amplifier (SLODA) requires six ALC bias voltages and one gate bias. The voltages for each of these biases are printed on the SLODA label. These voltages can be read with a DVM on the test connector on the Front End Driver, A13J12. The computer sends commands to the PSA to set the appropriate latch and bias DAC, and the DVM is used to verify that the proper bias voltages are present.

This adjustment should be performed after replacing the A21 or A13 assemblies.

Required Test Equipment

Test Equipment	Model Number
Digital Voltmeter	3458A
E4440-60041	Bias Adjustment Board
DC Probe	11002A, 11003A

SLODA Adjustment Setup



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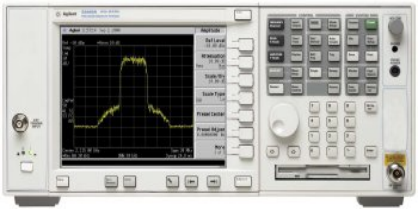


Frequency Extended Local Oscillator Multiplier Amplifier (FELOMA) Adjustment (E4446A, E4448A)

The Frequency Extended Local Oscillator Multiplier Amplifier (FELOMA) provides amplitude leveling and distribution of the first LO (3 to 7 GHz) to the Lowband assembly, RYTHM, SBTX, and the LO Synthesizer assembly. There are three ALC loops in the FELOMA. The main input ALC loop can have its sense voltage come from either the RYTHM/Lowband path or the Front Panel External LO out path. The 2nd ALC loop is used to level the power going into the sampler. The 3rd ALC loop is for the SBTX output. The SBTX output frequency is twice that of the LO.

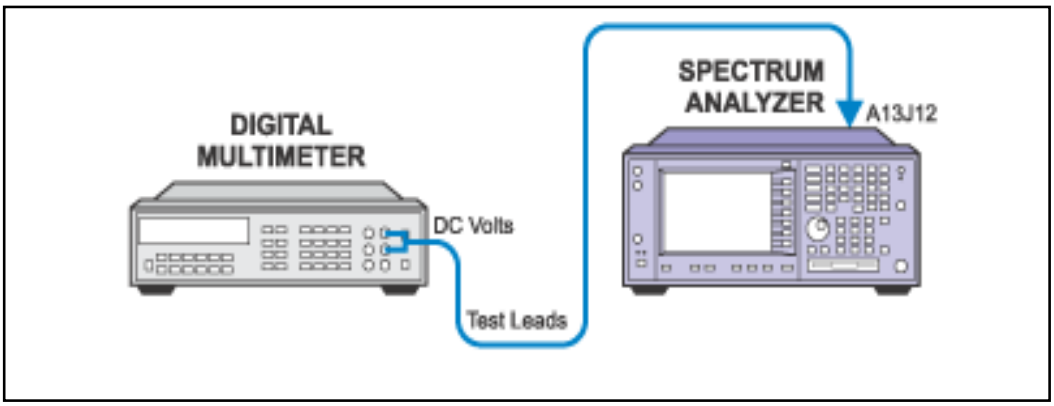
The FELOMA requires eleven level adjustments and four bias adjustments. The voltages for each of these adjustments are printed on the FELOMA level. The voltages are measured with a DVM which is connected to a board attached to the Front End Driver A13J12 connector.

This adjustment should be performed after replacing the A21 or A13 assemblies.

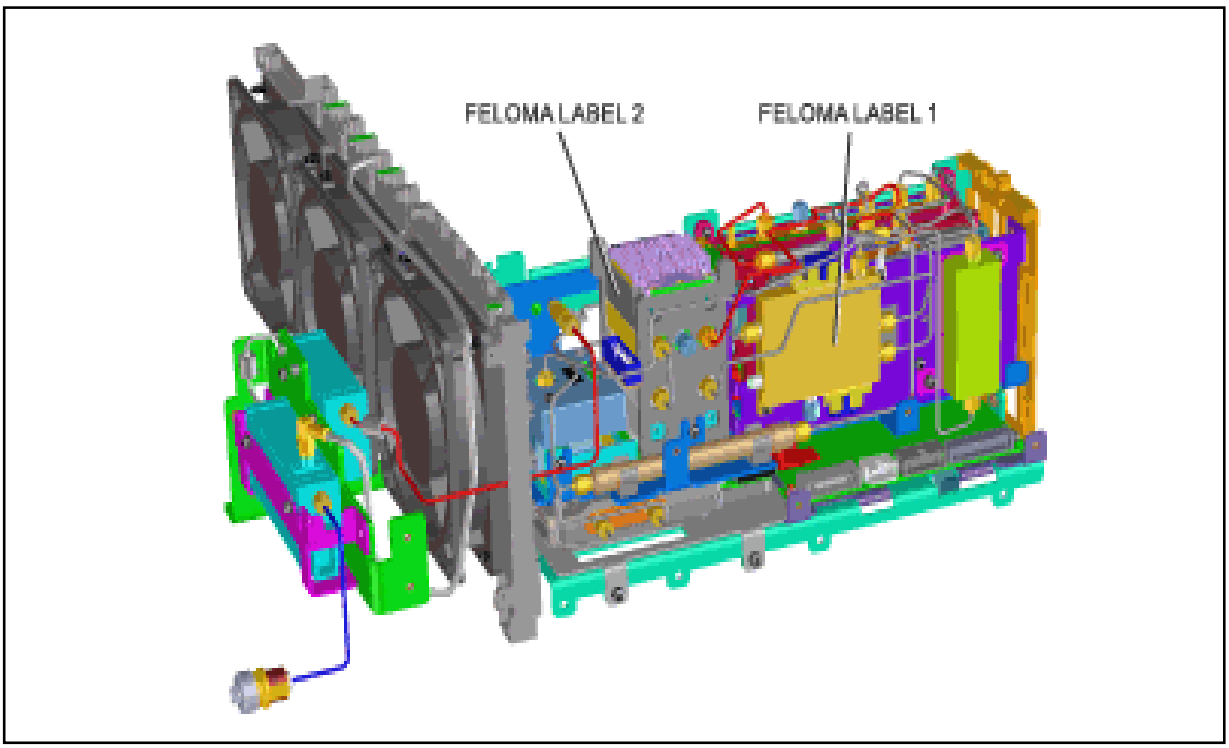
Required Test Equipment

Test Equipment	Model Number
Digital Voltmeter	3458A
E4440-60041	Bias Adjustment Board

FELOMA Adjustment Setup



FELOMA Label Locations



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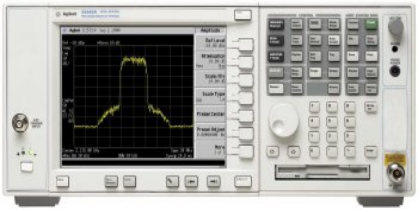


Second LO Power Adjustment

The 3.6 GHz 2nd LO Power is measured with a power meter at the A20 Lowband 2nd LO Test Port, A20J6. The power is controlled by a DAC on the A13 Front End Driver. The computer reads the power and adjusts the DAC for the proper level. The instrument cover and top shield must be removed to access the LO Test Port, but it is not necessary to put PC assemblies on extenders.

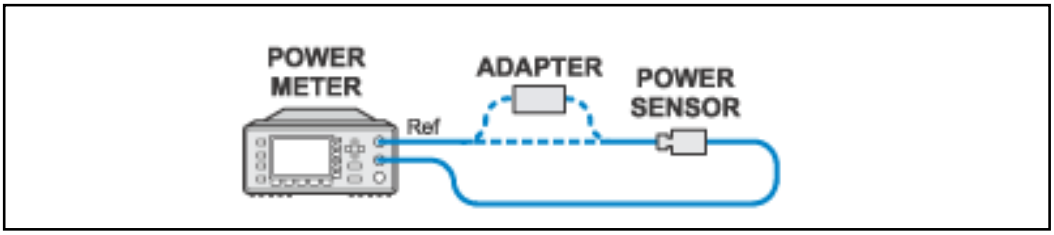
The instrument internally reads the power level with a detector and ADC. This is done to keep the power level constant with changing temperature. The adjustment stores a value in the FE Driver EEROM used to calibrate the ADC so that the value corresponds to the proper power level. The 2nd LO Power needs to be adjusted from a conservatively low level, and then gradually increased to the proper level in order to avoid saturating the 2nd LO amplifiers.

This adjustment should be performed after replacing the A20 and/or A13 assemblies.

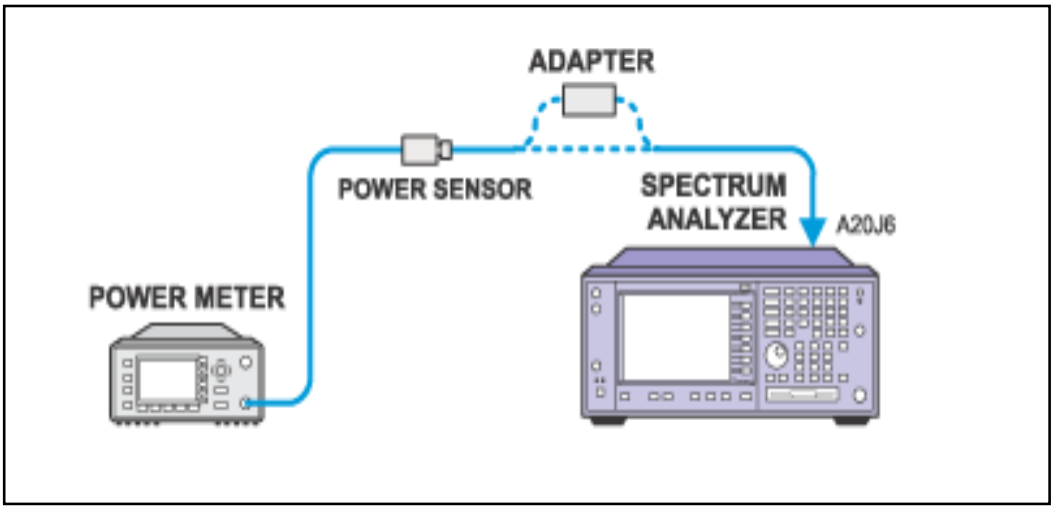
Required Test Equipment

Test Equipment	Model Number	E4440A E4443A, E4445A	E4446A E4448A
Power Meter	E4419A/B	X	X
Power Sensor	8481A	X	X
Type N (f) to 3.5 mm (m) adapter	1250-1750	X	X

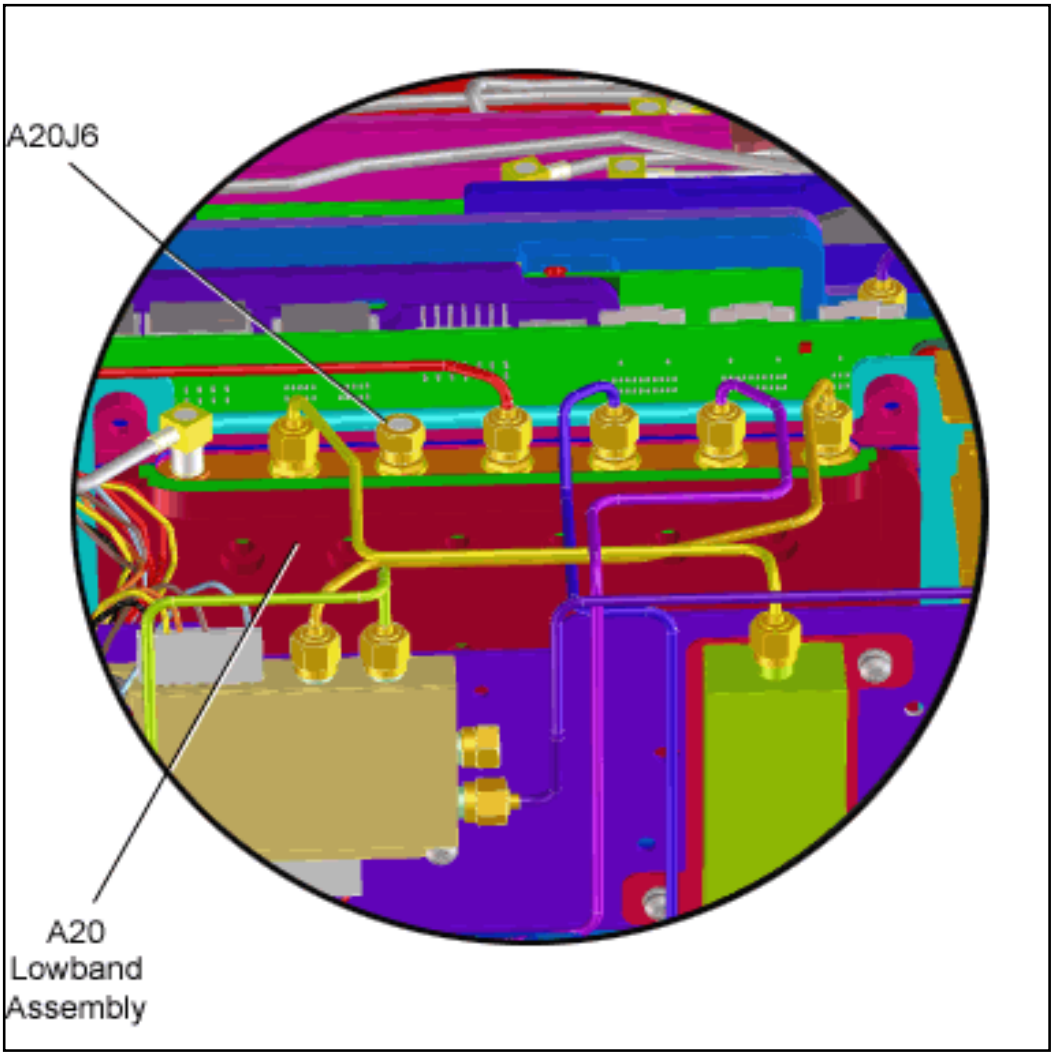
Power Meter Calibration



Second LO Power Adjustment Setup



A20J5


A20J6
A20
Lowband
Assembly

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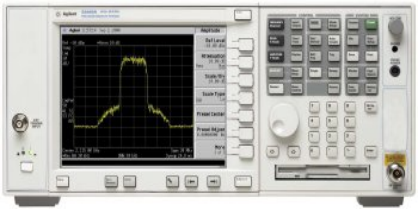
Test and Adjustment Software



Analog IF Input Detector Adjustment

The adjustment determines the power detected by the A8 Analog IF (AIF) input power detector under known conditions. The detector gives a DC level which corresponds to this power. An ADC converts this DC level to a digital value which is then stored in the A8 EEPROM.

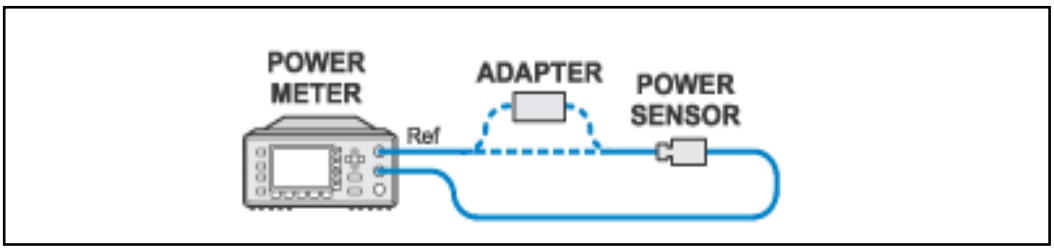
The 321.4 MHz calibrator on the A10 Third Converter is used to provide a stable -7 dBm, 21.4 MHz signal to the A8 input. A power meter is used to measure this signal at A10J5 to accurately set its power level.

This adjustment should be performed after replacing the A8 assembly.

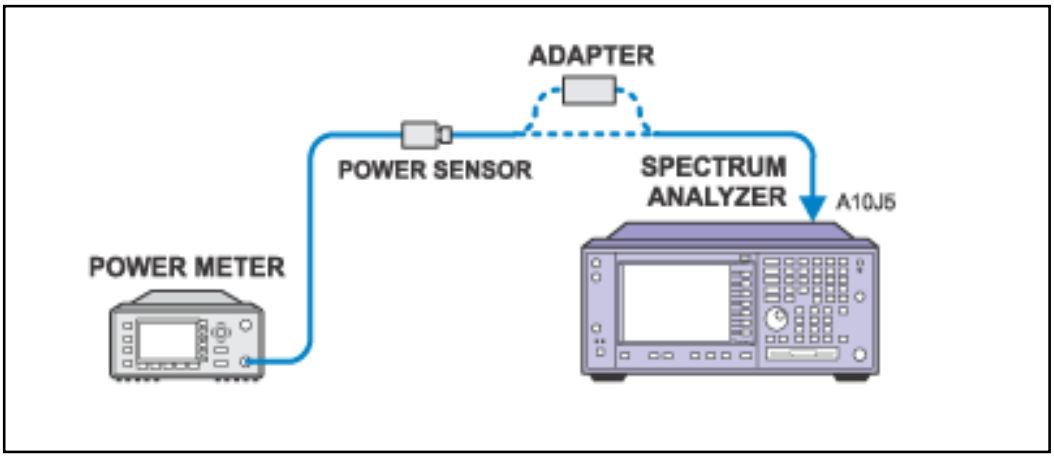
Required Test Equipment

Test Equipment	Model Number	E4440A E4443A, E4445A	E4446A E4448A
Power Meter	E4419A/B	X	X
Power Sensor	8481A	X	X
Type N (f) to BNC (m) adapter	1250-1477, 1250-0077	X	X
SMB (f) to BNC (f) adapter	1250-1236	X	X

Power Meter Calibration



Analog IF Input Detector Adjustment Setup



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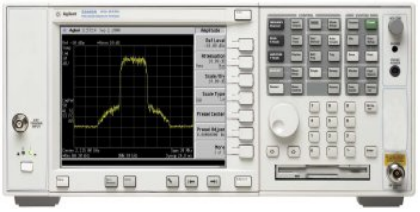


Attenuator Slope Adjustment

The slopes for each attenuator setting in DC Coupled mode, and in the 10 dB AC Coupled mode, are calculated and are stored in an array in EEROM on the A13 Front End Driver assembly. The test is performed at 50 MHz, 2.8 GHz, 6 GHz, 10 GHz, 15 GHz, and 20 GHz for the E4440A, up through 10 GHz for E4445A, up through 6 GHz for E4443A, and up through 40 GHz for E4446A/E4448A. At each test frequency, source power level is set so that the power meter reads -10 dBm with the PSA set at 10 dB, DC Coupled attenuation. This value is then used as the reference for the other attenuator states at that frequency.

Instrument covers do not need to be removed for this adjustment. Also, this adjustment must only be performed if the PSA has valid flatness correction data.

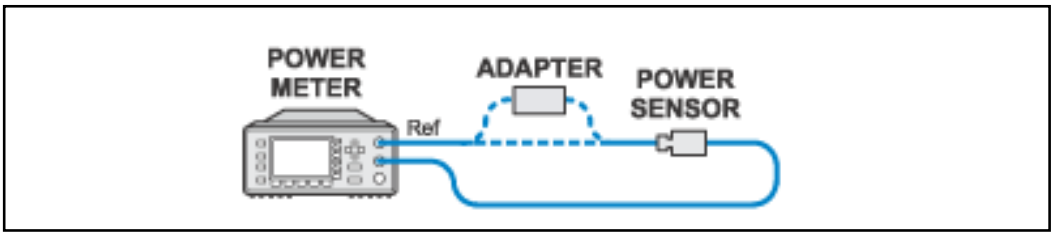
This adjustment should be performed after replacing the A13 Front End Driver, or after replacing the A14 and/or A15 step attenuators.

Required Test Equipment

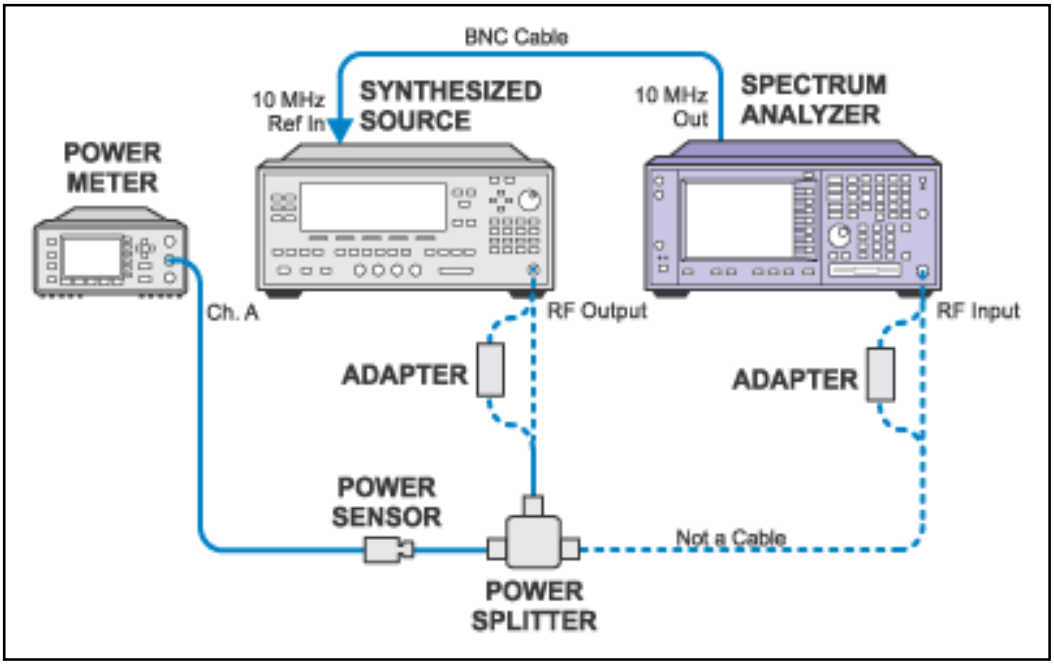
Test Equipment	Model Number	E4440A E4443A, E4445A	E4446A E4448A

Synthesized Sweeper	83630A/B 83640A/B, 83650A/B	X	
Synthesized Sweeper	83640A/B, 83650A/B		X
Power Meter	E4419A/B	X	X
Power Sensor	8485A	X	
Power Sensor	8487A		X
Power Splitter	11667C		X
Power Splitter	11667B	X	
BNC Cable	10503A	X	X
2.4 mm Cable	8120-6164		X
3.5 mm Cable	8120-4921	X	
3.5 mm (f) to 3.5 mm (f) adapter	83059B	X	
Type N (m) to 3.5 mm (m) adapter	1250-1743	X	
2.4 mm (f) to 3.5 mm (f) adapter	11901B	X	
2.4 mm (f) to Type N (m) adapter	11903D		X

Power Meter Calibration



Attenuator Slope Adjustment Setup


BNC Cable
10 MHz
Ref In
SYNTHESIZED
SOURCE
10 MHz
Out
SPECTRUM
ANALYZER
POWER
METER
Ch. A
RF Output
RF Input
ADAPTER
ADAPTER
POWER
SENSOR
Not a Cable
POWER
SPLITTER

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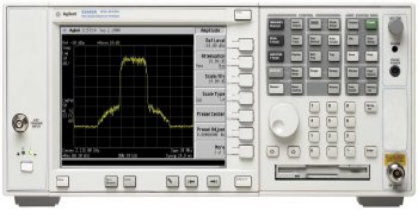


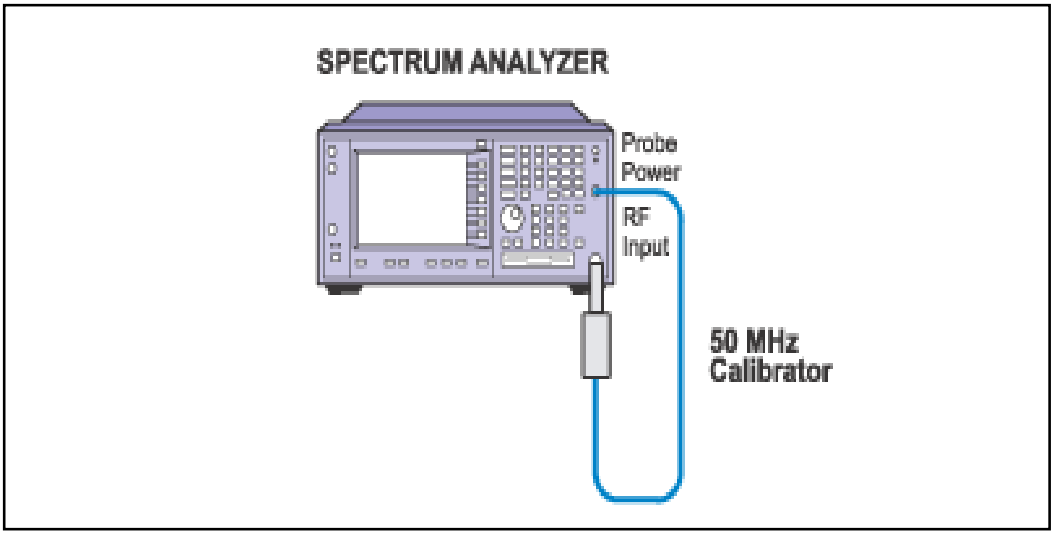
50 MHz Calibrator Amplitude Adjustment

An RF substitution method is made using the 50 MHz, -25 dBm calibrator Z5602A. The level of the calibrator is read by the PSA and then the PSA's internal 50 MHz calibrator is measured. The difference is stored in memory as a correction.

Required Test Equipment

Test Equipment	Model Number	E4440A E4443A, E4445A	E4446A E4448A
50 MHz Calibrator	Z5602A 0ption 51 (Opt H35 for BAB Opt H24 for E4446A, E4448A)	X	X

50 MHz Calibrator Amplitude Adjustment Setup


SPECTRUM ANALYZER
Probe Power
RF Input
50 MHz Calibrator

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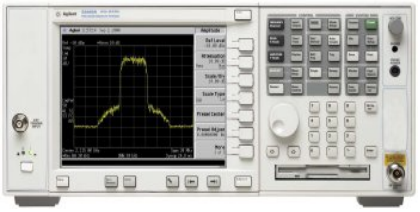


Overload Detector DAC Adjustment

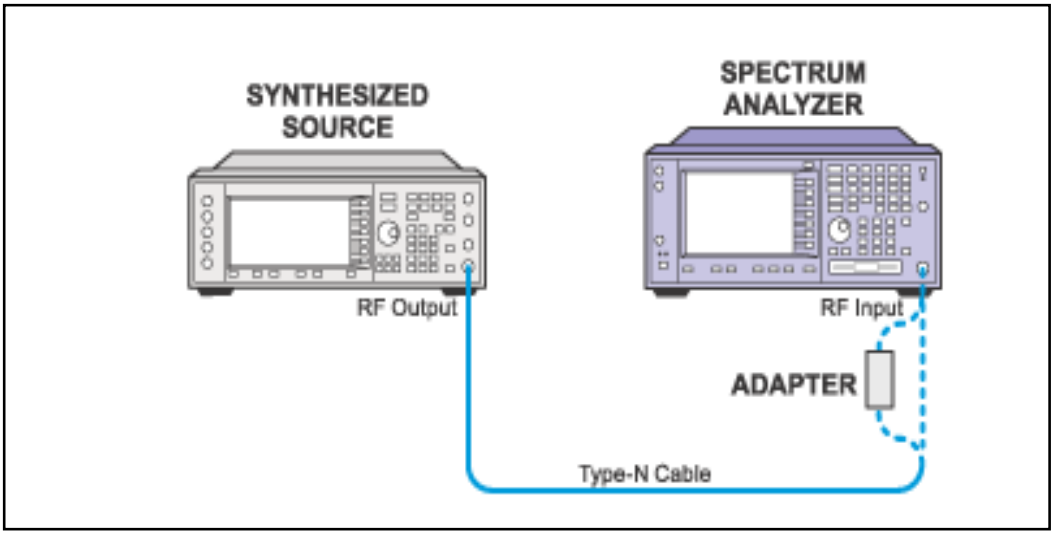
The overload detector is in the first IF in the A20 Low Band. It is used as a warning when a high input level outside the viewing span is compressing the first mixer. It can also be used as a diagnostic tool.

This adjustment should be performed after replacing the A20 assembly.

Required Test Equipment

Test Equipment	Model Number	E4440A E4443A, E4445A	E4446A E4448A
Signal Generator	E4433B	X	X
Type N Cable	11500C	X	X
Type N (f) to 3.5 mm (f) adapter	1250-1745	Opt BAB	
2.4 mm (f) to Type N (f) adapter	11903B		X

Overload Detector DAC Adjustment Setup


SYNTHESIZED SOURCE
SPECTRUM ANALYZER
RF Output
RF Input
ADAPTER
Type-N Cable

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PSA Series Spectrum Analyzers
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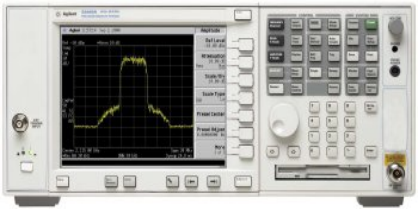


10 MHz Internal Frequency Reference Adjustment

This procedure adjusts the 10 MHz internal frequency reference within minimal variance. This adjustment is generally done after the results from the Internal Frequency Reference Performance Test indicate that it is time for an adjustment. In this test the signal from a 10 MHz frequency standard is inserted into the RF input of the PSA. The instrument's internal timebase is then adjusted by programming its DAC and doing a marker count on the displayed signal.

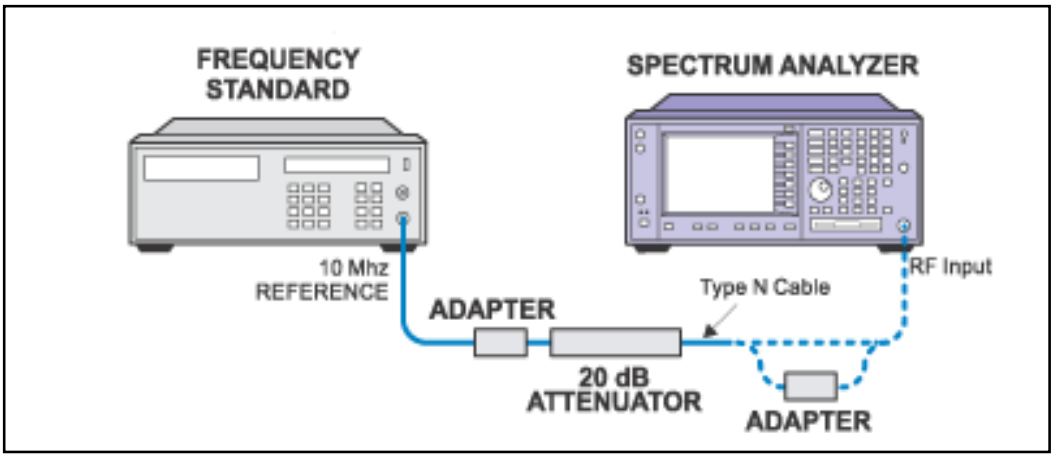
The specification for the 10 MHz reference accuracy is ± [(Time Since Last Adjustment x $1x10^{-7}$) + (Temperature Stability) + (Achievable Initial Calibration Accuracy)]. With this adjustment the first term is zero. At 20° to 30° C the rest of the specification comes to ±0.8 Hz. The objective of this procedure is to bring the reference to within 0.1 Hz of 10 MHz.

Note: A minimum warm-up time of 24 hours is required for minimal frequency reference drift.

Required Test Equipment

Test Equipment	Model Number	E4440A E4443A, E4445A	E4446A E4448A
Frequency Standard	5071A	X	X
20 dB Fixed Attenuator	8491A/ Option 020	X	X
Type N Cable	11500C	X	X
Type N (f) to BNC (m) adapter	1250-1477, 1250-0077	X	X
Type N (f) to 3.5 mm (f) adapter	1250-1745	Opt BAB	
2.4 mm (f) to Type N (f) adapter	11903B		X

10 MHz Internal Frequency Reference Adjustment Setup



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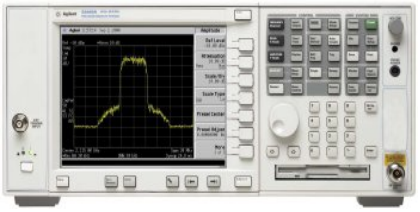


YTF Alignment (RYTHM and SBTX)

The instrument firmware tunes the YTF (Yig Tunable Filter) via a DAC. The relationship between DAC value and tuned center frequency follows a 3rd order polynomial curve. The non-linearity of this curve is enough to offset the center frequency of this filter by several tens of MHz. This alignment calculates the coefficients of the 3rd order polynomial.

The RYTHM YTF tunable range (2.85 GHz to 26.5GHz) is split into two different regions:
Band 1-2-3 (2.85 GHz to 19.2 GHz) and Band 4 (18.7 GHz to 26.5 GHz).

The SBTX YTF frequency range is separated into band 5 (26.4 GHz to 31.15 GHz) and band 6 (31 GHz to 50 GHz).

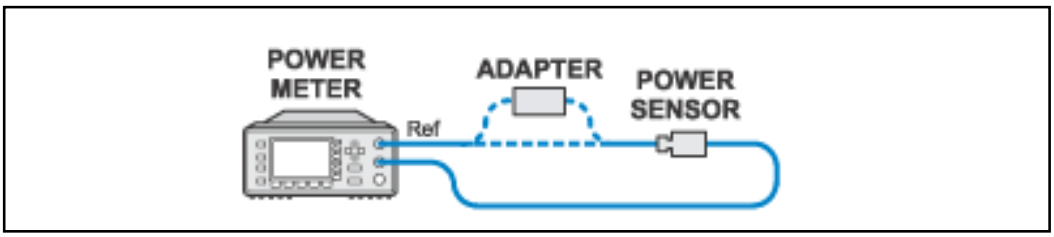
For each freq:

- The DUT is tuned to the desired Cal Freq.
- The YTF center freq is found using a SW controlled preselector center routine.
- The YTF center amplitude is found during the fine adjust.
- The associated Start Tune Dac number is found.

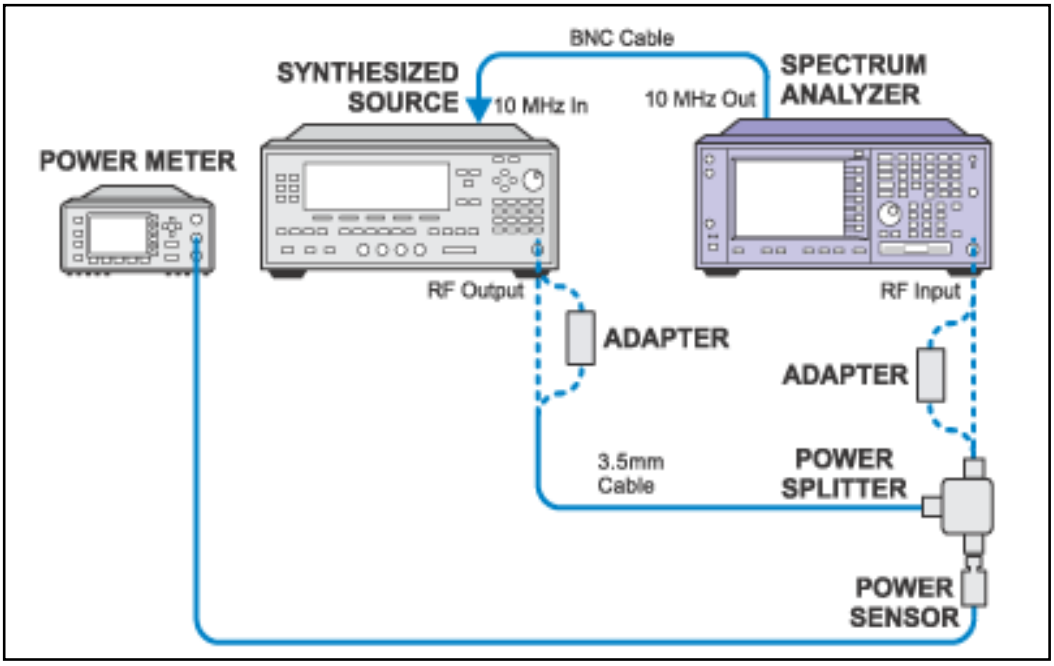
Required Test Equipment

Test Equipment	Model Number	E4440A E4443A, E4445A	E4446A E4448A
Synthesized Sweeper	83630A/B 83640A/B, 83650A/B	X	
Synthesized Sweeper	83640A/B, 83650A/B		X
Power Meter	E4419A/B	X	X
Power Sensor	8485A	X	
Power Sensor	8487A		X
Power Splitter	11667B	X	
Power Splitter	11667C		X
3.5 mm Cable	8120-4921	X	
2.4 mm Cable	8120-6164		X
BNC Cable	10503A	X	X
3.5 mm (f) to 2.4 mm (f) adapter	11901B	X	X
Type N (m) to 3.5 mm (m) adapter	1250-1743	X	

Power Meter Calibration



YTF Alignment Setup


BNC Cable
SYNTHESIZED SOURCE
10 MHz In
10 MHz Out
SPECTRUM ANALYZER
POWER METER
RF Output
RF Input
ADAPTER
ADAPTER
3.5mm Cable
POWER SPLITTER
POWER SENSOR

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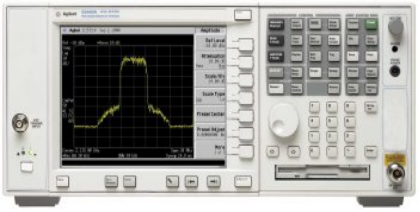


Frequency Response Adjustment

This adjustment procedure performs the following steps:

The instrument's internal flatness corrections are turned off.
Amplitude error as a function of frequency from 9 kHz to 26.5 GHz is measured and normalized to the 50 MHz measurement. Predetermined frequency points are used when testing from 9 kHz to 50 MHz and 3 GHz to 26.5 GHz. Frequency points tested from 50 MHz to 3 GHz are determined by the Adaptive Flatness procedure. The Adaptive Flatness procedure gathers a custom list of the most critical frequency points for each instrument. At each frequency the source amplitude is adjusted to keep the power constant as measured by a power meter connected to the power splitter.

Special note for E4443A and E4445A instruments: Since these instruments have max frequency limits that line up near the band breaks of the 26.5 GHz E4440A, it is necessary to gather a few correction points in the next higher band. This allows the instrument to tune a center screen signal at the instrument's specified max frequency and still be able to sweep 400 MHz past the signal. For example, the 6.7 GHz E4443A will have correction values gathered from 6.2 GHz to 7.1 GHz in Band 2. This is not only necessary to sweep past a 6.7 MHz center screen signal, but also, Band 1 ends at 6.6 GHz, not 6.7 GHz.

If the instrument contains Option 1DS, 500 kHz to 3 MHz preamplifier, additional testing is performed with the preamp turned on.

Two sources, and two sets of power sensors are used to provide the needed frequency range.
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 specially-calibrated 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 PSA.

Before testing frequencies >3 GHz, measurements are made at several frequencies in bands 1 through 4, as applicable, to determine a target power level. The target power level is the highest power level measured at the PSA that allows the synthesized sweeper output to remain leveled. The ideal target power level is –10 dBm, but levels as low as –20 dBm may be used.

Uncorrected flatness data is collected for each state. This is the raw frequency response data.
The uncorrected flatness data is normalized to the 50 MHz reference measurement taken in each state.
Further processing manipulates the uncorrected data so all states are measured relative to the 10 dB input atten, preamp off, DC coupled reference.
The corrections are stored in the Front End Driver EEPROM as frequency/amplitude pairs under unique File ID numbers.

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

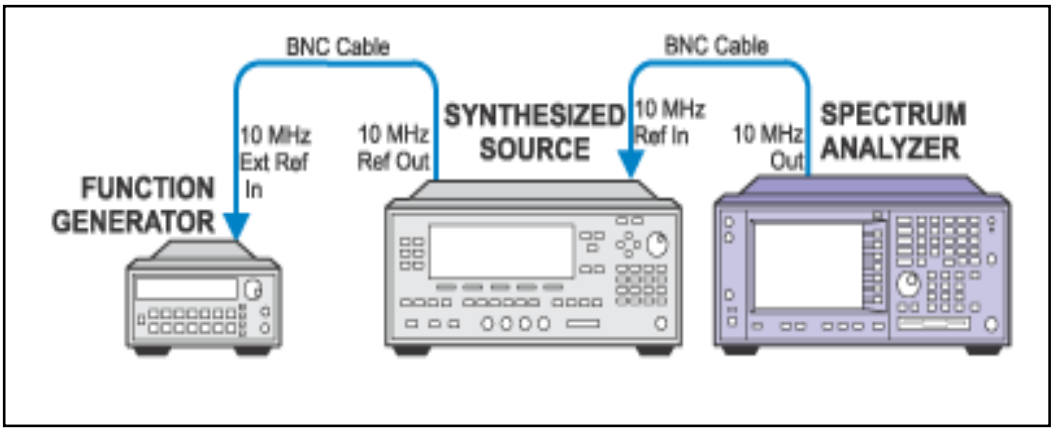
Required Test Equipment

Test Equipment	Model Number	E4440A E4443A, E4445A	E4446A E4448A
Synthesized Sweeper	83630A/B 83640A/B, 83650A/B	X	
Synthesized Sweeper	83640A/B, 83650A/B		X
Function Generator	33120A	X	X
Multimeter	3458A	X	X

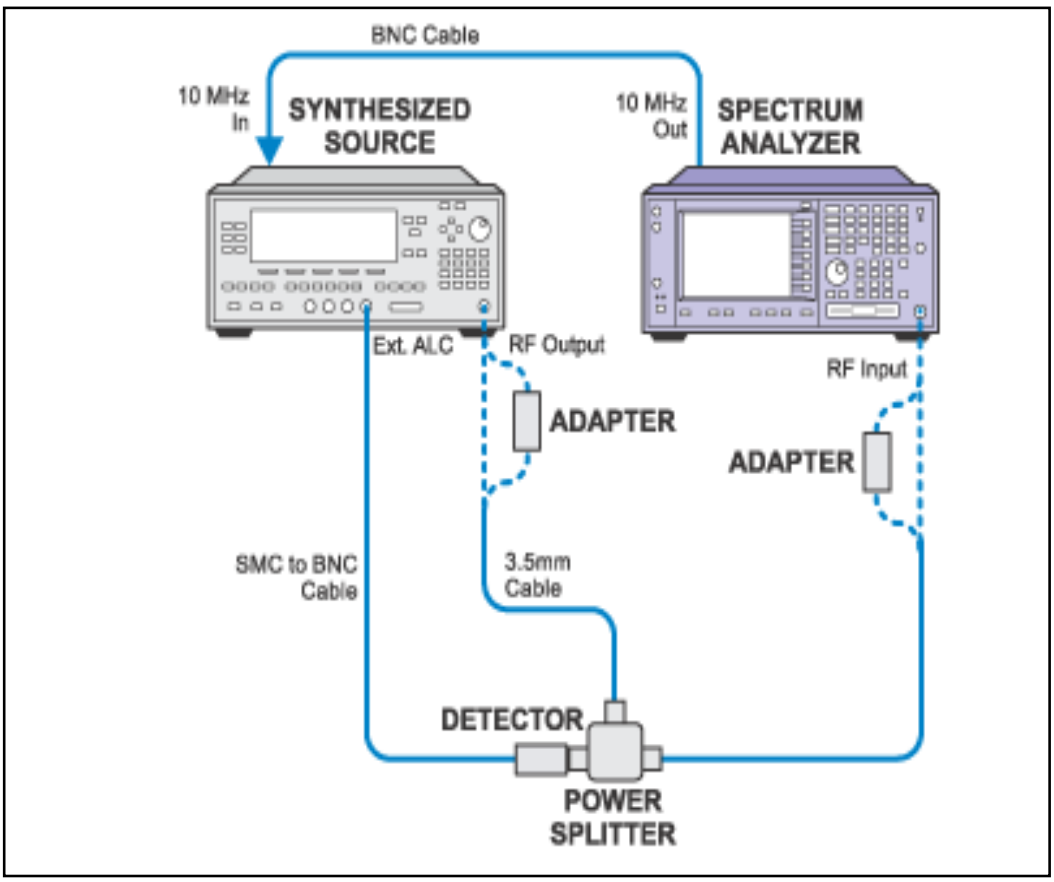
Power Meter	E4419A/B	X	X
Power Sensor (2 required)	8482A	X	X
Power Sensor	8485A	X	
Power Sensor	8487A		X
Power Splitter	11667A	X	X
Power Splitter	11667B	X	
Power Splitter	11667C		X
50 ohm Termination	1250-0207	X	X
20 dB Attenuator	8491A Option 020	X	X
20 dB Attenuator	8493C	X	X
3.5 mm Cable	8120-4921	X	X
2.4 mm Cable	8120-6164		X
BNC Cable (3 required)	10503A	X	X
BNC (m) to SMC (f) Cable	10020-61605[1]	X	X
Type N (m) to 3.5 mm (m) adapter	1250-1743	X	
Type N (f) to 3.5 mm (f) adapter	1250-1745	X	
Type N (m) to 3.5 mm (f) adapter (2 required)	1250-1744	X	
BNC (f) to SMA (m) adapter	1250-1200	X	X
Dual Banana to BNC (f) adapter	1251-2277	X	X
BNC Tee (f, m, f)	1250-0781	X	X
Type N (m) to BNC (f) adapter	1250-1476	X	X
Type N (m) to Type N (m) adapter	1250-1475	X	X
3.5 mm (f) to 3.5 mm (f) adapter	83059B	X	
3.5 mm (f) to 2.4 mm (f) adapter	11901B	X	X
2.4 mm (f) to 3.5 mm (m) adapter	11901D		X
Detector	33330C	X	

[1] As an alternative to this cable you can use a 10503A BNC cable with a 1250-0832 BNC to SMC adapter.

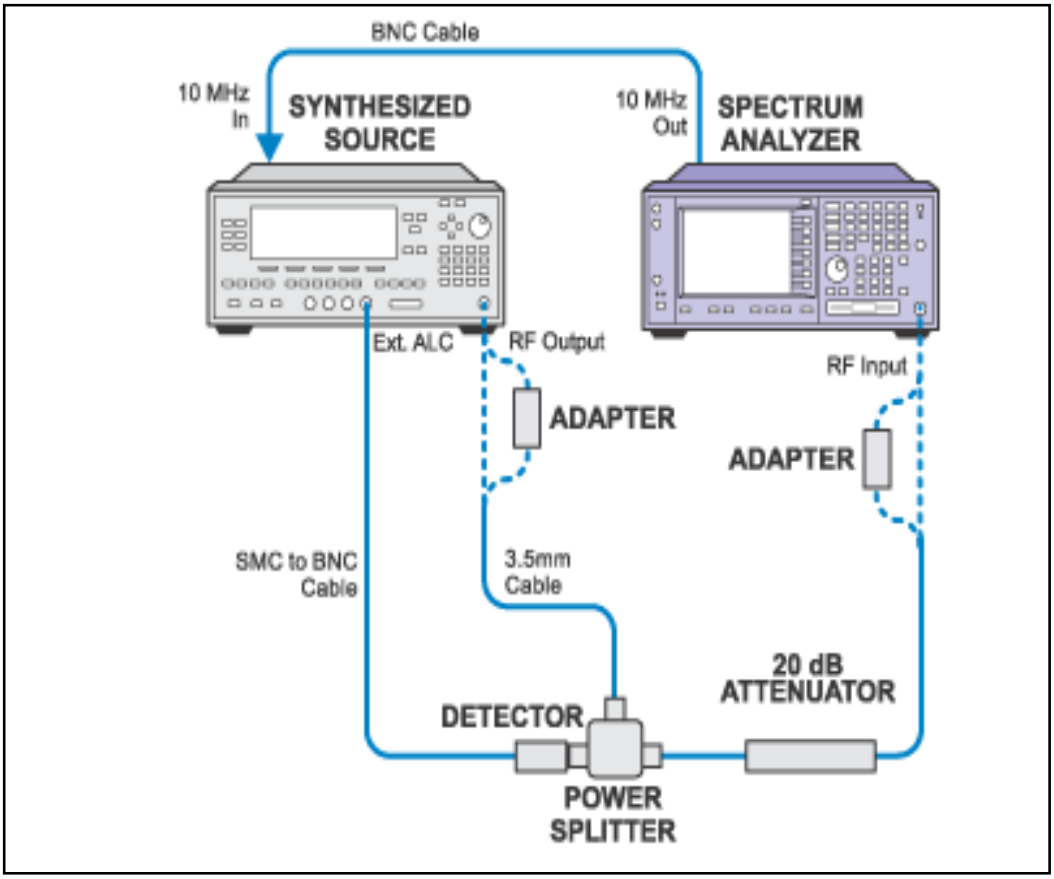
10 MHz Reference Connections



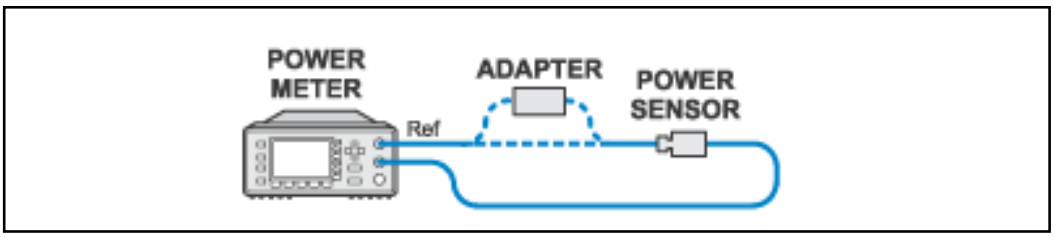
Adaptive Flatness



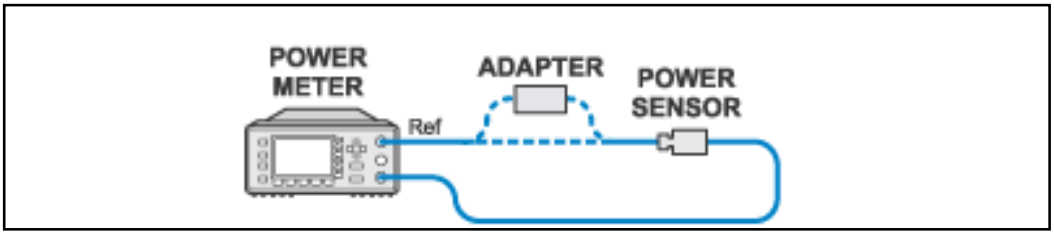
Adaptive Flatness (Preamp on, Opt. 1DS only)



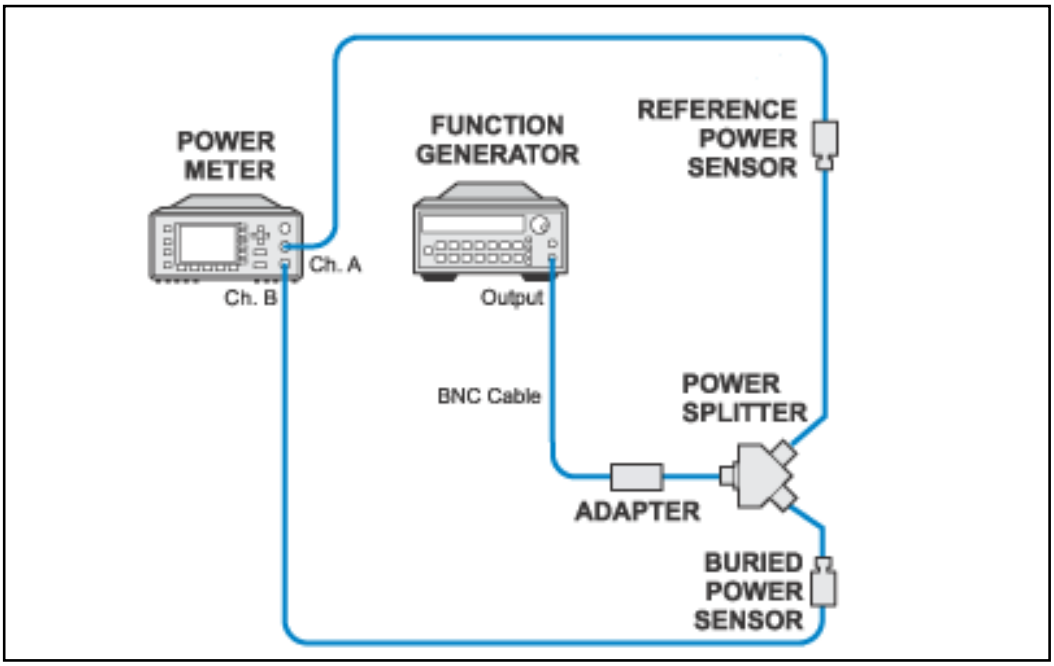
Power Meter Calibration (Channel A)



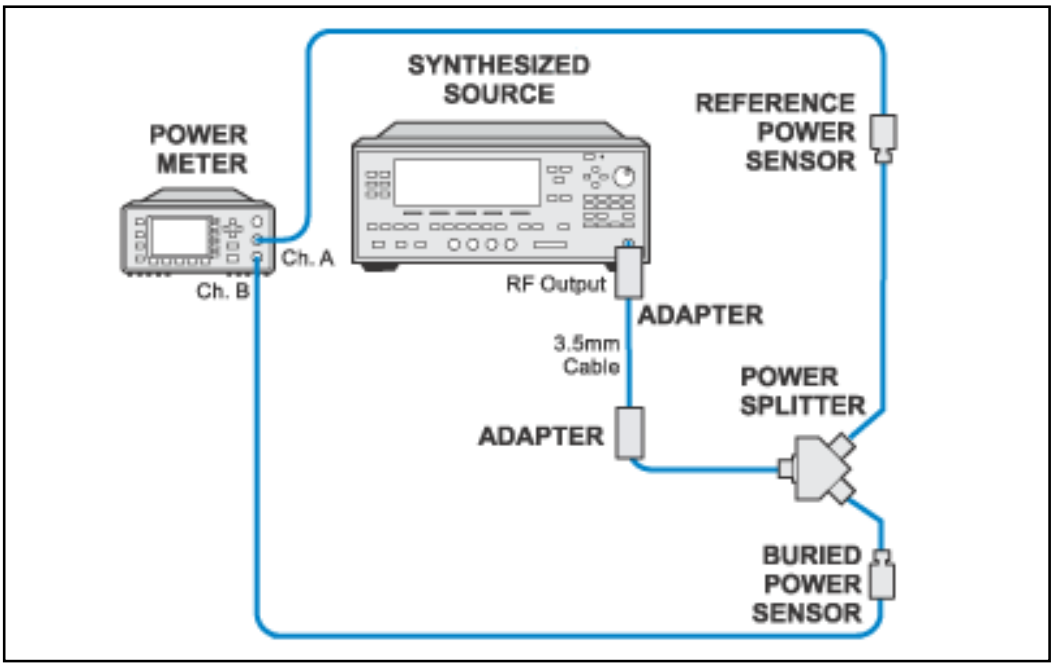
Power Meter Calibration (Channel B)



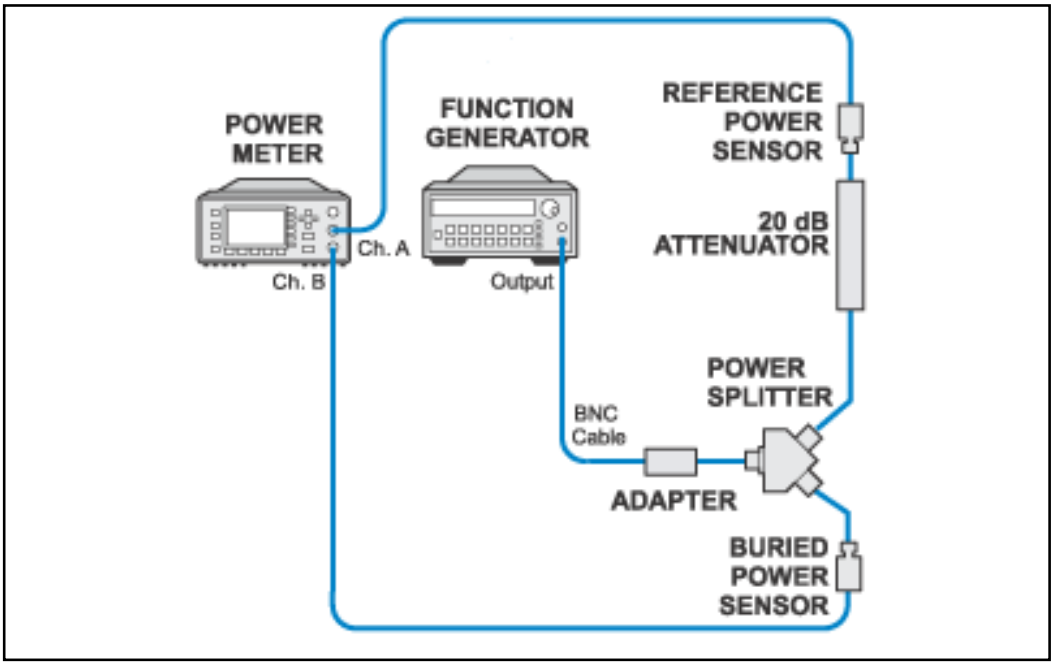
Frequency Response Adjustment (100 kHz to 3 GHz) Splitter Calibration, Step 1



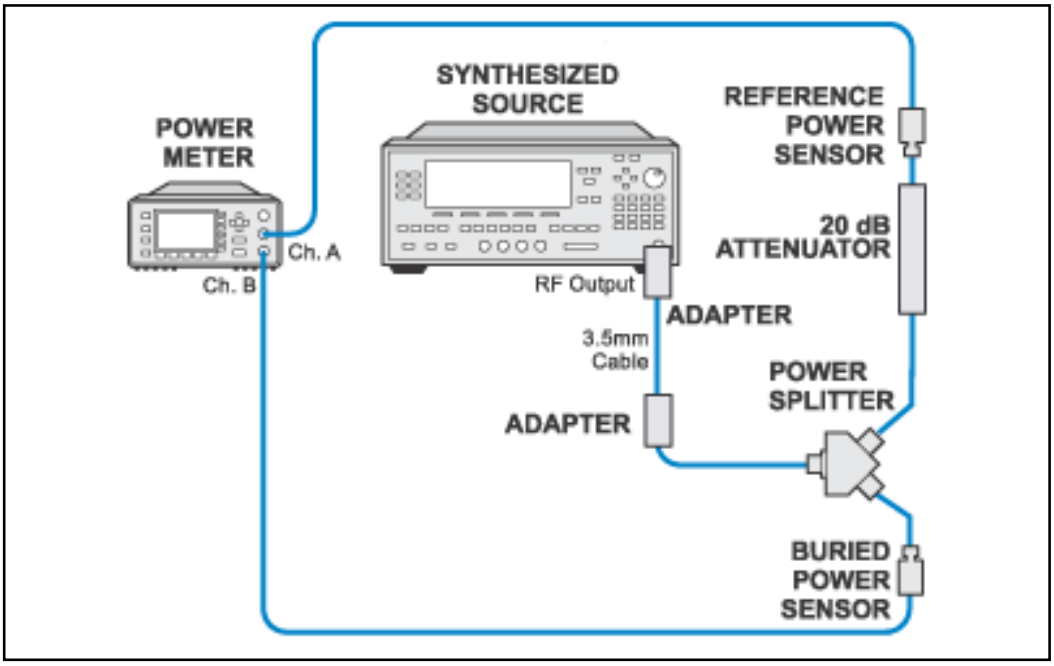
Frequency Response Adjustment (100 kHz to 3 GHz) Splitter Calibration, Step 2



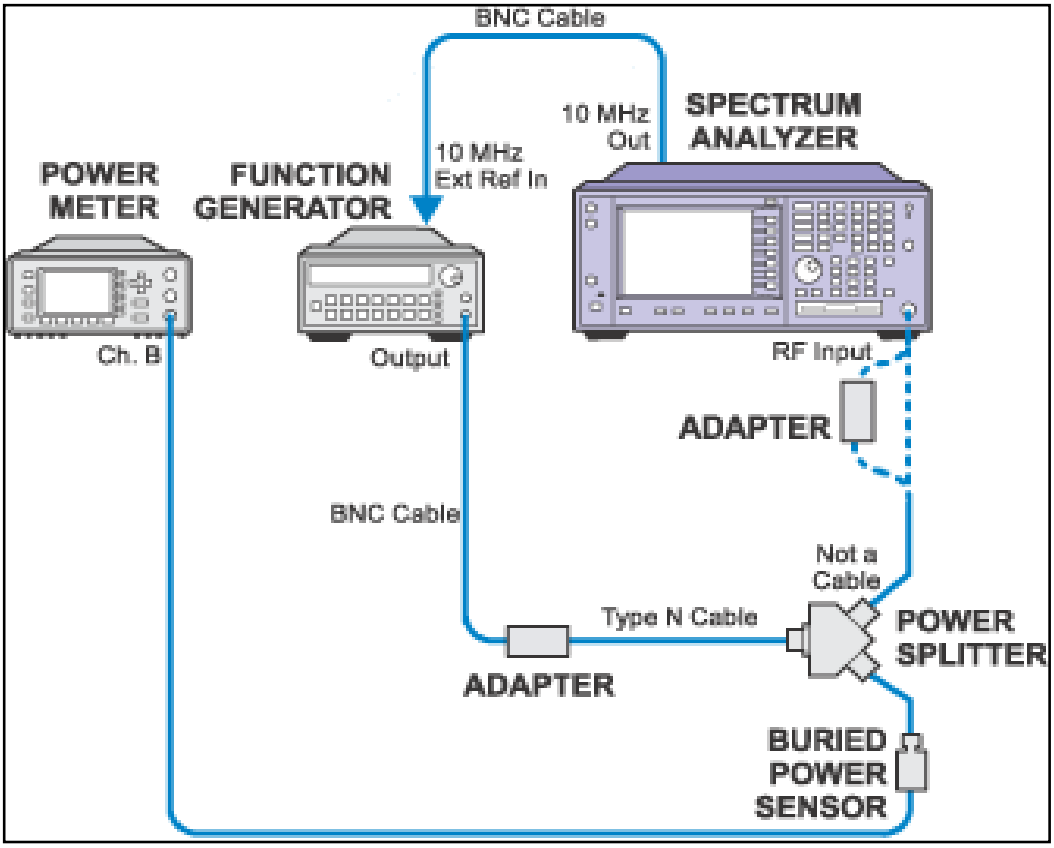
Frequency Response Adjustment (100 kHz to 3 GHz) Splitter Calibration, Step 1 (Preamp on, Opt. 1DS only)



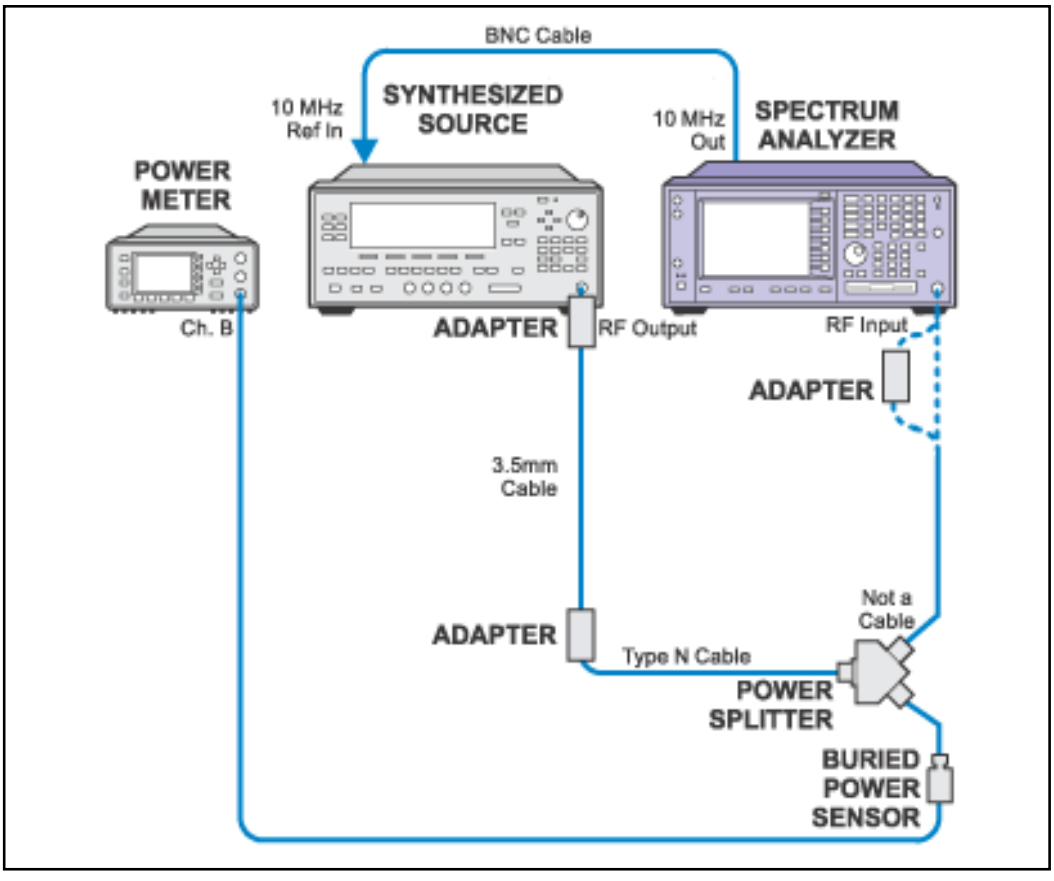
Frequency Response Adjustment (100 kHz to 3 GHz) Splitter Calibration, Step 2 (Preamp on, Opt. 1DS only)



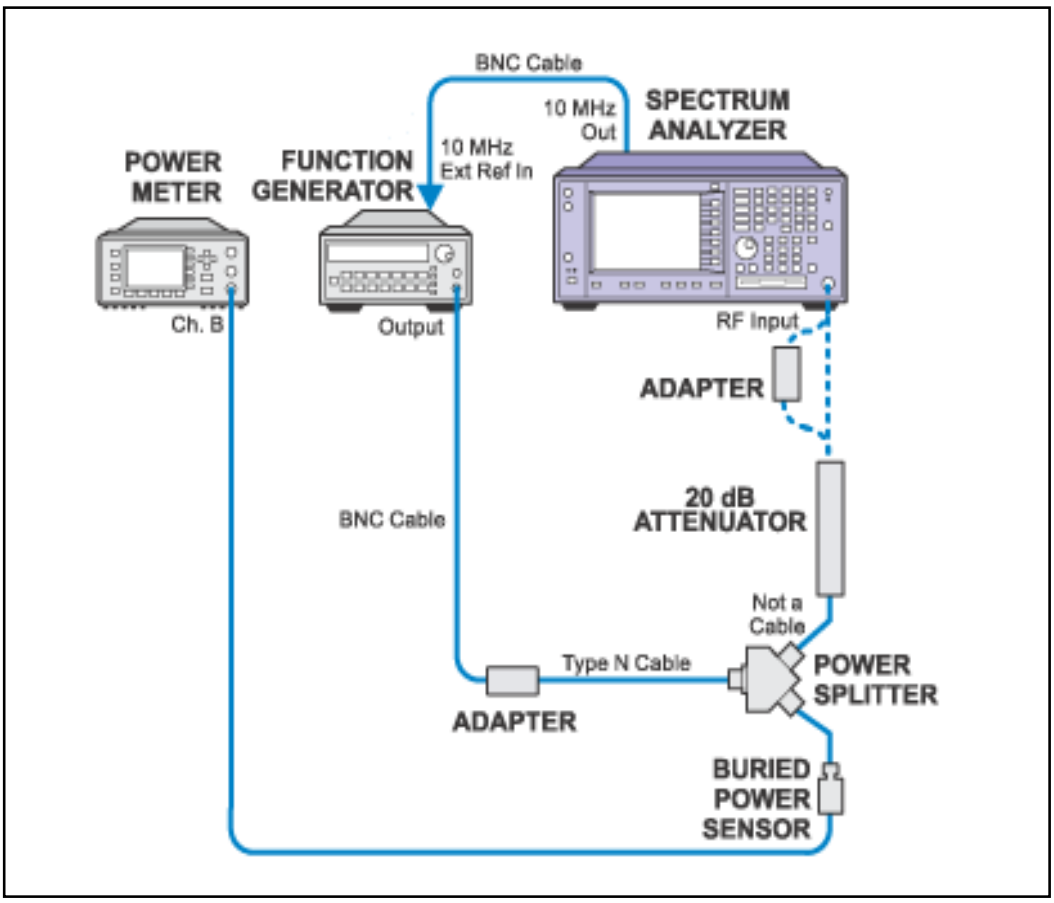
Frequency Response Adjustment (100 kHz to 3 GHz) Setup, Step 1



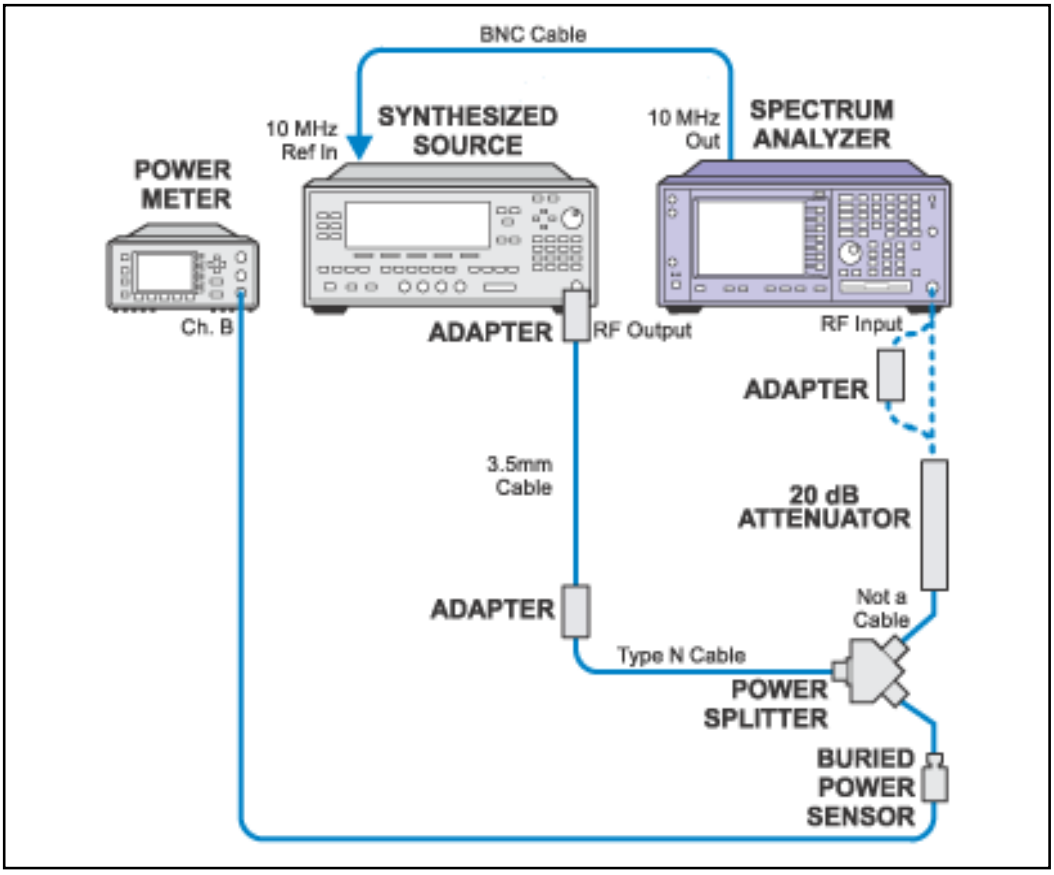
Frequency Response Adjustment (100 kHz to 3 GHz) Setup, Step 2



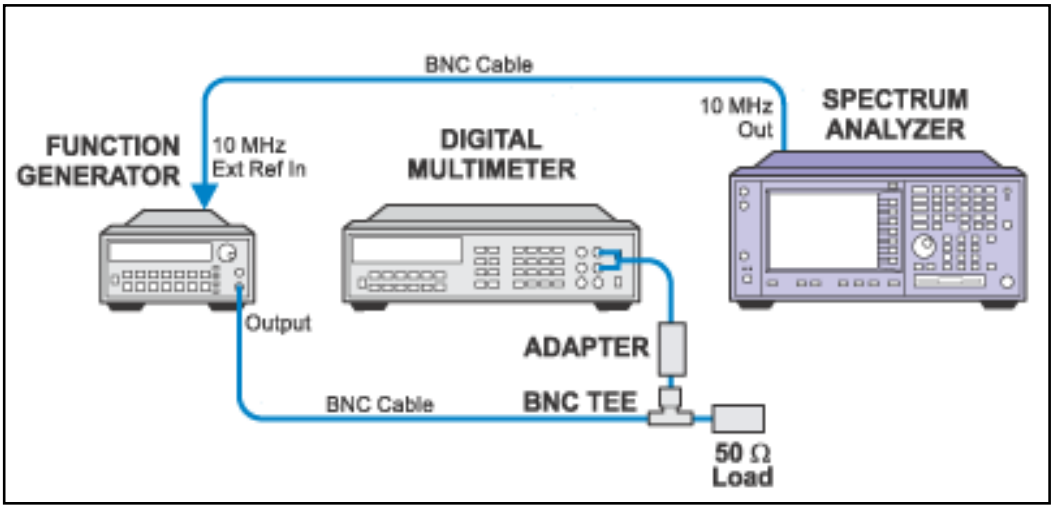
Frequency Response Adjustment (100 kHz to 3 GHz) Setup, Step 1 (Preamp on, Opt. 1DS only)



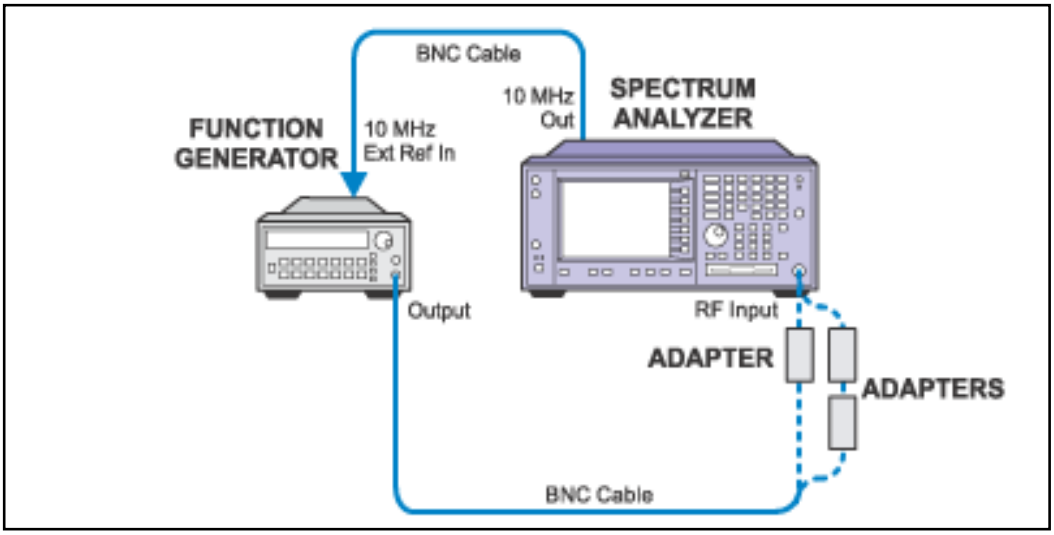
Frequency Response Adjustment (100 kHz to 3 GHz) Setup, Step 2 (Preamp on, Opt. 1DS only)



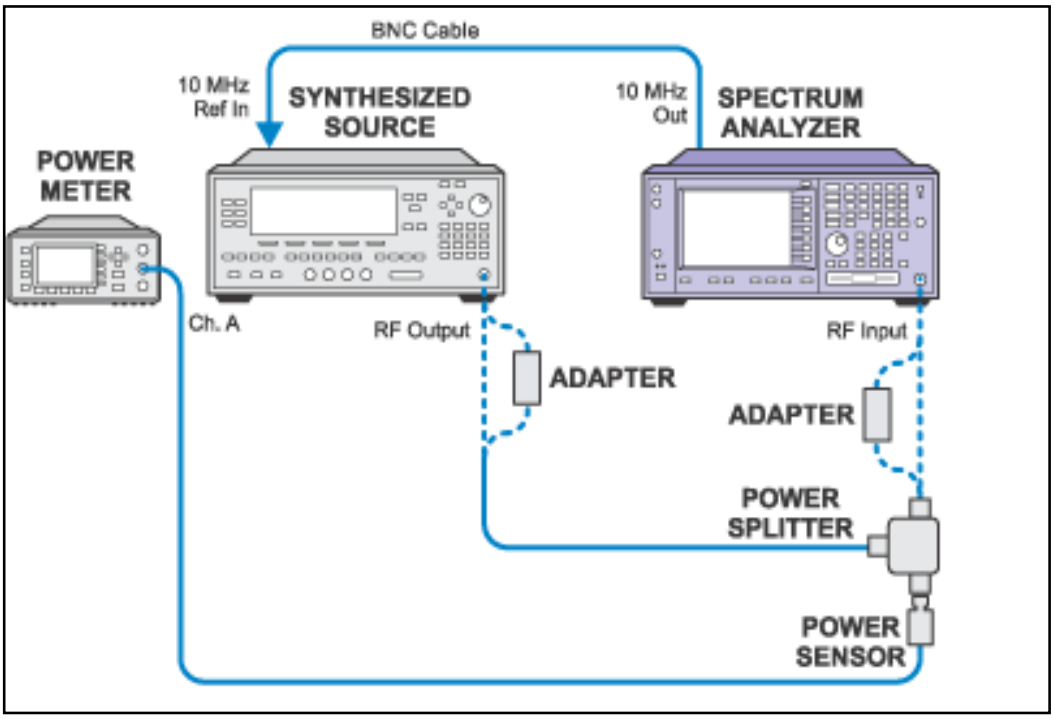
Frequency Response Adjustment (< 100 kHz) System Calibration



Frequency Response Adjustment (< 100 kHz) Setup



Frequency Response Adjustment (Bands 1 through 4) Setup



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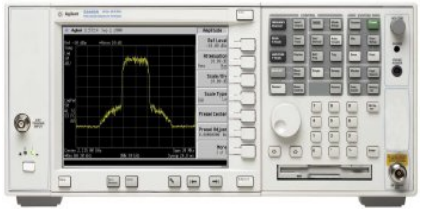


Frequency Response Adjustment (Option B7J)

The E4440A Option B7J is a Digital Modulation Demodulation option. An electric attenuator is included in the option.

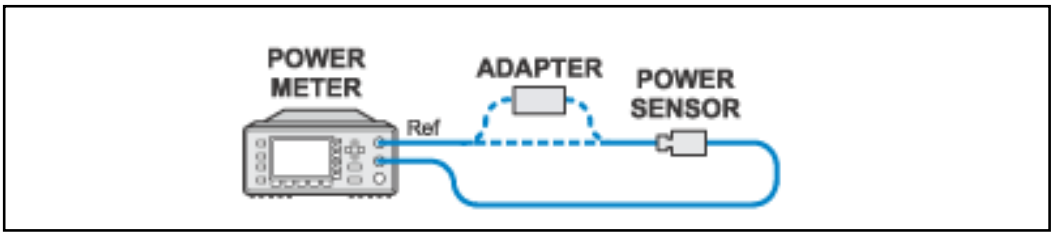
The E4440A Electronic Attenuator contains six attenuator sections. The sections are 1, 2, 2, 5, 10, and 20 dB steps. A maximum of 40 dB attenuation can be realized with these six sections. The E4440A Electronic Attenuator Flatness is corrected with 101 data points from 1 MHz to 3 GHz. These correction points are not evenly spaced across the 1 MHz to 3 GHz band. The points are spaced in 15 MHz intervals in the Comms bands, and 50 MHz intervals outside the Comms bands. The same correction points are used for each of the 41 attenuator steps.

Required Test Equipment

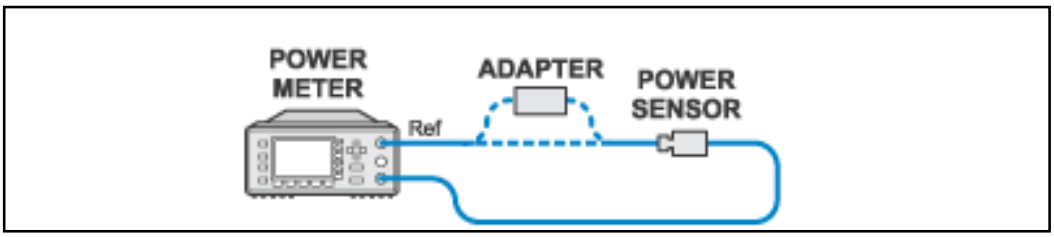
Test Equipment	Model Number	E4440A E4443A, E4445A	E4446A E4448A
Signal Generator	8665B	X	X
Power Meter	E4419A/B	X	X
Power Sensor (2 required)	8482A	X	X
Power Splitter	11667A	X	X

Type N Cable	11500C	X	X
BNC Cable	10503A	X	X
Type N (m) to Type N (m) adapter	1250-1475	X	X
Type N (m) to 3.5 mm (f) adapter	1250-1744	Opt BAB	
2.4 mm (f) to Type N (m) adapter	11903D		X

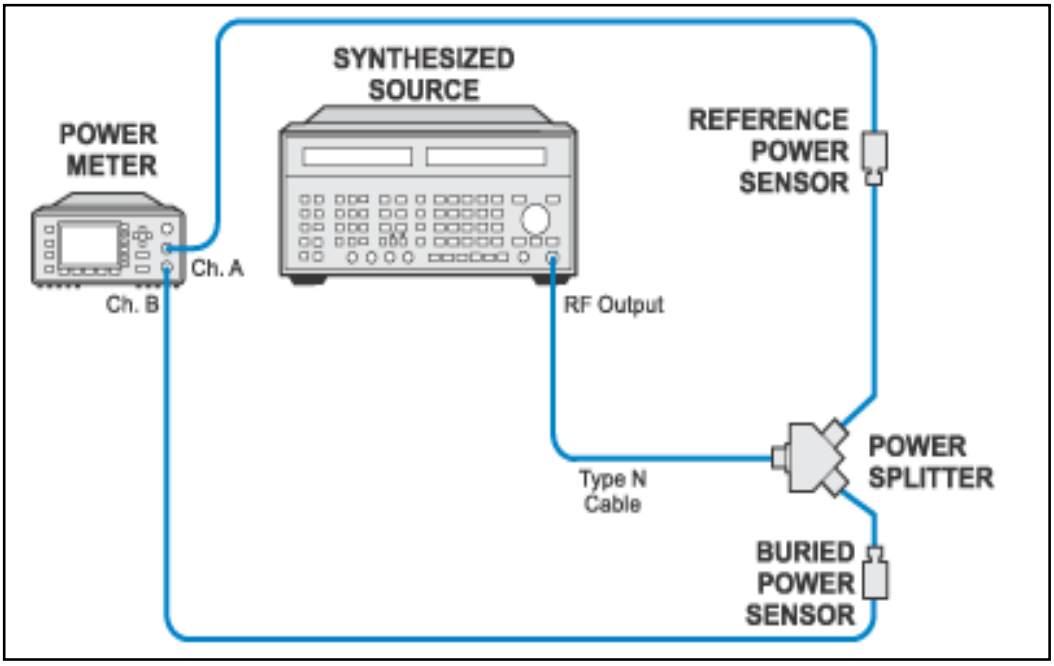
Power Meter Calibration (Channel A)



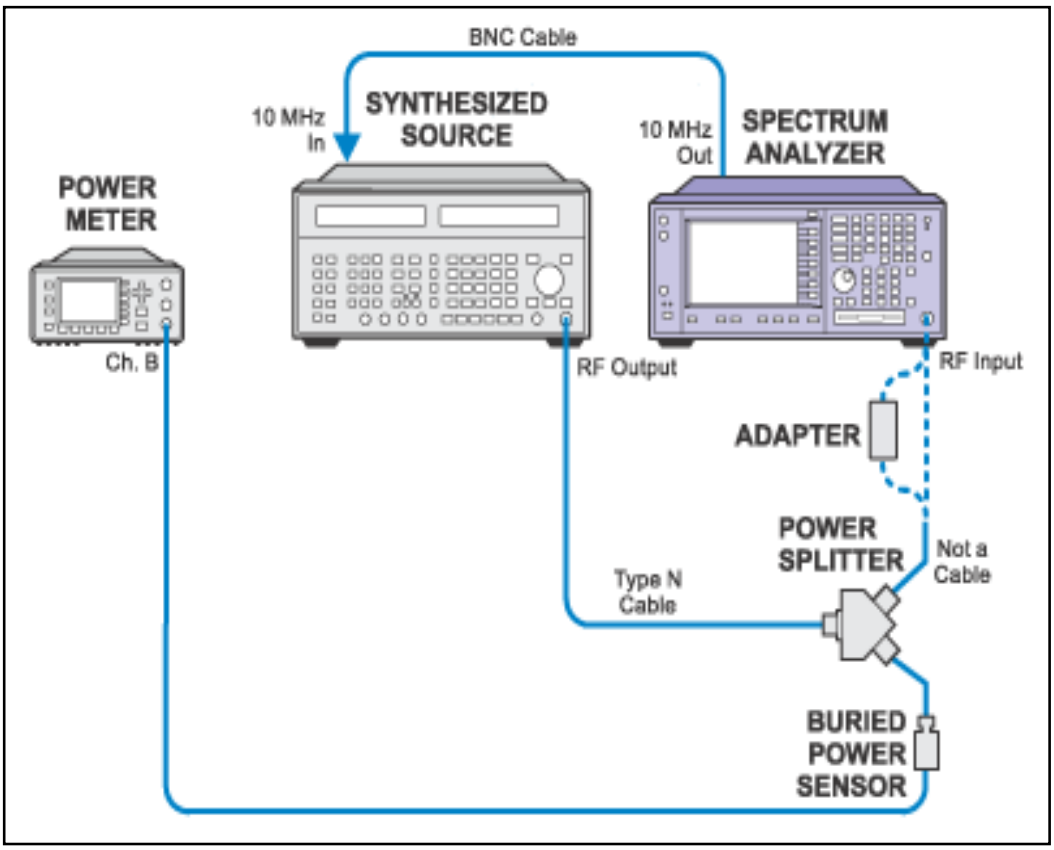
Power Meter Calibration (Channel B)



Frequency Response Adjustment (Option B7J) Splitter Calibration



Frequency Response Adjustment (Option B7J) Setup



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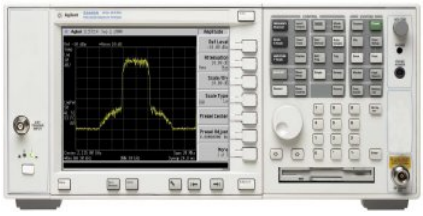

Troubleshooting Test Failures

If a test will not proceed, then suspect either the setup is incorrect, or the test equipment or DUT is faulty. Specifically you should:

- Compare your test connections with the test setup on the computer screen.
- Ensure the cables and adapters are correct and not damaged.
- Check the output and input connectors on the test equipment for damage.
- Check for error messages on the PSA display such as unlock or overload states that signal an instrument failure.

If the test can be completed as normal, but the test fails, you should:

- Ensure the equipment connections are torqued to proper specs.
- Ensure that cables and adapters meet the specifications listed in the software and the Getting Started Guide.
- Check cables and adapters for damage.
- Check the output and input connectors on the test equipment for damage.
- Ensure that there are no error messages on the DUT screen that can signal a problem elsewhere in the instrument.

Each of the performance tests has an associated troubleshooting procedure should problems be encountered. These troubleshooting procedures can be accessed used the following links.

1. Residual Responses Troubleshooting
2. Displayed Average Noise Level Troubleshooting
3. Frequency Reference Accuracy Troubleshooting
4. Frequency Readout Accuracy Troubleshooting
5. Count Accuracy Troubleshooting
6. Spurious Responses Troubleshooting
7. Third Order Intermodulation Distortion Troubleshooting
8. Gain Compression Troubleshooting
9. Second Harmonic Distortion Troubleshooting
10. Power Bandwidth Accuracy Troubleshooting
11. Resolution Bandwidth Switching Accuracy Troubleshooting
12. IF Amplitude Ripple Troubleshooting
13. IF Phase Ripple Troubleshooting
14. Input Attenuation Switching Uncertainty Troubleshooting
15. Display Scale Fidelity Troubleshooting
16. Absolute Amplitude Accuracy Troubleshooting
17. Noise Sidebands Troubleshooting
18. Frequency Response Troubleshooting

Memory Initialization Utilities

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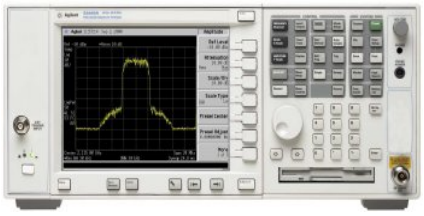

Residual Responses Troubleshooting

Related Adjustments

- None

If the residuals test fails, check the results of the DANL TEST. If DANL is out of spec, there is a good possibility that the high average noise level is causing the residuals test to indicate a false failure.

Also assure the 50 ohm load is attached to the analyzer RF Input connector. Failures are usually caused by loose or defective cables or loose shielding on an assembly. See the PSA Service Guide for troubleshooting information.

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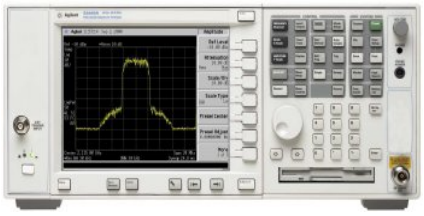

Displayed Average Noise Level Troubleshooting

Related Adjustments

- None

An increase in the Displayed Average Noise level is often the result of incorrect gain in the signal path. There may be an assembly with low gain that is compensated for by adding excessive gain elsewhere in the signal path. See the PSA Service Guide for troubleshooting information.

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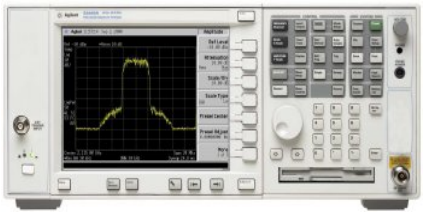

Frequency Reference Accuracy Troubleshooting

Related Adjustments

- 10 MHz Internal Frequency Reference Adjustment

If the adjustment does not solve the problem, suspect a faulty A11 Reference assembly.

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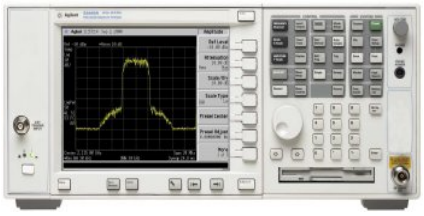

Frequency Readout Accuracy Troubleshooting

Related Adjustments

- 10 MHz Internal Frequency Reference Adjustment

If a failure occurs, be sure the 10 MHz reference is connected.

Failure to meet this specification can be due to a faulty A11 Reference assembly if the adjustment does not solve the problem.

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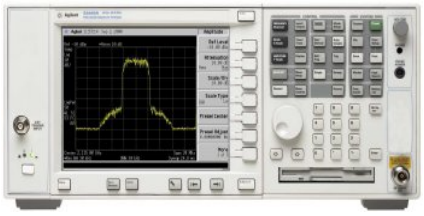

Count Accuracy Troubleshooting

Related Adjustments

- 10 MHz Internal Frequency Reference Adjustment

If a failure occurs, be sure the 10 MHz reference is connected.

Failure to meet this specification can be due to a faulty A11 Reference assembly if the adjustment does not solve the problem.

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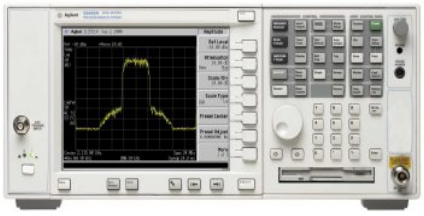

Spurious Responses Troubleshooting

Related Adjustments

- None

Spurious responses can be caused by a loose or damaged cable, a faulty filter or a faulty assembly. See the PSA Service Guide for troubleshooting details.

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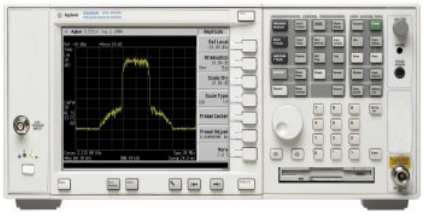

Third Order Intermodulation Distortion Troubleshooting

Related Adjustments

- Lowband Mixer Bias Adjustment
- Switched LO Distribution Amplifier Adjustment
- Second LO Power Adjustment

If TOI fails to meet specifications, suspect the first mixer of the band which fails (A20 Low Band or A19 RYTHM). Next suspect the A10 Third Converter assembly.

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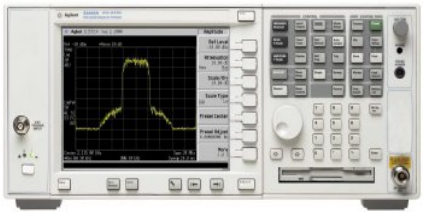

Gain Compression Troubleshooting

Related Adjustments

- Lowband Mixer Bias Adjustment
- Switched LO Distribution Amplifier Adjustment
- Second LO Power Adjustment

Failures can be caused by the A20 Lowband assembly or the or the A10 3rd Converter. See the PSA Service Guide for troubleshooting information.

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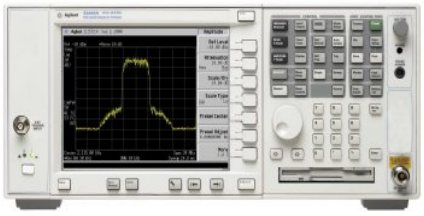
Test and Adjustment Software



Second Harmonic Distortion Troubleshooting

Related Adjustments

- Lowband Mixer Bias Adjustment
- Switched LO Distribution Amplifier Adjustment

Failures when the source frequency is less than or equal to 1.5 GHz are usually a low band path problem. Suspect the A20 Lowband Assembly or something between the input connector and the Lowband assembly.

Failures when the source frequency is greater than 1.5 GHz are usually a high band problem. Suspect the A19 RYTHM or something between the input connector and the RHYTHM assembly. See PSA Service Guide for more troubleshooting information.

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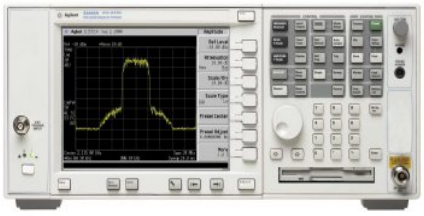
Test and Adjustment Software



Power Bandwidth Accuracy Troubleshooting

Related Adjustments

- None

Failures could be caused by A8 Analog IF (prefilters) or A7 Digital IF Assembly. See the PSA Service Guide for troubleshooting information.

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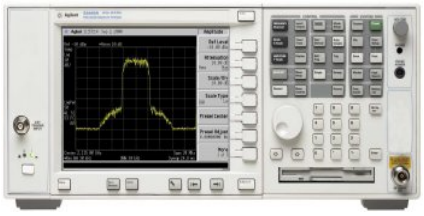
PSA Series Spectrum Analyzers
Test and Adjustment Software



Resolution Bandwidth Switching Uncertainty Troubleshooting

Related Adjustments

- None

Failures could be caused by A8 Analog IF (prefilters) or A7 Digital IF Assembly. See the PSA Service Guide for troubleshooting information.

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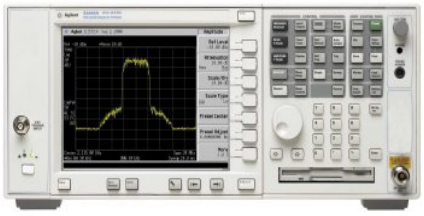
PSA Series Spectrum Analyzers
Test and Adjustment Software



IF Amplitude Ripple Troubleshooting

Related Adjustments

- None

If the IF Amplitude Ripple Test fails, the most likely caused by the A8 Analog IF. Less likely is the A10 Third Converter or A7 Digital IF.

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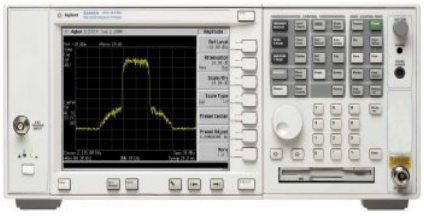
PSA Series Spectrum Analyzers
Test and Adjustment Software



IF Phase Ripple Troubleshooting

Related Adjustments

- None

A failure of the IF Phase Ripple test would most likely be the A12 synthesizer board, provided the other tests passed.

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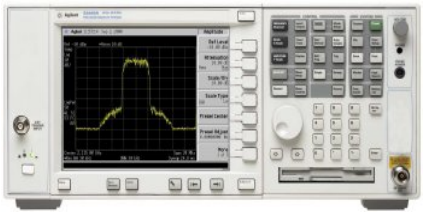
PSA Series Spectrum Analyzers
Test and Adjustment Software



Input Attenuation Switching Uncertainty Troubleshooting

Related Adjustments

- None

A faulty attenuator (A14 or A15) will cause this to fail. A second possible cause can be the A13 Front End Driver not properly driving an attenuator.

NOTE: This test might fail due to incorrect calibration data of the 8494 and 8496 step attenuators. Make sure you have entered the calibration data for the step attenuators that you're using. Please refer to the Enter Equipment Calibration Data section in the TME help for details on how to enter this data. You must enter the data for the following columns to obtain valid results: Attn(dB), Uncert(dB) and ReflSize.

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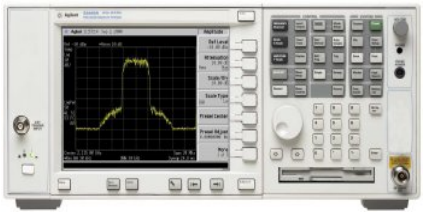

Display Scale Fidelity Troubleshooting

Related Adjustments

- None

If this test fails at input power levels greater than -15 dBm, suspect the A8 Analog IF Assembly (gain compression), or possibly the A7 Digital IF Assembly. Failures at input power levels of less than -15 dBm may be caused by the A7 Digital IF Assembly (ADC).

NOTE: This test might fail due to incorrect calibration data of the 8494 and 8496 step attenuators. Make sure you have entered the calibration data for the step attenuators that you're using. Please refer to the Enter Equipment Calibration Data section in the TME help for details on how to enter this data. You must enter the data for the following columns to obtain valid results: Attn(dB), Uncert(dB) and ReflSize.

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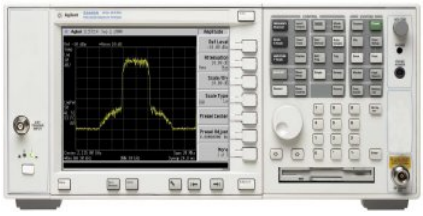

Absolute Amplitude Accuracy Troubleshooting

Related Adjustments

- 50 MHz Calibrator Amplitude Adjustment
- Switched LO Distribution Amplifier Adjustment
- Second LO Power Adjustment

Perform the 50 MHz Calibrator Adjustment if this test fails. If the adjustment does not cure the problem, suspect a hardware failure. See the PSA Service Guide for troubleshooting information. Assemblies that can cause a failure are anything in the Lowband signal path, especially the input attenuators or A20 Lowband Assembly.

NOTE: This test might fail due to incorrect calibration data of the 8494 and 8496 step attenuators. Make sure you have entered the calibration data for the step attenuators that you're using. Please refer to the Enter Equipment Calibration Data section in the TME help for details on how to enter this data. You must enter the data for the following columns to obtain valid results: Attn(dB), Uncert(dB) and ReflSize.

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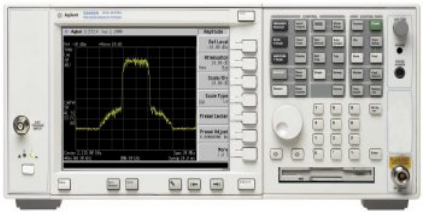

Noise Sidebands Troubleshooting

Related Adjustments

- None

If the Noise Sidebands test fails, check the results of the DANL TEST. If DANL is out of spec, there is a good possibility that the high average noise level is causing the noise sidebands test to indicate a false failure.

Phase Noise is a parameter that describes short term instability of LO tune frequency. Phase Noise appears as modulation sidebands near the LO. The modulation source is noise within the LO Phase Lock Loop.

A Noise Sidebands failure would indicate that noise is being injected into the LO Phase Lock Loop. The assembly most likely to be the source of the failure would be the A18 YTO assembly.

If the noise sideband is relative to a carrier frequency below 3 GHz, suspect the A9 2nd LO Assembly. The 2nd LO Assembly is turned off in highband (frequencies above 3 GHz), which means it cannot cause a problem in highband.

Failures at the 100 HZ offset are usually caused by 10 MHz Oven Controlled Crystal

Oscillator (OCXO) on the A11 Reference Board.

Failures at other offsets can be caused by the A12 Synthesizer Assembly. See the PSA Service Guide for troubleshooting information on how to determine which half of the A12 Synthesizer assembly is at fault.

Another, but least likely, assembly that could cause a Phase Noise failure would be the A13 Front End Driver assembly.

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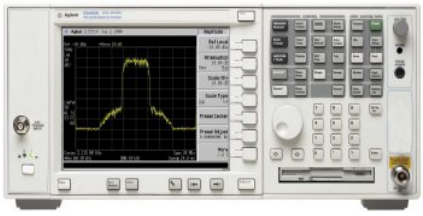

Frequency Response Troubleshooting

Related Adjustments

- Frequency Response Adjustment

If the Frequency Response Test fails by a small amount (5 dB or less) the instrument can probably be fixed by performing the Flatness Adjustment. If an adjustment cannot fix the problem, or the test fails by a large error (5 dB or more), this would indicate a faulty assembly.

In order to troubleshoot an RF problem, refer to the PSA Series Service Guide for troubleshooting procedures and the overall block diagram. Assemblies can be bypassed by injecting 321.4 MHz, or 3921.4 MHz signals at the appropriate places.

If the frequency response test fails at frequencies 3 GHz and above (high bands), the following should be done:

Perform the Frequency Response Adjustment in its entirety. If the adjustment does not fix the problem, or the adjustment can not complete, suspect a hardware problem. Major assemblies at fault could be: The A19 RYTHM, the RYTHM/Bias control signals from the A13 Front End Driver Assembly may be wrong, the amplitude of the LO signal from A21 SLODA may be too low, or the A10 Third Converter input stage could be damaged.

If the frequency response test fails at frequencies below 3 GHz (Low band), the following should be done:

Perform the Frequency Response Adjustment in its entirety. If the adjustment does not fix the problem, or the adjustment cannot complete, suspect a hardware problem. Major assemblies to suspect are: The A20 Lowband Assy, the optional A22 Lowband preamp, optional A27 Electronic attenuator, or the A13 Front End Driver circuits that control the assemblies listed.

If frequency response fails at several frequencies between 9 kHz and the maximum frequency range of the analyzer (failures in both High band and Low band), and a readjustment does not fix the problem, suspect assemblies that are common to both High and Low bands such as a damaged Input Attenuator or the A10 Third Converter.

In order to troubleshoot an RF problem, refer to the PSA Series Service Guide for troubleshooting procedures and the overall block diagram. Assemblies can be bypassed by injecting 321.4 MHz, or 3921.4 MHz signals at the appropriate places.

Frequency Response (Option B7J)

Related Adjustments

- Frequency Response Adjustment (Option B7J)

If the option B7J frequency response test fails, but the standard frequency response is in spec, suspect the A27 Electronic Attenuator or A27 interconnect cables. If both the option B7J and the standard frequency response both fail, troubleshoot as if B7J were not present, but do not discount the signal path switch in the A27 electronic attenuator.

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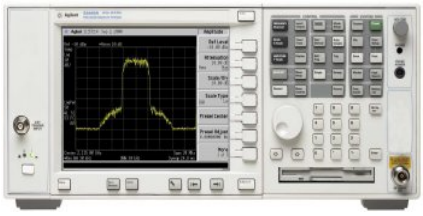

Option 266/Basic Mode Conflicts

The A.03.xx release of PSA firmware introduced Option 266 (8566 code compatibility). It was discovered that Option 266 I/O commands collided with the Basic Mode I/O. Since it was reasonable to assume that Basic Mode (with Option B7J for digital comms measurements) and Option 266 would not be needed at the same time, there were two firmware builds created. One build contained Basic mode without Option 266.The other build contained Option 266 without Basic mode (the Basic mode key is grayed out).

By the time the A.04.00 release was introduced, the Option 266 I/O conflicts were resolved, so the new firmware allows Option 266 and Basic mode to coexist in the PSA.

NOTE: If your analyzer has the A.03.xx firmware build without Basic mode, and contains Option 266 (8566/8568B code compatibility firmware) and Option B7J (digital demod hardware), Option B7J hardware cannot be verified. This will result in an incomplete calibration.

It is highly recommended that customers upgrade to the latest firmware, available from the Agilent Technologies web site at http://www.agilent.com/find/psa. Be sure to close the Agilent Test Management Environment (TME) before upgrading your firmware.

If you do not want to upgrade your A.03 firmware, please contact the Agilent Technologies Call Center.

If you choose to continue testing without upgrading your firmware, these

tests/adjustments will have invalid results:

- IF Phase Ripple
- IF Amplitude Ripple
- Absolute Amplitude Accuracy
- Input Attenuation Switching Uncertainty
- Frequency Response (Option B7J)
- Frequency Response Adjustment
- Frequency Response Adjustment (Option B7J)