

# **HP 8561E and 8563E Spectrum Analyzers Service Guide Supplement**

**Using Performance Tests When an  
HP 3335A Source Is Not Available**



**Manufacturing Part Number: 08563-srvsup**

**Printed in USA**

**October 1999**

© Copyright 1999 Hewlett-Packard Company

---

## Notice

The information contained in this document is subject to change without notice.

Hewlett-Packard makes no warranty of any kind with regard to this material, including but not limited to, the implied warranties of merchantability and fitness for a particular purpose. Hewlett-Packard shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material.

---

## Assistance

*For any assistance, contact your nearest Hewlett-Packard Sales and Service Office.*

---

## General Safety Considerations

---

**WARNING**     ***Before this instrument is switched on, make sure it has been properly grounded through the protective conductor of the ac power cable to a socket outlet provided with protective earth contact.***

**Any interruption of the protective (grounding) conductor, inside or outside the instrument, or disconnection of the protective earth terminal can result in personal injury.**

---

---

**WARNING**     **There are many points in the instrument which can, if contacted, cause personal injury. Be extremely careful.**

**Any adjustments or service procedures that require operation of the instrument with protective covers removed should be performed only by trained service personnel.**

---

---

**CAUTION**     ***Before this instrument is switched on, make sure its primary power circuitry has been adapted to the voltage of the ac power source.***

**Failure to set the ac power input to the correct voltage could cause damage to the instrument when the ac power cable is plugged in.**

---

---

# Contents

<b>1. Using this Adjustment Procedure Supplement</b>	
Introduction .....	1-2
Implementation Instructions .....	1-3
<b>2. Adjustment Procedures</b>	
Introduction .....	2-3
Using the TAM .....	2-11
<b>2a. Manual Adjustment Procedures: HP 3335A Source Not Available</b>	
What You'll Find in This Chapter .....	2a-2
Required Test Equipment .....	2a-3
4a. IF Amplitude Adjustments .....	2a-4
5a. DC Log Amplifier Adjustments .....	2a-9



---

# **1 Using this Adjustment Procedure Supplement**

This chapter contains an introduction that explains the need for this service guide supplement and instructions on how to implement the supplement material.

## Introduction

The HP 3335A Synthesizer Level Generator signal source has become obsolete because parts used in the manufacture of this instrument are no longer available from suppliers. To meet the needs of our customers, HP has created new performance verification tests and adjustment tests that use alternative signal sources.

The calibration and service guides are being revised to add additional procedures that do not use the HP 3335A. The changes include the addition of signal sources required to replace the 3335A, changes to the test equipment setup illustrations, and changes in the steps required to execute the procedures.

Because all of our customers will not need to replace the HP 3335A immediately, we are releasing the changes to the calibration guide and service guides in the form of two manual supplements. HP is making these procedure revisions available at this time in electronic form, only. You can download this manual supplement, and add it to your current manual as needed. You will not be required to replace your manuals just to incorporate these changes. These changes will be incorporated in new manuals shipped in the future.

To add these changes to your existing manuals, refer to [“Implementation Instructions,”](#) on [page 3](#).

## Implementation Instructions

Update your service guide by performing the following steps:

- Step 1.** After downloading this supplement, print a hard copy of the entire document.
- Step 2.** Remove page 2-1 through 2-10 from your service guide.
- Step 3.** Cross out Table 2-5, “Required Test Equipment for TAM,” on page 2-11.
- Step 4.** Insert page 2-1 through 2-12 from the supplement into the service guide.
- Step 5.** Remove the adjustment procedure chapter from the supplement, and insert it into your service guide as [Chapter 2a, “Manual Adjustment Procedures: HP 3335A Source not Available,”](#) immediately after Chapter 2.





---

## **2 Adjustment Procedures**

## Introduction

This chapter contains information on automated and manual adjustment procedures. Perform the automated procedures using the HP 85629B test and adjustment module (TAM). Adjustments should be performed after a repair or performance test failure, never perform adjustments as routine maintenance. Refer to [Table 2-1](#) to for which adjustments to perform.

### Automated Procedures

Using the TAM

### Manual Procedures

1. High Voltage Power Supply Adjustment
2. Display Adjustment
3. IF Bandpass Adjustment
4. IF Amplitude Adjustments
5. DC Log Amplifier Adjustments
6. Sampling Oscillator Adjustment
7. YTO Adjustment
8. LO Distribution Amplifier Adjustment (HP 8561E)
9. LO Distribution Amplifier Adjustment (HP 8563E)
10. Dual Band Mixer Bias Adjustment (HP 8561E)
11. Frequency Response Adjustment (HP 8561E)
12. Frequency Response Adjustment (HP 8563E)
13. Calibrator Amplitude Adjustment
14. 10 MHz Reference Adjustment — OCXO
15. 10 MHz Reference Adjustment — TCXO (Option 103)
16. Demodulator Adjustment
17. External Mixer Bias Adjustment
18. External Mixer Amplitude Adjustment
19. Signal ID Oscillator Adjustment
20. Switched YIG-Tuned Filter (SYTF) Adjustment (HP 8561E)
21. YIG-Tuned Filter/Mixer (RYTHM) Adjustment (HP 8563E)
22. 16 MHz PLL Adjustment
23. 600 MHz Reference Adjustment (serial prefix 3406A and above)

---

**NOTE** Before performing any adjustments, allow the spectrum analyzer to warm up for at least 5 minutes.

---

## Safety Considerations

Although this instrument has been designed in accordance with international safety standards, this manual contains information, cautions, and warnings which must be followed to ensure safe operation and to prevent damage to the instrument. Service and adjustments should be performed only by qualified service personnel.

---

**WARNING**

- **These servicing instructions are for use by qualified personnel only. To avoid electrical shock, do not perform any servicing unless you are qualified to do so.**
  - **The opening of covers or removal of parts is likely to expose dangerous voltages. Disconnect the product from all voltage sources while it is being opened.**
  - **Adjustments in this section are performed with power supplied to the instrument and protective covers removed. There are voltages at many points in the instrument which can, if contacted, cause personal injury. Be extremely careful. Adjustments should be performed only by trained service personnel.**
  - **Power is still applied to this instrument with the LINE switch in the off position. Before removing or installing any assembly or printed circuit board, remove the line-power cord.**
  - **The power cord is connected to internal capacitors inside that may remain live for 5 seconds after the instrument has been disconnected from its source of supply.**
  - **Use a nonmetallic adjustment tool whenever possible.**
- 

## Which Adjustments Should Be Performed?

Table 2-1 lists the manual adjustments that should be performed when an assembly is repaired or changed. It is important to perform the adjustments in the order indicated to ensure that the instrument meets its specifications.

Chapter 2a, “Manual Adjustment Procedures: HP 3335A Source not Available,” provides instructions and procedures for making adjustments when the HP 3335A Synthesizer Level Generator is not available. If the HP 3335A is not available, substitute those procedures for the procedures of the same number and name found in this chapter.

## Test Equipment

The equipment required for the manual adjustment procedures is listed in Table 1-4, “Recommended Test Equipment.” Any equipment that satisfies the critical specifications given in the table may be substituted for the preferred test equipment.

## Adjustable and Factory-Selected Components

Table 2-2 lists the adjustable components by reference designation and name. For each component, the table provides a description and lists the adjustment number.

Refer to Table 2-3 for a complete list of factory-selected components used in the instrument along with their functions. Factory-selected components are identified with an asterisk on the schematic diagrams.

## **Adjustment Tools**

For adjustments requiring a nonmetallic tuning tool, use fiber tuning tool, HP part number 8170-0033.

Two different tuning tools may be necessary for IF bandpass adjustments, depending on the type of tuning slug used in the slug-tuned inductors. If the tuning slug requires a slotted tuning tool, use HP part number 8710-1010. If the tuning slug requires a forked tuning tool, use HP part number 8710-0772.

Never try to force an adjustment control. This is especially critical when tuning variable capacitors or slug-tuned inductors. Required service accessories, with part numbers, are listed under “Service Kit” in Chapter 1, “General Information”.

## **Instrument Service Position**

Refer to Chapter 3, “Assembly Replacement”, for information on removing the spectrum analyzer cover assembly and accessing all internal assemblies.

**Table 2-1 Related Adjustments**

Assembly Changed or Repaired	Perform the Following Related Adjustments in the Order Listed	Adjustment Number
A1A1 keyboard	No related adjustment	
A1A2 RPG	No related adjustment	
A2 controller	16 MHz PLL adjustment	22
	Display adjustment	2
	If EEROM from old A2 controller could not be used in a new A2 or if EEROM must be replaced, also perform the following adjustments:	
	LO distribution amplifier adjustment (HP 8561E)	8
	LO distribution amplifier adjustment (HP 8563E)	9
	Dual band mixer bias adjustment (HP 8561E)	10
	External mixer amplitude adjustment	18
	Switched YIG-tuned filter adjustment (HP 8561E)	20
	YIG-tuned filter/mixer adjustment (HP 8563E)	21
	Frequency response adjustment (HP 8561E)	11
	Frequency response adjustment (HP 8563E)	12
A3 interface	Display adjustment (fast zero span)	2
	Frequency response adjustment (HP 8561E)	11
	Frequency response adjustment (HP 8563E)	12
A4 log amp/cal osc	Display adjustment (Fast Zero Span)	2
	Demodulator adjustment	16
	IF amplitude adjustment	4
	DC log amplifier adjustment	5
A5 IF	IF bandpass adjustment	3
	IF amplitude adjustment	4
A6 power supply	High voltage power supply adjustment	1
	Display adjustment	2
A6A1 HV module	High voltage power supply adjustment	1
	Display adjustment	2
A7 LO distribution amplifier	LO distribution amplifier adjustment (HP 8561E)	8
	Frequency response adjustment (HP 8561E) (or perform the frequency response performance test in the <i>HP 8560 E-Series Spectrum Analyzer Calibration Guide</i> . The adjustment must be performed if the performance test fails.)	11

**Table 2-1 Related Adjustments (Continued)**

Assembly Changed or Repaired	Perform the Following Related Adjustments in the Order Listed	Adjustment Number
A7 switched LO distribution amplifier	LO distribution amplifier adjustment (HP 8563E)	9
	Frequency response adjustment (HP 8563E) (or perform the frequency response performance test in the <i>HP 8560 E-Series Spectrum Analyzer Calibration Guide</i> . The adjustment must be performed if the performance test fails.)	12
A8 dual band mixer	Dual band mixer bias adjustment (HP 8561E)	10
	Frequency response adjustment (HP 8561E)	11
A8 low band mixer	Frequency response adjustment (HP 8563E)	12
A9 input attenuator	Frequency response adjustment (HP 8561E) (or perform the frequency response performance test in the <i>HP 8560 E-Series Spectrum Analyzer Calibration Guide</i> . The adjustment must be performed if the performance test fails.)	11
A9 input attenuator	Frequency response adjustment (HP 8563E) (or perform the frequency response performance test in the <i>HP 8560 E-Series Spectrum Analyzer Calibration Guide</i> . The adjustment must be performed if the performance test fails.)	12
A10 SYTF	Switched YIG-tuned filter (SYTF) adjustment (HP 8561E)	20
	Frequency response adjustment (HP 8561E)	11
A10 RYTHM	YIG-tuned filter/mixer (RYTHM) adjustment (HP 8563E)	21
	Frequency response adjustment (HP 8563E)	12
A11 YTO	YTO adjustment	7
A13 2nd converter	Frequency response adjustment (HP 8561E)	11
	Frequency response adjustment (HP 8563E)	12
A14 frequency control	Display adjustment (fast zero span)	2
	YTO adjustment	7
	LO distribution amplifier adjustment (HP 8561E)	8
	LO distribution amplifier adjustment (HP 8563E)	9
	Frequency response adjustment (HP 8561E)	11
	Frequency response adjustment (HP 8563E)	12
	10 MHz reference adjustment (TCXO, Option 103)	15
A15 RF	Calibrator amplitude adjustment	13
	External mixer bias adjustment	17
	Sampling oscillator adjustment	6
	Signal ID oscillator adjustment	19
	External mixer amplitude adjustment	18
	Frequency response adjustment (HP 8561E)	11
	Frequency response adjustment (HP 8563E)	12

**Table 2-1 Related Adjustments (Continued)**

<b>Assembly Changed or Repaired</b>	<b>Perform the Following Related Adjustments in the Order Listed</b>	<b>Adjustment Number</b>
A15U100 sampler	Sampling oscillator adjustment	6
A17 CRT driver	Display adjustment	2
A18V1 CRT	Display adjustment	2
A19 HP-IB	No related adjustment	
A21 OCXO	10 MHz reference adjustment (OCXO)	14

**Table 2-2 Adjustable Components**

<b>Reference Designator</b>	<b>Adjustment Name</b>	<b>Adjustment Number</b>	<b>Description</b>
A2R152	16 MHz PLL ADJ	22	Adjusts the free-running frequency of the 16 MHz CPU clock.
A2R206	DGTL X GAIN	2	Adjusts the horizontal gain in the X line generator.
A2R209	SWEEP OFFSET	2	Adjusts the beginning of the trace to the leftmost vertical graticule line in fast-analog zero-span mode.
A2R215	DGTL Y GAIN	2	Adjusts the vertical gain in the Y line generator.
A2R218	VIDEO OFFSET	2	Adjusts the vertical position in fast-analog zero span to match the digital zero-span input.
A2R262	STOP BLANK	2	Adjusts the blanking at the end of a vector on the display.
A2R263	START BLANK	2	Adjusts the blanking at the start of a vector on the display.
A2R268	VIDEO GAIN	2	Adjusts the vertical gain in fast-analog zero span to match with the digital zero-span input.
A2R271	SWEEP GAIN	2	Adjusts the end of the trace to the rightmost vertical-graticule line in fast-analog zero-span mode.
A4C707	FM DEMOD	16	Adjusts the FM demodulation for a peak response.
A4R445	LIMITER PHASE	5	Adjusts Limiter Phase for peak response.
A4R531	LOG AMP TOS	5	Minimizes error to Top of Screen.
A4R544	LIN FIDELITY BOW	5	Minimizes Linearity Fidelity error.

**Table 2-2 Adjustable Components (Continued)**

<b>Reference Designator</b>	<b>Adjustment Name</b>	<b>Adjustment Number</b>	<b>Description</b>
A4R826	CAL OSC AMPTD	4	Sets calibration oscillator output power (nominally –35 dBm). This power is injected into the IF during the AUTO IF ADJUST routines.
A5L300	LC CTR 1	3	Adjusts center frequency of first stage of LC bandwidth filter to 10.7 MHz.
A5L301	LC CTR 2	3	Adjusts center frequency of first stage of LC bandwidth filter to 10.7 MHz.
A5L700	LC CTR 3	3	Adjusts center frequency of third stage of LC bandwidth filter to 10.7 MHz.
A5L702	LC CTR 4	3	Adjusts center frequency of fourth stage of LC bandwidth filter to 10.7 MHz.
A5R343	15 DB ATT	4	Adjusts the attenuation of the reference 15 dB attenuator for 15 dB between minimum and maximum attenuation.
A5T200	XTAL CTR 1	3	Adjusts center frequency of first stage of crystal bandwidth filter to 10.7 MHz.
A5T202	XTAL CTR 2	3	Adjusts center frequency of second stage of crystal bandwidth filter to 10.7 MHz.
A5T500	XTAL CTR 3	3	Adjusts center frequency of third stage of crystal bandwidth filter to 10.7 MHz.
A5T502	XTAL CTR 4	3	Adjusts center frequency of fourth stage of crystal bandwidth filter to 10.7 MHz.
A6R410	HV ADJ	1	Adjusts the voltage between A6TP405 and A6TP401 to the voltage marked on the A6A1 high voltage module.
A14R42	6.01 GHz	7	Adjusts the main coil tune driver current at a YTO frequency of 6.01 GHz (near the upper YTO frequency limit).
A14R76	FM SPAN	7	Adjusts the FM span accuracy by affecting the sensitivity of the FM coil driver.
A14R93	3.2 GHz	7	Adjusts the main coil fixed driver current at a YTO frequency of 3.2 GHz (near the lower YTO frequency limit).
A15C100	SMPL MATCH	6	Transforms the sampler input impedance to 50 ohms over the 285 to 297.2 MHz range.
A15C210	VCO RANGE	6	Adjusts the VCO tank capacitance so that 21 V on the VCO tune line equals 298 MHz VCO frequency.



**Table 2-2 Adjustable Components (Continued)**

<b>Reference Designator</b>	<b>Adjustment Name</b>	<b>Adjustment Number</b>	<b>Description</b>
A15C629	SIG ID	19	Fine adjusts the 298 MHz SIG ID oscillator frequency to optimize its performance.
A15U302	10 MHz ADJ	15	Adjusts frequency of the temperature compensated crystal oscillator (TCXO) to 10 MHz.
A15R561	CAL AMPTD	13	Adjusts amplitude of the 300 MHz calibrator signal to -10.0 dBm.
A15R926	EXT BIAS ZERO	17	Adjusts zero bias point of external mixer bias.
A17R4	Z GAIN	2	Adjusts maximum intensity.
A17R11	CUTOFF	2	Adjusts intensity to turn off blanked lines.
A17R21	Z FOCUS	2	Adjusts focus for lines of different brightness.
A17R26	X FOCUS	2	Adjusts focus at the left and right corners of the display.
A17R34	COARSE FOCUS	2	Adjusts focus at the center of the display.
A17R55	X GAIN	2	Adjusts the horizontal-deflection amplifier gain.
A17R57	X POSN	2	Adjusts the CRT horizontal position.
A17R75	Y GAIN	2	Adjusts the vertical-deflection amplifier gain.
A17R77	Y POSN	2	Adjusts the CRT vertical position.
A17R90	TRACE ALIGN	2	Adjusts the display axis rotation.
A17R92	DDD	2	Adjusts focus of the center of the display.
A17R93	ASTIG	2	Adjusts for the spot roundness on the CRT display.

**Table 2-3 Factory Selected Components**

<b>Reference Designator</b>	<b>Adjustment Number</b>	<b>Basis of Selection</b>
A5C204	3	Selected to optimize center frequency of LC tank that loads the crystal.
A5C216	3	Selected to optimize center frequency of LC tank that loads the crystal.
A5C326	3	Selected to optimize LC pole center frequency.
A5C327	3	Selected to optimize LC pole center frequency.
A5C505	3	Selected to optimize center frequency of LC tank that loads the crystal.
A5C516	3	Selected to optimize center frequency of LC tank that loads the crystal.
A5C717	3	Selected to optimize LC pole center frequency.
A5C718	3	Selected to optimize LC pole center frequency.

## Using the TAM

The HP 85629B TAM can be used to perform approximately half of the spectrum analyzer adjustment procedures. [Table 2-4](#) lists the TAM adjustments and their corresponding manual adjustments.

The TAM adjustments do not include procedures for choosing factory-selected components. If an adjustment cannot be made and a factory-selected component must be changed, refer to the corresponding manual adjustment.

To select an adjustment, press **MODULE** to display the TAM main menu, then press **ADJUST**. Position the pointer next to the desired adjustment using either the knob or step keys. Press **EXECUTE**, then follow the instructions displayed on-screen.

## Test Equipment

During the TAM adjustments, instructions for setting test equipment controls are displayed, with the exclusion of the two tests listed below. Test equipment for these adjustments are controlled automatically.

Test 10. Low Band Flatness

Test 11. High Band Flatness and YTF

[Table 2-5](#) lists the test equipment needed to perform each TAM adjustment. Required models must be used. Substitutions may be made for recommended models. Substitute sources must operate over the frequency ranges indicated. Recommended substitutes are listed in the configuration menu. If you must substitute the source with a user-defined model, the adjustments run faster using a synthesized source rather than an unsynthesized source.

---

**NOTE** When connecting signals from the HP 8340A/B (or any microwave source) to the adjustment setup, use a high-frequency test cable with minimum attenuation to 26.5 GHz. HP part number 8120-4921 is recommended for its ruggedness, repeatability, and low insertion loss.

---

## Adjustment Indicator

To aid in making adjustments, the TAM displays an “Analog Voltmeter Display Box” along the left-hand side of the display. A horizontal line moves inside the box to represent the needle of an analog voltmeter. A digital readout appears below the box. Tick marks are often displayed on the inside edges of the box indicating the desired needle position. (The tick marks and needle are intensified when the needle is within this acceptable region.) During some adjustments, an arrow appears along the right edge of the box. This arrow always indicates the highest position the needle has reached. The arrow is useful when a component must be adjusted for a peak response; if the peak is overshoot, the arrow indicates where the peak was. The component can be readjusted until the needle is at the same position as the arrow.

**Table 2-4 TAM Adjustments**

<b>TAM Adjustment</b>	<b>Corresponding Manual Adjustment</b>	<b>Adjustment Number</b>
1. IF bandpass, LC poles	IF bandpass adjustment	3
2. IF bandpass, crystal poles	IF bandpass adjustment	3
3. IF amplitude	IF amplitude adjustment	4
4. Limiter phase	DC log amplifier adjustments, A4 limiter phase	5
5. Linear fidelity	DC log amplifier adjustments, A4 linear fidelity	5
6. Log fidelity	DC log amplifier adjustments, A4 log fidelity	5
7. Sampling oscillator	Sampling oscillator adjustment	6
8. YTO	YTO adjustment	7
9. LO distribution amplifier	First LO distribution amplifier adjustment	8
10. Low band flatness	Frequency response adjustment	9
11. High band flatness and YTF	Frequency response adjustment	9
	YIG-tuned filter/mixer adjustment	17
12. Calibrator amplitude	Calibrator amplitude adjustment	10
13. 10 MHz reference oscillator	10 MHz reference adjustment – TCXO (Option 103)	12
14. External mixer bias	External mixer bias adjustment	14
15. External mixer amplitude	External mixer amplitude adjustment	15

**Table 2-5 Required Test Equipment for TAM**

Adjustment	Equipment Used	Required Model	Recommended Model
1. IF Bandpass, LC Poles	None		
2. IF Bandpass, Crystal Poles	None		
3. IF Amplitude	Signal Generator Test Cable (SMB to BNC) Manual Probe Cable	HP E4421B or HP 8663A	85680-60093
4. Limiter Phase	Signal Generator Test Cable BNC	HP E4421B or HP 8663A	HP 10503A
5. Linear Fidelity	Signal Generator Test Cable BNC	HP E4421B or HP 8663A	HP 10503A
6. Log Fidelity	Signal Generator Test Cable BNC	HP E4421B or HP 8663A	HP 10503A
7. Sampling Oscillator	Manual Probe Cable		
8. YTO	Frequency Counter (3 to 6.8 GHz)		HP 5342A, HP 5343A
9. LO Distribution Amplifier	Power Meter Power Sensor (3 to 6.8 GHz, 10 to 20 dBm)		HP 8902A, HP 436A, HP 438A HP 8485A
10. Low Band Flatness	Source (10 MHz to 2.9 GHz) Power Meter Power Sensor (10 MHz to 2.9 GHz) Power Splitter (10 MHz to 2.9 GHz)		HP 8340A/B HP 8902A, HP 436A, HP438A HP 8482A, HP 8481A HP 11667B
11. High band flatness and YTF	Source (2.8 to 26.5 GHz) Power meter Power sensor (2.8 to 26.5 GHz) Power splitter (2.8 to 26.5 GHz)		HP 8340A HP 8902A, HP 436A, HP 438A HP 8485A HP 11667B
11. Calibrator Amplitude	Power Meter Power Sensor	HP 8482A, HP 8481A	HP 8902A, HP 436A, HP 438A
12. 10 MHz Reference Oscillator	Frequency Counter (9 to 11 MHz)		HP 5342A, HP 5343A
13. External Mixer Bias	Manual Probe Cable		
14. External Mixer Amplitude	Power Meter Power Sensor (310.7 MHz, -25 to -35 dBm) Source (310.7 MHz, -30 dBm)		HP 8902A, HP 436A, HP 438A HP 8481D, HP 8484A HP 8340A/B

---

**2a Manual Adjustment Procedures:  
HP 3335A Source Not Available**

## **What You'll Find in This Chapter**

This chapter provides alternative procedures for the adjustment of the spectrum analyzer that do not require the use of the HP 3335A Synthesizer Level Generator. The HP 3335A has been discontinued. Because of the unavailability of the HP 3335A, new adjustment procedures are required that use different signal sources. If the HP 3335A is not available, substitute these procedures for those of the same number found in [Chapter 2, "Adjustment Procedures."](#)

## Required Test Equipment

The following table lists the test equipment required to execute the adjustments in this chapter. These adjustments originally required the use of the HP 3335A Synthesizer Level Generator. .

**Table 2a-1 Recommended Test Equipment**

Instrument	Critical Specifications for Equipment Substitution	Recommended Model
<b>Sources</b>		
Synthesized Signal Generator	Frequency range: 250 kHz to 3 GHz Frequency resolution: 1 Hz Attenuator resolution: 0.02 dB Level accuracy: $\pm 0.5$ dB External 10 MHz Ref. Input	HP E4421B or HP E4422B, HP E4432B, HP E4433B
<b>Cables</b>		
Cable, 50 $\Omega$ coaxial <i>(four required)</i>	Connectors: BNC (m) Length: $\geq 122$ cm (48 in.)	HP 10503A
Cable	Test Cable	85680-60043
<b>Adapters</b>		
Adapter <i>(four required)</i>	Type N (m)-to-BNC (f)	1250-1476
Adapter <i>(Option 026 only)</i>	APC-3.5 (f) to APC-3.5 (f)	5061-5311
Adapter <i>(Option 026 only)</i>	APC-3.5 (f) to BNC-3.5 (f)	1250-1200

## 4a. IF Amplitude Adjustments

The IF amplitude adjustments consist of the cal oscillator amplitude adjustment and the reference 15 dB attenuator adjustment.

### Assembly Adjusted

A4 log amp/cal oscillator A5 IF assembly

### Related Performance Tests

IF Gain Uncertainty Scale Fidelity

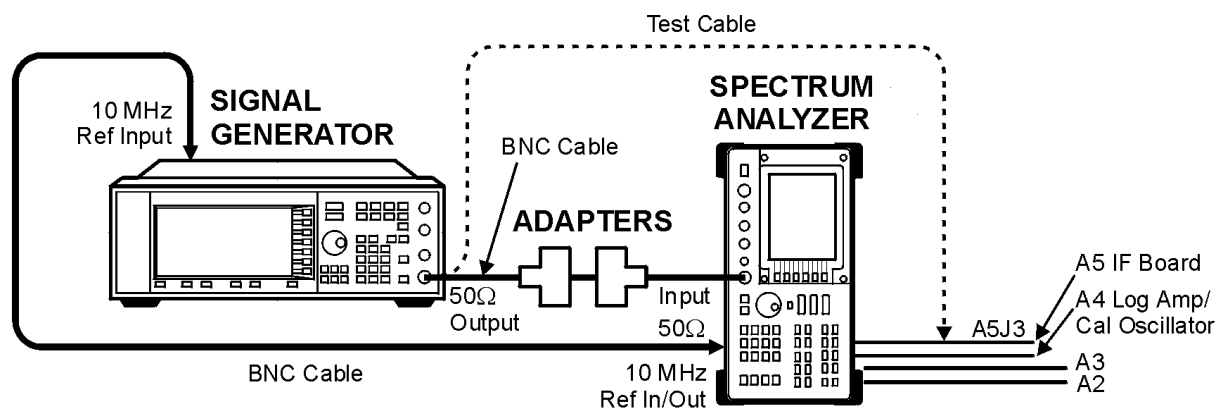
### Description

This adjustment sets the output amplitude of the A4 log amp/cal oscillator and the absolute amplitude of the reference 15 dB attenuator.

The output of the A4 log amp/cal oscillator is adjusted so that a  $-55$  dBm signal applied to the 10.7 MHz IF input on the A5 IF assembly (A5J3) causes a displayed signal of  $-60$  dBm. The effect of this adjustment is visible only after the **ADJ CURR IF STATE** sequence is complete. **ADJ CURR IF STATE** causes the IF gain adjustment to use the “new” output amplitude from the A4 log amp/cal oscillator.

This procedure also sets the attenuator of the reference 15 dB attenuator so that a source amplitude change of 50 dB combined with a spectrum analyzer reference level change of 50 dB displays an amplitude difference of 50 dB.

**Figure 2a-1 IF Amplitude Adjustment Setup**



hj11e



## Equipment

Signal Generator ..... HP E4421B

### Adapters

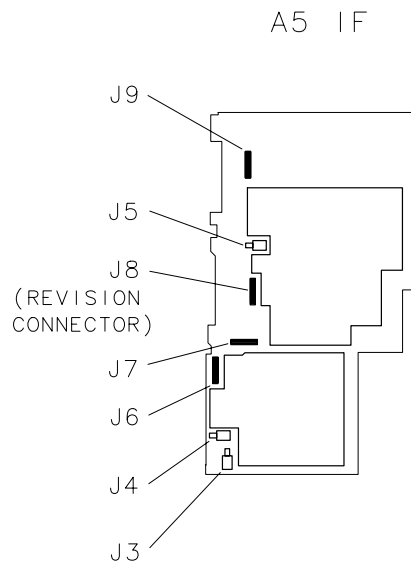
Type N (m) to BNC (f) ..... 1250-1476

### Cables

BNC, 122 cm (48 in) ..... HP 10503A

Test cable ..... 85680-60093

**Figure 2a-2 IF Amplitude Adjustment Locations**



sj115c

---

**NOTE**      The 15 dB reference attenuator adjustment is preset at the factory and need not be done if the entire A5 IF assembly is replaced.

---

## 4a. IF Amplitude Adjustments

**Procedure**

1. Press **LINE** to turn the spectrum analyzer off. Remove the spectrum analyzer cover and place the spectrum analyzer in the service position as illustrated in [Figure 2a-1](#).
2. Disconnect W29, violet coax cable, from A5J3. Connect the test cable between A5J3 and the RF output of the HP E4421B. Press **LINE** to turn the spectrum analyzer on.
3. Set the spectrum analyzer controls as follows:

Center Frequency . . . . . 10.7 MHz  
 Span . . . . . 200 kHz  
 Reference Level . . . . . -60 dBm  
 Attenuator . . . . . 0 dB  
 dB/division . . . . . 1 dB/DIV  
 Resolution bandwidth . . . . . 300 kHz  
 Video bandwidth . . . . . 100 Hz

4. On the spectrum analyzer, press **MKR**, **CAL**, and **IF ADJ ON OFF** so **OFF** is underlined.
5. Set the HP E4421B controls as follows:

Frequency . . . . . 10.7 MHz  
 Amplitude . . . . . -55 dBm  
 Mod On/Off. . . . . Off

6. Note the marker value. Ideally it should read  $-60 \text{ dBm} \pm 0.1 \text{ dB}$ .
7. If the marker reads less than  $-60.1 \text{ dBm}$ , rotate A4R826 CAL OSC AMPTD one-third turn clockwise for every 0.1 dB less than  $-60 \text{ dBm}$ . See [Figure 2a-2](#) for the location of A4R826. A change in the displayed amplitude will not be seen until **ADJ CURR IF STATE** is pressed.
8. If the marker reads greater than  $-59.9 \text{ dBm}$ , rotate A4R826 CAL OSC AMPTD one-third turn counter clockwise for every 0.1 dB greater than  $-60 \text{ dBm}$ . See [Figure 2a-2](#) for the location of A4R826. A change in the displayed amplitude will not be seen until **ADJ CURR IF STATE** is pressed.

---

**NOTE**      If A4R826 has inadequate range, refer to “Inadequate CAL OSC AMPTD Range” in Chapter 8, “IF Section”.

---

9. On the spectrum analyzer, press **ADJ CURR IF STATE**. After allowing the analyzer time to complete the adjustments, the displayed amplitude and marker reading should change.
10. Repeat [step 7](#) through [step 9](#) until the marker reads  $-60 \text{ dBm} \pm 0.1 \text{ dB}$ .
11. Disconnect the test cable from A5J3 and reconnect W29 to A5J3.

## A5 Reference Attenuator Adjustment

1. Set the spectrum analyzer reference level to  $-60$  dBm. If markers are displayed, press **MKR** and **MARKERS OFF**.
2. Set the HP E4421B **Amplitude** to  $-60$  dBm.
3. Connect a BNC cable between the RF output of the HP E4421B and the spectrum analyzer INPUT  $50\Omega$
4. On the spectrum analyzer, press **CAL** and **REF LVL ADJ**. Use the front panel knob or step keys to place the peak of the displayed signal 3 dB to 5 dB below the reference level.
5. On the spectrum analyzer, press **PEAK SEARCH** and **MARKER DELTA**. Set the spectrum analyzer reference level to  $-10$  dBm.
6. Change the HP 4421B **Amplitude** to  $-10$  dBm.
7. On the spectrum analyzer, press **CAL**.
8. Note the  $\Delta$ MKR amplitude. Ideally, it should read  $50.00$  dB  $\pm 0.1$  dB.
9. If the  $\Delta$ MKR amplitude is less than  $49.9$  dB, rotate A5R343 15 dB ATTEN one-half turn counterclockwise for each  $0.1$  dB less than  $50.00$  dB. Do not adjust A5R343 more than five turns before continuing with the next step.
10. If the  $\Delta$ MKR amplitude is greater than  $50.1$  dB, rotate A5R343 15 dB ATTEN one-half turn clockwise for each  $0.1$  dB greater than  $50.00$  dB. Do not adjust A5R343 more than five turns before continuing with the next step.
11. On the spectrum analyzer, press **ADJ CURR IF STATE**. Note the  $\Delta$ MKR amplitude reading.
12. Repeat [step 1](#) through [step 11](#) until the  $\Delta$ MKR amplitude reading is  $50.00$  dB  $\pm 0.1$  dB.

## A5 Adjustment Verification

1. On the spectrum analyzer, disconnect W29 from A5J3. Connect the test cable between A5J3 and the RF output of the HP E4421B.
2. Set the spectrum analyzer reference level to  $-10$  dBm.
3. Set the HP E4421B **Amplitude** to  $-5$  dBm.
4. On the spectrum analyzer, press **MKR** and **MARKER NORMAL**.
5. The **MARKER** amplitude should read  $-10$  dBm  $\pm 0.13$  dB. If the reading is outside of this range, repeat [step 4, on page 2a-6](#) through [step 12, on page 2a-7](#).
6. On the spectrum analyzer, reconnect W29 to A5J3. Press **PRESET** and set the controls as follows:  
Center frequency ..... 300 MHz  
Span ..... 0 Hz  
Reference level .....  $-10$  dBm  
Resolution bandwidth ..... 300 kHz
7. Connect a BNC cable between the HP 8563E **CAL OUTPUT** and **INPUT 50 $\Omega$**
8. On the spectrum analyzer, press **MKR CAL** and **REF LVL ADJ**.
9. Use the knob or step keys to adjust the **REF LEVEL CAL** setting until the **MKR** reads  $-10.00$  dBm  $\pm 0.1$  dB.
10. On the spectrum analyzer, press **STORE REF LVL**.

## 5a. DC Log Amplifier Adjustments

There are three DC log adjustments; limiter phase, linear fidelity, and log fidelity.

### Assembly Adjusted

A4 log amp/cal oscillator

### Related Performance Tests

IF Gain Uncertainty Scale Fidelity

### Description

These three adjustment need only be done under the following conditions:

Limiter phase Only if a repair is made to blocks F, G, H, I, or J.

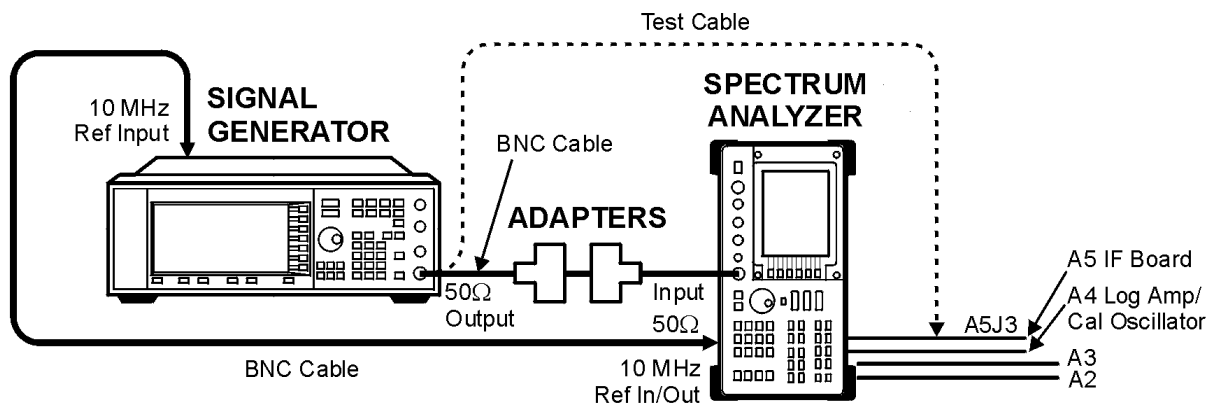
Linear fidelity Only if a repair is made to blocks C, D, F, G, H, I, J, K, O, IF gain accuracy, RBW switching, or log fidelity.

Log fidelity Only if a repair is made to blocks D, F, H, K, IF gain accuracy, RBW switching, or log fidelity.

If multiple adjustments are required they should be done in the following order:

1. Limiter Phase
2. Linear Fidelity
3. Log Fidelity

Figure 2a-3 DC Log Adjustment Setup



hj11e

## Equipment

Signal Generator .....HP E4421B

### Adapters

Type N (m) to BNC (f) ..... 1250-1476

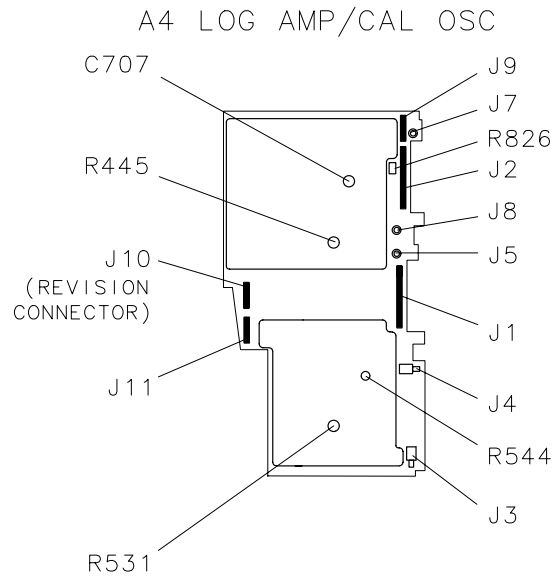
Type N (f) to 2.4 mm (f) ..... HP 11903B

### Cables

BNC, 122 cm (48 in) ..... HP 10503A

Test cable ..... 85680-60093

**Figure 2a-4 DC Log Adjustment Locations**



sj116c

---

**NOTE** Adjustments should be made with all of the shields on and only after allowing at least a 20 minute warmup.

---

## A4 Limiter Phase Adjustment

1. Press **LINE** to turn the spectrum analyzer off. Remove the spectrum analyzer cover and place the spectrum analyzer in the service position as illustrated in [Figure 2a-3](#). See [Figure 2a-4](#) for adjustment location.
2. Connect the HP E4421B RF output to the spectrum analyzer 50 $\Omega$  input. Press **LINE** to turn the spectrum analyzer on.
3. Set the spectrum analyzer controls as follows:  
Center frequency ..... 15 MHz  
Span ..... 0 MHz  
Reference level ..... -10 dBm  
dB/division ..... 1 dB/DIV  
Resolution bandwidth ..... 300 kHz  
IF ADJ ..... OFF
4. Set up an HP E4421B as follows:  
Frequency ..... 15 MHz  
Amplitude ..... -18 dBm  
Mod On/Off ..... Off
5. Press **CAL**, **ADJ CURR IF STATE**, wait for the analyzer to complete adjustments then press **MKR**.
6. Adjust A4R445 for maximum on-screen amplitude. Refer to [Figure 2a-4](#) for the location of A4R445.

## A4 Linear Fidelity Adjustment

1. Press **LINE** to turn the spectrum analyzer off. Remove the spectrum analyzer cover and place the spectrum analyzer in the service position as illustrated in [Figure 2a-3](#). See [Figure 2a-4](#) for adjustment location.
2. Connect the HP E4421B RF output to the spectrum analyzer 50Ω input. Press **LINE** to turn the spectrum analyzer on.
3. On the spectrum analyzer, press **PRESET AMPLITUDE, LINEAR, MORE 1 of 3, AMPTD UNITS, dBm, CAL,** and **IF ADJ ON OFF (OFF)**.
4. Set the spectrum analyzer controls as follows:  
Center frequency . . . . . 15 MHz  
Span . . . . . 5 MHz  
Resolution bandwidth . . . . . 300 kHz  
Reference level . . . . . -10 dBm
5. Set up an HP E4421B as follows:  
Frequency . . . . . 15 MHz  
Amplitude . . . . . -10 dBm  
Mod On/Off . . . . . Off
6. On the spectrum analyzer, press **PEAK SEARCH** and **MARKER DELTA**.
7. Reduce the HP E4421B input power to -58 dBm.
8. If the delta marker amplitude reads -40 dB ±2 dB, no adjustment is necessary.
9. If the signal is lower on the screen than expected (delta marker amplitude reads less than -42dB) then adjust A4R544 (see [Figure 2a-4](#)) for an even lower level and press **CAL** and **ADJ CURR IF STATE**. Allow sufficient time for the analyzer to complete the adjustment.
10. If the signal is higher on the screen than expected (delta marker amplitude reads greater than -38 dB) then adjust A4R544 for an even higher level signal and press **CAL** and **ADJ CURR IF STATE**. Allow sufficient time for the analyzer to complete the adjustment.
11. Repeat [step 7](#) through [step 10](#).



## A4 LOG Fidelity Adjustment

1. Press **LINE** to turn the spectrum analyzer off. Remove the spectrum analyzer cover and place the spectrum analyzer in the service position as illustrated in [Figure 2a-3](#). See [Figure 2a-4](#) for adjustment location.
2. Connect the HP E4421B RF output to the spectrum analyzer 50Ω input. Press **LINE** to turn the spectrum analyzer on.
3. On the spectrum analyzer, press **PRESET**, **CAL**, **IF ADJ ON OFF (OFF)**, and **ADJ CURR IF STATE**.
4. Set the spectrum analyzer controls as follows:

Center frequency . . . . . 15 MHz  
Span. . . . . 0 MHz  
Resolution bandwidth. . . . . 300 kHz  
Reference level . . . . . -10 dBm

5. Set up an HP E4421B as follows:  
Frequency . . . . . 15 MHz  
Amplitude . . . . . -10 dBm  
Mod On/Off . . . . . Off
6. On the spectrum analyzer, press **MKR**, **MARKER DELTA** on the spectrum analyzer.
7. Decrease the HP E4421B power to -26 dBm.
8. Calculate the error:

$$\text{Error} = \text{delta marker reading} - 16 \text{ dB}$$

9. If the error is less than ±0.2 dB, no adjustment is necessary.
10. Set the HP 3335A power to -10 dBm.
11. Adjust A4R531 (see [Figure 2a-4](#)) to read two times the error.  
For example, if the calculated error is +0.75 dB, adjust A4R531 for a delta marker amplitude reading of +1.5 dB.
12. On the spectrum analyzer, press **CAL** and **ADJ CURR IF STATE**.
13. Repeat [step 7](#) through [step 12](#).



## A

A4 limiter phase adjustment, [2a-10](#)  
A4 linear fidelity adjustment, [2a-11](#)  
A4 log fidelity adjustment, [2a-12](#)  
adjustment  
adjustable components table, [2-6](#)  
factory selected components, [2-6](#)  
related adjustments table, [2-5](#)  
safety considerations, [2-3](#)  
TAM and corresponding manual adjustments, [2-11](#)  
TAM test equipment information, [2-11](#)  
TAM test equipment list, [2-12](#)  
tools, [2-5](#)  
using TAM, [2-11](#)  
adjustment procedures, [2-3](#), [2-13](#)  
cal oscillator amplitude, [2a-4](#)  
DC log amplifiers, [2a-9](#)  
IF amplitude, [2a-4](#)  
adjustments  
recommended test equipment, [2a-3](#)

## C

components  
adjustable components table, [2-6](#)

## D

DC log amplifier adjustments, [2a-9](#)

## H

HP 85629B Test and Adjustment Module, [2-11](#)

## I

IF amplitude adjustments, [2a-4](#)  
implementation instructions, [1-3](#)  
introduction, [1-2](#)

## L

limiter phase adjustment, [2a-10](#)  
linear fidelity adjustment, [2a-11](#)  
log fidelity adjustment, [2a-12](#)

## T

TAM adjustments, [2-11](#), [2-13](#)  
adjustment indicators, [2-11](#)  
corresponding manual adjustments, [2-11](#)

test equipment information, [2-11](#)  
test equipment list, [2-12](#)  
test and adjustment module, [2-11](#)  
test equipment list, [2a-3](#)  
test equipment list for TAM adjustments, [2-12](#)  
tools  
adjustment, [2-5](#)

## U

using the supplement, [1-1](#)