2 Making Adjustments

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

Most adjustments require access to the interior of the analyzer.

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

Before You Start

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

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

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

This adjustment applies to:

All 8590 E-Series and L-Series spectrum analyzers

8591C cable TV analyzers

8594Q QAM analyzers

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

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

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

Procedure

Display Position

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

   PRESET

   CAL, More 1 of 4

   CRT HORZ POSITION

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

   CRT VERT POSITION

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

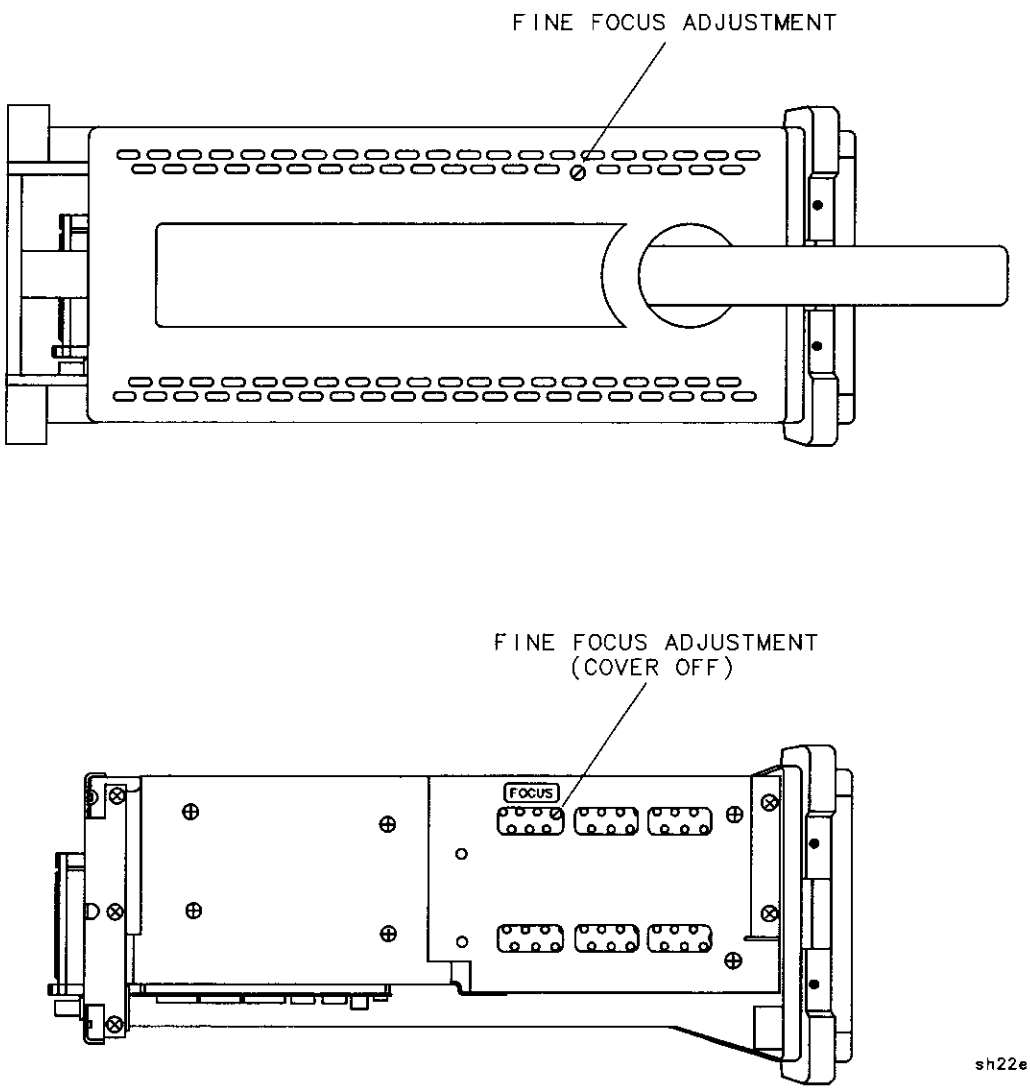
   CAL

   CAL STORE

Fine Focus

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

Figure 2-1 **Fine Focus Adjustment Location**



Coarse Focus

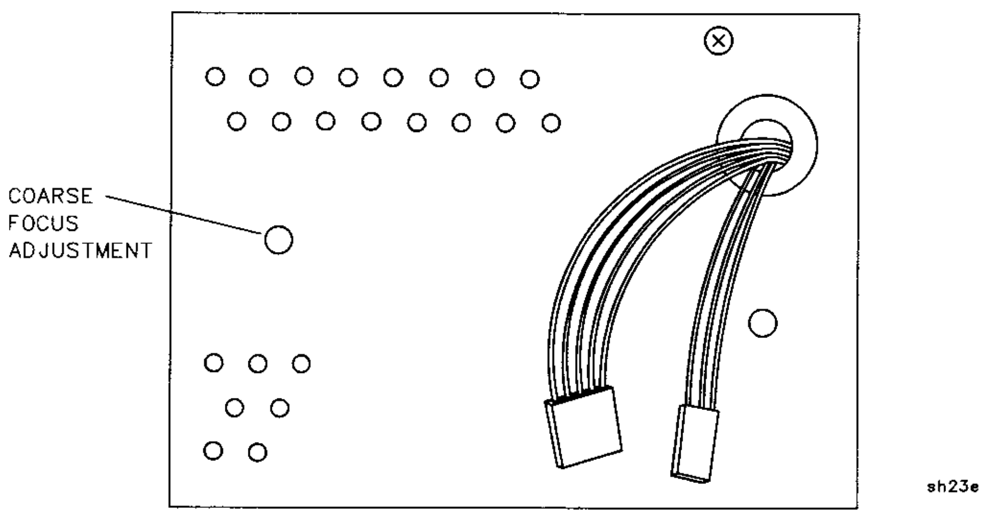
The Coarse Focus adjustment point is located at the rear of the display assembly, therefore, it is required to place the display in a service position to perform this procedure.

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

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

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

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



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

This adjustment applies to:

All 8590 E-Series and L-Series spectrum analyzers

8591C cable TV analyzers

8594Q QAM analyzers

CAUTION

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

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

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

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

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

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

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

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

Equipment Required

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

Procedures

Before Performing any Adjustment

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

CONFIG, More 1 of 3, More 2 of 3

DEFAULT SYNC

CAL, More 1 of 4, More 2 of 4

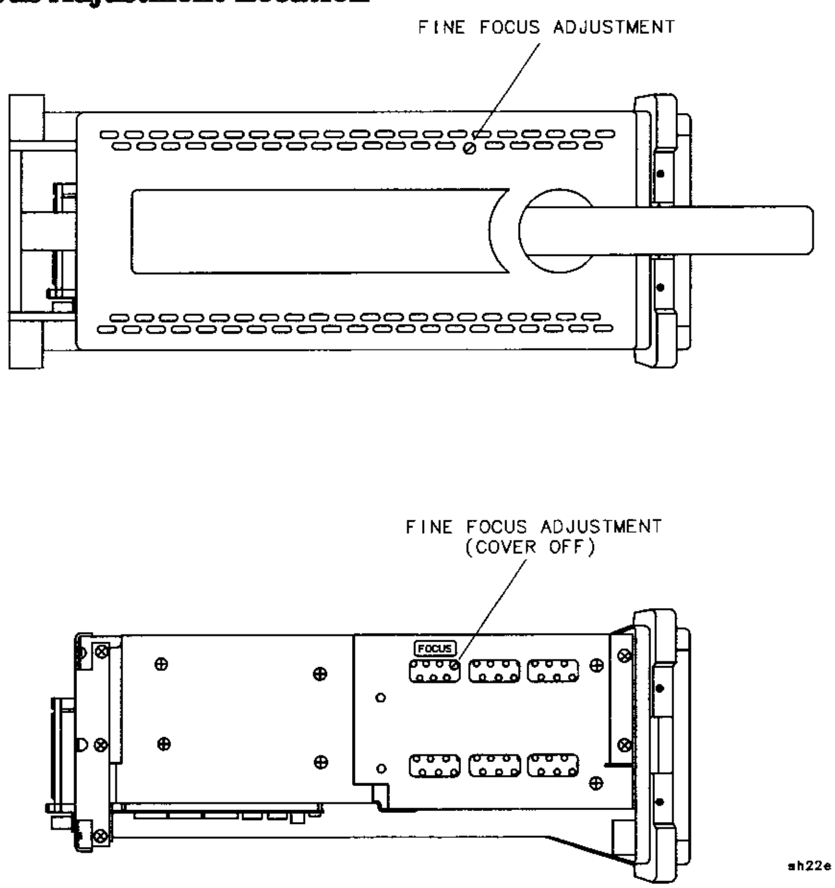
DEFAULT CAL DATA

Focus

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

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

Figure 2-3 **Focus Adjustment Location**



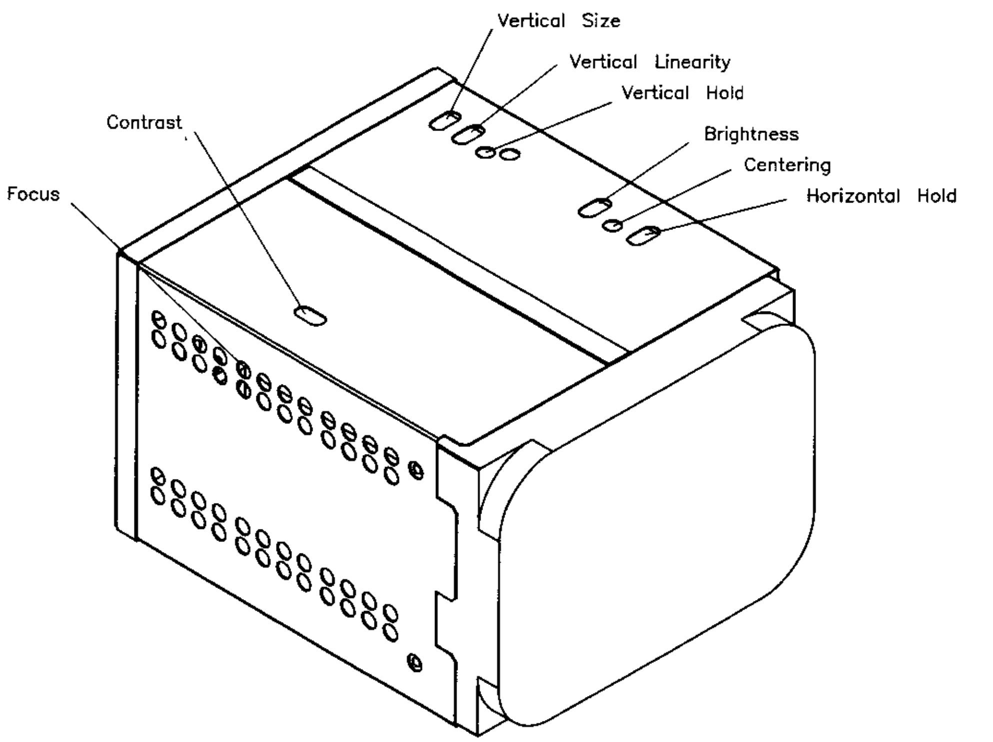
Centering

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

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

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

Figure 2-4 **Display Adjustment Locations**



Horizontal Hold

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

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

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

Vertical Hold

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

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

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

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

   This is the third softkey from the top.

Vertical Size

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

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

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

Vertical Linearity

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

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

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

Brightness and Contrast

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

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

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

2. Sampler Match

This adjustment applies to:

All 8590 E-Series and L-Series spectrum analyzers

8591C cable TV analyzers

8594Q QAM analyzers

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

Equipment Required

Digital multimeter

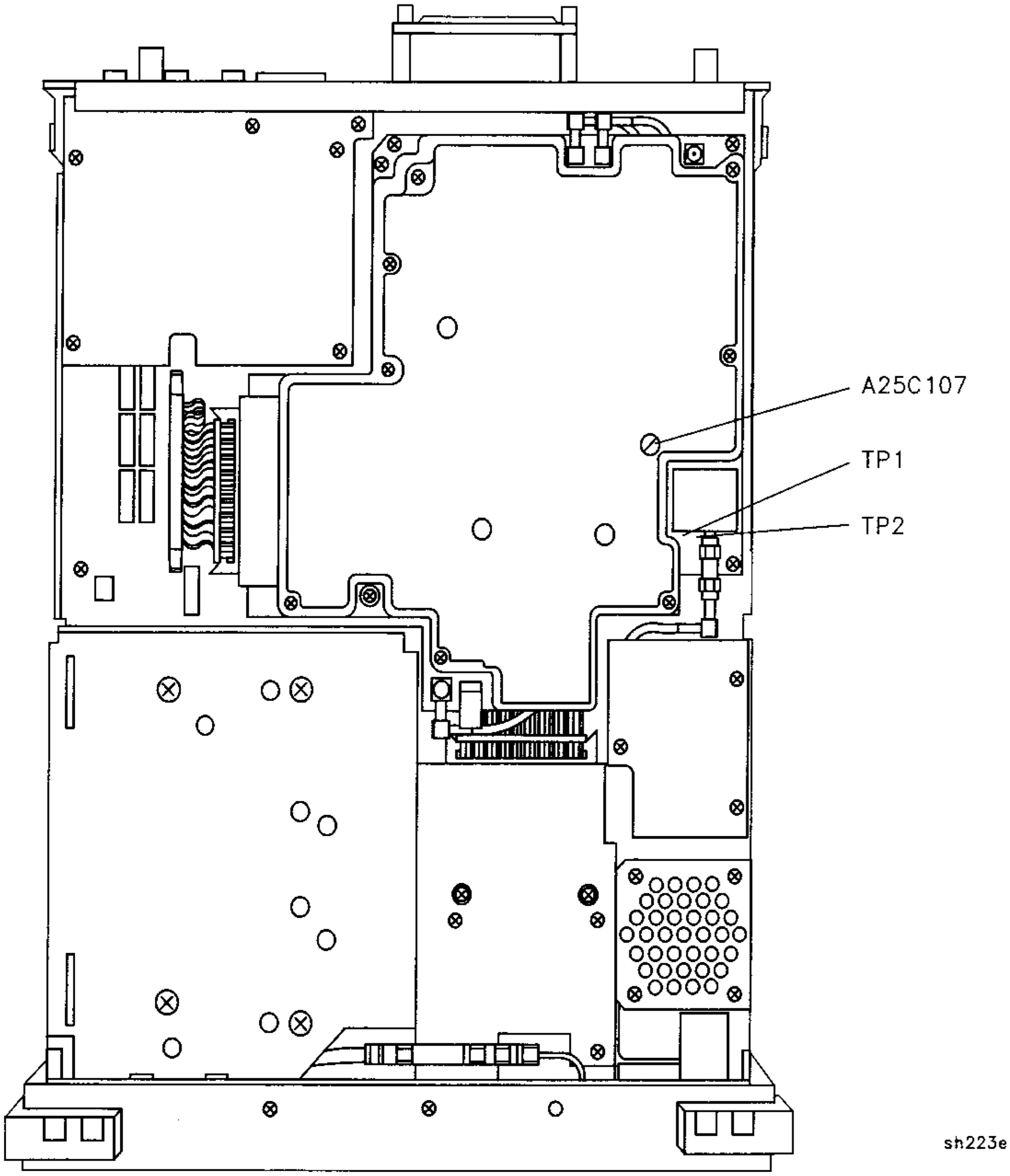
DMM test leads

Procedure

1. Turn the analyzer **LINE** switch to OFF. Remove the instrument over assembly.
2. Turn the analyzer **LINE** switch to ON.
3. Set the center frequency of the analyzer to 194 MHz. If you are adjusting an 8590L, or 8591E spectrum analyzer, or an 8591C cable TV analyzer, set the center frequency to 265 MHz.
4. Press the following analyzer keys.

   SPAN, 10, **MHz**
5. Connect the digital multimeter (DMM) from chassis ground to A25TP1. Refer to Figure 2-5.
6. Adjust A25C107 for maximum voltage as read on the DMM. This voltage must be −1.5 V ±1.0 V.
7. Measure the voltage at A25TP2. It should be +1.5 V ±1.0 V. If it is not, readjust A25C107 until a compromise is established between the two test points, such that the voltage specifications of step 6 and step 7 are met.

Figure 2-5 A25 Counter Lock Assembly Test Points



3. 10 MHz Reference

This adjustment applies to:

All 8590 E-Series and L-Series spectrum analyzers

8591C cable TV analyzers with Option 704

8594Q QAM analyzers with Option 704

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

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

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

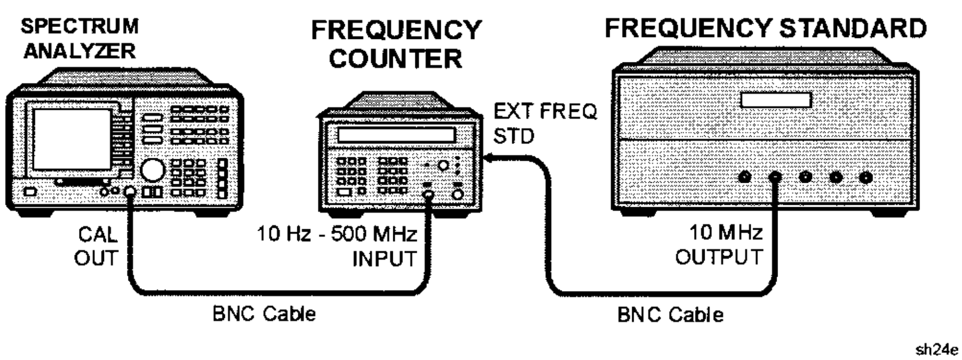
Equipment Required

Microwave frequency counter

Frequency standard

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

Figure 2-6 10 MHz Reference Adjustment Setup



Procedure

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

1. Connect the equipment as shown in Figure 2-6.
2. Set the microwave frequency counter controls as follows:

   50 Ω/1 MΩ .... 50 Ω Impedance

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

   SAMPLE RATE .... Midrange

   FREQUENCY STANDARD .... EXTERNAL

3. Press the following analyzer keys.

   PRESET

   FREQUENCY, –2001, **Hz**

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

   SERVICE CAL, CAL TIMEBASE

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

4. 10 MHz Precision Frequency Reference

This adjustment applies to:

All 8590 E-Series spectrum analyzers, Option 004

8591C cable TV analyzers

8594Q QAM analyzers

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

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

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

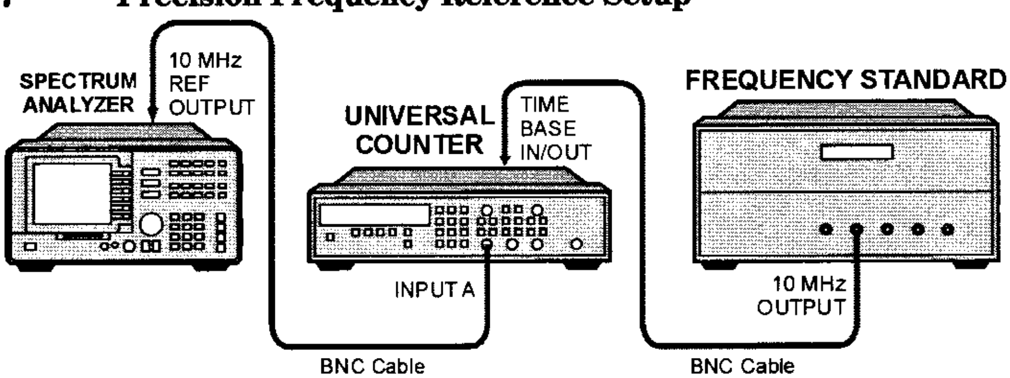
Equipment Required

Frequency standard

Frequency counter

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

Figure 2-7 **Precision Frequency Reference Setup**



Procedure

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

   FUNCTION/DATA .... FREQ A

   INPUT A:

   - x10 ATTN .... OFF
   - AC .... OFF (DC coupled)
   - 50 Ω Z .... OFF (1 MΩ input impedance)

   AUTO TRIG .... ON

   100 kHz FILTER A .... OFF

   INT/EXT switch (rear panel) .... EXT

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

   GATE TIME, 1, **GATE TIME**

   MATH, SELECT/ENTER

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

   SELECT/ENTER

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

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

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

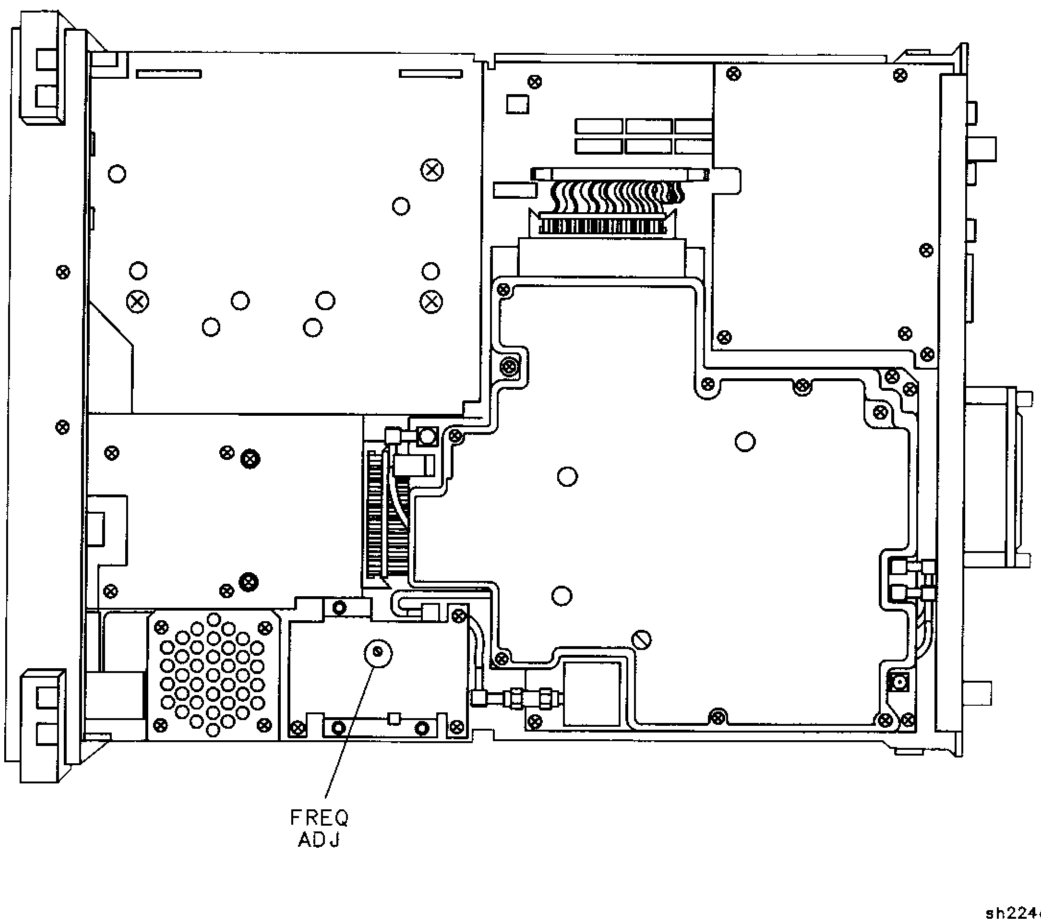
   GATE TIME, 10, **GATE TIME**

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

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

11. Replace the dust cap screw on the OCXO.

Figure 2-8 **Oven Reference Adjustment Location**



5. Crystal and LC Bandwidth Filter

This adjustment applies to:

All 8590 E-Series and L-Series spectrum analyzers

8591C cable TV analyzers

8594Q QAM analyzers

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

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

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

Equipment Required

Crystal shorts *(set of three)*

Cable, BNC, 23 cm (9 in)

Additional Equipment for 75 Ω Input

Cable, BNC, 75 Ω, 30 cm (12 in)

Procedure

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

   PRESET

   CAL, More 1 of 4

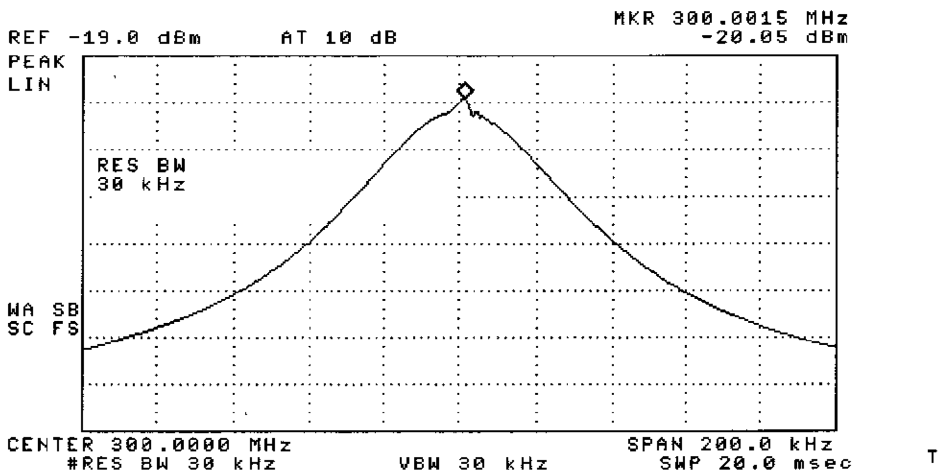
   CORRECT ON OFF (OFF)

Crystal Alignment

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

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

Figure 2-9 Crystal Symmetry and Centering



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

4. Press the following analyzer keys.

   FREQUENCY, 300, **MHz**

   SPAN, 10, **MHz**

   PEAK SEARCH

   MKR FCTN, MK TRACK ON OFF (ON)

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

   SPAN, 200, **kHz**

   AMPLITUDE, 20, **–dBm**

   SCALE LOG LIN (LIN)

   More 1 of 2, AMPTD UNITS, dBm

   BW, 3, **kHz**

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

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

7. Connect the crystal shorts (through the access holes on the assembly cover) across the following pairs of test points.

   A13TP1 and A13TP2

   A11TP1 and A11TP2

   A11TP4 and A11TP5

8. Adjust A13C54 CTR for minimum signal amplitude. Then adjust A13C38 SYM and A13C54 CTR for a centered and symmetrical bandpass response as shown in Figure 2-9.
9. Remove the crystal short from A13TP1 and A13TP2 and connect it across A13TP4 and A13TP5.
10. Adjust A13C25 CTR for minimum signal amplitude. Then adjust A13C15 SYM and A13C25 CTR for a centered and symmetrical bandpass response.
11. Remove the crystal short from A11TP4 and A11TP5. Connect the short across A13TP1 and A13TP2.
12. Adjust A11C54 CTR for minimum signal amplitude. Then adjust A11C38 SYM and A11C54 CTR for a centered and symmetrical bandpass response.
13. Remove the crystal short from A11TP1 and A11TP2. Connect the short across A11TP4 and A11TP5.
14. Adjust A11C25 CTR for minimum signal amplitude. Then adjust A11C15 SYM and A11C25 CTR for a centered and symmetrical bandpass response.

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

PEAK SEARCH

MKR FCTN, MK TRACK ON OFF (ON)

SPAN, 50, **kHz**

MKR FCTN, MK TRACK ON OFF (OFF)

BW, 3, **kHz**

PEAK SEARCH, MARKER DELTA

BW, 30, **kHz**

PEAK SEARCH

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

If the signal shift is out of tolerance, repeat step 3 to step 16.

17.Press the following analyzer keys.

MKR

MARKER 1 ON OFF (OFF)

LC Alignment

18.Press the following analyzer keys.

BW, 100, **kHz**
SPAN, 5, **MHz**

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

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

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

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

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

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

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

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

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

LC Centering

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

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

BW, 30, **kHz**

SPAN, 200, **kHz**

MKR FCTN, MK TRACK ON OFF (OFF)

BW, 100, **kHz**

26.Adjust A13C45 LC CTR for maximum signal at center-screen.

27.Move the short from A11TP10 and A11TP11 to A11TP12 and A11TP13, then adjust A11C23 LC CTR for maximum signal at center-screen.

28.Move the short from A13TP12 and A13TP13 to A11TP10 and A11TP11, then adjust A13C45 LC CTR for maximum signal at center-screen.

29.Move the short from A13TP10 and A13TP11 to A13TP12 and A13TP13, then adjust A13C23 LC CTR for maximum signal at center-screen.

30.Disconnect all the shorts from A11 and A13 bandwidth board assemblies.

LC Amplitude

31.Press the following analyzer keys.

BW, 3, **MHz**

SPAN, 2, **MHz**

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

33.Press the following analyzer keys.

PEAK SEARCH, MARKER Δ

MKR FCTN, MK TRACK ON OFF (ON)

BW, 100, **kHz**

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

34.Adjust A11R26 LC and A13R26 LC equally for a MARKER Δ amplitude of 0 dB. Each potentiometer should be adjusted to accomplish one-half of the necessary increase in signal amplitude. If A11R26 or A13R26 reaches its limit, recenter both potentiometers and repeat step 31 to step 35.

35.Press **MKR FCTN, MK TRACK ON OFF** (OFF) on the analyzer.

Final LC Centering

36.Press the following analyzer keys.

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

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

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

39.Press the following analyzer keys.

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

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

If the signal shift is out of tolerance, repeat step 26 to step 39.

Crystal Amplitude

41.Press the following analyzer keys.

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

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

43.If A11R31 or A13R31 reaches its limit, recenter both potentiometers and repeat step 41 and step 42.

Final BW Amplitude Check

44.Run the "CAL FREQ Adjustment Routine" and the "CAL AMPTD Adjustment Routine."

45.Remember to press **CAL STORE** after the completion of the routines to store data in nonvolatile memory.

46.Press the following analyzer keys to verify that the bandwidth amplitude corrections are within specifications.

CAL, More 1 of 4, More 2 of 4

SERVICE DIAG

DISPLAY CAL DATA

47.Refer to the BW-AMP column of the analyzer display to locate the XTAL and LC bandwidth amplitude-correction numbers of the analyzer. All LC and XTAL bandwidth readings should be between –0.8 dB to +0.5 dB. Table 2-1 describes and shows an example of the XTAL and LC bandwidth amplitude-correction numbers that will be displayed on the analyzer. Perform the following steps that apply to your analyzer.

- If the difference between the bandwidth amplitude-correction numbers of the 30 kHz XTAL and 3 MHz LC is greater than 0.8 dB, pad A11R8 or A13R8 and repeat the Final BW Amplitude Check. Refer to the Component-Level Information Package for the location of A11R8 and A13R8.
- If the 30 kHz XTAL bandwidth amplitude correction is greater than the 3 MHz LC bandwidth correction, increase the value of A11R8 or A13R8.
- If the 3 MHz LC bandwidth amplitude correction is greater than the 30 kHz XTAL bandwidth correction, decrease the value of A11R8 or A13R8.
- If just the 100 kHz LC amplitude is out of range, repeat step 23 to step 38 and step 44 to step 47.
- If the 1 kHz XTAL amplitude is out of the above range, repeat step 44 to step 46.

Table 2-1 Bandwidth Amplitude-Correction Map

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

6. Cal Attenuator Error

This adjustment applies to:

All 8590 E-Series and L-Series spectrum analyzers

8591C cable TV analyzers

8594Q QAM analyzers

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

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

Equipment Required

Synthesizer/level generator

Cable, BNC, 120 cm (48 in)

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

Additional Equipment for Option 026

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

Additional Equipment for 75 Ω Input

Cable, BNC, 75 Ω, 120 cm (48 in)

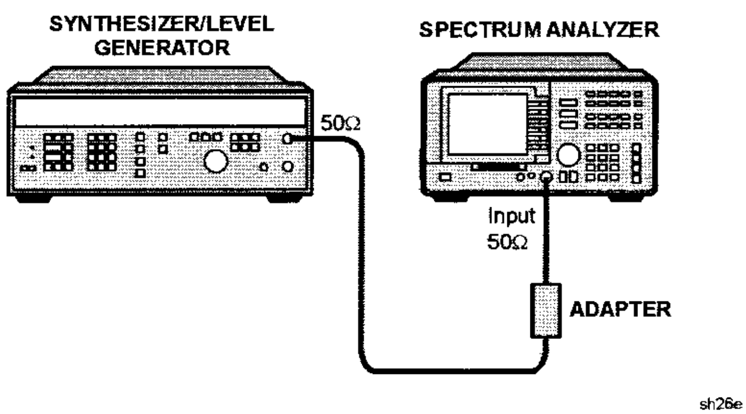
Procedure

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

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

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

Figure 2-10 Cal Attenuator Error Correction Setup



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

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

   PRESET

   CAL, More 1 of 4

   CORRECT ON OFF (OFF)

1 dB Step Check

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

   FREQUENCY, 25, **MHz**

   SPAN, 10, **MHz**

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

   AMPLITUDE, 18, **–dBm**

   SCALE LOG LIN (LIN), **More 1 of 2**

   AMPTD UNITS, dBm

   PEAK SEARCH

   MKR FCTN, MK TRACK ON OFF (ON)

   SPAN, 50, **kHz**

   BW, 3, **kHz**

   VID BW AUTO MAN, 300, **Hz**

7. Press the following analyzer keys.

   PEAK SEARCH, MARKER DELTA

   MKR FCTN, MK TRACK ON OFF (ON)

8. The MKR Δ amplitude reading should be 0.0 dB ±0.01 dB. If it is not, repeat step 7.

9. Set the analyzer by pressing **AMPLITUDE**, 17, **–dBm**.

10. Set the amplitude of the synthesizer/level generator to −18 dBm.

11. Press **MKR** on the analyzer.

12. Record the MKR Δ amplitude reading in Table 2-2. This is the 1 dB attenuator step error of the A12 amplitude control assembly.

2 dB Check

13.Press the following analyzer keys.

AMPLITUDE, 16, **–dBm**.

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

15.Press the following analyzer keys.

PEAK SEARCH

MARKER DELTA, MARKER DELTA

MKR FCTN, MK TRACK ON OFF (ON)

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

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

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

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

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

4 and 8 dB Step Error

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

Table 2-2 A12 Amplitude Control Assembly Attenuator Errors

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

Entering Attenuator Error Correction Data

22.Press the following analyzer keys.

PRESET

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

FREQUENCY, –2001, **Hz**

CAL, More 1 of 4, More 2 of 4

SERVICE CAL, SET ATTN ERROR

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

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

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

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

CAL, More 1 of 4, More 2 of 4

SERVICE DIAG

DISPLAY CAL DATA

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

7. Log and Linear Amplifier

This adjustment applies to:

All 8590 E-Series and L-Series spectrum analyzers

8591C cable TV analyzers

8594Q QAM analyzers

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

Equipment Required

Synthesizer/level generator

Digital multimeter (DMM)

IF test board

Cable, BNC, 120 cm (48 in)

Cable, BNC (f) to dual banana plug

Test cable

Procedure

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

   PRESET

   CAL, More 1 of 4

   CORRECT ON OFF (OFF), **More 2 of 4**

   SERVICE DIAG

   STP GAIN ZERO

   SPAN, 0, **Hz**

   BW, 10, **kHz**

   VID BW AUTO MAN, 300, **Hz**

   AMPLITUDE, 10, **–dBm**

   SCALE LOG LIN (LIN)
5. Set the synthesizer as follows:

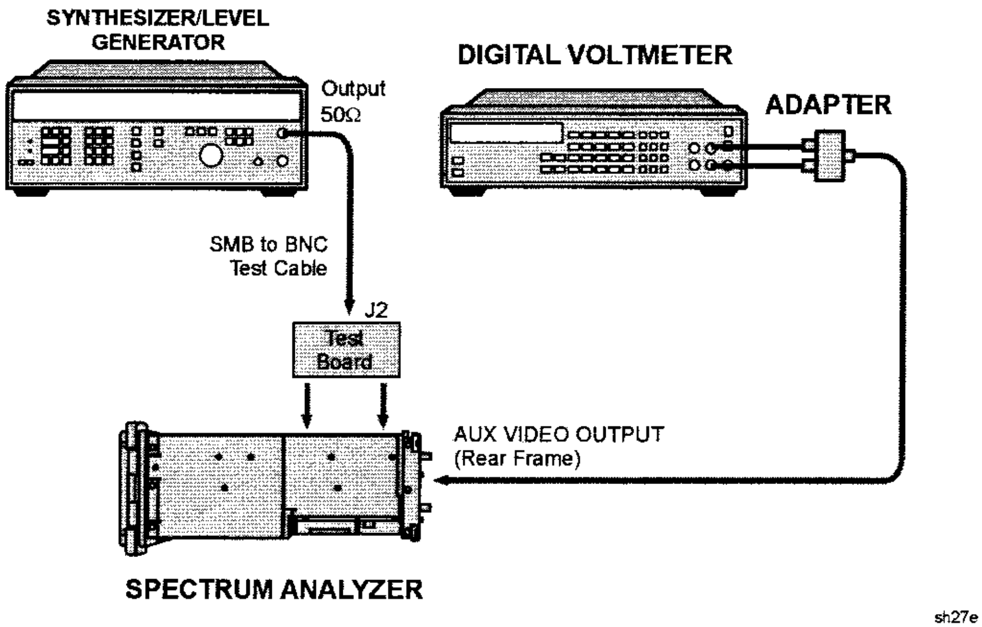
   FREQUENCY .... 21.4 MHz

   MANUAL TUNE .... ON

   AMPTD INCR .... 0.01 dBm

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

Figure 2-11 Log and Linear Amplifier Adjustment Setup



Log Fidelity Adjustment

7. Adjust the synthesizer knob for maximum signal amplitude on the display. Adjust the synthesizer amplitude as necessary to keep the signal on the display.

8. Adjust the synthesizer output level for a DMM reading of 1000 mV ±1.0 mV. Record the synthesizer amplitude readout for later reference:

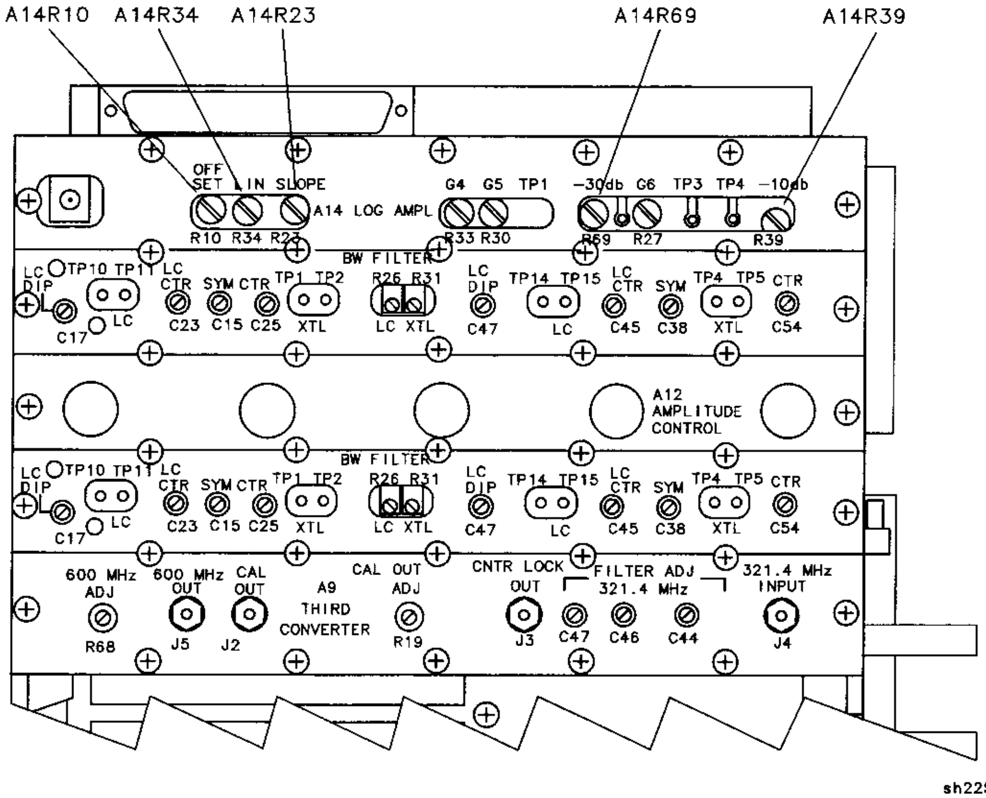
    ____________________dBm

9. Press **AMPTD**, **INCR**, 10, **dB** on the synthesizer.

10. Press **SCALE** (LOG) on the analyzer.

11. Set the synthesizer to the level recorded in step 8 and adjust A14R23 SLOPE (refer to Figure 2-12) for a DMM reading of 1000 mV ±1 mV.

Figure 2-12 Log and Linear Amplifier Adjustment Location



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

Table 2-3 Log Fidelity Check

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

Linear Output and Step Gain Adjustments

21. Press the following analyzer keys.

    AMPLITUDE, 50, **–dBm**

    SCALE LOG LIN (LIN), **More 1 of 2**

    AMPTD UNITS, dBm

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

23. Make the adjustments indicated in Table 2-9.

Table 2-4 Linear Gain Check

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

8. CAL FREQ Adjustment Routine

This adjustment applies to:

All 8590 E-Series and L-Series spectrum analyzers

8591C cable TV analyzers

8594Q QAM analyzers

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

Sweeptime calibration

YTO offset and slope

FM coil timing constants

Span attenuator

FM detector sensitivity

Equipment Required

Cable, BNC, 20 cm (9 in)

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

Additional Equipment for Option 026

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

Additional Equipment for 75 Ω Input

Cable, BNC, 75 Ω, 30 cm (12 in)

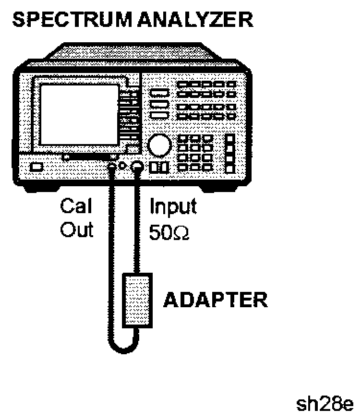
Procedure

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

1. Connect the CAL OUT to the INPUT 50 Ω with the BNC cable. See Figure 2-13.

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

Figure 2-13 CAL FREQ Adjustment Routine Setup



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

2. Press the following analyzer keys.

   CAL, CAL FREQ

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

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

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

9. CAL AMPTD Adjustment Routine

This adjustment applies to:

All 8590 E-Series and L-Series spectrum analyzers

8591C cable TV analyzers

8594Q QAM analyzers

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

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

Equipment

Cable, BNC, 20 cm (9 in)

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

Additional Equipment for Option 026

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

Additional Equipment for 75 Ω Input

Cable, BNC, 75 Ω, 30 cm (12 in)

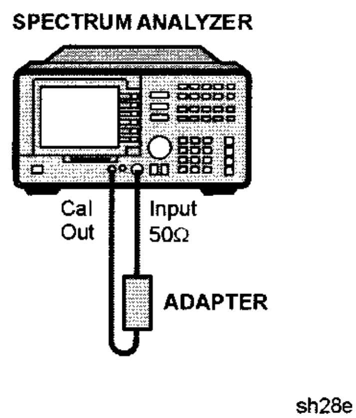
Procedure

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

1. Connect the CAL OUT to the INPUT 50 Ω using a BNC cable. See Figure 2-14.

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

Figure 2-14 CAL AMPTD Adjustment Routine Setup



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

2. Press the following analyzer keys.

   CAL, CAL AMPTD

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

10. CAL YTF Adjustment Routine

This adjustment applies to:

8592L spectrum analyzers

8593E spectrum analyzers

8595E spectrum analyzers

8596E spectrum analyzers

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

Equipment Required

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

Additional Equipment for Option 026

Cable, SMA (m) to (m)

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

Additional Equipment for Model 8595E

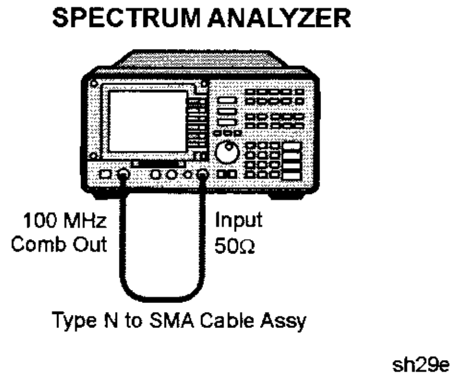
Cable, BNC, 20 cm (9in)

Procedure

1. Perform the CAL FREQ routine as indicated in the "CAL FREQ Adjustment Routine" in this chapter.
2. Connect the 100 MHz COMB OUT to INPUT 50 Ω using the YTF CAL cable. Refer to Figure 2-15.

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

Figure 2-15 CAL YTF Adjustment Setup



3. Press the following keys.

   PRESET

   CAL, CAL YTF

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

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

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

Mixer Bias DAC Initialization

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

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

1. Press the following keys to activate title mode.

   PRESET

   CAL, More 1 of 4, More 2 of 4

   SERVICE DIAG

   DISPLAY CAL DATA

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

Table 2-5 Acceptable Mixer Bias DAC Correction Values

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

3. If the recorded "Optimum Bias" values are within the acceptable ranges indicated in Table 2-5, RF section troubleshooting is necessary.

   If the recorded "Optimum Bias" values are not within the acceptable ranges indicated in Table 2-5, complete the rest of this procedure to initialize the mixer bias DAC values.

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

   PRESET

   FREQUENCY, −2001, **Hz**

   DISPLAY

   CHANGE TITLE

5. Enter `CALMXRDATA 1600,1;` as a title entry to set the mixer bias value to 1600 for band 1.

6. Press the following keys to store the mixer bias value for band 1 in nonvolatile memory.

   CAL, More 1 of 4, More 2 of 4

   SERVICE CAL

   EXECUTE TITLE

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

   DISPLAY

   CHANGE TITLE

   CLEAR

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

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

   CAL, More 1 of 4, More 2 of 4

   SERVICE CAL

   EXECUTE TITLE

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

   DISPLAY

   CHANGE TITLE

   CLEAR

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

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

    CAL, More 1 of 4, More 2 of 4

    SERVICE CAL

    EXECUTE TITLE

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

    DISPLAY

    CHANGE TITLE

    CLEAR

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

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

    CAL, More 1 of 4, More 2 of 4

    SERVICE CAL

    EXECUTE TITLE

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

    PRESET

    CAL, More 1 of 4, More 2 of 4

    SERVICE DIAG

    DISPLAY CAL DATA

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

16. Repeat the CAL YTF adjustment procedure.

17. Perform the CAL MXR adjustment procedure.

11. CAL MXR Adjustment Routine

This adjustment applies to:

8592L spectrum analyzers

8593E spectrum analyzers

8595E spectrum analyzers

8596E spectrum analyzers

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

Equipment Required

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

Additional Equipment for Option 026

Cable, CAL Comb

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

Additional Equipment for Model 8595E

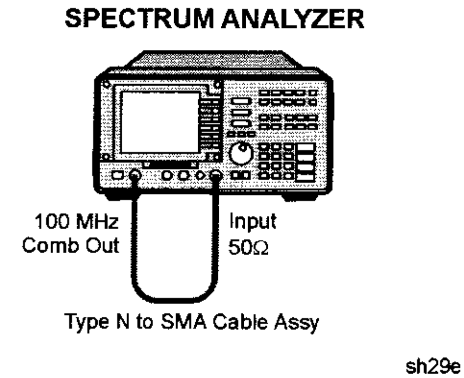
Cable, BNC, 20 cm (9in)

Procedure

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

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

Figure 2-16 CAL MXR Adjustment Setup



3. Press the following analyzer keys.

   PRESET

   FREQUENCY, −2001, **Hz**

   CAL, More 1 of 4, More 2 of 4

   SERVICE CAL, CAL MXR

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

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

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

12. Second Converter

This adjustment applies to:

8590L spectrum analyzers

8591E spectrum analyzers

8591C cable TV analyzers

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

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

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

Equipment Required

Microwave spectrum analyzer

Tuning tool

Cable, SMB (f) to BNC (m)

Adapter, SMB (f) to SMB (f)

Adapter SMB (m) to SMB (m)

Adapter, N (m) to BNC (f)

Procedure

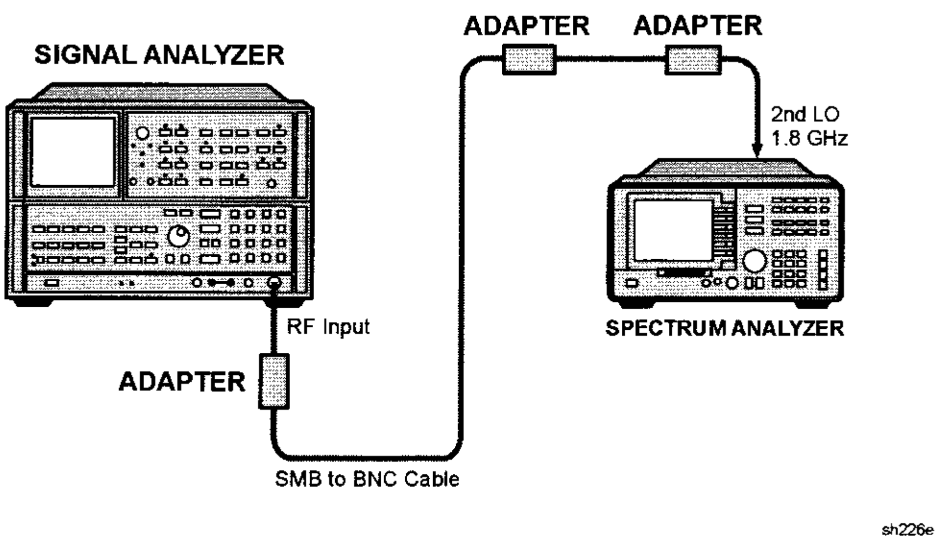
Tripler Adjustment

1. Turn the analyzer **LINE** switch to OFF. Remove the instrument cover assembly. Refer to the "Instrument Cover" removal procedure in Chapter 3.
2. Turn the analyzer **LINE** switch to ON.
3. Press INSTRUMENT PRESET on the microwave spectrum analyzer and set the controls as follows:

   CENTER FREQUENCY .... 1.8 GHz
   FREQUENCY SPAN .... 10 MHz
   REFERENCE LEVEL .... −20 dBm
   dB/DIV .... 2 dB/DIV

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

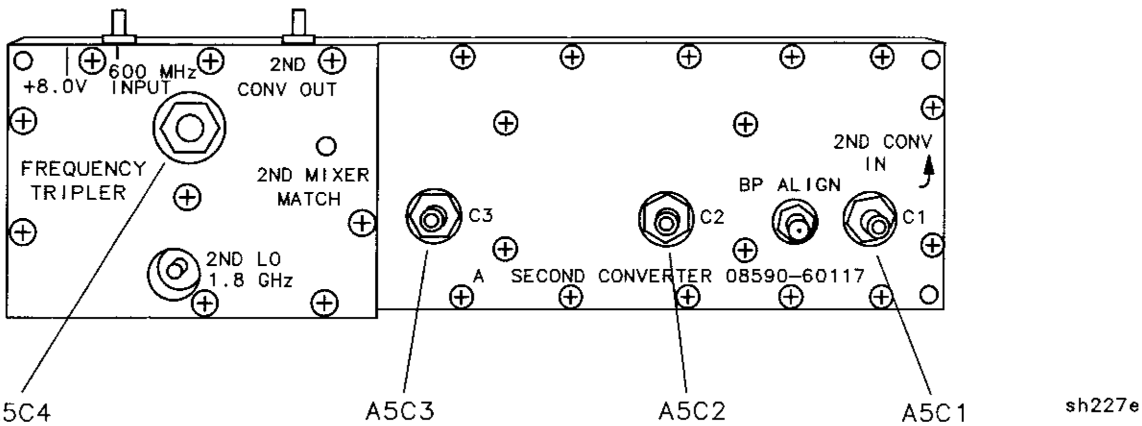
Figure 2-17 Tripler Adjustment Setup



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

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

Figure 2-18 Second Converter Adjustment Location



Second Converter Bandpass

6. Set the microwave spectrum analyzer controls as follows:

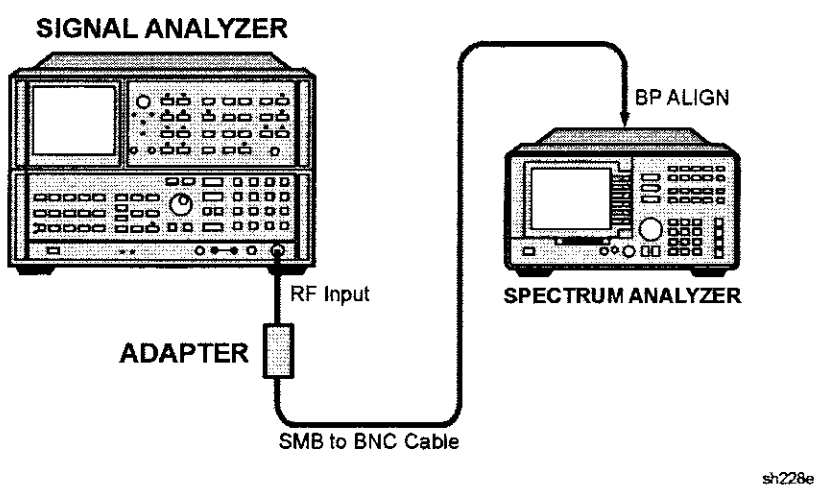
   CENTER FREQUENCY .... 2.1214 GHz

   FREQUENCY SPAN .... 5 MHz

   REFERENCE LEVEL .... −30 dBm

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

Figure 2-19 Second Converter Bandpass Adjustment Setup



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

   PRESET

   PEAK SEARCH

   MKR FCTN, MK TRACK ON OFF (ON)

   SPAN, 10, **MHz**

   Wait for AUTO ZOOM message to disappear.

9. Set the analyzer as follows:

   MKR FCTN, MK TRACK ON OFF (OFF)

   SPAN, 0, **Hz**

10. Loosen the lock nut on A5C1, A5C2, and A5C3. Carefully turn tuning screws clockwise until they reach the bottom of the cavity. *Do not force the tuning screws down.*

11. Turn A5C1 counterclockwise for a peaked signal on the 8566A/B. Lightly tighten the lock nut.

12. Turn A5C2 counterclockwise for a minimum signal on the analyzer. Lightly tighten the lock nut.

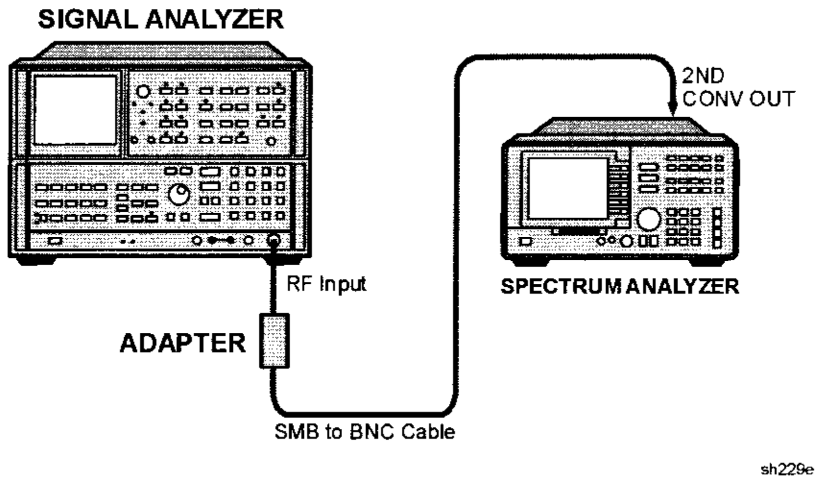
13. Turn A5C3 counterclockwise for peak signal on the analyzer. Lightly tighten the lock nut.

14. Repeat step 11 to step 13 until no further improvement is noticeable. Tighten the lock nuts without changing the amplitude on the display.

Second Mixer Match

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

Figure 2-20 Second Mixer Match Adjustment Setup



16. Set the microwave spectrum analyzer controls as follows:

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

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

Swept Bandpass Check

18. Set the analyzer controls as follows:

   SPAN, 20, **MHz**

   SWEEP, 20, **SEC**

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

   TRACE B VIEW

   A ⇐ ⇒ B

   PEAK SEARCH

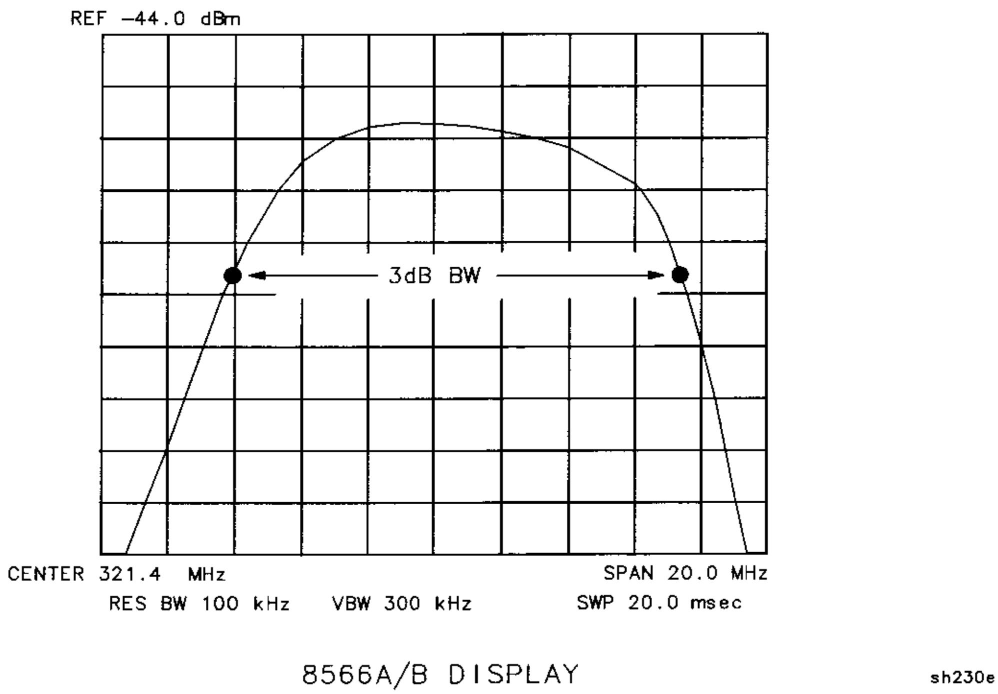
   MARKER MODE, Δ

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

21. Press **MARKER MODE,** Δ and rotate the knob clockwise so that the marker delta amplitude reads 0 dB and is on the right-hand side of the response. Read the marker delta frequency; it should be 15 MHz ±2.5 MHz. See Figure 2-21.

22. The maximum ripple should be less than 1 dB for a bandwidth of 6 MHz.

Figure 2-21 Second Converter Bandpass Ripple Measurement



13. Third Converter and Second IF Bandpass

This adjustment applies to:

All 8590 E-Series and L-Series spectrum analyzers

8591C cable TV analyzers

8594Q QAM analyzers

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

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

Equipment Required

Synthesized sweeper

Microwave spectrum analyzer

Measuring receiver *(used as a power meter)*

Power meter

Low power sensor with a 50 MHz reference attenuator

Power sensor, 300 MHz

Power splitter

Attenuator, 10 dB, Type N (m to f), dc-12.4 GHz

Low-pass filter, 300 MHz

IF test board

Cable, Type N, 152 cm (60 in)

Cable, BNC, 120 cm (48 in)

Test cable, SMB (f) to BNC (m) *(two required)*

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

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

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

Additional Equipment for Models 8590L Option 713

Microwave frequency counter

Additional Equipment for 75 Ω Input

Adapter, minimum loss

Adapter, 75 Ω to 50 Ω

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

Cable, BNC, 75 Ω, 30 cm (12 in)

Procedure

Second IF Bandpass Filter

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

   CENTER FREQUENCY .... 21.4 MHz

   FREQUENCY SPAN .... 50 MHz

   REFERENCE LEVEL .... −30 dBm

   dB/DIV .... 1 dB/DIV

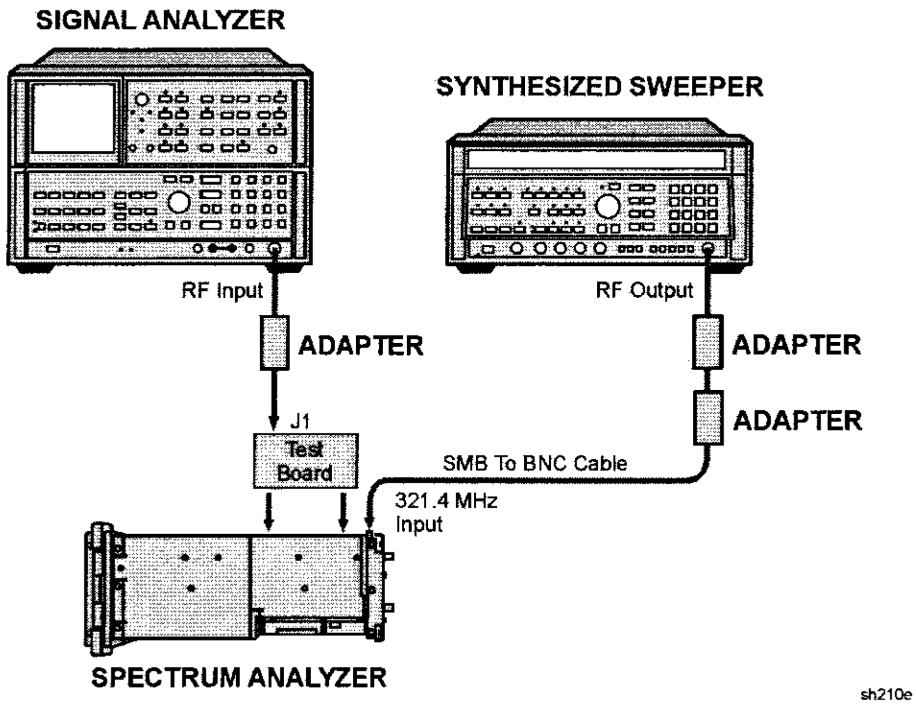
2. Set the synthesized sweeper controls as follows:

   CW .... 321.4 MHz

   POWER LEVEL .... −26 dBm

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

Figure 2-22 Second IF Bandpass Filter Adjustment Setup



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

   PRESET

   SPAN, 0, **Hz**

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

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

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

600 MHz Adjustment

14.Set the microwave frequency counter controls as follows:

50 Ω/1 MΩ .... 50 Ω Impedance

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

SAMPLE RATE .... Midrange

15.Disconnect W8 from A9J5 600 MHz OUT, then connect the microwave frequency counter to A9J5.

16.Adjust A9R68, 600 MHz ADJ, for a frequency of 600 MHz±2 kHz (599.998000 MHz to 600.002000 MHz).

17.Remove the test cable from A9J5, then reconnect W8.

18.Continue with "LPF, Attenuator and Adapter Insertion Loss Characterization."

LPF, Attenuator and Adapter Insertion Loss Characterization

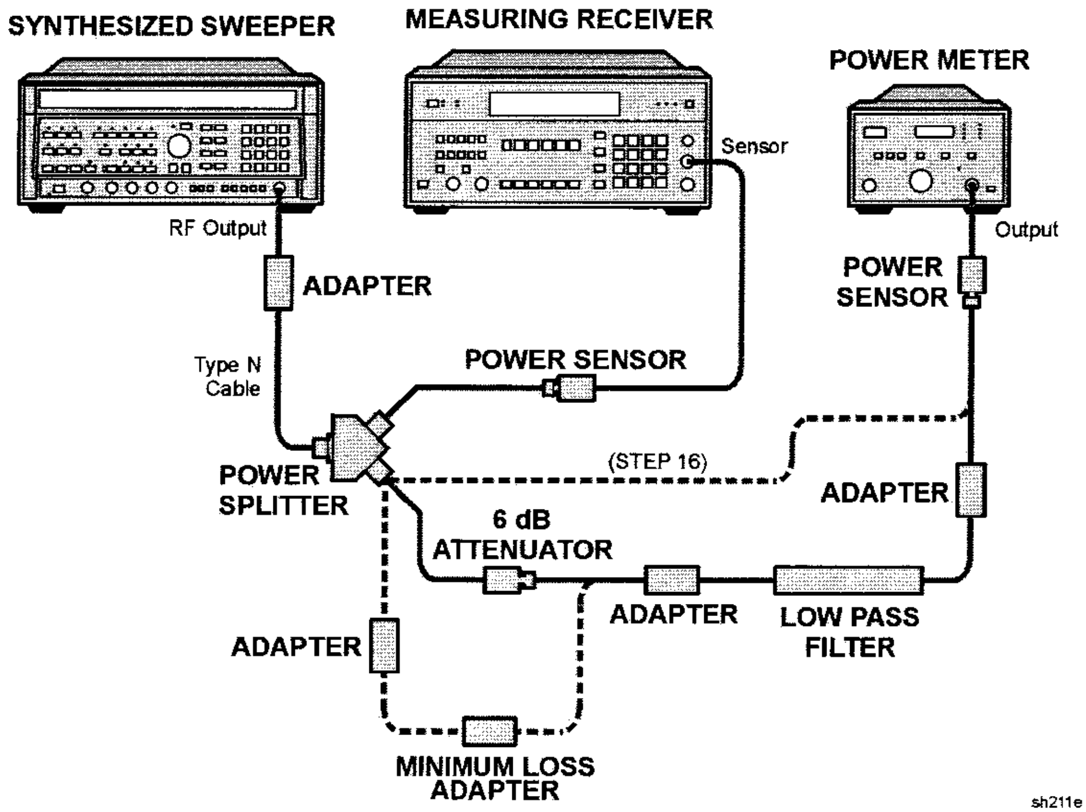
19.Zero and calibrate the measuring receiver and power sensor combination in LOG mode as described in the measuring receiver operation manual.

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

20.Zero and calibrate the power meter and 300 MHz power sensor, as described in the power meter operation manual.

21.Connect the equipment as shown in Figure 2-23. Connect the 300 MHz power sensor directly to the Power Splitter (bypass the LPF, Attenuator and Adapters).

Figure 2-23 LPF Characterization



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

CW .... 300 MHz

POWER LEVEL .... −15 dBm

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

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

25. Connect the LPF, Attenuator and adapters as shown in Figure 2-23.

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

Mismatch Error__________________dB

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

Uncorrected Insertion Loss__________________dB

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

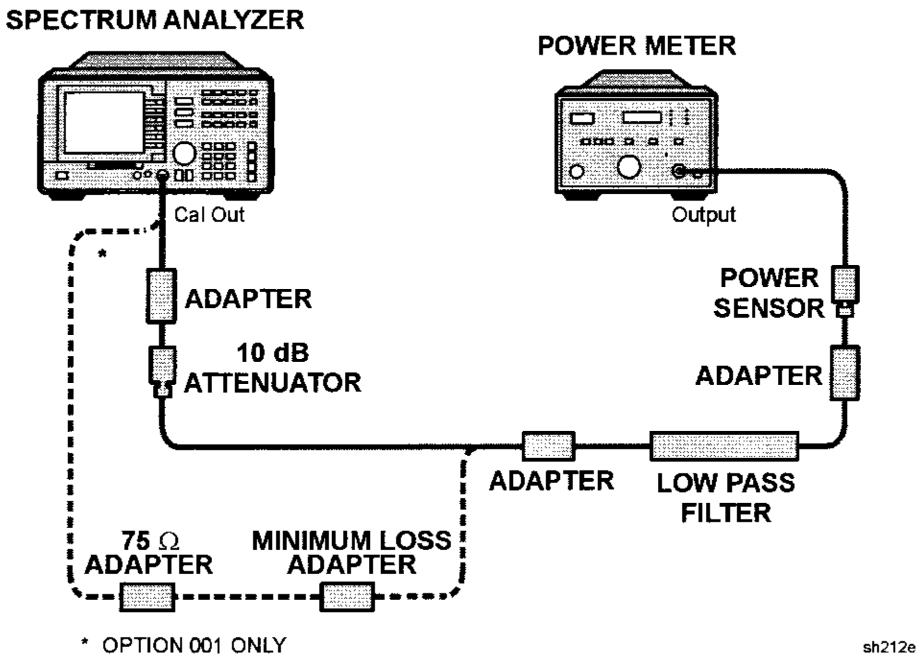
Corrected Insertion Loss__________________dB

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

300 MHz Calibrator Amplitude Adjustment

29.Connect the equipment as shown in Figure 2-24. The analyzer should be positioned so that the setup of the adapters, LPF and attenuator do not bind. It may be necessary to support the center of gravity of the devices.

Figure 2-24 300 MHz Calibrator Amplitude Accuracy Test Setup



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

Power Meter Reading__________________dBm

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

CAL OUT Power = Power Meter Reading − Corrected Insert Loss

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

CAL OUT Power_________________dBm

32. Adjust A9R19 CAL OUT ADJ accordingly if the CAL OUT amplitude is not −20 dBm ±0.4 dB as calculated in step 26.

14. Comb Generator

This adjustment applies to:

8592L spectrum analyzers

8593E spectrum analyzers

8596E spectrum analyzers

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

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

A3A1C5 FREQ is adjusted for a comb generator frequency of 100.000000 MHz ±0.000010 MHz (tolerance of ±10 Hz).

Equipment Required

Oscilloscope

Frequency counter

Measuring receiver *(used as a power meter)*

Power sensor, 300 MHz

Attenuator, 20 dB

Cable, SMA, 90 cm (36 in.)

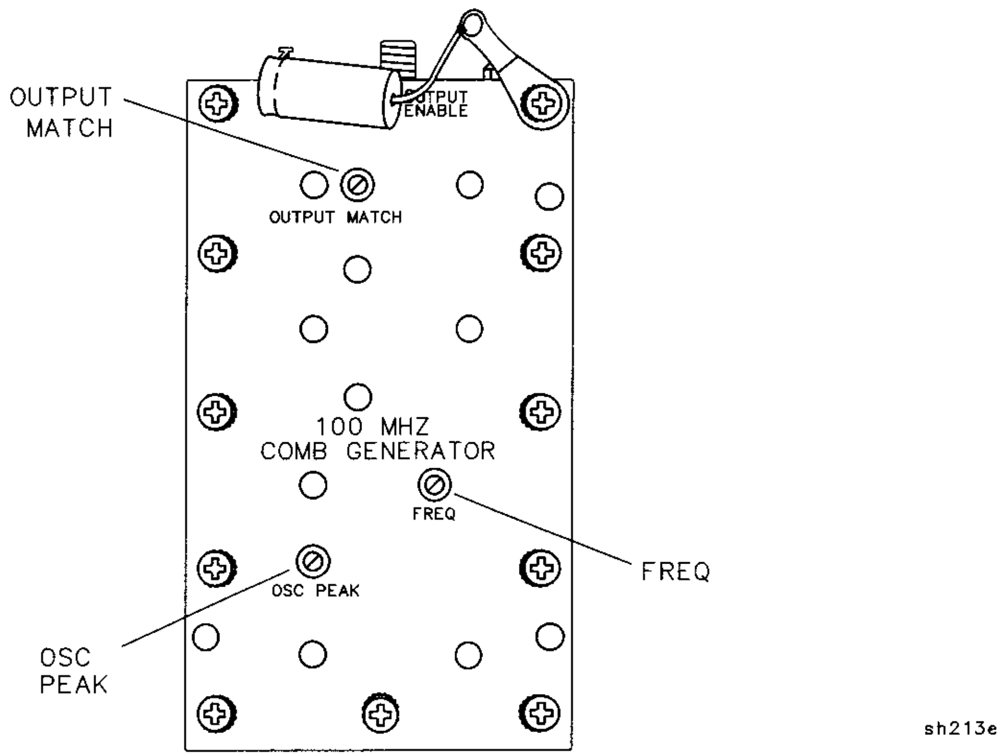
Cable, BMC, 120 cm (48 in.)

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

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

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

Figure 2-25 **Comb Generator Adjustment Location**



Procedure

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

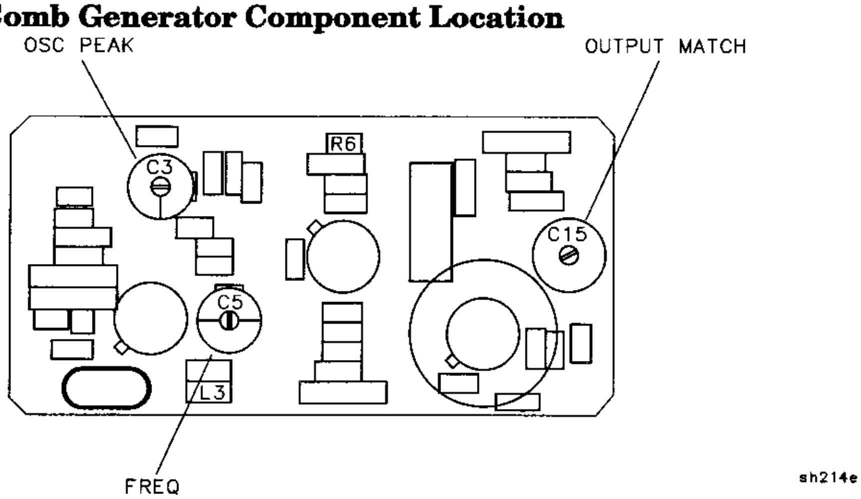
   AUX CTRL, COMB GEN ON OFF (ON)

Frequency

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

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

Figure 2-26 Comb Generator Component Location



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

Output Power

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

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

This adjustment applies to:

8590L spectrum analyzers

8591E spectrum analyzers

8591C cable TV analyzers

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

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

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

Equipment Required

Synthesized sweeper

Measuring receiver *(used as a power meter)*

Frequency synthesizer

Power sensor, 1 MHz to 1.8 GHz

Power splitter

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

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

Cable, BNC, 122 cm (48 in.)

Cable, Type N, 183 cm (72 in.)

Additional Equipment for 75 Ω Inputs

Power meter

Power sensor, 75 Ω

Cable, BNC, 120 cm (48 in) 75 Ω

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

Adapter, Type N (m) to BNC (m), 75 Ω

Procedure for System Characterization *(75 Ω input)*

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

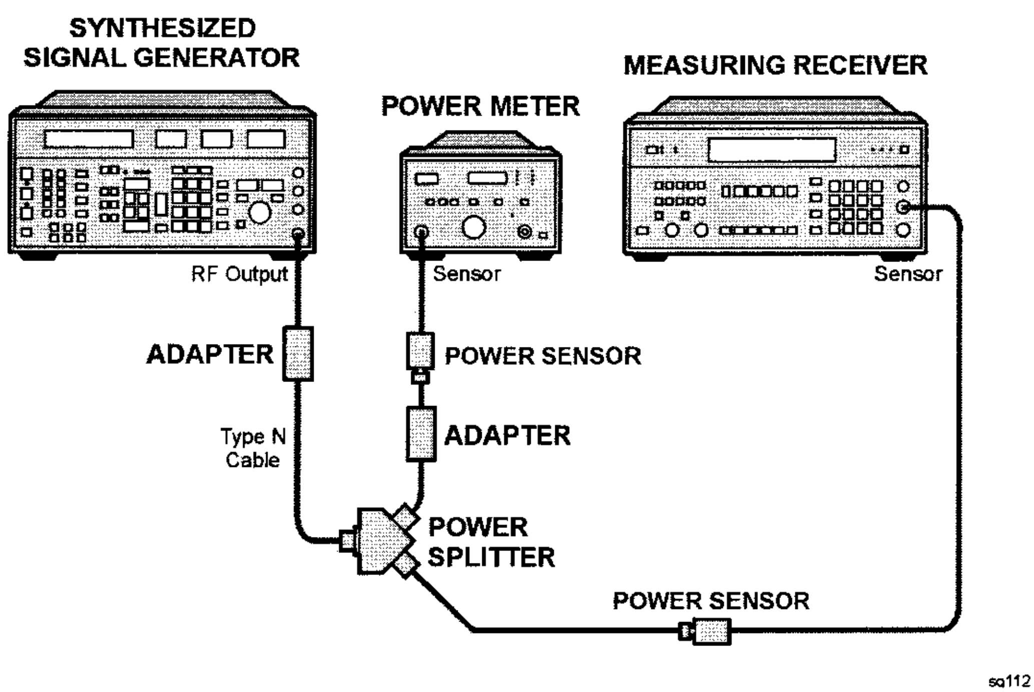
   CW .... 41 MHz

   FREQ STEP .... 37 MHz

   POWER LEVEL .... 5 dBm

4. Connect the equipment as shown in Figure 2-27.

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



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

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

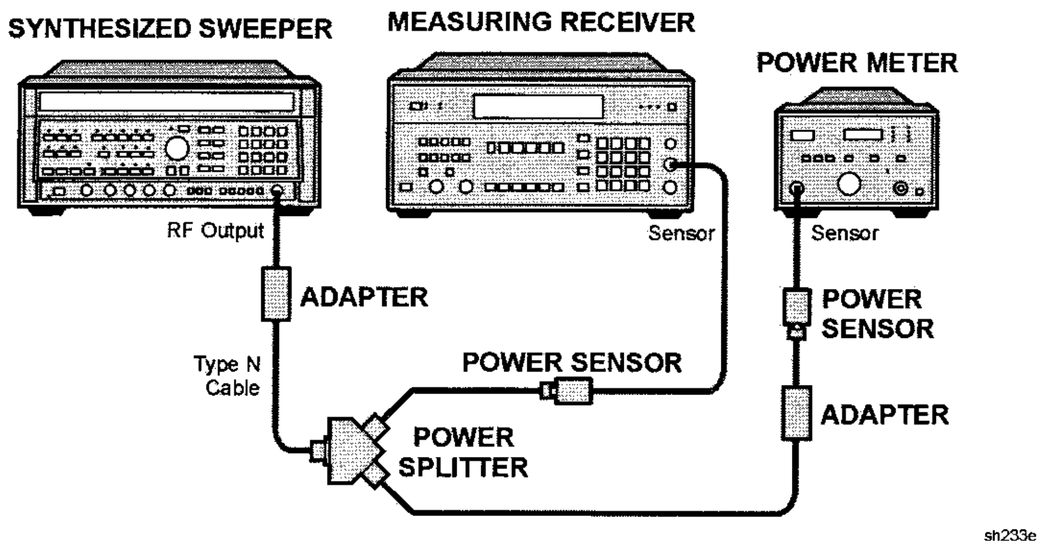
7. On the synthesized sweeper, press CW and STEP UP, to step through the remaining frequencies listed in Table 2-6.

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

Procedure

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

Figure 2-28 Frequency Response Setup



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

   CW .... 300 MHz

   FREQ STEP .... 37 MHz

   POWER LEVEL .... –9 dBm

4. On the analyzer, press the following keys.

   PRESET

   CAL, More 1 of 4

   CORRECT ON OFF (OFF)

   FREQUENCY, 300, **MHz**

   CF STEP AUTO MAN, 37, **MHz**

   SPAN, 12, **MHz**

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

   AMPLITUDE, 10, **–dBm**

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

   BW, 1, **MHz**

   PEAK SEARCH

   MKR FCTN, MK TRACK ON OFF (ON)

5. Adjust the synthesized sweeper POWER LEVEL for a MKR-TRK amplitude reading of –14 dBm ±0.1 dB.
6. Press RATIO mode on the measuring receiver.
7. Press the following analyzer keys.

   FREQUENCY, 41, **MHz**

8. Set the synthesized sweeper CW to 41 MHz.
9. Adjust the synthesized sweeper POWER LEVEL for an analyzer MKR-TRK amplitude reading of –14 dBm ±0.1 dB.
10. Record the power ratio here and in Column 2 of Table 2-6 for 41 MHz.

    Measuring Receiver Reading at 41 MHz__________________dB

11. Press the following analyzer keys.

    FREQUENCY, 78, **MHz**

12. Set the synthesized sweeper CW to 78 MHz.
13. Adjust the synthesized sweeper POWER LEVEL for an analyzer MKR-TRK amplitude reading of –14 dBm ±0.1 dB.
14. Record the power ratio displayed on the measuring receiver in Column 2 of Table 2-6 for 78 MHz.

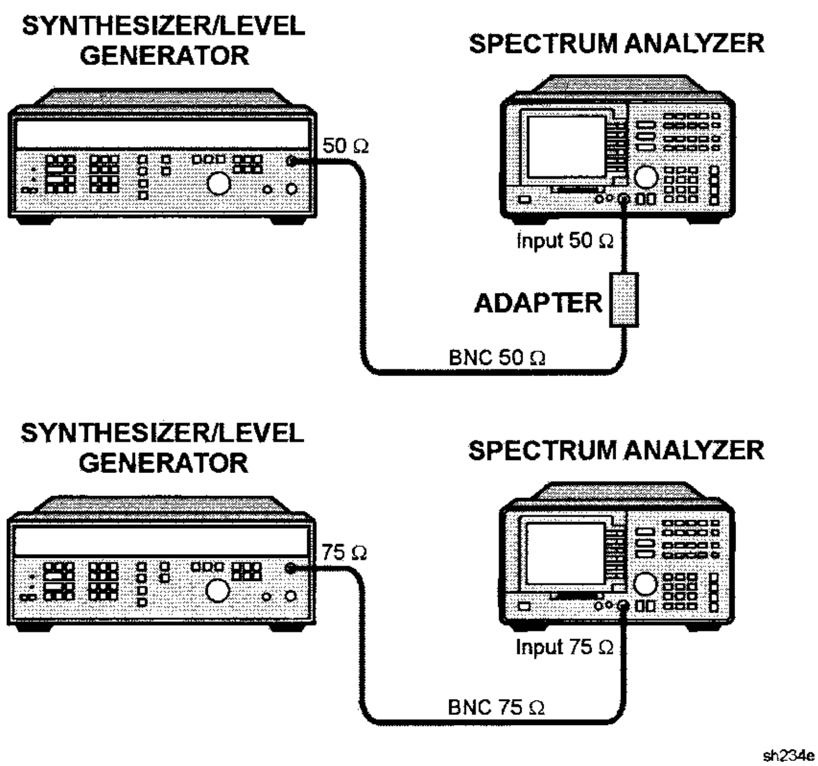
15.On the analyzer, press **FREQUENCY** and ⇑ (step up), to step through the remaining frequencies listed in Column 1 of Table 2-6. At each new frequency repeat step 13 to step 15, entering the power sensor Cal Factor into the measuring receiver as indicated in Column 3 of Table 2-6.

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

Frequency Response Error At 4 MHz

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

Figure 2-29 Frequency Response for 4 MHz Setup



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

18. Set the frequency synthesizer controls as follows:

FREQUENCY .... 41 MHz

AMPLITUDE .... –15 dBm

AMPTD INCR .... 0.05 dB

19. Press the following analyzer keys.

MKR, MARKER 1 ON OFF (OFF)

SPAN, 12, **MHz**

FREQUENCY, 41, **MHz**

PEAK SEARCH

MKR FCTN, MK TRACK ON OFF (ON)

BW, 10, **kHz**

SPAN, 100, **kHz**

Wait for AUTO ZOOM message to disappear.

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

AMPLITUDE setting (41 MHz)__________________dBm

21. Set the frequency synthesizer FREQUENCY to 4 MHz.

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

FREQUENCY, 4, **MHz**

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

FREQUENCY, 4, **MHz**

SPAN, 12, **MHz**

PEAK SEARCH, NEXT PK RIGHT

MKR FCTN, MK TRACK ON OFF (ON)

SPAN, 100, **kHz**

Wait for AUTO ZOOM message to disappear.

23.Adjust the frequency synthesizer AMPLITUDE for a MKR amplitude reading of −14.00 dBm±.05 dB. Record the frequency synthesizer AMPLITUDE setting here.

AMPLITUDE setting (4 MHz)__________________dBm

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

4 MHz Amplitude Relative to 41 MHz__________________dBm

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

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

Entering Flatness Correction Data

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

PRESET

FREQUENCY, −2001, **Hz**

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

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

CAL, More 1 of 4, More 2 of 4

SERVICE CAL

FLATNESS DATA

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

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

   INIT FLT

   PRESET

   FREQUENCY, −2001, **Hz**

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

   CAL, More 1 of 4, More 2 of 4

   SERVICE CAL

   FLATNESS DATA

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

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

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

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

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

33. Repeat step 30 for the remaining flatness correction data points listed in Table 2-6.

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

   If some data is incorrect after entering all of the data from Table 2-6, select the incorrect data point using ⇑ (step up) or ⇓ (step down) and re-enter the proper data.

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

Table 2-6 Frequency Response Errors

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

Table 2-6 Frequency Response Errors (Continued)

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

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

This adjustment applies to:

8592L spectrum analyzers

8593E spectrum analyzers

8594E spectrum analyzers

8594L spectrum analyzers

8594Q QAM analyzer

8595E spectrum analyzers

8596E spectrum analyzers

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

Table 2-7 Analyzer Bands Measured and Adjusted

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

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

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

Equipment Required

Synthesized sweeper

Measuring receiver *(used as a power meter)*

Power sensor, 50 MHz to 26.5 GHz

Power sensor, 1 MHz to 2.9 GHz

Power splitter

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

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

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

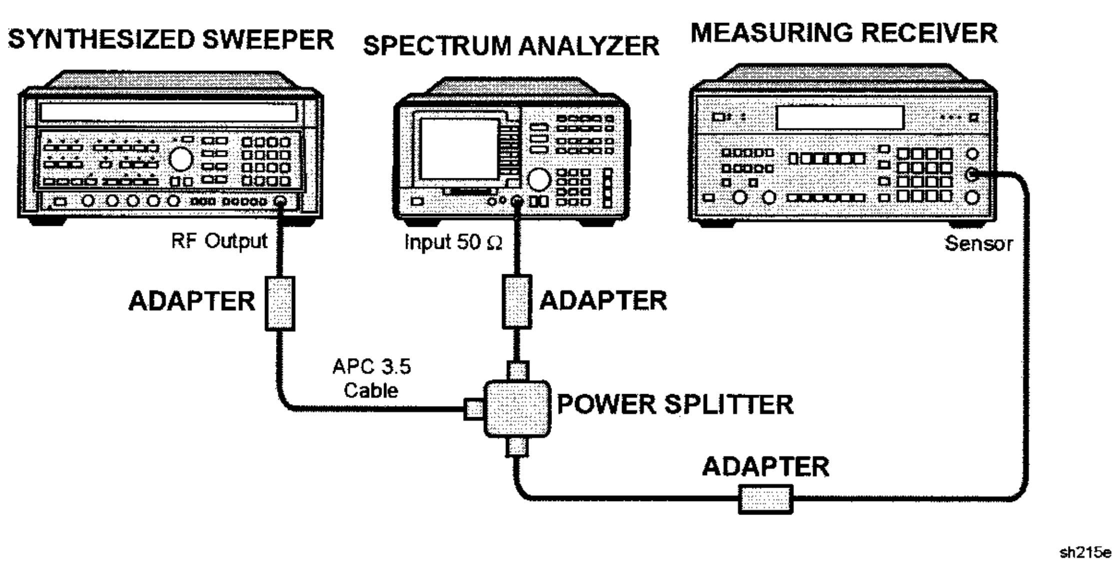
Cable, APC 3.5, 91 cm (36 in.)

Procedure

Measuring Uncorrected Flatness

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

Figure 2-30 Frequency Response Setup



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

   CW .... 300 MHz

   FREQ STEP .... 72 MHz

   POWER LEVEL .... −3 dBm

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

   PRESET

   CAL, More 1 of 4

   CORRECT ON OFF (OFF)

   FREQUENCY, BAND LOCK, 0 - 2.9 Gz BAND 0
   (Skip these key presses for the 8594E, 8594L and 8594Q analyzers.)

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

   FREQUENCY, 300, **MHz**

   CF STEP AUTO MAN (MAN), 72, **MHz**

   SPAN, 10, **MHz**

   AMPLITUDE, 0, **dBm**

   SCALE LOG LIN (LOG), 10, **dB**

   BW, 1, **MHz**

   PEAK SEARCH

   MKR FCTN, MKR TRACK ON OFF (ON)

6. Adjust the synthesized sweeper POWER LEVEL for a MKR-TRK amplitude reading of −9 dBm ±0.1 dB on the analyzer.

7. Press RATIO on the measuring receiver.

Band 0

8. Set the synthesized sweeper CW to 12 MHz.

9. Press the following analyzer keys.

   FREQUENCY, 12, **MHz**

10. Adjust the synthesized sweeper POWER LEVEL for a MKR-TRK amplitude reading of −9 dBm ±0.1 dB on the analyzer.

11. Record the power ratio displayed on the measuring receiver in Column 2 of Table 2-8.

12. On the synthesized sweeper, press **CW** and ⇑ (step-up key).

13.On the analyzer, press the following keys.

FREQUENCY, ⇑

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

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

Continue with the next step for all other analyzers.

Band 1

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

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

17.Set the synthesized sweeper CW to 300 MHz.

18.Press the following analyzer keys.

FREQUENCY, 300, **MHz**

19.Adjust the synthesized sweeper POWER LEVEL for a MKR-TRK amplitude reading of −9 dBm ±0.1 dB on the analyzer.

20.Press RATIO on the measuring receiver.

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

FREQUENCY, BAND LOCK, 2.75 - 6.4 BAND 1

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

FREQUENCY, 2.75, **GHz**

CF STEP AUTO MAN (MAN), 234.9, **MHz**

SPAN, 10, **MHz**

BW, 1, **MHz**

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

24.Press the following analyzer keys.

PEAK SEARCH

MKR FCTN, MK TRACK ON OFF (ON)

AMPLITUDE, PRESEL PEAK

25.Adjust the synthesized sweeper POWER LEVEL for a MKR-TRK amplitude reading of −9 dBm ±0.1 dB on the analyzer.

26.Record the power ratio displayed on the measuring receiver in Column 2 of Table 2-9.

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

28.On the analyzer, press the following keys.

FREQUENCY, ⇑

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

Continue with the next step for all other analyzers.

Band 2

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

FREQUENCY, BAND LOCK, 6.0-12.8 BAND 2

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

FREQUENCY, 6.2, **GHz**

CF STEP AUTO MAN (MAN), 184, **MHz**

SPAN, 10, **MHz**

BW, 1, **MHz**

32.Set the synthesized sweeper CW to 6.2 GHz and FREQ STEP to 184 MHz.

33.Press the following analyzer keys.

PEAK SEARCH

MKR FCTN, MK TRACK ON OFF (ON)

AMPLITUDE, PRESEL PEAK

34.Adjust the synthesized sweeper POWER LEVEL for a MKR-TRK amplitude reading of −15 dBm ±0.1 dB on the analyzer.

35.Add 6 dB to the power ratio displayed on the measuring receiver and record the result in Table 2-11.

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

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

37.Press the following analyzer keys.

FREQUENCY, ⇑

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

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

Continue with the next step for all other analyzers.

Band 3

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

FREQUENCY, BAND LOCK, 12.4-19. BAND 3

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

FREQUENCY, 12.45, **GHz**

CF STEP AUTO MAN, (MAN) 230, **MHz**

SPAN, 10, **MHz**

BW, 1, **MHz**

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

42.Press the following analyzer keys.

PEAK SEARCH

MKR FCTN, MK TRACK ON OFF (ON)

AMPLITUDE, PRESEL PEAK

43.Adjust the synthesized sweeper POWER LEVEL for a MKR-TRK amplitude reading of −20 dBm ±0.1 dB on the analyzer.

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

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

46.Press the following analyzer keys.

FREQUENCY, ⇑

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

Band 4

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

MKR, MARKERS OFF

SPAN, BAND LOCK, 19.1-22 BAND 4

Option 026 only: **19.1-26.5 BAND 4**

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

FREQUENCY, 19.15, **GHz**

CF STEP AUTO MAN (MAN), 150, **MHz**

Option 026 only: 148 **MHz**

SPAN, 5, **MHz**

BW, 1, **MHz**

VID BW AUTO MAN (MAN), 300, **Hz**

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

51.Press the following analyzer keys.

PEAK SEARCH

MKR FCTN, MK TRACK ON OFF (ON)

AMPLITUDE, PRESEL PEAK

52.Adjust the synthesized sweeper POWER LEVEL for a MKR-TRK amplitude reading of −34 dBm ±0.1 dB on the analyzer.

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

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

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

55.Press the following analyzer keys.

MKR, MARKERS OFF

FREQUENCY, ⇑

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

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

Entering Flatness Correction Data

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

PRESET

FREQUENCY, –2001, **Hz**

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

CAL, More 1 of 4, More 2 of 4

SERVICE CAL

FLATNESS DATA

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

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

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

PRESET

FREQUENCY, –2001, **Hz**

CAL, More 1 of 4, More 2 of 4

SERVICE CAL

FLATNESS DATA

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

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

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

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

63.Press ⇑ (step-up key) and enter the data from Column 2 of the "Frequency Response Errors" tables for the next data point as described in step 61.

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

If some data is incorrect after entering all of the data from the "Frequency Response Errors" tables, select the incorrect data point using ⇑ (step up) or ⇓ (step down) and re-enter the proper data.

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

Table 2-8 Frequency Response Errors

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

Table 2-8 **Frequency Response Errors**

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

Table 2-8 Frequency Response Errors

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

Table 2-8 **Frequency Response Errors**

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

Table 2-8 Frequency Response Errors

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

Table 2-8 **Frequency Response Errors**

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

Table 2-8 Frequency Response Errors

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

Table 2-8 **Frequency Response Errors**

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

Table 2-8 **Frequency Response Errors**

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

17. Time and Date

This adjustment applies to:

All 8590 E-Series and L-Series spectrum analyzers

8591C cable TV analyzers

8594Q QAM analyzers

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

Procedure

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

   CONFIG

   TIMEDATE

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

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

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

   CONFIG

   TIMEDATE

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

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

   CONFIG

   TIMEDATE

   SET DATE

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

To change the time, press the following analyzer keys.

CONFIG

TIMEDATE

SET TIME

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

18. Modulator Offset and Gain for Option 010 or 011

This adjustment applies to:

8590L spectrum analyzers, Option 010 or 011

8591E spectrum analyzers, Option 010 or 011

8591C cable TV analyzers, Option 011

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

Equipment Required

Digital multimeter (DMM)

DMM test leads

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

Cable, BNC, 50 Ω

Additional Equipment for Option 011

Cable, BNC, 75 Ω

Procedure

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

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

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

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

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

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

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

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

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

   Wait for the completion of the routine (less than 1 minute).
7. Press **CAL STORE.**
8. Press **PRESET**, then wait for preset routine to finish. Set the analyzer by pressing the following keys.

   FREQUENCY, 300, **MHz**

   SPAN, 0, **Hz**

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

   Set the analyzer reference level to +12 dBm.
9. Press the following analyzer keys.

   AUX CTRL, TRACK GENSRC PWR ON OFF (ON)

   CAL, More 1 of 4, More 2 of 4

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

   ALC TEST

   This breaks the ALC loop, causing `TG UNLVL` to appear on the screen; this is normal.
10. Connect the ground (–) lead of the DMM to A7TP1. Connect the positive (+) lead to A7TP2.
11. Adjust A7A1R43 and A7A1R49 fully clockwise.
12. Connect the MOD_TP test point, located on the A7A1 tracking generator control assembly, to A7TP2 by pressing **DISPLAY, CHANGE TITLE**, then type in the following:

```
DET TGMOD;
```

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

    CAL, More 1 of 4, More 2 of 4

    SERVICE CAL

    EXECUTE TITLE

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

14. Press the following analyzer keys.

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

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

15. Adjust the front-panel knob for 0.0 V ±0.01 V on the DMM, then press the following keys.

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

    MKR, MARKER Δ

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

17. Press the following analyzer keys.

    MKR, MARKER Δ, MARKER Δ

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

    AMPLITUDE, SCALE LOG LIN (LOG) 10 **dB**

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

18. Adjust the front-panel knob for −1.0 V ±0.01 V measured with the DMM, then press the following analyzer keys.

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

19. Adjust A7A1R43 so that the MARKER DELTA reading is −33 dB ±0.5 dB.

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

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

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

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

22. Press **CAL STORE.**

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

This adjustment applies to:

8590L spectrum analyzers, Option 010 or 011

8591E spectrum analyzers, Option 010 or 011

8591C cable TV analyzers, Option 011

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

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

Equipment Required

No equipment is required for this procedure.

Procedure

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

   Slope =__________________

   Offset =__________________

2. Press the following analyzer keys: **DISPLAY**, **CHANGE TITLE**, **More 1 of 2**.

3. Enter the CALTGX slope and offset correction constants in the format CALTGX *slope*, *offset*;. For example, a slope of 0.3079 and an offset of 3095 would be entered as:

   ```
   CALTGX 0.3079,3095;
   ```

4. Press the following analyzer keys.

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

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

   SERVICE DIAG, DISPLAY CAL DATA, NEXT PAGE

   Verify that the XSLOP and XOFST values are the same as you entered in step 3.

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

20. Checking the External ALC for Option 010 or 011

This adjustment applies to:

8590L spectrum analyzers, Option 010 or 011

8591E spectrum analyzers, Option 010 or 011

8591C cable TV analyzers, Option 011

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

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

Equipment Required

Digital multimeter (DMM)

Power meter

Power sensor, 1 MHz to 350 MHz

Cable, BNC (m) to dual banana plug

Cable, BNC, 122 cm (48 in)

Cable, BNC, 23 cm (9 in)

Adapter, BNC Tee

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

Additional Equipment for Option 011

Power sensor, 75 Ω

Cable, BNC, 75 Ω

Adapter, 75 Ω, Type N (f) to BNC (m)

Procedure

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

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

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

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

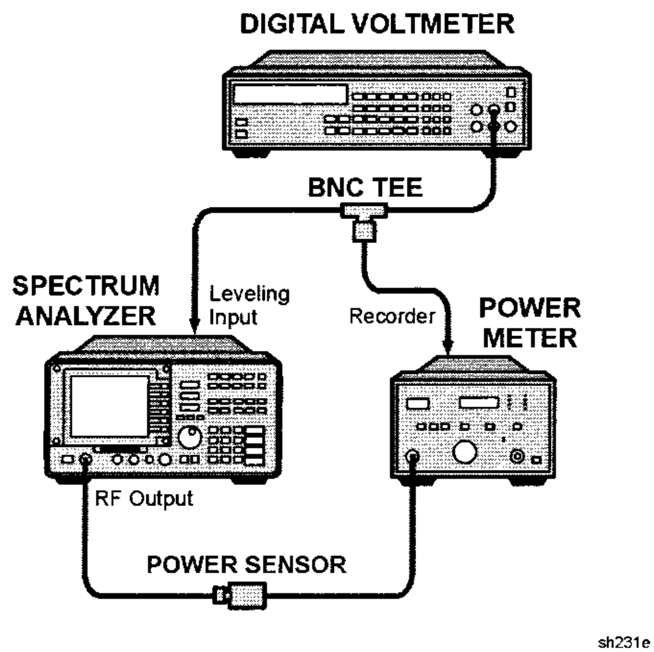
   Note that if the display shows CAL SIGNAL NOT FOUND, the routines default settings are not sufficient to find the signal. Press **FREQ**, −37, **Hz** before performing the CAL routines. This causes the routines to bypass the CAL signal check.
4. Press **CAL STORE** on the analyzer.
5. Connect a BNC cable from the RF INPUT to the RF OUTPUT.
6. Press **PRESET**, then wait for preset routine to finish.
7. Perform the tracking generator self-cal routine by pressing the following analyzer keys.

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

   Wait for the completion of the routine (less than 1 minute).
8. Press **CAL STORE**.
9. Zero and calibrate the power meter and power sensor as described in the power meter operation manual.

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

Figure 2-31 External ALC Verification Adjustment



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

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

11.Set the DMM to measure dc volts.

12.Set the analyzer by pressing the following keys.

FREQUENCY, 300, **MHz**

SPAN, 0, **Hz**

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

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

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

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

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

ALC voltage at 0 dBV # = ____________volts dc

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

ALC Voltage in dBv = ____________20 log (V)

The calculated ALC voltage, in dBV, should be ≥–0.75 dBV and ≤+0.75 dBV.

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

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

ALC voltage at -34 dBV = ____________volts dc

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

ALC voltage in fBV = 20 log (V)

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

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

This adjustment applies to:

8590L spectrum analyzers, Option 010 or 011

8591E spectrum analyzers, Option 010 or 011

8591C cable TV analyzers, Option 011

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

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

Equipment Required

Digital multimeter (DMM)

Power meter

Power sensor, 1 MHz to 350 MHz

Cable, BNC (m) to dual banana plug

Adapter, BNC Tee

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

Cable, BNC, 122 cm (48 in)

Cable, BNC, 32 cm (9 in)

Additional Equipment for Option 011

Power sensor, 75 Ω

Cable, BNC, 75 Ω

Adapter, 75 Ω, Type N (f) to BNC (m)

Procedure

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

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

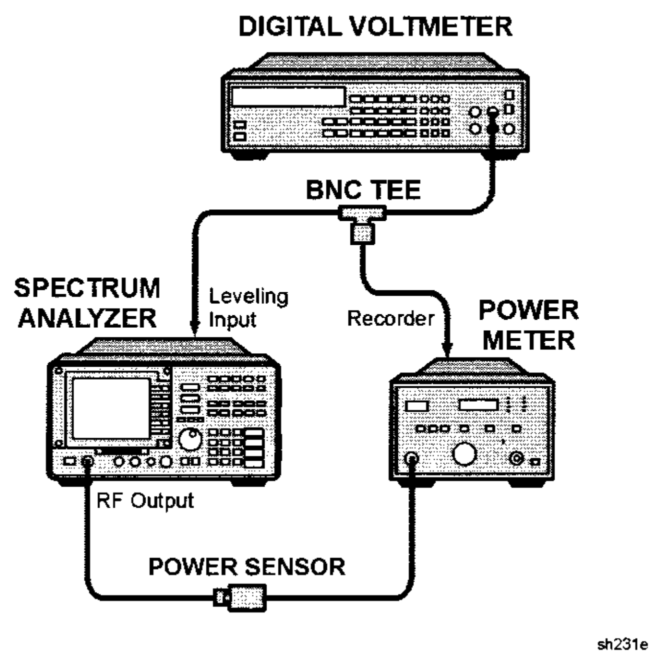
2. Press **PRESET**, then wait for preset routine to finish.
3. Perform the tracking generator self-cal routine by pressing the following analyzer keys.

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

   Wait for the completion of the routine (less than 1 minute).
4. Press **CAL STORE**.
5. Zero and calibrate the power meter and power sensor as described in the power meter operation manual.

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

Figure 2-32 External ALC Error Correction Adjustment



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

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

7. Set the DMM to measure dc volts.

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

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

   a. Press the following analyzer keys.

      DISPLAY, CHANGE TITLE

   b. Enter the following screen title.

      `CALTGX 0.3079,3095;`

   c. Press the following analyzer keys.

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

      CAL, More 1 OF 4, More 2 OF 4, SERVICE DIAG, NEXT PAGE

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

9. Set the analyzer by pressing the following keys.

   FREQUENCY, 300, **MHz**

   SPAN, 0, **Hz**

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

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

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

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

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

    V_{High} = ______________volts dc

14.Adjust the SRC PWR for –34 dBV as read on the analyzer display.

15.Note the voltage on the DMM. Wait until the reading stabilizes before recording it in the space provided. This is the ALC voltage at a source power of –34 dBV (V_{Low}).

V_{Low} = ____________volts dc

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

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

Slope = ____________

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

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

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

Offset = ____________

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

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

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

$$\text{Offset} = 3109$$

18.Enter the calculated Slope and Offset correction constants into nonvolatile memory using the TITLE mode as previously described in step 9.

19.Perform the “Checking the External Leveling” procedure to ensure correct operation.

22. First LO Distribution Amplifier for Option 009 or 010

This adjustment applies to:

8593E spectrum analyzers, Option 009 or 010

8594E spectrum analyzers, Option 009 or 010

8595E spectrum analyzers, Option 009 or 010

8596E spectrum analyzers, Option 009 or 010

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

Equipment Required

Measuring receiver

Digital multimeter

Power sensor

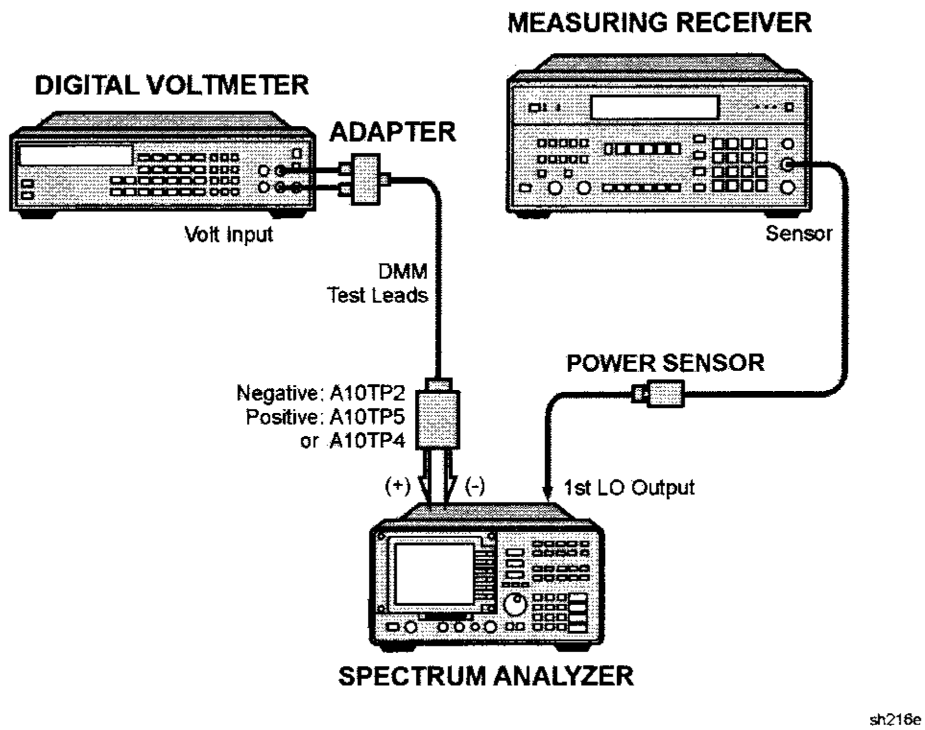
DMM test leads

Adapter, dual banana plug

Procedure

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

Figure 2-33 First LO Distribution Amplifier Adjustment Setup



4. Set the digital voltmeter controls as follows:

   FUNCTION .... DC VOLTS

   RANGE .... 10 V

   RESOLUTION .... 1 mV

5. Set the analyzer **LINE** switch to on.
6. Adjust A10R29 (GATE) for a digital voltmeter reading within 5 mV of the GATE (gate bias) voltage printed on the RF section label.
7. Zero and calibrate the measuring receiver and power sensor in LOG mode. (Power levels read in dBm.) Enter the power sensor's 5 GHz cal factor into the measuring receiver.
8. Connect the power sensor to the analyzer LO OUTPUT.
9. On the analyzer, press **PRESET**, **SPAN**, **ZERO SPAN**, **FREQUENCY**, 300, **MHz**.

10. Connect the positive DMM test lead to A10TP4, LOS (LO sense).

11. Note the SENS (LO sense) voltage printed on the RF section label. Adjust A10R25, LO AMP (LO power), until the DMM reads equal to the SENS voltage printed on the RF section label.

12. Check that the measuring receiver power level reads greater than +12 dBm.

13. Disconnect the power sensor from LO OUTPUT, then reconnect the 50 Ω termination to LO OUTPUT.

14. Disconnect the DMM leads from A10TP4 and A10TP2.

23. BITG Power Level for Option 010

This adjustment applies to:

8593E spectrum analyzers, Option 010

8594E spectrum analyzers, Option 010

8595E spectrum analyzers, Option 010

8596E spectrum analyzers, Option 010

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

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

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

Equipment Required

Measuring receiver

Power sensor, 1 MHz to 350 MHz

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

Additional Equipment for Option 026

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

Procedure

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

   PRESET

   FREQUENCY, −2001, **Hz**

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

   CAL, More 1 of 4, More 2 of 4

   SERV DIAG, DISPLAY CAL DATA, NEXT PAGE

   Verify that AOFST=0 under the tracking generator readouts.
3. Connect the cable between the RF OUT 50 Ω and INPUT 50 Ω connectors on the analyzer.
4. Press **PRESET** on the analyzer and set the controls as follows:

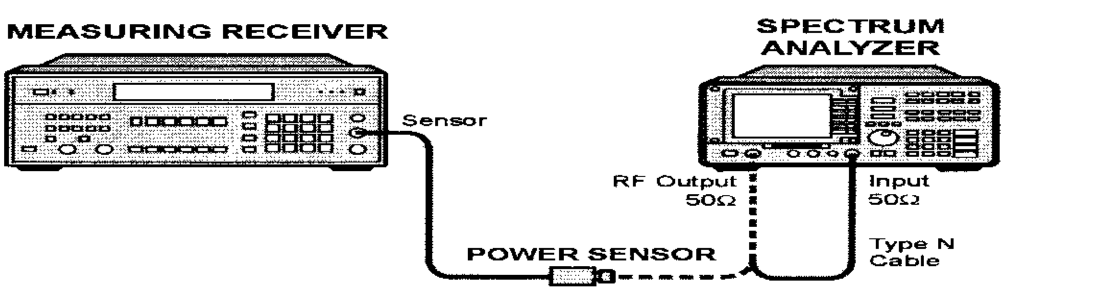
   CENTER FREQ .... 300 MHz

   SPAN .... 0 Hz
5. On the analyzer, press the following keys.

   BW, 10, **kHz**

   AUX CTRL, TRACK GEN, SRC PWR ON OFF (ON), 10, **−dBm**
6. On the analyzer, press **TRACKING PEAK**. Wait for the `PEAKING` message to disappear.
7. Zero and calibrate the measuring-receiver/power-sensor combination in log mode (power levels readout in dBm). Enter the power sensor 300 MHz cal factor into the measuring receiver.
8. Disconnect the cable from the RF OUT 50 Ω connector, then connect the power sensor to the RF OUT 50 Ω connector. See Figure 2-34.

Figure 2-34 BITG Power Level Adjustment Setup

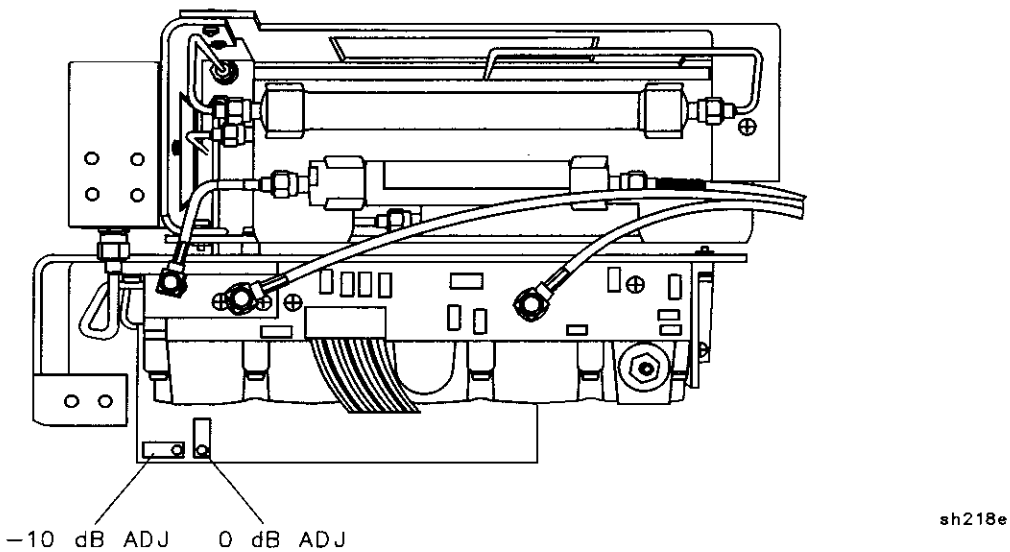


9. On the analyzer, press **SRC PWR ON OFF** (ON), 0, **dBm**, **SGL SWP**.

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

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

Figure 2-35 BITG Power Level Adjustment Locations



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

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

    Power at –10 dBm Setting ____________dBm

    If the power level noted in step 10 was outside the range of –10 dBm ±0.23 dB, perform the following:

    a. With the SRC PWR level set to –10 dBm, adjust –10 dB ADJ (A3A15R13) for a –10 dBm ±0.1 dB reading on the measuring receiver. Refer to Figure 2-35 for adjustment location.

    b. Set the SRC PWR level to 0 dBm. Adjust 0 dB ADJ (A3A15R18) for a 0 dBm ±0.2 dB reading on the measuring receiver. Refer to Figure 2-35 for adjustment location.

    c. Repeat this step until the output power level is within the tolerances indicated at both the –10 dBm and 0 dBm SRC PWR level settings. Adjust –10 dB ADJ only with the SRC POWER level set to –10 dBm, and adjust 0 dB ADJ only with the SRC PWR level set to 0 dBm.

24. Tracking Oscillator for Option 010

This adjustment applies to:

8593E spectrum analyzers, Option 010

8594E spectrum analyzers, Option 010

8595E spectrum analyzers, Option 010

8596E spectrum analyzers, Option 010

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

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

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

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

Equipment Required

Microwave frequency counter

Termination, 50 Ω termination

Alignment tool, non-metallic

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

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

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

Additional Equipment for Option 026

Cable, CAL comb

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

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

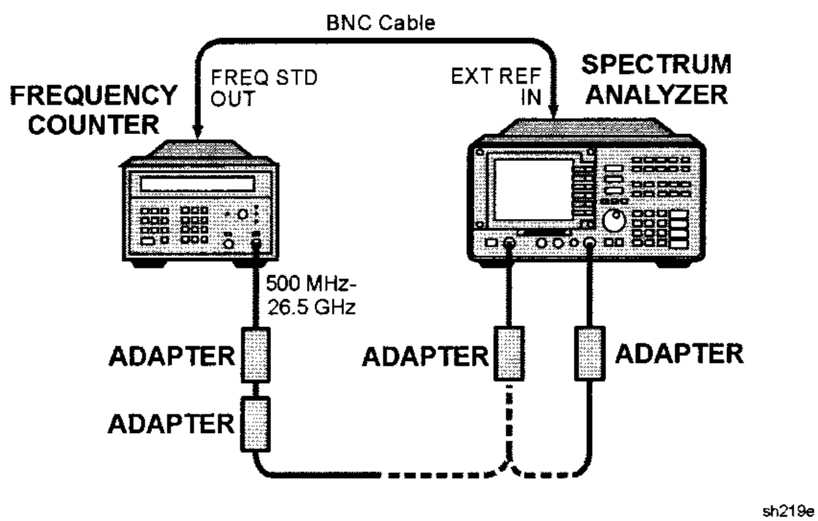
Adapter, Type BNC (f) to SMA (m)

Procedure

Frequency Tracking Range Check

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

Figure 2-36 Frequency Tracking Range Setup



2. Remove the rear-panel jumper that is between the 10 MHz REF OUTPUT and EXT REF IN jacks. Connect the frequency counter FREQ STD OUT connector to the analyzer EXT REF IN connector as shown in Figure 2-36.
3. Press **PRESET** on the analyzer, then set the controls as follows:

   CENTER FREQ .... 500 MHz

   SPAN .... 0 Hz

4. On the analyzer, press the following key.

   BW, 10, **kHz**

   AUX CTRL, TRACK GEN, SRC PWR ON OFF (ON), 5, **–dBm**

5. On the analyzer press **TRACKING PEAK**. Wait for the PEAKING message to disappear.

6. Set the microwave frequency counter controls as follows:

   SAMPLE RATE .... Midrange

   10 Hz-500 MHz SWITCH ....500 MHz - 26.5 GHz

   500 MHz-26.5 GHz SWITCH .....500 MHz - 26.5 GHz

   RESOLUTION .... 1 Hz

7. Connect the RF OUT 50 Ω connector to the microwave frequency counter input as shown in Figure 2-36.

8. Wait for the microwave frequency counter to gate two or three times, then record the microwave frequency counter reading below as the peaked frequency.

   Peaked Frequency: ____________MHz

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

   Minimum Frequency: ____________MHz

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

    Maximum Frequency: ____________MHz

11. If the absolute value of the difference between either the minimum or maximum frequency and the peaked frequency is less than 5 kHz, proceed with the adjustment procedure below. If the differences are greater than 5 kHz, no adjustment is necessary.

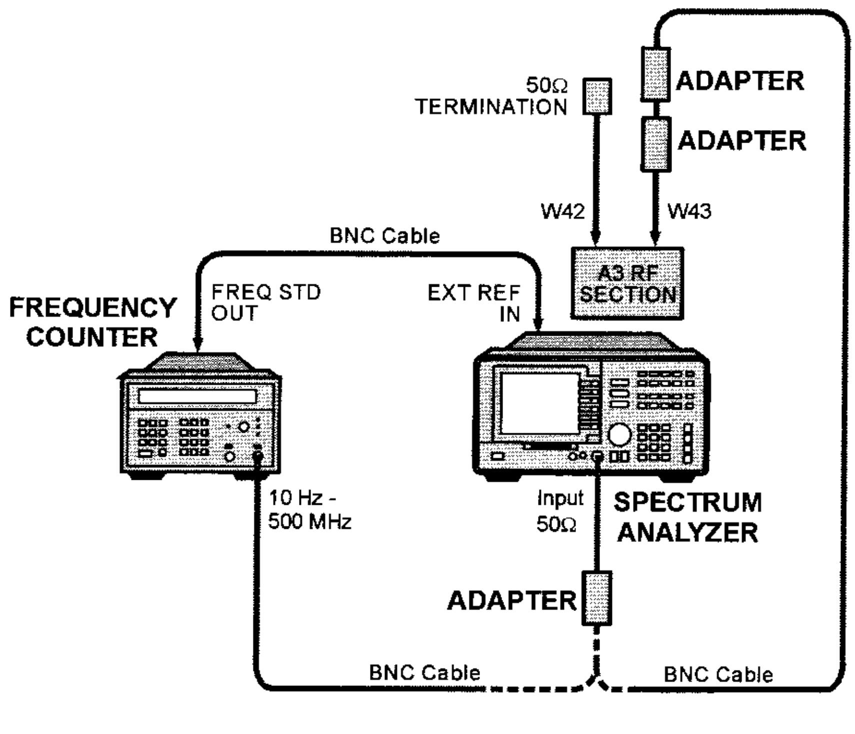
12. Disconnect the cable from the EXT REF IN connector, then replace the rear-panel jumper.

Adjust the Tracking Oscillator

13. Remove the A3 RF Section assembly as described in Chapter 9 of this manual. With A3 sitting on top of the A2 display assembly, reconnect all cables from A3 to their respective jacks on A7, A9, A25, and A10. Reconnect W40 to A3A15J8. Connect the 50 Ω termination to the end of W42.

14. Connect the equipment as shown in Figure 2-37. The microwave frequency counter provides the frequency reference for the analyzer.

Figure 2-37 Tracking Oscillator Adjustment Setup



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

CENTER FREQ .... 300 MHz

SPAN .... 0 Hz

16.Set the microwave frequency counter controls as follows:

SAMPLE RATE .... Fully CCW

10 Hz-500 MHz SWITCH .... 10 Hz-500 MHz

500 MHz-26.5 GHz SWITCH .... 10 Hz-500 MHz

50 Ω - 1 MΩ SWITCH .... 50 Ω

17.Remove the screw, located on the front of the tracking generator, used to seal the tracking oscillator adjustment.

18.On the analyzer, press **AUX CTRL**, **TRACK GEN**, **MAN TRK ADJUST**, 0, **Hz**.

19.Record the microwave frequency counter reading in Table 2-9 as F1.

20.On the analyzer, press **MAN TRK ADJUST**, 4095, **Hz**.

21.Record the microwave frequency counter reading in Table 2-9 as F2.

22. Calculate Fcenter as shown below, and record it in Table 2-9.

Fcenter = (F1 + F2)/2

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

24.Record the value of SRC TRACK ADJ in Table 2-9.

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

25.Adjust A3A15C3 (TRK OSC CTR) until the microwave frequency counter reads 300 MHz ±500 Hz.

26.Repeat step 17 to step 24 at least once more until no further adjustment of A3A15C3 is necessary.

27.Set the analyzer **LINE** switch to off, then replace the screw removed in step 17.

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

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

Table 2-9 Tracking Oscillator Range Centering

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

25. Checking the Absolute Amplitude Accuracy for Option 050

This adjustment applies to:

All 8590 E-Series spectrum analyzers, Option 050

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

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

Equipment required

Synthesized sweeper

Measurement receiver

Power splitter

Power sensor, 818 MHz to 948 MHz

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

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

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

Cable, Type N, 183 cm (72 in)

Additional Equipment for 026

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

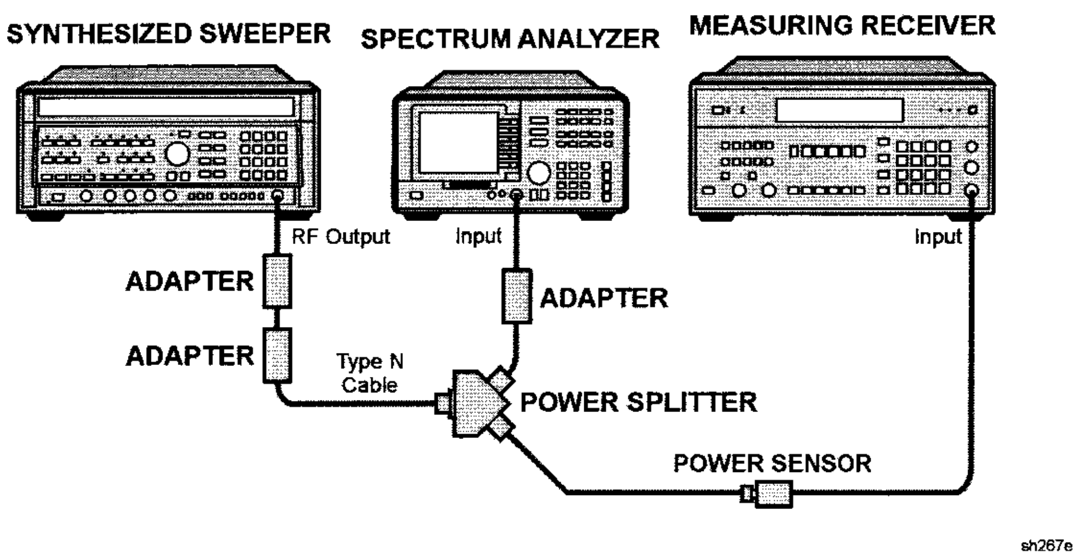
Procedure

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

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

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

Figure 2-38 Absolute Amplitude Accuracy Verification



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

   CW .... 818 MHz

   POWER LEVEL .... −2 dBm

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

   FREQUENCY, 818, **MHz**

   SPAN, 400, **kHz**

   BW, 100, **kHz**

   VID BW AUTO MAN, 30, **kHz**

   AMPLITUDE, 4, **–dBm**

   ATTEN AUTO MAN, 10, **dB**

   PEAK SEARCH

Log Fidelity

5. Set the power sensor cal factor for 818 MHz on the measuring receiver.
6. On the synthesized sweeper, press POWER LEVEL and adjust the output amplitude so that the analyzer marker amplitude reads –9 dBm ±0.05 dB.
7. Record the measuring receiver power reading in Table 2-10.
8. Adjust the output amplitude of the sweeper for analyzer marker amplitude readings of –14 dBm and –19 dBm.
9. Record the measuring receiver power readings in Table 2-10. The readings should be within the limits shown.

Table 2-10 Log Fidelity

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

Frequency Response Input Attenuator 10 dB

10.Set the frequency of the analyzer to the first measurement frequency shown in Table 2-11.

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

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

13. On the synthesized sweeper, press **POWER LEVEL** and adjust the output amplitude so the analyzer marker amplitude reads –9 dBm ±0.05 dB.

14. Set the power sensor cal factor (for frequency being measured) on the measuring receiver, then record the measuring receiver power reading in Table 2-11.

15. Repeat step 10 to step 14 for frequencies of 836 MHz, 881 MHz, and 948 MHz. Record the results in Table 2-11. The results should be within the limits shown.

Table 2-11 Frequency Response Attenuator 10 dB

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

Frequency Response Input Attenuator 20 dB

16. On the analyzer, press the following keys.

    AMPLITUDE, ATTEN AUTO MAN, 20, dB

    AMPLITUDE, 6, **+dBm**

17. Set the **FREQUENCY** of the analyzer to the measurement frequency shown in Table 2-12.

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

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

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

21. Set the power sensor cal factor (for frequency being measured) on the measuring receiver, then record the measuring receiver power reading in Table 2-12.

22. Repeat step 17 to step 21 for frequencies of 881 MHz, 836 MHz, and 818 MHz. Record the results in Table 2-12. The results should be within the limits shown.

Table 2-12 Frequency Response Attenuator 20 dB

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

Frequency Response Input Attenuator 30 dB

23. On the analyzer, press the following keys.

    AMPLITUDE, ATTEN AUTO MAN, 30, dB

    AMPLITUDE, 10, **+dBm**

24. Set the FREQUENCY of the analyzer to the measurement frequency shown in Table 2-13.
25. On the analyzer, press **PEAK SEARCH**.
26. On the synthesized sweeper, press CW and set the frequency to the same measurement frequency as the analyzer is set in the previous step.
27. On the synthesized sweeper, press POWER LEVEL and adjust the amplitude so the analyzer marker amplitude reads +5 dBm ±0.05 dB.
28. Set the power sensor cal factor (for frequency being measured) on the measuring receiver, then record the measuring receiver power reading in Table 2-13.
29. Repeat step 24 to step 28 for frequencies of 836 MHz, 881 MHz, and 948 MHz. Record the results in Table 2-13.

Table 2-13 Frequency Response Attenuator 30 dB

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

Frequency Response Input Attenuator 40 dB

30.On the analyzer, press the following keys.

AMPLITUDE, ATTEN AUTO MAN, 40, dB

AMPLITUDE, 10, **+dBm**

31.Set the FREQUENCY of the analyzer to the measurement frequency shown in Table 2-14.

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

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

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

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

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

Table 2-14 Frequency Response Attenuator 40 dB

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

26. Correcting for Absolute Amplitude Accuracy for Option 050

This adjustment applies to:

All 8590 E-Series spectrum analyzers, Option 050

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

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

   Average Error________________dB

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

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

2. Press the following analyzer keys.

   FREQUENCY, −2001, **Hz**

   CAL, More 1 of 4, More 2 of 4

   Service Cal

   Flatness Data

   EDIT FLATNESS

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

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

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

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

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

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

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

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

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

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

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

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

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

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

27. Checking the Absolute Amplitude Accuracy for Option 051

This adjustment applies to:

All 8590 E-Series spectrum analyzers, Option 051

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

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

Equipment required

Synthesized sweeper

Measurement receiver

Power splitter

Power sensor, 810 MHz to 1501 MHz

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

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

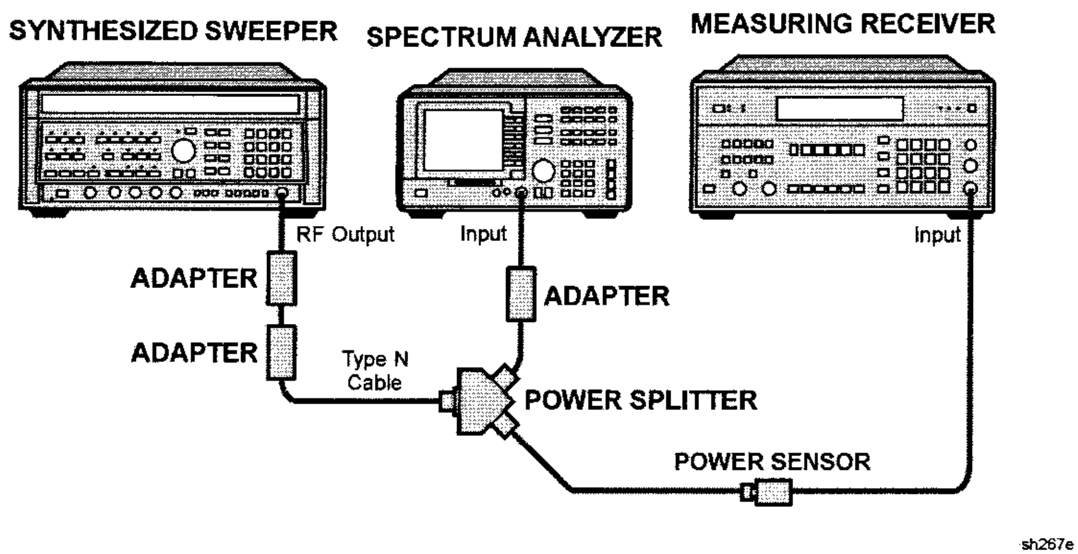
Adapter, Type N (m) to Type N (m)

Cable, Type N, 183 cm (72 in)

Additional Equipment for Option 026

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

Figure 2-39 Absolute Amplitude Accuracy Verification



Procedure

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

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

2. Connect the equipment as shown in Figure 2-39. Connect the power splitter to the analyzer using an adapter.

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

   CW .... 810 MHz

   POWER LEVEL .... −2 dBm

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

   FREQUENCY, 810, **MHz**

   SPAN, 400, **kHz**

   BW, 100, **kHz**

   VID BW AUTO MAN, 30, **kHz**

   AMPLITUDE, 4, **−dBm**

   ATTEN AUTO MAN, 10, **dB**

   PEAK SEARCH

Log Fidelity

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

Table 2-17 Log Fidelity

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

Frequency Range 810 MHz to 956 MHz

Frequency Response Input Attenuator 10 dB

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

Table 2-18 Frequency Response Attenuator 10 dB

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

Frequency Response Input Attenuator 20 dB

16. On the analyzer, press the following keys.

    AMPLITUDE, **ATTEN AUTO MAN**, 20, dB

    AMPLITUDE, 6, **+dBm**

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

Table 2-19 Frequency Response Attenuator 20 dB

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

Frequency Response Input Attenuator 30 dB

23.On the analyzer, press the following keys.

AMPLITUDE, **ATTEN AUTO MAN**, 30, dB

AMPLITUDE, 10, **+dBm**

24.Set the FREQUENCY of the analyzer to the measurement frequency shown in Table 2-20.

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

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

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

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

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

Table 2-20 Frequency Response Attenuator 30 dB

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

Frequency Response Input Attenuator 40 dB

30.On the analyzer, press the following keys.

AMPLITUDE, **ATTEN AUTO MAN**, 40, dB

AMPLITUDE, 10, **+dBm**

31.Set the FREQUENCY of the analyzer to the measurement frequency shown in Table 2-21.

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

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

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

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

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

Table 2-21 Frequency Response Attenuator 40 dB

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

Frequency Range 1429 MHz to 1501 MHz

Frequency Response input Attenuator 10 dB

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

Table 2-22 Frequency Response Attenuator 10 dB

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

Frequency Response Input Attenuator 20 dB

43. On the analyzer, press the following keys.

    AMPLITUDE, ATTEN AUTO MAN, 20, dB

    AMPLITUDE, 6, **+dBm**

44. Set the **FREQUENCY** of the analyzer to the measurement frequency shown in Table 2-23.

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

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

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

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

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

Table 2-23 Frequency Response Attenuator 20 dB

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

Frequency Response Input Attenuator 30 dB

50.On the analyzer, press the following keys.

AMPLITUDE, ATTEN AUTO MAN, 30, dB

AMPLITUDE, 10, **+dBm**

51.Set the FREQUENCY of the analyzer to the measurement frequency shown in Table 2-24.

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

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

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

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

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

Table 2-24 Frequency Response Attenuator 30 dB

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

Frequency Response Input Attenuator 40 dB

57. On the analyzer, press the following keys.

    AMPLITUDE, **ATTEN AUTO MAN**, 40, dB

    AMPLITUDE, 10, **+dBm**

58. Set the FREQUENCY of the analyzer to the measurement frequency shown in Table 2-25.
59. On the synthesized sweeper, press CW, then set the frequency to the same measurement frequency as the analyzer is set in the previous step.
60. On the analyzer, press **PEAK SEARCH**.
61. On the synthesized sweeper, press POWER LEVEL and adjust the amplitude so the analyzer marker amplitude reads +5 dBm ±0.05 dB.
62. Set the power sensor cal factor (for frequency being measured) on the measuring receiver, then record the measuring receiver power reading in Table 2-25.
63. Repeat step 58 to step 62 for frequencies of 1477 MHz, 1453 MHz, and 1429 MHz. Record the results in Table 2-25.

Table 2-25 Frequency Response Attenuator 40 dB

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

28. Correcting for Absolute Amplitude Accuracy for Option 051

This adjustment applies to:

All 8590 E-Series spectrum analyzers, Option 051

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

Frequency Range 810 MHz to 956 MHz

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

   Average Error__________________dB

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

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

2. Press the following analyzer keys.

   FREQUENCY, −2001, **Hz**

   CAL, More 1 of 4, More 2 of 4

   Service Cal

   Flatness Data

   EDIT FLATNESS

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

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

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

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

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

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

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

   Do not subtract more than 0.5 dB from the Amplitude ERROR. If the Average Error is more than 0.5 dB, it may not be possible to make corrections during the adjustment.
6. Using ⇓ (step down key), set the frequency displayed on the analyzer to 804 MHz *(781 MHz for 8591E spectrum analyzers or 8591C cable TV analyzers)*.

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

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

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

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

Frequency Range 1429 MHz to 1501 MHz

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

   Average Error________________dB

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

10.Press the following analyzer keys.

   PRESET (wait for completion)

   FREQUENCY, –2001, **Hz**

   CAL, More 1 of 4, More 2 of 4

   Service Cal

   Flatness Data

   EDIT FLATNESS

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

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

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

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

Table 2-29 Frequency Response Errors: 8591C and 8591E

Frequency	Amplitude ERROR	Corrected Flatness ERROR
1.410 GHz	________	________
1.447 GHz	________	________
1.484 GHz	________	________
1.521 GHz	________	________

Repeat step 10 and step 11 for the next frequency indicated in Table 2-28 or Table 2-29 until all four points have been recorded.

13. Subtract the Average Error, calculated in step 9, from each Amplitude ERROR from Table 2-28 or Table 2-29, then record column 3 as the Corrected Flatness ERROR.

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

14. Using ⇓ (step down key), set the frequency displayed on the analyzer to 1.380 GHz *(1.410 GHz for 8591E spectrum analyzers or 8591C cable TV analyzers)*.

15. Enter the Corrected Flatness ERROR from Table 2-28 or Table 2-29 for the frequency displayed using the DATA keys. Terminate the entry with the **+dBm**.

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

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

16. Press More, EXIT after all corrections are complete.

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