N7811A ESA Adjustments Overview

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

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

Reports

The adjustments produce text reports on completion to aid in troubleshooting. These reports are not accessible through the TME interface but can be found in the TME output directory. The default location of the output directory is `C:\Program Files\Agilent TME\Database\Output`

Within the output directory the reports are structured as follows:

ModelNumber\TestName\SerialNumber_Date_Time.txt

For example:

```
C:\Program Files\Agilent
TME\Database\Output\E4407B\YTFAdjustment\US39010002_20031114_073422.txt
```

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

1. 10 MHz Reference Frequency Adjustment
2. IF Amplitude Adjustment
3. Reference Amplitude Adjustment
4. LO Amplitude Adjustment
5. YTF Adjustment
6. Frequency Response Low Band Adjustment
7. Frequency Response High Band Adjustment
8. IF Input Adjustment
9. TG ALC Amplitude Adjustment
10. TG Frequency Slope Adjustment

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10 MHz Reference Frequency Adjustment

This adjustment should be performed only after the ESA has been allowed to warm up with the ESA in internal reference mode and in a 20° to 30° C environment during the entire warmup period. The warmup time depends upon the type of frequency reference installed and whether or not the analyzer has Opt 1D5. The 10 MHz reference output is connected to the frequency counter's Channel A input. A cesium beam frequency standard, or some other 10 MHz "house standard" provides the frequency reference for the frequency counter.

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

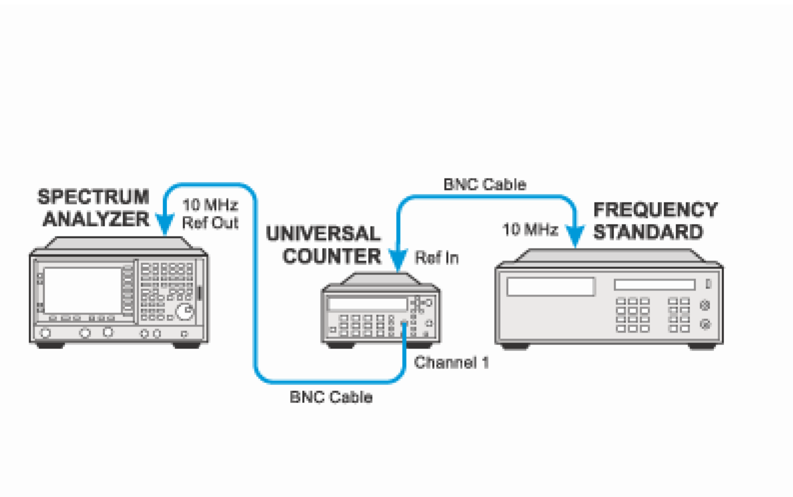
The fine timebase DAC is adjusted to yield a frequency counter reading of 10 MHz ± 0.01 Hz if the OCXO is installed or 10 MHz ± 5 Hz if the VCXO is installed. If the analyzer has a OCXO, but does not have Opt 1D5, the tolerance is ± 1 Hz.

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

Required Equipment

Instrument	Recommended Model	For ESA Models
Frequency Counter 1	53230A	All
Frequency Standard 1	Microsemi 5071A-C002	All
Cable, BNC (2 required)	8120-2582	All

Connection Setups



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IF Amplitude Adjustment

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

Related performance tests: Absolute Amplitude Accuracy (Reference Settings)

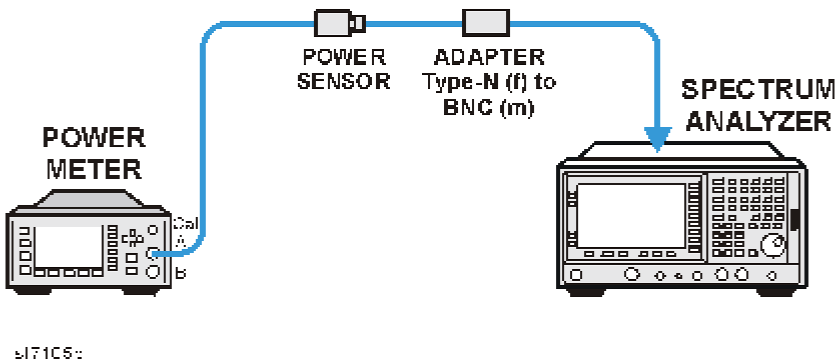
Overall Amplitude Accuracy

Required Equipment

Instrument	Recommended Model	For ESA Models
Power Meter 1	N1914A	All
Low-Power Power Sensor	8481D	All
Adapters, Type-N (f) to SMB (f)		All

Connection Setup

21.4 MHz IF Calibrator Adjustment



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Reference Amplitude Adjustment

This procedure adjusts the 50 MHz Amplitude Reference signal.

The amplitude of the E4401B, E4411B, and E7401A 50 MHz Amplitude Reference signal is determined by measuring a substituted external 50 MHz signal. A power sensor (the “buried sensor”), power splitter, and attenuator combination is characterized at 50 MHz using a second power sensor (the “reference sensor”). The analyzer’s 50 MHz Amplitude Reference signal is first turned on and the on-screen level is noted. The analyzer's 50 MHz Amplitude Reference signal is then turned off, and the external 50 MHz signal is turned on. The external source amplitude is adjusted to match the level of the internal signal. The amplitude of the external 50 MHz signal at the analyzer input is measured using the power meter reading, corrected for the splitter/attenuator tracking error. This amplitude level is stored in the analyzer.

The procedure to adjust the 50 MHz Amplitude Reference Output signal on the E4402B, E4403B, E4404B, E4405B, E4407B, E4408B, E7402A, E7403A, E7404A, and E7405A is slightly different. Since the Amptd Ref Out signal is accessible, a power meter is connected to the signal and it is measured. The amplitude is then adjusted via DACs to bring the Amptd Ref Out signal to within specifications. The final DAC setting and the measured power level are stored in EEROM.

Related performance tests: Absolute Amplitude Accuracy (Reference Settings)

Overall Amplitude Accuracy

Required Equipment

Instrument	Recommended Model	For ESA Models
Syn Source 1	E8257D	E4401B, E4411B, E7401A
Power Meter 1	N1914A	All
Power Sensor, 50 W	E9304A	All but E4401B, E4411B, and E7401A
Power Sensor Reference	N8482A-CFT	E4401B, E4411B, E7401A

Buried 50 W Input 75 W Input	N8482A-CFT 8483A	
Fixed Attenuator 50 W Input 75 WInput	8491A, Option 020 8491A, Option 010	E4401B, E4411B, E7401A
Power Splitter 1	11667A	E4401B, E4411B, E7401A
Cable, Type N	11500D	E4401B, E4411B, E7401A
Adapter, Type N (m) to Type N (m)	1250-1475	E4401B, E4411B, E7401A (50 W input only)
Adapter, Type N (f) to BNC (m)	1250-1477	All but E4401B, E4411B, and E7401A
Minimum Loss Adapter 50 W Type N (f) to 75 W Type N (m)	11852B	E4401B, E4411B, E7401A (75 W input only)
Adapter, Type N (f) to Type N (f) (75 W)	1250-1529	E4401B, E4411B, E7401A (75 W input only)
Adapter, Type N (m) to BNC (m) (75 W)	1252-1533	E4401B, E4411B, E7401A (75 W input only)

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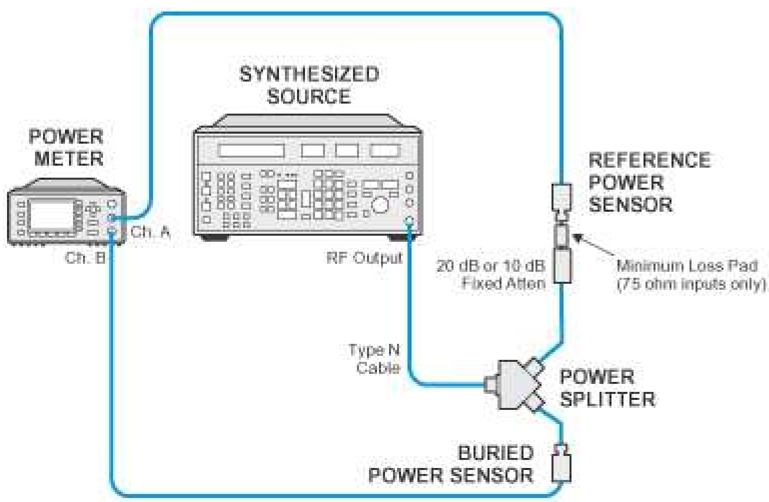
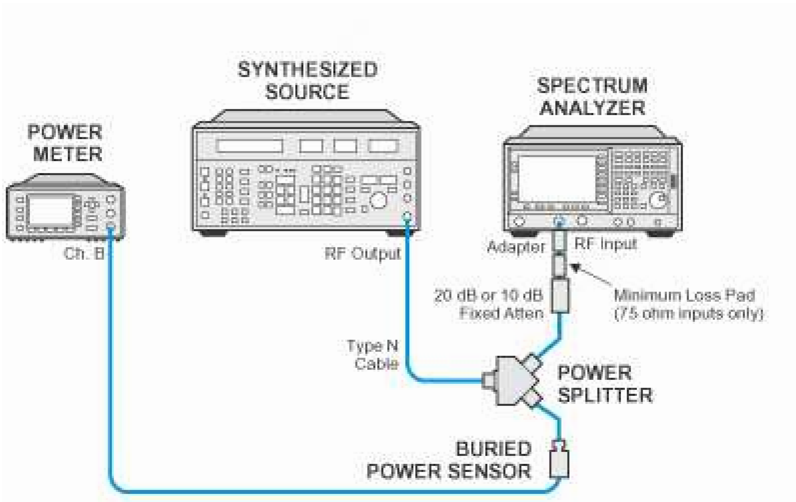
Connection Setups

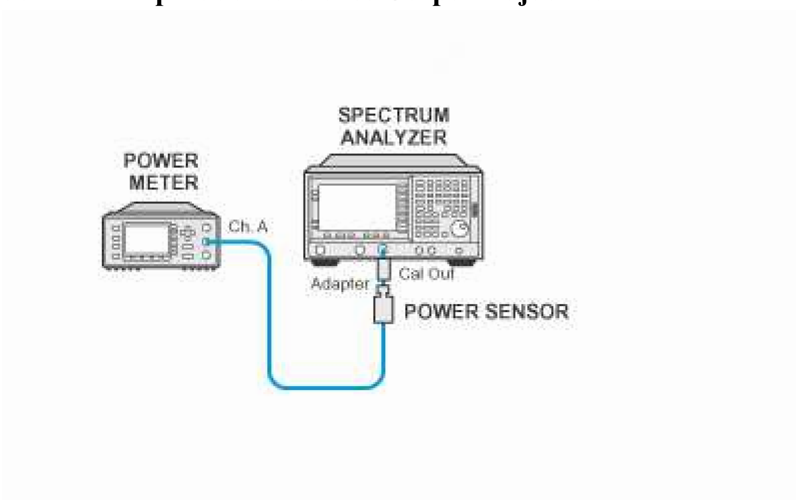
Power Splitter/Attenuator Characterization



Internal 50 MHz Amplitude Reference Adjustment



50 MHz Amplitude Reference Output Adjustment



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LO Amplitude Adjustment

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

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

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

Related performance test: Frequency Response

Frequency Response (Preamp On)

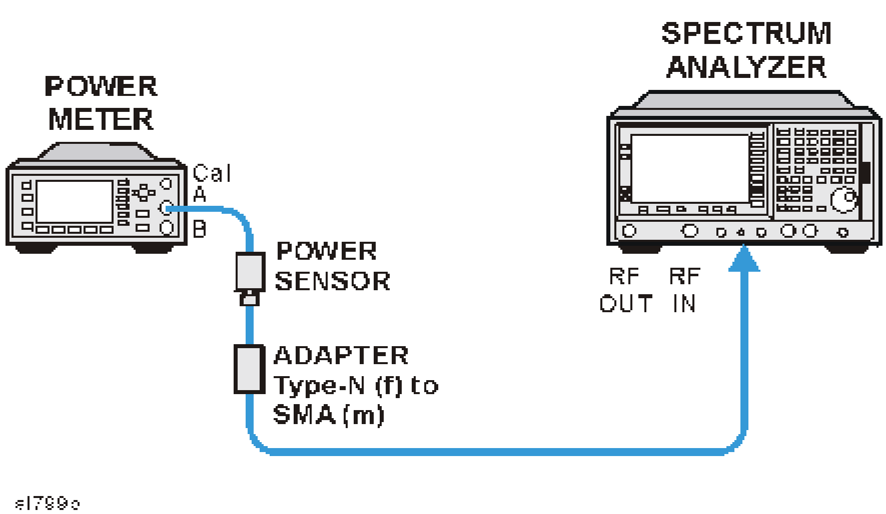
LO Output Amplitude Accuracy (Option AYZ)

Tracking Generator Level Flatness

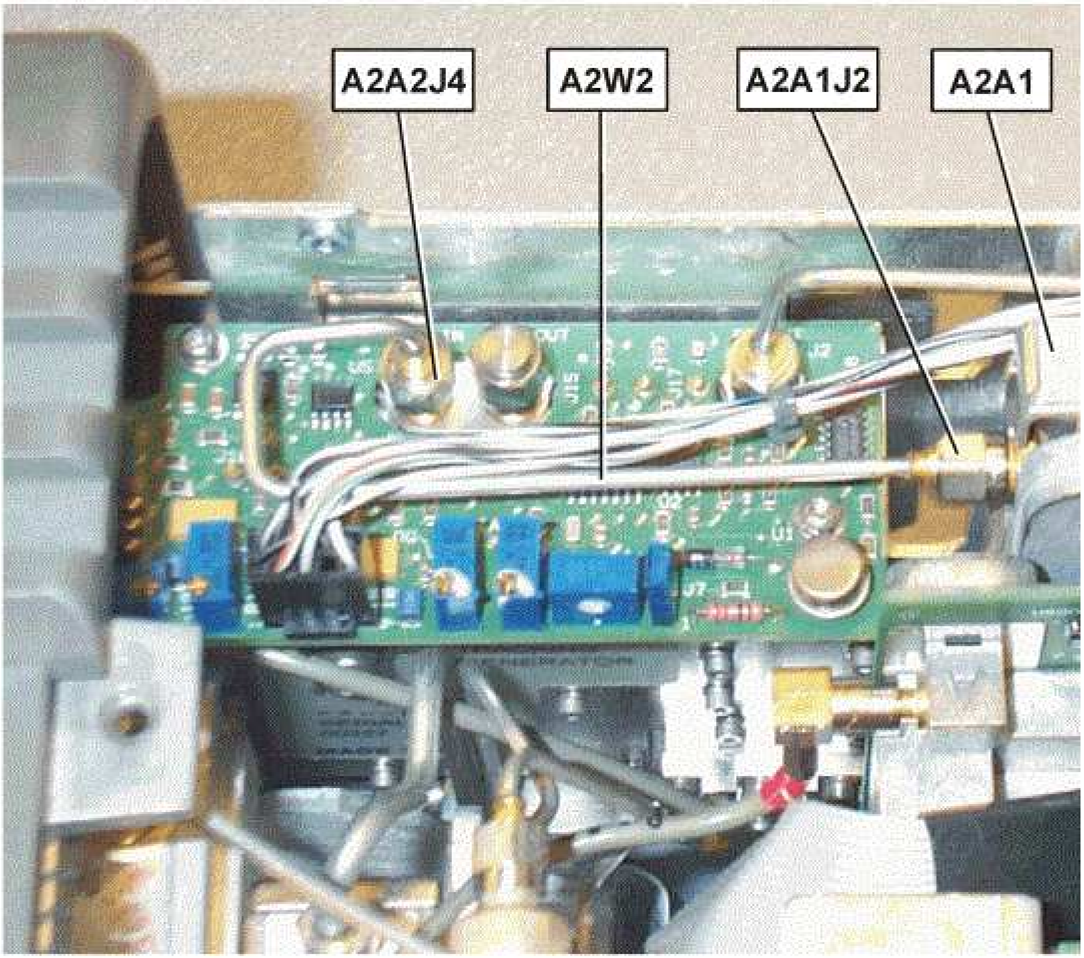
Required Equipment

Instrument	Recommended Model	For ESA Models
Power Meter 1	N1914A	All
Power Sensor	N8485A-CFT	All

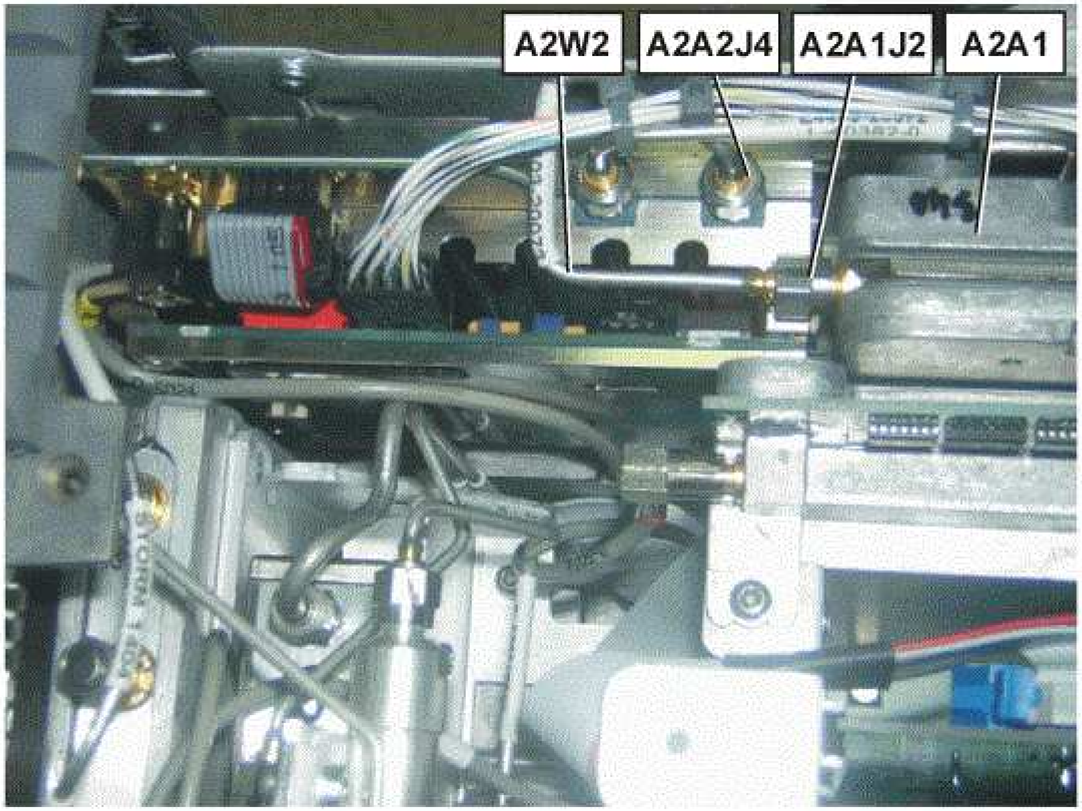
Connection Setups



BITG LO Adjustment Connections with Older BITG Microcircuit



BITG LO Adjustment Connections with Newer A2A2 BITG Microcircuit



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YTF Adjustment

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

Before any measurements are made, the default constants for the YTF are downloaded into the FEA's EEROM. A fine alignment is performed and four YTF tuning coefficients, A0 through A3, are downloaded in the FEA's EEROM. Finally, the frequency error with the YTF properly aligned is measured.

Related performance test: Frequency Response

Other Input Related Spurious Responses

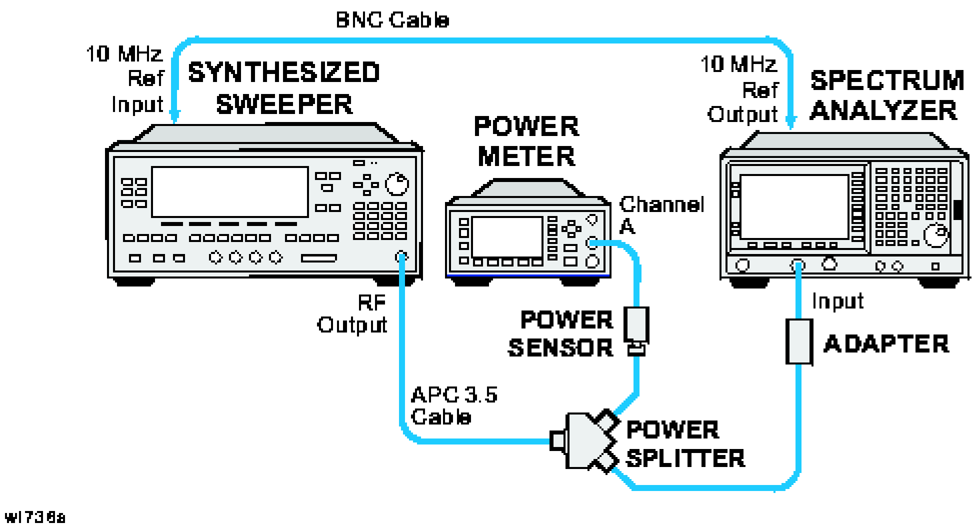
Spurious Responses — SHD

Required Equipment

Instrument	Recommended Model	For ESA Models
Syn Sweeper 1	E8257D	All
Power Meter 1	N1914A	All
Power Sensor	N8485A-CFT	All
Power Splitter 1	11667A	E4404B, E4405B, E7403A, E7404A
MW Power Splitter 1	11667B	E4407B, E4408B, E7405A
Cable, 3.5 mm	11500C	
Cable, BNC	8120-2582	

Adapter, 3.5 mm (m) to Type N (m)	1250-1743	
Adapter, 3.5 mm (m) to 3.5 mm (m)	1250-1749	

Connection Setups



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Frequency Response Low Band Adjustment

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

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

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

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

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

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

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

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

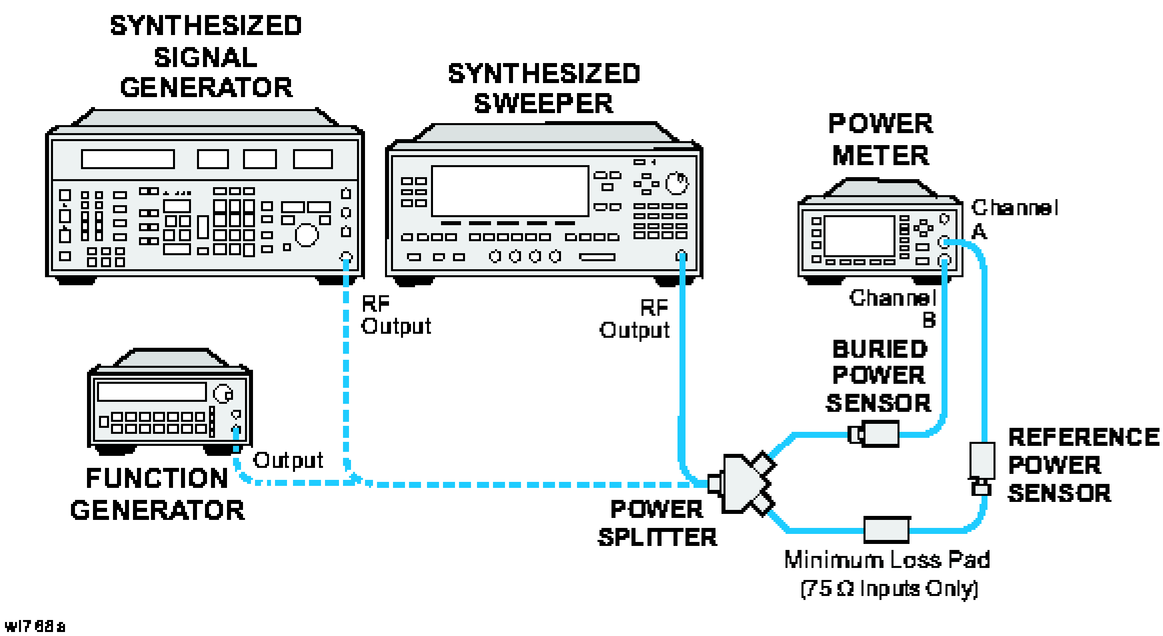
Related performance test: Frequency Response (Low Band)

Required Equipment

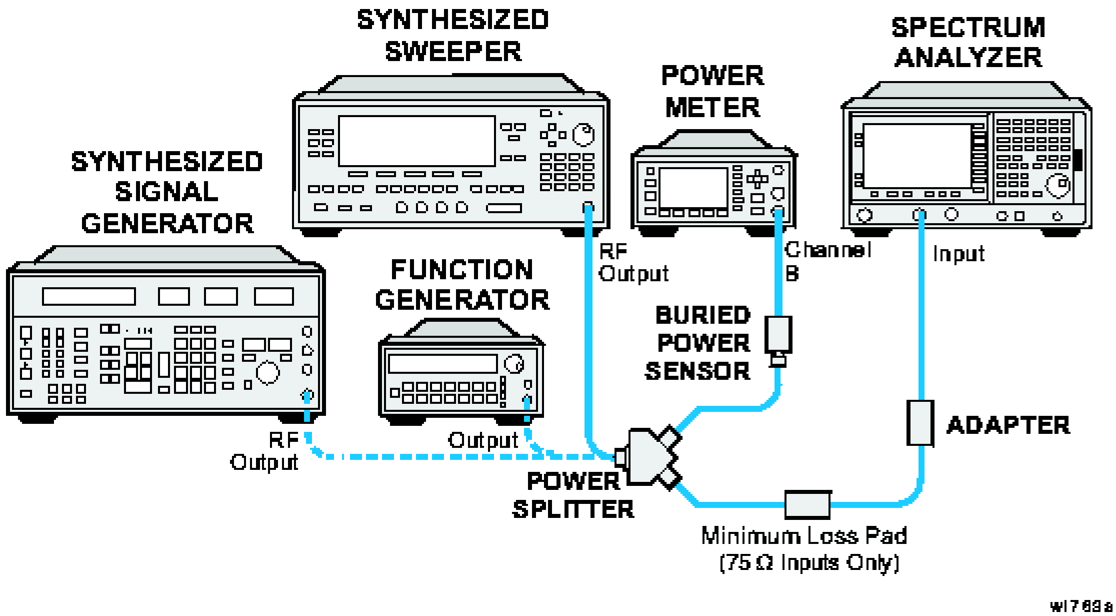
Instrument	Recommended Model	For ESA Models
Syn Source 1	E8257D	E4401B, E4411B, E7401A
Function Generator 1	33250A	All
Syn Sweeper 1	E8257D	All
Multimeter 1	3458A	
Power Meter 1	N1914A	All
75 W Power Sensor (Option 1DP only) "Reference" Sensor	8483A	E4401B, E4411B
RF Power Sensor Non-Option 1DP Option 1DP "Reference" and "Buried" Sensor	N8482A-CFT (2 required) 8482A	All E4401B, E4411B
RF Power Sensor Non-Option 1DP Option 1DP "Buried" Sensor	N8482A-CFT 8482A	All E4401B, E4411B
Termination	11593A	
20 dB fixed attenuator	8491A Option 020	
Power Splitter 1	11667A	All
Minimum Loss Pad (Option 1DP only)	11852B	E4401B, E4411B 75 W

Connection Setups

Source/Splitter Characterization Setup



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



Additional Information

Splitter Tracking Error

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

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

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

Flatness Error

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

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

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

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Frequency Response High Band Adjustment

This test has two major parts: Uncorrected Flatness and Corrected Flatness. This adjustment only covers frequencies above 3 GHz.

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

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

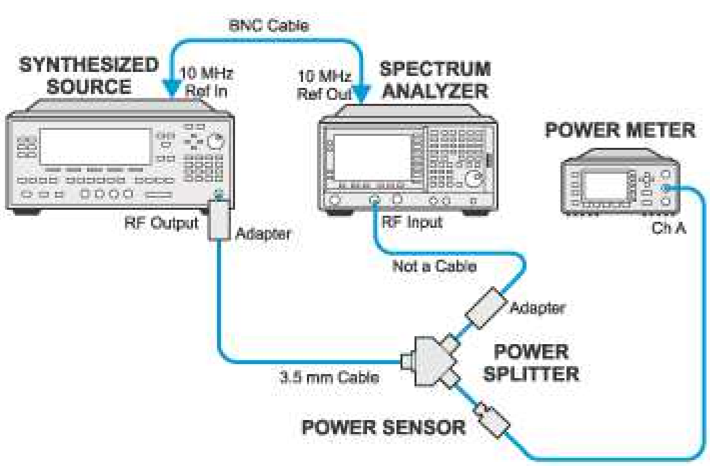
The values for flatness temperature compensation are also stored in the analyzer's EEPROM.

Related performance test: Frequency Response (High Band)

Required Equipment

Instrument	Recommended Model	For ESA Models
Syn Sweeper 1	E8257D	All
Power Meter 1	N1914A	All
Microwave Power Sensor	N8485A-CFT	E4404B, E4405B, E4407B, E4408B E7403A, E7404A, E7405A
Power Splitter 1	11667A	E4404B, E4405B, E7403A, E7404A
MW Power Splitter 1	11667B	E4407B, E4408B, E7405A

Connection Setup



Additional Information

Flatness Error

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

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

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IF Input Adjustment

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

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

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

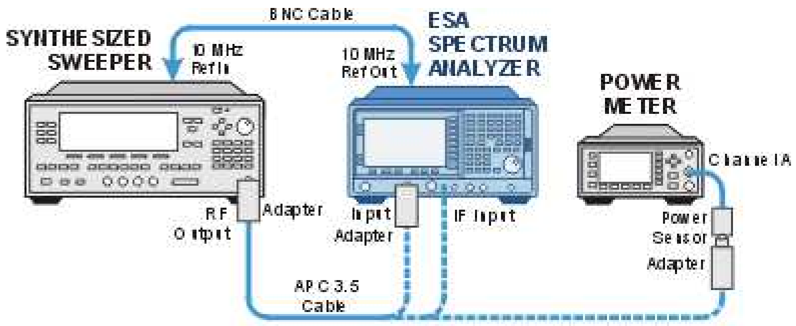
The analyzer will be automatically rebooted twice during this adjustment. The first reboot occurs after the default IF gain correction is stored in EEROM and the second reboot occurs after the measured IF gain correction is stored in EEROM.

Related performance test: IF Input Accuracy

Required Equipment

Instrument	Recommended Model	For ESA Models
Syn Sweeper 1	E8257D	All with Option AYZ
Power Meter 1	N1914A	All with Option AYZ
Low-power Power Sensor	8484A or 8481D	All with Option AYZ
30 dB Reference Attenuator	11708A	All with Option AYZ
Cable, BNC	8120-2582	All with Option AYZ
Cable, 3.5 mm	8120-4921	All with Option AYZ
Adapter, Type N (m) to 3.5 mm (f) (required for Option BAB)	1250-1744	All with Option AYZ
Adapter, 3.5 mm (f) to 3.5 mm (f) (not required for Option BAB)	1250-1749	All with Option AYZ
Adapter, Type N (f) to 3.5 mm (f)	1250-1745	All with Option AYZ

Connection Setup



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TG ALC Amplitude Adjustment

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

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

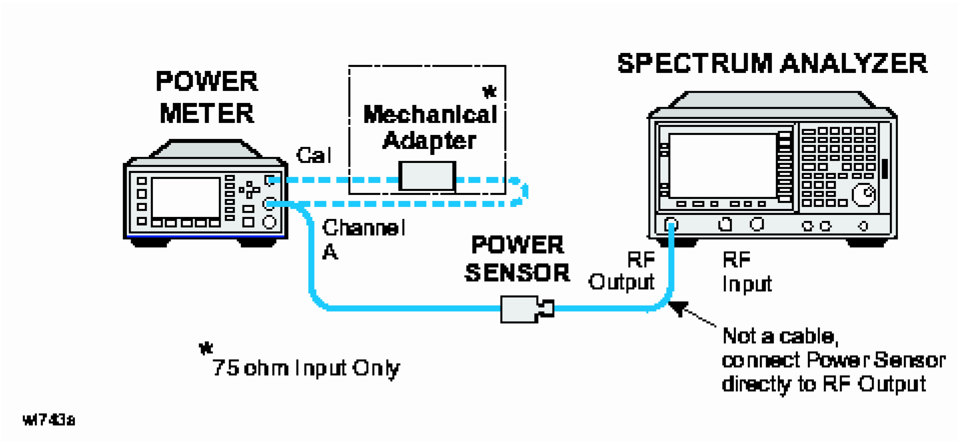
For a complete tracking generator adjustment, complete this adjustment first, then perform the Tracking Generator Frequency Slope adjustment which follows.

Related performance test: Tracking Generator Absolute Amplitude and Vernier Accuracy

Required Equipment

Instrument	Recommended Model	For ESA Models
Power Meter 1	N1914A	All
Power Sensor		All 50 W
Option 1DN	N8482A-CFT	E4401B, E4411B
Option 1DQ	8483A	75 W

Connection Setup



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TG Frequency Slope Adjustment

NOTE The TG ALC Calibration must be performed before this adjustment.

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

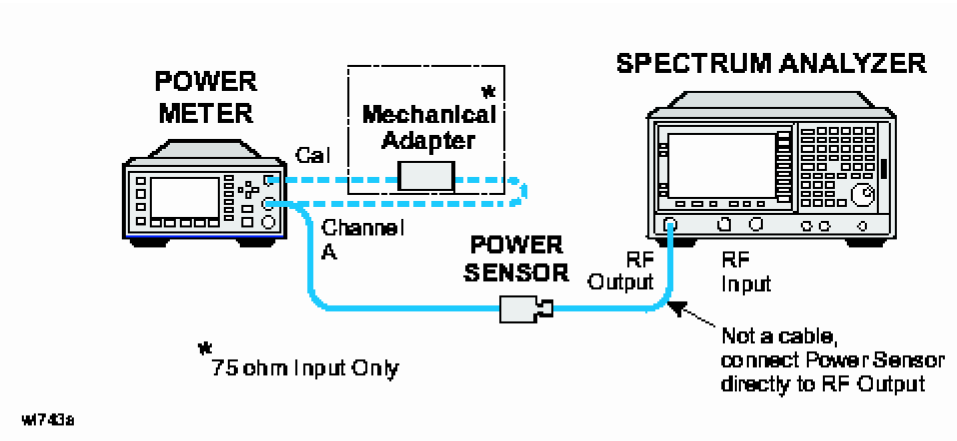
The tracking generator frequency slope adjustment is performed after the ALC adjustment is completed. In this adjustment the slope DAC is initially set to 0 (no slope correction). The output flatness is measured from 50 MHz to 1500 MHz and the optimum slope DAC setting is calculated and set. The output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

Related Performance Test: Tracking Generator Level Flatness

Required Equipment

Instrument	Recommended Model	For ESA Models
Power Meter 1	N1914A	All
Power Sensor Option 1DN Option 1DQ	 N8482A-CFT 8483A	All 50 W E4401B, E4411B 75 W

Connection Setup


POWER METER
Mechanical Adapter *
SPECTRUM ANALYZER
Cal
Channel A
POWER SENSOR
RF Output
RF Input
Not a cable, connect Power Sensor directly to RF Output
* 75 ohm Input Only
wl743a

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