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Installation Note

Attenuator Retrofit Kit

Part Number 08565-90014

HEWLETT PACKARD

HP Part No. 5958-7185 Supersedes: 5958-7004
Printed in USA April 1990

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Attenuator Retrofit Kit

INSTRUMENTS AFFECTED:

HP 8565A Spectrum Analyzer
Serial Numbers: 0000A00000/2608A03234

HP 8569A Spectrum Analyzer
Serial Numbers: 0000A00000/9999A99999

HP 8569B Spectrum Analyzer
Serial Numbers: 0000A00000/9999A99999

HP 8570A Spectrum Analyzer
Serial Numbers: 0000A00000/9999A99999

HP 70300A Tracking Generator Option 001
Serial Numbers: 0000A00000/2818A00542

HP 70600A Preselector
Serial Numbers: 0000A00000/2930A00465

HP 70601A Preselector
Serial Numbers: 0000A00000/2929A00146

HP 70904A RF Section
Serial Numbers: 0000A00000/2924A01254

HP 70905A RF Section
Serial Numbers: 0000A00000/2925A00776

HP 70906A RF Section
Serial Numbers: 0000A00000/2928A00406

HP 70907A External Mixer Interface
Serial Numbers: 0000A00000/2932A00370

APPLICABLE SERVICE NOTES: 8565A-23, 8569A-14, 8569B-12, 8570A-02, 70300A-07A, 70601A-02A, 70601A-02A, 70904A-05A, 70905A-05A, 70906A-05A, and 70907A-03A

TO BE PERFORMED BY: HP-Qualified Personnel

Purpose

Certain attenuators are obsolete and are to be replaced with new designs when a failure occurs.

This Installation Note documents the recommended procedure for replacing the attenuator in the instruments listed above.

Section 1 describes the procedure to replace attenuators in the HP 70XXX instruments (except the HP 70300A Option 001). The 85XX instrument procedure is described in Section 2, and the HP 70300A Option 001 is described in Section 3.

Ordering Information

Table 1 describes the different retrofit kits available and their HP part numbers.

Table 1. Retrofit Kit Ordering Information

For Instrument	Order: Retrofit Kit HP Part Number	C D	Kit Includes: New Attenuator HP Part Number	Replaces: Old Attenuator HP Part Number
HP 8565A HP 8569A HP 8569B HP 8570A	5062-6418	3	5086-7842	5086-7365
HP 70300A Option 001	5062-6410	5	5085-7844	5086-7753
HP 70600A	5062-6418	3	5086-7842	5086-7365
HP 70601A	5062-6420	7	5086-7837	5086-7763
HP 70904A	5062-6419	4	5086-7843	5086-7724
HP 70905A	5062-6418	3	5086-7842	5086-7365
HP 70906A	5062-6420	7	5086-7837	5086-7763
HP 70907A	5062-6410	5	5086-7844	5086-7753

Table 2 describes the contents of the retrofit kit.

Table 2. Attenuator Retrofit Kit Contents

Quantity	Description	HP Part Number
1	Attenuator	See Table 1
1	Attenuator Ribbon Cable	5062-0701
1	Attenuator Ribbon Cable	5062-0703
1	Attenuator Bracket	5021-9372
2	Screw, Allen	3030-0638
2	Washer	2190-0654
1	Installation Note	5958-7185

Section 1. HP 70XXX Instruments (except HP 70300A Option 001)

The following removal and installation procedure applies to HP 70XXX instruments except HP 70300A Option 001. Keep track of where the hardware is used during the disassembly process; some of the parts (screws and bracket) are reused.

Removal

1. Looking at the front of the unit, remove the right-side cover.
2. Loosen both end connectors of the rigid-coax cable that is connected to the attenuator input. Disconnect the cable connected to the attenuator input.
3. Loosen both end connectors of the rigid-coax cable that is connected to the attenuator output. Disconnect the cable connected to the attenuator output.
4. Disconnect the ribbon cable connector from the attenuator driver PC board assembly.
5. Remove the two screws and lock washers securing the attenuator front-mounting and rear-mounting brackets to the module chassis.
6. Lift the attenuator out of the module.
7. Remove the allen screws and lock washers securing the mounting brackets to the attenuator.

Replacement

For the location of the callouts in this procedure see Figure 1.

1. Secure the new mounting bracket (HP part number 5021-9372) with two screws (HP part number 3030-0638) and two washers (HP part number 2190-0654) to the ribbon-cable-socket end of the attenuator (1).
2. Secure the bracket previously removed from the old attenuator (opposite the ribbon connector end) to the same end of the new attenuator using the old bracket, screws, and washers (2).
3. The allen screws should be torqued to a recommended three-inch pounds with a #8 allen wrench.
4. Connect the female connector of the ribbon cable (HP part number 5062-0701 or 5062-0703 for HP 70907A) to the attenuator male connector (3).
5. Place the attenuator in the module with the two SMA connectors pointing toward the top of the module. Carefully fit and connect the input and output rigid cables to the attenuator (4, 5), being careful not to damage the center conductor fingers, or the center conductor of the attenuator connector through the use of excessive force .
6. Place the two old screws with lock washers into the attenuator mounting bracket and secure the attenuator to the module (2).
7. Connect the ribbon cable to the PC board assembly connector, dressing the cable to ensure that it is not pinched by the cover (6).
8. The rigid-coax cable connectors should be torqued to a recommended 10 inch-pounds using a 5/16 inch torque wrench. The attenuator mounting screws should be torqued to a recommended 20 inch-pounds.

9. Replace the module cover.
10. Perform all Final and RF Input Return Loss tests found in the Module Verification test list.

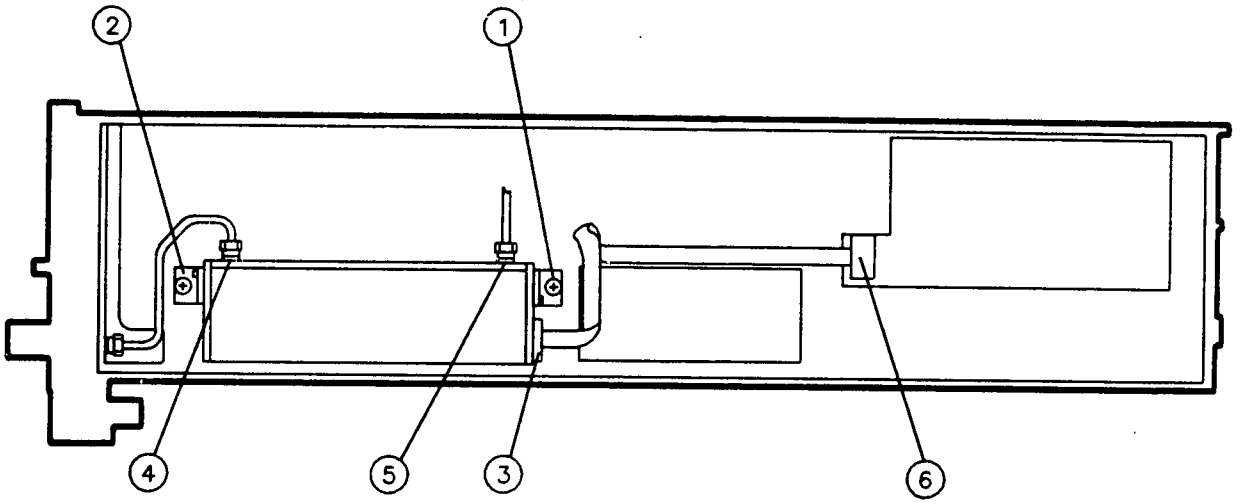


Figure 1. HP 70XXX Attenuator Replacement

Section 2. HP 8565A, HP 8569A, HP 8569B and HP 8570A Spectrum Analyzers

The following removal and installation procedure applies to HP 8565A, HP 8569A, HP 8569B and the HP 8570A Spectrum Analyzers. Keep track of where the hardware is used during the disassembly process; the same hardware will be used in the installation procedure.

Note The attenuator bracket, allen screws, and washers included in the Attenuator Retrofit Kit (HP part number 5062-6418) are not required in the HP 8565A, HP 8569A, HP 8569B, or HP 8570A. Discard these parts.

Removal

1. Looking at the front of the instrument, remove the top cover. Turn the unit upside down and remove the left-side cover and the bottom cover.
2. Loosen FL4 on the output of AT2 and pull free from AT2. Loosen W1, the input rigid-coax cables connected to the attenuator (closest to front panel). Remove W2, the rigid-coax cable going from the attenuator output to K2.
3. Remove the HP 11593A (50Ω load) from the EXT mixer input. Remove the six screws (three top and three bottom) holding the front-control assembly to the frame. Very carefully pull the front-control assembly clear of the unit.
4. Remove the two screws in the left-side frame piece that hold the attenuator bracket in place. Pull W1 free of the attenuator input and remove the attenuator (and bracket). Place the removed assembly in an area clear of the immediate work area.
5. Remove the cables connected to the front-control assembly with the exception of A2A2J1, which is connected to the frequency-display control. Carefully pull the assembly to the side.
6. Pull A29J1 off the motherboard: this will allow you to gain access to the attenuator cable connection to the motherboard. Remove the connector. Loosen W9, the rigid-coax cable connection to the input of AT2. Noting the attenuator cable routing, remove the cable and pull the attenuator and bracket clear of the unit.
7. With the connector to the motherboard in your right hand, make a 90 degree fold in the cable towards you. Carefully maneuver the new attenuator cable and connector into position over the motherboard connector and install the connector. Check that the connector is properly installed before proceeding to the next step.
8. Route the cable back to the attenuator area using the same routing of the old attenuator cable.
9. Remove the two screws holding the old attenuator to the bracket. Place the bracket on the new attenuator and replace the screws.

Note The round head screw is at the input connector end of the attenuator.

Replacement

1. Place the cable connector into the new attenuator and place the attenuator in a convenient place away from the work area.
2. Connect cable A29J1 to the motherboard and connect the other three cables that were removed in step 5, above, to the front-control assembly.
3. Replace W9 to the input of AT2.
4. Return A2A4J1 to its original routing and reconnect to the rear switch assembly.
5. Install the attenuator (and bracket) to the side rail using the two round-head screws removed earlier.
6. Connect W1 to the attenuator input. Start the threaded fastener, but do not tighten until the front control assembly has been secured in place.
7. Carefully replace the front control assembly (taking care not to pinch any cables) and secure in place with the six flat-head screws removed earlier.
8. Tighten W1 on the attenuator input.
9. Replace W2 going from the attenuator output to K2, and tighten the fasteners.
10. Connect FL4 to the output of AT2 and tighten.
11. Place the HP 11593 (50Ω load) on the EXT mixer input.
12. Replace the side, bottom, and top covers.
13. Perform appropriate electrical tests.

Section 3. HP 70300A Tracking Generator Option 001

The following removal and installation procedure applies to HP 70300A, Option 001. Keep track of where the hardware is used during the disassembly process; these parts (screws and bracket) are reused.

Note The attenuator bracket, allen screws, and washer included in the Attenuator Retrofit Kit (HP part number 5062-6418) are not required in the HP 70300A Option 001. Discard these parts.

Removal

For the location of callouts in this procedure, see Figure 2.

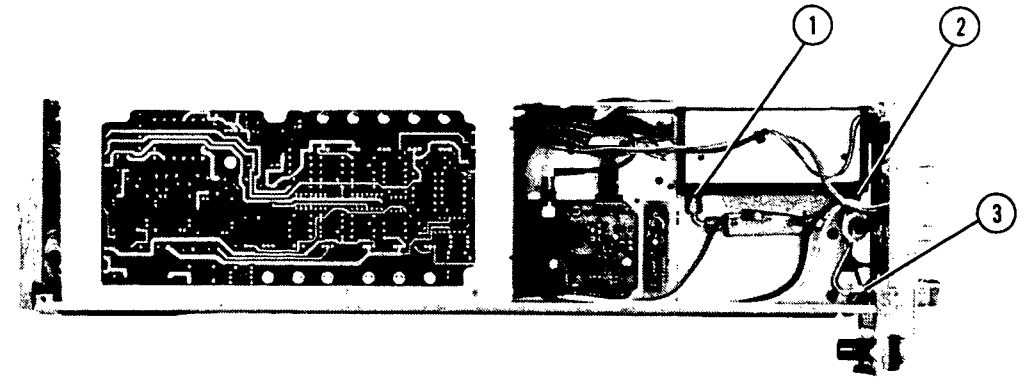
1. Remove the module cover.
2. Remove the A7 VCXO Assembly and set it aside.
3. Disconnect SMA connector (1). See Figure 2.
4. Loosen, but do not remove, SMA connectors (2) and (3).
5. Remove two screws (4) to free the attenuator from the frame.
6. Rotate the the center end of the attenuator outward.
7. Disconnect SMA connector (3), then disconnect SMA connector (2) to free the attenuator from the module.
8. Remove three bottom screws (5), then two card-cage screws (6). See Figure 2.
9. Remove two screws (7) to free the card cage from the module.
10. Swing the center end of the card cage out just far enough to gain access to the ribbon cable connectors. Release and disconnect the ribbon cable.
11. Remove two screws (8) to allow separation of the card-cage board assemblies.
12. Disconnect the attenuator cable (9) at the back of the control board assembly.

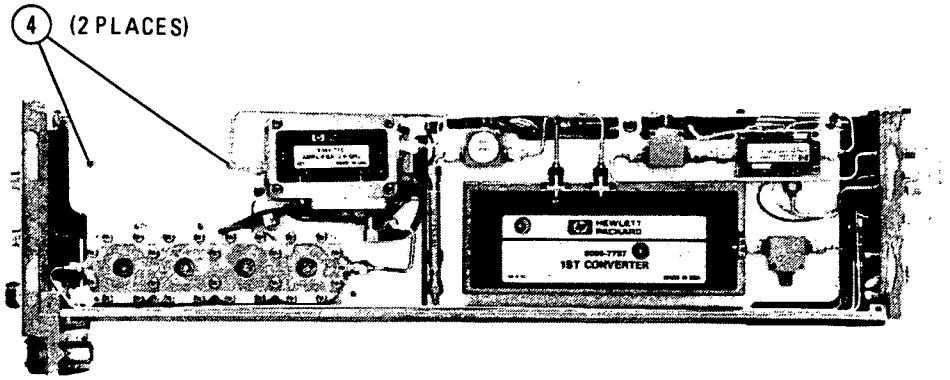
Replacement

1. Connect the female connector of the new ribbon cable (HP part number 5062-0703) to the new attenuator male connector.
2. Connect the other end of the new ribbon cable (9) at the back of the control board assembly.
3. Position the A5/A6 board assembly in the cage frame, then replace two screws (8).
4. Replace two screws (7).

Note Verify that the connectors at the rear of the card cage are pressed firmly into place before positioning the cage in the module frame. Also, be sure the three coaxial cables are on the bottom and against the third converter; these cables can be damaged if not carefully positioned.

5. Carefully position the card cage in the module frame and swing the cage inward just far enough to allow the ribbon cable to be reconnected and clamped. Close the cage.
6. Replace two screws (6), then replace three screws (5).
7. Position the attenuator and reconnect, but do not tighten, SMA connectors (2) and (3).
8. Rotate the attenuator into position and reconnect SMA connector (1).
9. Tighten SMA connectors (2) and (3).
10. Replace two screws (4).
11. Perform all Final tests found in the Module Verification test list.





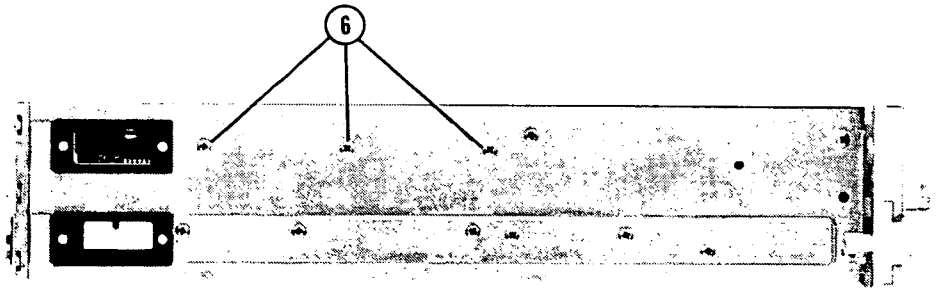


Figure 2. HP 70300A, Option 001, Attenuator Replacement (1 of 2)

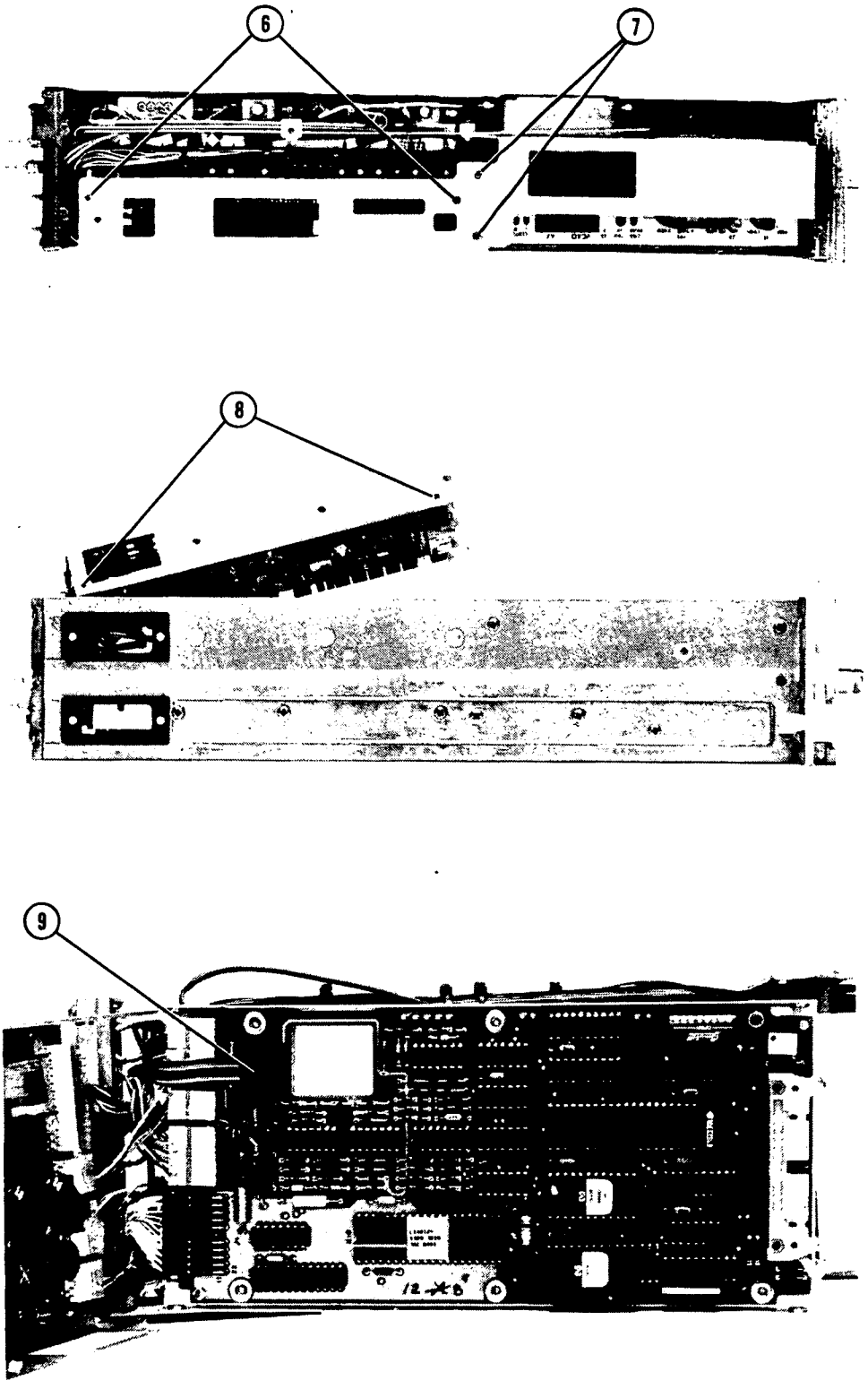


Figure 2. HP 70300A, Option 001, Attenuator Replacement (2 of 2)

HEWLETT hp PACKARD

OPERATING AND SERVICE MANUAL

8565A
SPECTRUM ANALYZER
Includes Options 100, 200, and 400

SERIAL NUMBERS

This manual applies directly to HP Model 8565A Spectrum Analyzer having serial prefix number 1712A.

For additional important information about serial numbers see INSTRUMENTS COVERED BY MANUAL in Section I.

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1400 FOUNTAIN GROVE PARKWAY, SANTA ROSA, CALIFORNIA, U.S.A.

MANUAL PART NO. 08565-90014
MICROFICHE PART NO. 08565-90015

Printed: August 1977

SAFETY

This instrument has been designed and tested according to International Safety Requirements. To ensure safe operation and to keep the instrument safe, the information, cautions, and warnings in this manual must be heeded. Refer to Section I for general safety considerations applicable to this instrument.

CERTIFICATION

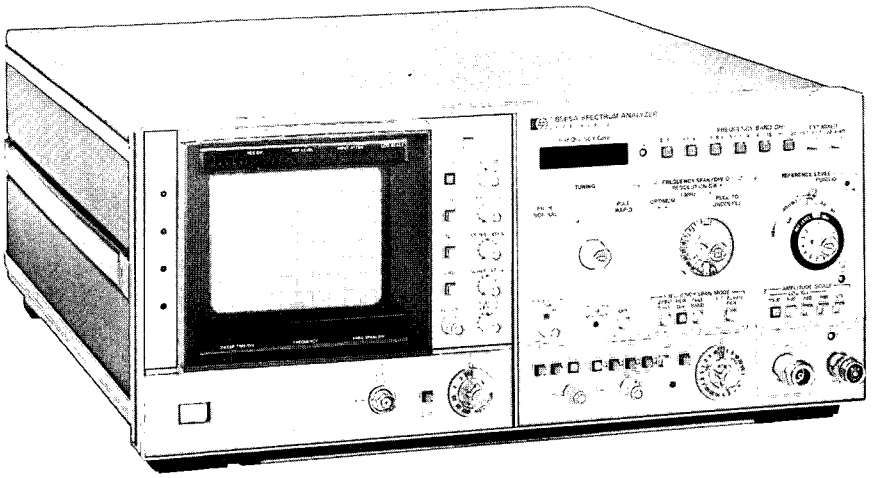
Hewlett-Packard Company certifies that this instrument met its published specifications at the time of shipment from the factory. Hewlett-Packard Company further certifies that its calibration measurements are traceable to the United States National Bureau of Standards, to the extent allowed by the Bureau's calibration facility, and to the calibration facilities of other International Standards Organization members.

WARRANTY AND ASSISTANCE

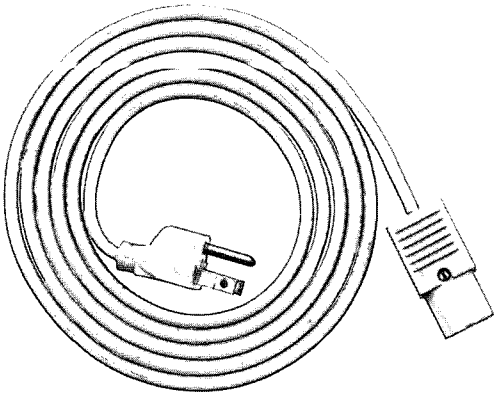
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HP 8565A



LINE POWER CABLE

(SEE TABLE 2-2 FOR
HP PART NUMBER)

Figure 1-1. Model 8565A Spectrum Analyzer With Accessories Supplied

SECTION I
GENERAL INFORMATION

1-1. INTRODUCTION

1-2. This Operating and Service Manual contains information required to install, operate, test, adjust, and service the Hewlett-Packard Model 8565A. Figure 1-1 shows the instrument and accessories supplied. This section covers instrument identification, description, options, accessories, specifications, and other basic information.

1-3. This manual is divided into eight sections which provide information as follows:

a. SECTION I, GENERAL INFORMATION, contains the instrument description and specifications as well as the accessory and recommended test equipment list.

b. SECTION II, INSTALLATION/INCOMING INSPECTION, contains information relative to receiving inspection, preparation for use, mounting, packing, shipping, and incoming inspection.

c. SECTION III, OPERATION, contains instructions for operating the instrument.

d. SECTION IV, PERFORMANCE TESTS, contains information required to verify that instrument performance is in accordance with published specifications.

e. SECTION V, ADJUSTMENTS, contains information required to properly adjust and align the instrument after repair.

f. SECTION VI, REPLACEABLE PARTS, contains information required to order all parts and assemblies.

g. SECTION VII, MANUAL BACKDATING CHANGES, contains backdating information to make this manual compatible with earlier equipment configurations.

h. SECTION VIII, SERVICE, contains descriptions of the circuits, schematic diagrams, parts location diagrams, and troubleshooting procedure to aid the user in maintaining the instrument.

1-4. Supplied with this manual is an Application Note entitled "Operating the 8565A Spectrum Analyzer." This Application Note should be kept with the instrument for use by the operator.

1-5. SPECIFICATIONS

1-6. Instrument specifications are listed in Table 1-1. These specifications are the performance standards or limits against which the instrument is tested. Table 1-2 lists supplemental characteristics. Supplemental characteristics are not specifications but are typical characteristics included as additional information for the user.

NOTE

To ensure that the 8565A meets specifications listed in Table 1-1, Performance Tests (Section IV) should be performed every six months.

1-7. SAFETY CONSIDERATIONS

1-8. General

1-9. This is a Safety Class I instrument and has been manufactured and tested according to international safety standards.

1-10. Operation

1-11. BEFORE APPLYING POWER make sure the instrument's ac input is set for the available ac line voltage, that the correct fuse is installed, and that all normal safety precautions have been taken. (See Warnings below).

Table 1-1. Model 8565A Specifications (1 of 3)

SPECIFICATIONS

FREQUENCY SPECIFICATIONS

FREQUENCY RANGE

Internal mixer 0.01 to 22 GHz

Covered in six ranges selectable by Frequency Band pushbuttons (in GHz): .01 to 1.8; 1.7 to 4.1; 3.8 to 8.5; 5.8 to 12.9; 8.5 to 18; 10.5 to 22.

External mixer HP 11517A 14.5 to 40 GHz

Covered in two ranges selectable by Frequency Band pushbuttons (in GHz) : 14.5 to 26.6 (6+ harmonic mode); 22.9 to 40 (10+ harmonic mode).

Tuning Accuracy

The overall tuning accuracy of the digital Frequency readout in any span mode:

Internal mixing

.01 to 2.5 GHz $<$ ±5 MHz ±20% of Frequency Span/Div
2.5 to 22 GHz $<$ ±0.2% ±20% of Frequency Span/Div

External mixing

14.5 to 40 GHz $<$ ±0.7% ±20% of Frequency Span/Div

Digital readout resolution (included in tuning accuracy)

Internal mixing 1 MHz; External mixing 10 MHz

FREQUENCY SPANS (on a 10 division CRT horizontal axis)

1.7 to 22 GHz

Multiband span of spectrum from 1.7 to 22 GHz in one sweep. The frequency (position) corresponding to the tuning marker is set by the Tuning control and indicated in GHz by the digital Frequency displays on the front panel and the CRT bezel.

Full Band

Displays spectrum of entire Frequency Band selected. Tuning marker displayed in Full Band mode (becomes center frequency when Per Division mode is selected). Marker frequency is given on the digital displays.

Per Division

Eighteen calibrated spans from 1 kHz/div to 500 MHz/Div in a 1, 2, 5, 10 sequence. In "F" position the entire Frequency Band selected is spanned.

Span width accuracy

The frequency error for any two points on the display for spans from 500 MHz to 20 kHz/Div (unstabilized) is less than ±5% of the indicated separation; for stabilized spans 100 kHz/Div and less, the error is less than ± 15%.

Center Frequency

The center frequency represented by the CRT is indicated in GHz by the digital Frequency displays on the front panel and the CRT bezel.

Zero Span

Analyzer becomes a manually tuned receiver (for the time domain display of signal modulation) set to the frequency indicated in GHz by the digital Frequency displays.

SPECTRAL RESOLUTION AND STABILITY

Resolution Bandwidths

Resolution (3 dB) Bandwidths from 1 kHz to 3 MHz in 1, 3, 10 sequence. Bandwidth may be varied independently or coupled to Frequency Span/Div control. Optimum coupling (best ratio of Frequency Span/Div to Resolution Bandwidth) is indicated by alignment of markers (▶◀) on both controls.

Uncoupled, the controls for Frequency Span/Div and Resolution Bandwidth may be independently set so any resolution bandwidth (3 MHz to 1 kHz) may be used with any span width (F and 500 mHz to 1 kHz/Div).

Resolution Bandwidth accuracy

Individual resolution bandwidth 3 dB points: $<$ ±15%.

Selectivity: (60 dB/3 dB bandwidth ratio) $<$ 15:1 for bandwidths 1 kHz to 3 MHz.

Stability

Total residual FM

Stabilized: $<$200 Hz p-p in 0.1 sec .01 – 8.5 GHz
Unstabilized: $<$10 kHz p-p in 0.1 sec .01 – 4.1 GHz
(Fundamental mixing)

Stabilization range: First LO automatically stabilized (unless auto stabilizer is OFF) for frequency spans 100 kHz/div or less.

Noise sidebands: At least 70 dB down, greater than 30 kHz from center of CW signal when set to a 1 kHz Resolution Bandwidth and a 10 Hz (.01) Video Filter.

Video Filter

Post detection low-pass filter used to average displayed noise for a smooth trace. Nominal settings are given as decimal fractions of the Resolution Bandwidth: OFF, .3, .1, .03, .01, and .003. A 1 Hz NOISE AVG (noise averaging) setting is provided for noise level measurement.

AMPLITUDE SPECIFICATIONS

AMPLITUDE RANGE — Internal mixer

(Amplitude specifications for the HP 8565A Spectrum Analyzer with the HP 11517A External Mixer are given near the end of Table 1-1.)

Measurement range:

Damage levels:

Total power: +30 dBm (1 watt)
dc: 0V with 0 dB Input attenuation
± 7V with ≥ 10 dB Input attenuation
ac: ($<$50Ω nominal source impedance):
0V with 0 dB Input attenuation
10V peak with ≥ 10 dB Input attenuation

Gain compression:

For signal levels below MAXIMUM input setting, gain compression is less than 1 dB.

Table 1-1. Model 8565A Specifications (2 of 3)

Average noise level:
Sensitivity (minimum discernible signal) is given by the signal level which is equal to the average noise level, causing approximately a 3 dB peak above the noise. Maximum average noise level with 1 kHz Resolution Bandwidth (0 dB attenuation and 0.003 (3 Hz) video filter) is given in the table below:

Frequency Band (GHz)	First IF in MHz	Harmonic Mode	Avg. Noise Level (dBm)
.01-1.8	2050	1–	–110
1.7-4.1	321.4	1–	–106
3.8-8.5	321.4	2–	–102
5.8-12.9	321.4	3–	–92
8.5-18	321.4	4+	–83
10.5-22	321.4	5+	–72

Reference Level

Reference Level range: +70 dBm[1] to –102 dBm in 10 dB steps and continuous 0 to –12 dB calibrated vernier.

Reference Level accuracy:
With Sweep Time/Division control in Auto setting, the optimum sweep rate is selected automatically for any combination of Frequency Span/Div, Resolution Bandwidth and Video Filter settings. Thus, the Auto Sweep setting insures a calibrated amplitude display within the following limits:

Calibrator output
–10 dBm ±0.3 dB
100 MHz ±10 kHz

Reference Level variation (Input Attenuator at 0 dB)

10 dB Steps: < ±0.5 dB (0 to –70 dBm)
< ±1.0 dB (0 to –90 dBm)

Vernier (0 to –12 dB) continuous: Maximum error <±0.5 dB, when read from Reference Level Fine control.

Input Attenuator (at preselector input, 70 dB range in 10 dB steps)

Step size variation (for steps from 0 to 60 dB):
< ±1.0 dB .01 to 18 GHz
Maximum cumulative Error (from 0 to 60 dB):
< ±2.4 dB .01 to 18 GHz

Frequency Response (with 0 or 10 dB of Input Attenuation)
Frequency response includes input attenuator, preselector and mixer frequency response plus mixing mode gain variation (band to band).

Frequency Band (GHz)	Frequency Response (± dB MAX.)
0.01 to 1.8	1.2
1.7 to 4.1	1.7
3.8 to 8.5	2.2
5.8 to 12.9	2.5
8.5 to 18	3.0
10.5 to 22	4.5

Switching between bandwidths: 3 MHz to 300 kHz, ±0.5 dB; 3 MHz to 1 kHz, ±1.0 dB[2].

Calibrated display range

Log — expanded from reference level down:
70 dB with 10 dB/Div scale factor
40 dB with 5 dB/Div scale factor
16 dB with 2 dB/Div scale factor
8 dB with 1 dB/Div scale factor

Linear. Full scale from 56 μV (–102 dBm across 50 ohms to 707 volts (+70 dBm)[1] in 10 dB steps and continuous 0 to –12 dB vernier. Full scale signals in linear translate to approximately full scale signals in the log modes.

Display accuracy
Log: < ±0.1 dB/dB but not more than ±1.5 dB over full 70 dB display range.
Linear: < ±0.1 division over full 8 division deflection

Residual responses (no signal present at input):
With 0 dB input attenuation on fundamental mixing (0.01 to 4.1 GHz) < –90 dBm.
Signal Identifier: Provided on all Frequency Bands in 1 MHz/Div frequency span for signal identification (reads incorrectly for 100 MHz Cal Output signal)

SWEEP SPECIFICATIONS

SWEEP TIME

Auto: Sweep time is automatically controlled by Frequency Span/Div, Resolution Bandwidth and Video Filter controls to maintain an absolute amplitude calibrated display.

Calibrated Sweep times: 21 internal sweep times from 2 μsec/Div to 10 sec/Div in 1, 2, 5, 10 sequence. Sweep time accuracy ±10% except for 2, 5, and 10 sec/Div which are ±20%. Swept frequency modes use sweep times 2 msec/Div through 10 sec/Div. When operated as a fixed tuned receiver (Zero Span) the full range of sweep times (2 μsec to 10 sec/Div) may be used to display modulation waveforms.

GENERAL SPECIFICATIONS

TEMPERATURE RANGE:
Operating 0°C to 55°C, storage –40° to +75°C.

HUMIDITY RANGE (Operating):
< 95% R.H. 0°C to 40°C.

EMI:
Conducted and radiated interference is within the requirements of methods CE03 and RE02 of MIL STD 461A, VDE 0871 and CISPR pub'n 1, 2, and 4.

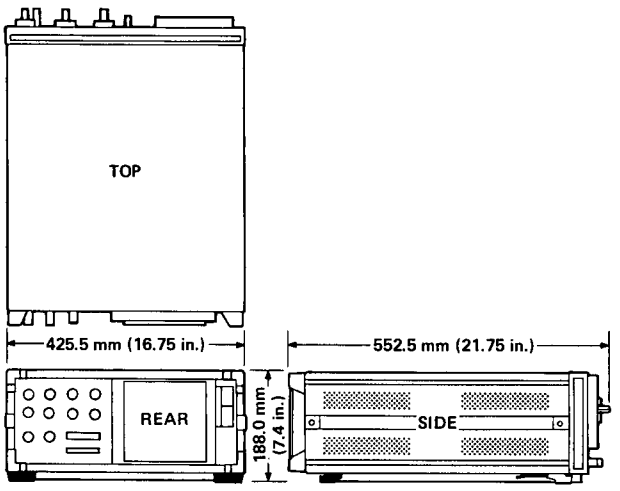
POWER REQUIREMENTS
48-66 Hz, 100, 120, 200 or 240 volts (–10% to +5%) 220 VA maximum . Fan cooled.

1 Input level not to exceet + 30 dBm damage level.
2 100 kHz BW limited to 90% relative humidity.

Table 1-1. Model 8565A Specifications (3 of 3)

DIMENSIONS

426 mm wide: 188 mm high, 552 mm deep (16 3/4 in. x 7 3/8 in. x 21 3/4 in.)



WEIGHT: 30.4 kg (60 lbs.)

11517A EXTERNAL MIXER

When used with the 8565A for operation in waveguide 14.5 to 40 GHz:

MEASUREMENT RANGE

Maximum waveguide input: Saturation (gain compression < 1 dB), −15 dBm; Damage Level > 0 dBm or 0.1 erg.

Sensitivity:
(Average noise level in a 10 kHz IF bandwidth)
14.5-18 GHz < −80 dBm
18-26.5 GHz < −70 dBm
26.5-40 GHz < −60 dBm
Typical sensitivity is 10 dB better for each band.

STANDARD OPTIONS AVAILABLE

OPTION 100, 100 Hz RESOLUTION

Adds .3 kHz and .1 kHz resolution BW settings.
All specifications identical to standard 8565A except:

Spectral Resolution and Stability
Resolution Bandwidths: Resolution (3 dB) bandwidths from 100 Hz to 3 MHz in a 1, 3, 10 sequence.

Selectivity: (60 dB/3 dB bandwidth ratio) <15:1 for bandwidths 3 kHz to 3 MHz; <11:1 for bandwidths .1, .3, and 1 kHz.

Stability
Total Residual FM
Stabilized: <100 Hz p-p in 0.1 sec **.01–8.5 GHz**
Unstabilized: <10 kHz p-p in 0.1 sec .01 – 4.1 GHz (fundamental mixing)

OPTION 200, CALIBRATION IN dBμV

Front panel controls read in dBm as in standard instrument.

All specifications identical to standard 8565A except:
Bezel readout (top line, Reference Level): Reference level displayed in dBμV given in 1 dB increments from +177 dBμV[1] to +5 dBμV.

Average noise level (with 1 kHz IF bandwidth):

Band (GHz)	Max. Avg. Noise Level (dBμV)
0.01 to 1.8 GHz	−3
1.7 to 4.1	+1
3.8 to 8.5	+5
5.8 to 12.9	+15
8.5 to 18	+24
10.5 to 22	+35

Log Reference Level range: +177 dBμV[1] to +5 dBμV in 10 dB steps and continuous 0 to −12 dB calibrated vernier.

Calibrator Output: Amplitude +97 dBμV ± 0.3 dB.

OPTION 400, 400 Hz POWER SUPPLY

Permits operation on 50, 60, or 400 Hz mains.

All specifications identical to standard 8565A except:

GENERAL SPECIFICATIONS

Temperature range (operating): 50-60 Hz 0° to 40° C
400 Hz 0° to 55° C

Power requirements: 50, 60, or 400 Hz; 100, 120, 200, or 240 volts (−10% to +5%) 220 VA ,maximum. Fan cooled.

[1]Input level not to exceed +137 dBμV damage level.

Table 1-2. Model 8565A Supplemental Characteristics (1 of 4)

SUPPLEMENTAL CHARACTERISTICS

NOTE: Values in this table are not specifications but are typical characteristics included for user information.

FREQUENCY CHARACTERISTICS

FREQUENCY SPANS

1.7 to 22 GHz

When this mode is selected the analyzer displays the entire spectrum from 1.7 to 22 GHz. A 3 MHz Resolution Bandwidth, 9 kHz Video Filter, and 100 msec/div Sweep Time are automatically selected.

Full Band

When selected by panel pushbutton, analyzer displays spectrum of Frequency Band chosen. This automatically selects a 3 MHz Resolution Bandwidth and a 9 kHz Video Filter. Sweep Time/Div varies from approximately 10 msec to 100 msec/div depending on which Frequency Band is chosen. Tuning marker frequency (position) indicates where analyzer tuning will be centered if a Per Division span mode is chosen.

Per Division

In "F" position (full band), the entire range of the Frequency Band selected is spanned, thus allowing the use of Resolution Bandwidth and Video Filter settings other than those chosen when the Full Band push button is depressed. Center frequency of the analyzer's display is set by the tuning control and indicated by the LED readouts. The Frequency CAL control to the right of the display window on the front panel is used to set the LED readout to agree with the actual center frequency of the CRT display (normally set using the 100 MHz CAL OUTPUT as a 0.100 GHz frequency reference).

Out-of-range blanking

The out-of-range portion of the CRT trace is automatically blanked whenever the analyzer is swept beyond a band edge.

RESOLUTION

Bandwidth Ranges

See Figure 1 for curves of typical analyzer resolution using different IF bandwidths.

IF Bandwidth shape: *Approximately gaussian (synchronously tuned, 4-pole filter)*

Frequency drift (fundamental mixing, .01-4.1 GHz) long term

At fixed center frequency after 2 hours warm-up:
Stabilized $< \pm 3.0$ kHz/10 minutes
Unstabilized $< \pm 25$ kHz/10 minutes

With Temperature Changes
Stabilized < 10 kHz/°C
Unstabilized < 200 kHz/°C
Auto stabilizer may be disabled in narrow spans (<100 kHz/Div) by depressing front panel pushbutton switch to "OFF" position.

VIDEO FILTER

Video Filter bandwidths typically ±20% of nominal value.

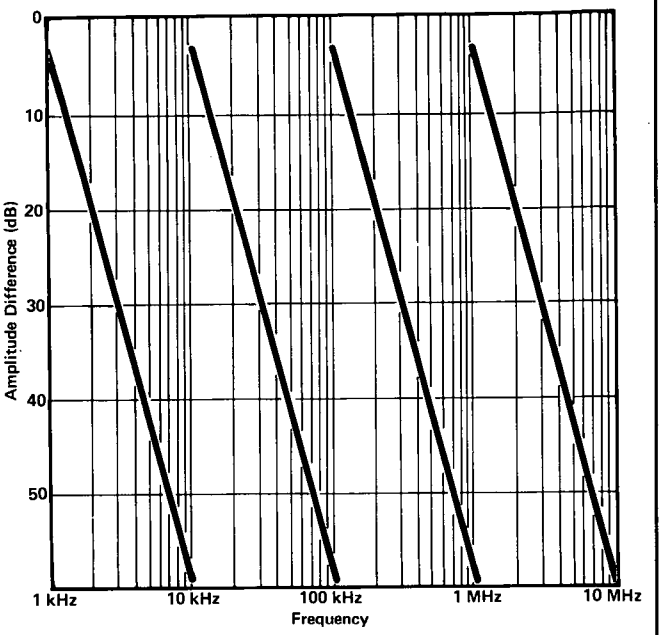


FIGURE 1. Typical Spectrum Analyzer Resolution

INTERNAL PRESELECTOR

Frequency Range	Description	Rejection
0.01 to 1.8 GHz	Low-pass filter	> 50 dB above 2.05 GHz
1.7 to 22 GHz	Tracking YIG tuned filter	> 70 dB greater than 642.8 MHz from center of pass band 1.7 to 18GHz, > 60 dB from 18 to 22 GHz

TRACKING PRESELECTOR

Preselector skirt roll-off: *Characteristics of a three-pole filter (nominally 18 dB/octave), 3 dB bandwidth typically varies from 25 MHz (at 1.7 GHz) to 70 MHz (at 22 GHz).*

AMPLITUDE CHARACTERISTICS

DYNAMIC RANGE

Maximum power ratio of two signals simultaneously present at the input that may be measured within the limits of specified accuracy, sensitivity and distortion (i.e., spurious responses): 0.01 to 22 GHz > 70 dB.

Spurious responses: *(Input attenuator set to 0 dB)*

Second harmonic distortion

Frequency Range	*Input Power*	*Relative Distortion*
0.01-1.8 GHz	*−40 dBm*	*−70 dB*
1.7-22 GHz	*0 dBm*	*−100 dB**
**May be below average noise level.*		

Table 1-2. Model 8565A Supplemental Characteristics (2 of 4)

SUPPLEMENTAL CHARACTERISTICS

NOTE: Values in this table are not specifications but are typical characteristics included for user information.

Third order intermodulation

Frequency Range	For Two Input Signals With		Relative Distortion
	Input Power	Signal Sep.	
0.01-22 GHz	−25 dBm	50 kHz	70 dB
1.7-12.9 GHz	0 dBm	70 MHz	100 dB*
1.7-22 GHz	0 dBm	100 MHz	100 dB*

*May be below average noise level.

For typical harmonic and third order intermodulation distortion, see Figure 2.

Image and Multiple Responses:

Frequency	Image (out of band)	Multiple (in-band)
0.01-1.8 GHz	−50 dB	non-existent
1.7-18 GHz	−70 dB	−70 dB
18-22 GHz	−60 dB	−60 dB

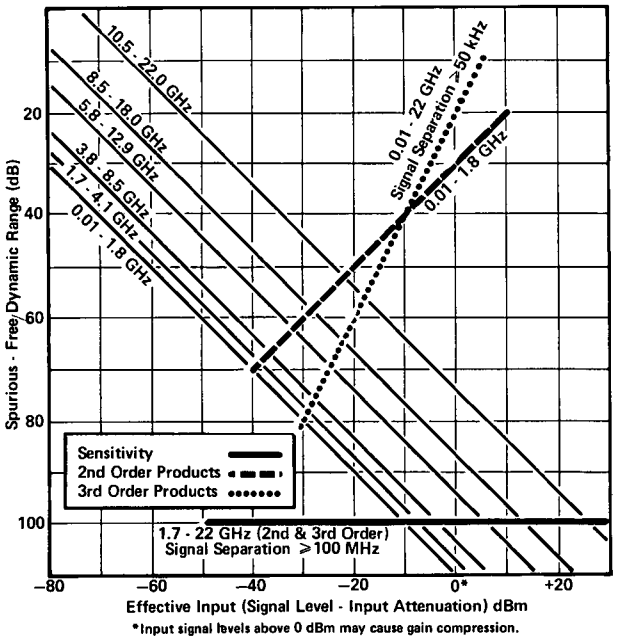


FIGURE 2. Optimum Dynamic Range Chart

AMPLITUDE ACCURACY

The overall amplitude accuracy of a measurement depends on an analyzer's performance and the measurement technique used. Applying IF substitution eliminates errors due to the display, bandwidth gain variation, scale factor and input attenuator step size. Only IF gain variation (reference level change with input attenuation constant: < ±1.0 dB), calibrator amplitude (< ±0.3 dB), and frequency response remain. In brief, IF substitution minimizes error by minimizing control changes from the reference measurement (e.g., calibration).

For measurements in the Frequency Bands covering 1.7 to 22 GHz that don't require the best possible accuracy, the front panel preselector peak may be left centered in its "green" setting. This adds typically < ±1.0 dB of error to the reference level value at room temperature.

Input Attenuator (at preselector input, 70 dB range in 10 dB steps)

Step size variation: <±1.0 dB .01 to 18 GHz
<±1.5 dB .01 to 22 GHz

Maximum cumulative error over the 0 to 70 dB range:
<±2.1 dB .01 to 12.4 GHz
<±2.4 dB .01 to 18 GHz
<±4.0 dB .01 to 22 GHz

Reference Level Variation (For any change of scale factor): *< ±1 dB.*

FREQUENCY RESPONSE AND SENSITIVITY

For typical frequency response and sensitivity versus input frequency, see Figure 3.

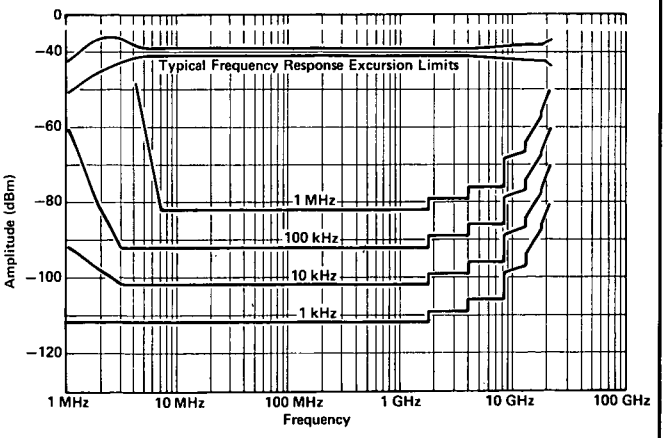


FIGURE 3. Average Noise Level vs. Input Frequency

Table 1-2. Model 8565A Supplemental Characteristics (3 of 4)

SUPPLEMENTAL CHARACTERISTICS

NOTE: Values in this table are not specifications but are typical characteristics included for user information.

SIGNAL INPUT CHARACTERISTICS

INPUT 50Ω 0.01 TO 22 GHz

Input connector: *Precision Type N female*

Input impedance

Input attenuator at 0 dB: *50 ohms nominal*
SWR: *<1.5 0.01 to 1.8 GHz*
<2.0 1.7 to 22 GHz (at analyzer tuned frequency)
Input attenuator at 10 dB or more: *50 ohms nominal*
SWR: *<1.3 0.01 to 1.8 GHz*
<2.0 1.7 to 22 GHz

LO Emission (2.00 to 4.46 GHz):
−50 dBm 0.01 to 1.8 GHz
−85 dBm 1.7 to 22 GHz

Input Protection (For input signals from .01 to 22 GHz)
0.01 to 1.8 GHz Frequency Band: *Internal diode limiter.*
1.7 to 22 GHz Frequency Bands: *Saturation of YIG filter (preselector) occurs at total input signal power levels below input mixer damage.*

EXTERNAL MIXER INPUT

BNC female connector is a port for LO power transfer, bias current and IF return.

SWEEP CHARACTERISTICS

SWEEP SOURCE

Manual: *Sweep determined by front panel control; continuously settable across CRT in either direction.*

External: *Sweep determined by 0 to + 10V external signal applied to External Sweep Input on rear panel. Blanking is controlled by signal at Blanking Input.*

Internal: *Sweep generated from internal sweep generator.*

SWEEP TRIGGER

Free Run: *Sweep triggered repetitively by internal source.*

Line: *Sweep triggered by power line frequency.*

Video: *Sweep internally triggered by detected waveform of input signal (signal amplitude of 0.5 division peak-to-peak required on CRT display).*

Trigger Level: *Functions in the Video and Ext Trigger modes to set the level of the displayed trace or Ext Trigger Input which will trigger the sweep.*

External Trigger: *Sweep triggering determined by signal input (between −+1 and +10 volts) to rear panel BNC connector.*

Single: *Sweep triggered or reset by front panel Start/Reset button.*

Start/reset: *Also can reset any internal sweep to left edge of display.*

REAR PANEL INPUT AND OUTPUT CHARACTERISTICS

X,Y, and Z Axis Outputs: These rear panel outputs are compatible with and may be used to drive all current HP XY recorders (using positive pencoils or TTL penlift input) and CRT monitors.

Horizontal Sweep Output (X axis): *A voltage proportional to the horizontal sweep of the CRT trace which ranges from −5 V for the left edge to +5 V for the right edge. Output impedance is 5kΩ.*

Vertical Output (Y axis): *Detected video output proportional to vertical deflection of the CRT trace. Output increases 100 mV/div from 0 to 800 mV (from a 50Ω source) for a full 8 division deflection. Output impedance is 50Ω.*

Blank (Penlift or Z axis) Output: *A blanking output, 15 V from 10 kΩ, which occurs during CRT retrace or when sweeping beyond band edges. Otherwise output is low at 0V with a 10Ω output impedance for a normal or unblanked trace (pen down).*

Blanking Input: *Permits remote Z axis control of CRT with TTL Levels; normal <0.5V or open circuit, blanked >2V.*

10 kΩ input impedance.

Caution: *maximum input ± 40V.*

External Sweep Input: *When the front panel Sweep Source switch is set to the EXT mode, a 0 to 10V ramp will sweep the analyzer through the frequency range determined by front panel Tuning and Frequency Span/Div controls. 100 kΩ input impedance.* ***Caution:*** *maximum input ±40 V.*

External Trigger Input: *With the Sweep Trigger in EXT mode, a signal will trigger a sweep on the signal's positive slope between +1 and +10 volts according to the setting of the Trigger Level control. 100 kΩ input impedance, dc coupled.*
Caution: *maximum input ±40V.*

21.4 MHz IF Output: *A 50 ohm, 21.4 MHz output linearly related to the RF input to the analyzer. Bandwidth controlled by the analyzer's Resolution Bandwidth setting; amplitude controlled by the Input Attenuator, IF gain vernier and first 6 IF Reference Level step gain positions (0 through −50 dBm level with 0 dB input attenuation). Output is approximately −10 dBm from 50Ω for full scale signals on the CRT.*

First LO Output: *Terminate in a 50Ω load when not in use.*

Frequency: *2.00 to 4.46 GHz*
Power Level: *typically at +8 dBm*
Stability (Typical residual FM):
Stabilized: 30 Hz P-P
Unstabilized: 2 kHz P-P

Aux A: *Interconnection for use with 8750A normalizer.*

Aux B: *Used during factory calibration.*

Table 1-2. Model 8565A Supplemental Characteristics (4 of 4)

SUPPLEMENTAL CHARACTERISTICS

NOTE: Values in this Table are not specifications but are typical characteristics included for user information.

DISPLAY CHARACTERISTICS

CATHODE RAY TUBE

Type: *Post deflection accelerator, approximately 8.5 kV accelerating potential, aluminized P31 phosphor, electrostatic focus and deflection.*

Graticule: *8 x 10 division internal graticule, 1 division equals 0.90 cm (0.35 inches) with 5 subdivisions per major division.*

Persistence

Conventional: *Natural persistence of P31 phosphor (approximately 40 μsec).*

Write: *Continuously adjustable from 0.2 sec to full storage.*

Storage time: *> 1 minute at full brightness in Write mode extending to > 30 minutes in Store mode at lower brightness. Storage time (Store Intensity) in Store mode is continuously adjustable from 1 minute (full brightness) to >30 minutes (minimum brightness).*

Baseline Clipper: *Adjusts the vertical level below which the CRT is blanked. Helps prevent blooming by blanking the bright baseline area on the CRT. Eases analysis of pulsed RF and transient signals.*

Scale: *Turns on internal scale illumination for photography after erasing CRT. Frequency readout is frozen.*

Scale Intensity: *Adjusts scale illumination.*

CRT BEZEL READOUT

Light emitting diodes in the bezel display the following measurement data: (included in CRT photographs taken with the HP 197A Option 006 Oscilloscope Camera).

Top Line

Amplitude Scale: *Indicates the vertical scale factor chosen; linear (LIN), 10, 5, 2, or 1 dB/div.*

Reference Level: *Given in 1 dB increments from +70 dBm[1] to −102 dBm.*

Input Attenuation

Resolution Bandwidth

Bottom line

Sweep Time/Div: *A for Auto otherwise sweep times given in sec, msec, or μsec per division.*

Frequency: *Marker frequency displayed in 1.7-22 GHz and full band modes. Center frequency displayed for Per Div and Zero Span modes.*

Freq Span/Div: *F Hz for full band spans and 1.7-22 span, or horizontal calibration in MHz or kHz per division.*

[1] Maximum RF Input + 30 dBm.

1-12. Safety Symbols



Instruction manual symbol: the apparatus will be marked with this symbol when it is necessary for the user to refer to the instruction manual in order to protect the apparatus against damage.



Indicates dangerous voltages.



Earth terminal

WARNING The WARNING sign denotes a hazard. It calls attention to a procedure, practice, or the like, which, if not correctly performed or adhered to, could result in injury or loss of life. Do not proceed beyond a WARNING sign until the indicated conditions are fully understood and met.

CAUTION The CAUTION sign denotes a hazard. It calls attention to an operating procedure, practice, or the like, which, if not correctly performed or adhered to, could result in damage to or destruction of part or all of the equipment. Do not proceed beyond a CAUTION sign until the indicated conditions are fully understood and met.

1-13. Service

1-14. Although this instrument has been manufactured in accordance with international safety standards, this manual contains information, cautions, and warnings which must be followed to insure safe operation and to keep the instrument safe. Service should be performed only by qualified service personnel, and the following warnings should be observed:

WARNINGS

Any maintenance or repair of the opened instrument under voltage should be avoided as much as possible, and when inevitable, should be carried out only by a skilled person who is aware of the hazard involved.

Capacitors inside the instrument may still be charged even if the instrument has been disconnected from its source of supply.

Make sure that only fuses with the required rated current and of the specified type (normal blow, time delay, etc.) are used for replacement. The use of repaired fuses and the short-circuiting of fuseholders must be avoided.

When it is likely that the protection has been impaired, the instrument must be made inoperative and be secured against any unintended operation.

If this instrument is to be energized via an auto-transformer (for voltage reduction) make sure the common terminal is connected to the earthed pole of the power source.

BEFORE SWITCHING ON THE INSTRUMENT, the protective earth terminals of the instrument must be connected to the protective conductor of the mains power cord. The mains plug shall only be inserted in a socket outlet provided with a protective earth contact. The protective action must not be negated by the use of an extension cord (power cord) without a protective conductor (grounding). Grounding one conductor of a two conductor outlet is not sufficient protection.

Any interruption of the protective (grounding) conductor (inside or outside the instrument) or disconnecting the protective earth terminal is likely to make this instrument dangerous.

CAUTIONS

BEFORE SWITCHING ON THIS INSTRUMENT, make sure instrument's ac input is set to the voltage of the ac power source (see Figure 2-1).

BEFORE SWITCHING ON THIS INSTRUMENT, make sure the ac line fuse is of the required current rating and type (normal-blow, time delay, etc.).

1-15. INSTRUMENTS COVERED BY MANUAL

1-16. Attached to the instrument is a serial number plate (Figure 1-2). The serial number is in two parts. The first four digits and the letter are the serial number prefix; the last five digits are the suffix. The prefix is the same for all identical instruments; it changes only when a change is made to the instrument. The suffix, however, is assigned sequentially and is different for each instrument. The contents of this manual apply to instruments with the serial number prefix(es) listed under SERIAL NUMBERS on the title page.

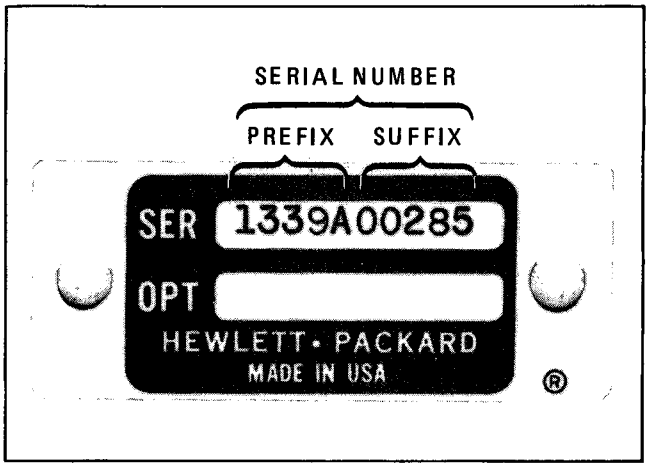


Figure 1-2. Typical Serial Number Plate

1-17. An instrument manufactured after the printing of this manual may have a serial number prefix that is not listed on the title page. This unlisted serial number prefix indicates the instrument is different from those described in this manual. The manual for this newer instrument is accompanied by a yellow Manual Changes supplement. This supplement contains "change information" that explains how to adapt the manual to the newer instrument.

1-18. In addition to change information, the supplement may contain information for correcting errors in the manual. To keep this manual as curent as possible, Hewlett-Packard recommends that you periodically request the latest Manual Changes supplement. The supplement for this manual is identified with this manual's print date and part number, both of which appear on the manual's title page. Complimentary copies of the supplement are available from Hewlett-Packard.

1-19. For information concerning a serial number prefix that is not listed on the title page or in the Manual Changes supplement, contact your nearest Hewlett-Packard office.

1-20. DESCRIPTION

1-21. The HP Model 8565A Spectrum Analyzer provides a visual display of RF signals in the frequency domain. Input signal amplitude is plotted on the CRT as a function of frequency.

1-22. The HP Model 8565A is designed for simplicity of operation. Most measurements can be made using only three controls once the green Normal Settings have been preset. The Model 8565A has absolute amplitude and frequency calibration from 10 MHz to 22 GHz. The frequency span, bandwidth, and video filter are all coupled with automatic sweep time to maintain a calibrated display and simplify operation of the analyzer.

1-23 Internal preselection eliminates most spurious image and multiple responses to simplify signal identification. The preselector also extends dynamic range of the analyzer as well as provides some protection for the input mixer.

1-24. All major spectrum analyzer control settings are displayed on the CRT bezel readout. The frequency range of the HP Model 8565A is 10 MHz to 22 GHz in direct coaxial input and 14.5 to 40 GHz when used with the HP Model 11517A External Mixer.

1-25. OPTIONS

1-26. Option 100

1-27. The HP Model 8565A Option 100 provides RESOLUTION BW settings of .3 kHz and .1 kHz in addition to the standard 3 MHz to 1 kHz settings. These additional resolution bandwidths provide capability of measuring signals which are very close in frequency. The Option 100 also provides greater sensitivity then the standard Model 8565A. Average noise level in the 100 Hz bandwidth is typically 10 dB better than average noise level in the 1 kHz bandwidth.

1-28. Option 200

1-29. The HP Model 8565A Option 200 provides calibration in dBμV. Front panel controls read in dBm as in standard instrument but bezel readout displays Reference Level in dBμV. Reference Level is displayed in 1 dB increments from +177 dBμV to +5 dBμV.

1-30. Option 400

1-31. The HP Model 8565A Option 400 permits operation on 50, 60, or 400 Hz mains. All specifications are identical to standard Model 8565A except operating temperature range and power requirements (see Table 1-1).

1-32. Option 907 Front Handle Kit

1-33. Option 907, HP Part Number 5061-0090, contains front handles and necessary hardware for attaching the handles. See Figure 2-2 for installation procedure.

1-34. Option 908 Rack Flange Kit

1-35. Option 908, HP Part Number 5061-0078, contains flanges and hardware required to mount the 8565A in an equipment rack with 482, 6mm (19 inches) horizontal spacing. See Figure 2-2 for installation procedure.

1-36. Option 909 Rack Flange/Front Handle Kit

1-37. Option 909, HP Part Number 5061-0084, consists of one Option 907 Front Handle Kit and one Option 908 Rack Flange Kit (see descriptions above.) See Figure 2-2 for installation procedure.

1-38. Option 910 Additional Operating and Service Manuals

1-39. Option 910 provides additional Operaing and Service manual(s). The number of additional manuals depends on quantity of Option 910's ordered. To obtain additional Operating and Service manuals after initial shipment, order by manual part number (refer to title page or rear cover of manual).

1-40. ACCESSORIES SUPPLIED

1-41. Figure 1-1 shows the HP Model 8565A Spectrum Analyzer and line power cord. Two 50-ohm terminations (HP 11593A's) are also supplied. One termination is connected to the front-panel EXT MIXER port and the other is connected to the rear-panel 1st LO OUTPUT port.

1-42. EQUIPMENT AVAILABLE

1-43. Service Accessories

1-44. A Service Accessories Package is available for convenience in aligning and troubleshooting the specrum analyzer. The Service Accessories Package is shown in Figure 1-3. The package may be obtained from Hewlett-Packard by ordering HP Part Number 08565-60100.

1-45. Measurement Accessories

1-46. HP Model 11517A External Mixer. This mixer extends the frequency range coverage of the HP Model 8565A to 40 GHz. Transition sections (HP Model 11518, 11519A, and 11520A) are available to adapt the Model 11517A External Mixer to standard waveguide sizes.

1-47. HP Model 197A Option 006 Oscilloscope Camera. This camera can be used with the Model 8565A to make permanent records of your measurements. Photographs include the bezel readout information.

1-48. HP Model 8750A Storage-Normalizer. True long term storage and trace comparison make the Model 8750A a useful compliment to the HP Model 8565A's display.

CAUTION

Prolonged use of 8565A in CONVentional mode with 8750A Storage-Normalizer is not recommended; may cause changes in 8565A display storage characteristics (WRITE mode).

1-49. HP Model K01-8565A Transit Case. This case protects the 8565A and provides a storage compartment for cables and reference booklets.

1-50. RECOMMENDED TEST EQUIPMENT

1-51. Equipment required for incoming inspection, performance testing and troubleshooting of the Hewlett-Packard Model 8565A is listed in Table 1-3. Other equipment may be substituted if it meets or exceeds the critical specifications listed in the table.

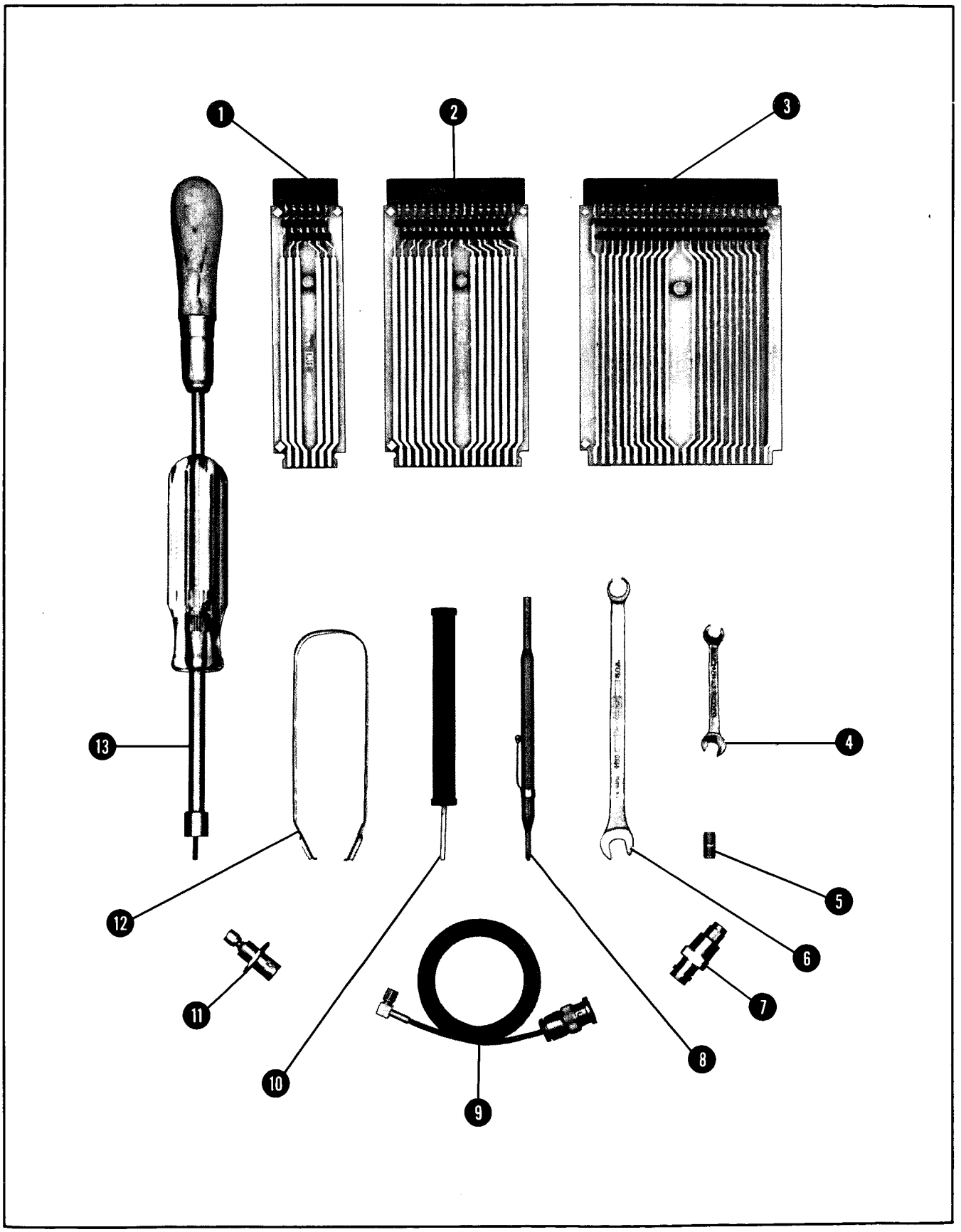


Figure 1-3. Service Accessories, HP Part Number 08565-60100 (1 of 2)

Item	Description	HP Part Number
1	Extender board, 6 pin (12 conductors)	08505-60109
2	Extender board, 15 pin (30 conductors)	08505-60041
3	Extender board, 22 pin (44 conductors)	08565-60107
4	Wrench, 15/64 inch open end	8710-0946
5	Adapter, SMA male to male	1250-1158
6	Wrench, 5/16 inch slotted box end/open end	08555-20097
7	Adapter, BNC female to SMA male	1250-1200
8	Alignment tool	8710-0630
9	Test cable, subminiature (SMC) female to BNC male (36 inches long)	11592-60001
10	Alignment tool, non-metalic	8710-0033
11	Adapter, BNC female to SMC female (used to measure second LO output)	08565-60087
12	Connector extractor	8710-0580
13	Tuning tool (consists of modified 5/16 inch nut driver with modified No. 10 Allen driver)	08555-60107

Figure 1-3. Service Accessories, HP Part Number 08565-60100 (2 of 2)

Table 1-3. Recommended Test Equipment (1 of 3)

Instrument	Critical Specifications	Recommended Model	Use*
Digital Multimeter	Range: −1000V to +1000V Accuracy: ±0.004% of reading plus 0.001% of range. Input impedance: 10 Meg ohms	HP 3490A	P,A,T
Oscilloscope	Frequency: 100 MHz Sensitivity: 5mV/Div	HP 1740A	A,T
Probe	High Voltage - 4KV	HP 34111A	A,T
Probe	10:1 Divider	HP 10004D	A,T
Probe	1:1 Divider	HP 10007D	A,T
Function Generator	Amplitude: 0 to +10V p-p sine wave with dc offset. Frequency: 1 to 5 kHz	HP 3312A	P,A,T
Pulse Generator	Transition time: 20 ns Pulse Width: 30 ns Pulse Repetition Rate: 100μs Amplitude: +4V p-p	HP 8002A	A
Signal Generator	Frequency: 50 to 500 MHz Modulation Frequency: 100 kHz Modulation Deviation: 1% of lowest frequency in range.	HP 8460B, Opt. 001	P,A,T
Time Mark Generator	Range: 5 ns to 10 sec Output: +1V peak; 50 Ohm Accuracy: ±0.005%	HP 226A	P, A
Frequency Counter	Range: .01 to 23 GHz (0.1 to 18 GHz for Incoming Inspection)	HP 5340A, Opt. H10	P,A,T,I
Comb Generator	Frequency Markers: 10 and 100 MHz Increments up to 5 GHz	HP 8406A	P,A,I
Power Meter	Range: −20 to +10 dBm (usable with waveguide thermistor mount)	HP 432A	P,A,T
Power Meter	Range: −20 to +10 dBm Accuracy: ±1.2% worst case	HP 4[illegible]A	P,A,I
Thermistor Mount	Frequency Range: .01 to 18 GHz	HP 8478B	P,A,T
Thermistor Mount	Frequency Range: 18 to 22 GHz	HP K486A	P,A
Power Sensor	Frequency Range: .03 to 18 GHz	HP 8481A	P,A,I
Spectrum Analyzer	Frequency: 300 MHz	HP 140T/8552B 8555A	A,T
Sweep Oscillator	Mainframe for RF Plug-In	HP 8620C	P,A,T,I

Table 1-3. Recommended Test Equipment (2 of 3)

Instrument	Critical Specifications	Recommended Model	Use*
RF Plug-In	Frequency: 2 to 22 GHz (2 to 18 GHz for Incoming Inspection) Residual FM: <30 kHz in 10 kHz Bandwidth	HP 86290A, Opt. H08	P,A,T,I
RF Plug-In	Frequency: .01 to 2.4 GHz	HP 86222A	P,A
Sweep Oscillator***	Mainframe for RF Plug-In	HP 8690B	P,A
RF Plug-In***	Frequency: 18 to 22 GHz	HP 8696A	P,A
Synchronizer	No Substitute	HP 8709A, Opt. H10	A
Power Splitter	Frequency: 2 to 18 GHz Attenuation: 6 dB each arm Connectors: Type N Female Input APC-7 Outputs	HP 11667A, Opt. 002	P, A
Crystal Detector	Frequency: .1 to 22 GHz Input Connector: APC-3.5	HP 33330C	P,A,T
Mixer	Input Frequency: 23 GHz	HP 11517A	P
Adapter	K-Band to R-Band; for use with HP 11517A Mixer	HP 11519A	P
Directional Coupler***	Frequency: 18 to 22 GHz Nominal Coupling: 10 dB	HP K752C	P
Step Attenuator	Attenuation: 0 to 12 dB in 1 dB steps Frequency: 100 MHz, Calibrated	HP 355C, Opt. H80	P, A
Step Attenuator	Attenuation: 0 to 120 dB in 10 dB steps Frequency: 100 MHz, Calibrated	HP 355D, Opt. H80	P, A
Attenuator	Attenuation: 10 dB ±0.5 dB Frequency: .01 to 18 GHz Connectors: Type N	HP 8491B, Opt. 010	P, A
Attenuator	Attenuation: 10 dB ±0.5 dB Frequency: .01 to 18 GHz Connectors: APC-7	HP 8492A, Opt. 010	P
Termination	Frequency: dc to 18 GHz Impedance: 50 Ohms Connector: Type N Male	HP 909A, Opt. 012	P
Adapter**	BNC Female to SMC Female	HP 08565-60087	A,T
Adapter (2 required)****	Waveguide to SMA Jack	Narda 4608	P, A

Table 1-3. Recommended Test Equipment (3 of 3)

Instrument	Critical Specifications	Recommended Model	Use*
Adapter	APC-7 to Type N Male	HP 11525A	P, A
Adapter	APC-7 to SMA Female	HP 11534A	P, A
Adapter	APC-7 to Type N Female	HP 11524A	P, A
Adpater	Type N Female to SMA Female	HP 08690-60005	P, T
Adapter	Type N Plug to SMA Jack	HP 1250-1250	P, T
Adapter (2 required)	Type N Male to BNC Female	HP 1250-0780	P, T
Adapter	Type N Female to BNC Male	HP 1250-0077	P
BNC Tee	Connectors: BNC Jack and Plug	HP 1250-0781	A
BNC Short	Impedance: 50 Ohms	HP 1250-0774	A
Cable Assembly	SMA Plug both ends	HP 8120-1578	P, T
Cable Assembly	Type N Connector both ends	HP 11500A	P, T
Test Cable**	SMA Female to BNC Male	HP 11592-60001	P

* P = Performance Test; A = Adjustments; T = Troubleshooting; I = Incoming Inspection
** These parts are included in Service Package; HP Part Number 08565-60100.
*** Not required if HP 86290A, Opt. H08 used.
**** Only one required if HP 86290A, Opt. H08 used.

SECTION II
INSTALLATION
INCOMING INSPECTION

2-1. INTRODUCTION

2-2. This section includes information on the initial inspection, preparation for use, storage/shipment instructions, and incoming inspection for the HP Model 8565A.

2-3. INITIAL INSPECTION

2-4. Inspect the shipping container for damage. If the shipping container or cushioning material is damaged it should be kept until the contents of the shipment have been checked for completeness and the instrument has been checked mechanically and electrically. The contents of the shipment should be as shown in Figure 1-1. Procedures for checking electrical performance are given in Section IV. If the contents are incomplete, if there is mechanical damage or defect, or if the instrument does not pass the electrical performance test, notify the nearest Hewlett-Packard office. If the shipping container is damaged, or the cushioning material shows signs of stress, notify the carrier as well as the Hewlett-Packard office. Keep the shipping materials for carrier's inspection. The HP office will arrange for repair or replacement without waiting for claim settlement.

2-5. PREPARATION FOR USE

2-6. Power Requirements

2-7. The Model 8565A requires a power source of 100, 120, 220, or 240 Vac +5% −10%, 48-66 Hz. Power consumption is less than 220 volt-amperes. The Model 8565A Option 400 permits operation on 50, 60, or 400 Hz mains at voltages specified above.

2-8. Line Voltage and Fuse Selection

WARNING

BEFORE THIS INSTRUMENT IS SWITCHED ON, its protective earth terminals must be connected to the protective conductor of the mains power cable (cord). The mains power cable plug shall only be inserted in a socket outlet provided with a protective earth contact. DO NOT negate the earth-grounding protection by using an extension cable, power cable, or autotransformer without a protective ground conductor. Failure to ground the instrument properly can result in personal injury.

CAUTION

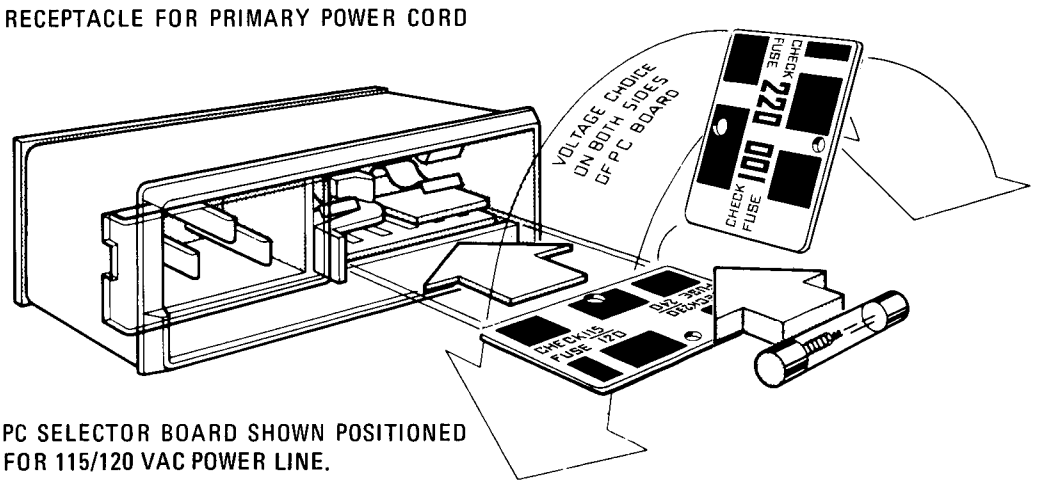
BEFORE SWITCHING ON THIS INSTRUMENT, make sure it is adapted to the voltage of the ac power source. You must set the voltage selector card correctly to adapt the 8565A to the power source. Failure to set the ac power input of the instrument for the correct voltage level could cause damage to the instrument when switched on.

2-9. Select the line voltage and fuse as follows:

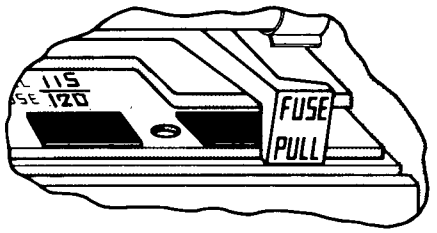
a. Measure the ac line voltage.

b. Refer to Figure 2-1. At the instrument's rear panel power line module, select the line voltage (100V, 120V, 220V, 240V) closest to the voltage you measured in step a. Line voltage must be within +5% or −10% of the voltage setting. If it is not, you must use an autotransformer between the ac source and the 8565A.

c. Make sure the correct fuse is installed in the fuse holder. The required fuse rating for each line voltage selection is indicated below the power line module.



OPERATING VOLTAGE APPEARS IN MODULE WINDOW.



SELECTION OF OPERATING VOLTAGE

1. SLIDE OPEN POWER MODULE COVER DOOR AND PUSH FUSE-PULL LEVER TO LEFT TO REMOVE FUSE.
2. PULL OUT VOLTAGE-SELECTOR PC BOARD. POSITION PC BOARD SO THAT VOLTAGE NEAREST ACTUAL LINE VOLTAGE LEVEL IS ON TOP-LEFT SIDE OF BOARD. PUSH BOARD BACK INTO ITS SLOT.
3. PUSH FUSE-PULL LEVER INTO ITS NORMAL RIGHT-HAND POSITION.
4. CHECK FUSE TO MAKE SURE IT IS OF CORRECT RATING AND TYPE FOR INPUT AC LINE VOLTAGE. FUSE RATINGS FOR DIFFERENT LINE VOLTAGES ARE INDICATED BELOW POWER MODULE.
5. INSERT CORRECT FUSE IN FUSEHOLDER.

Figure 2-1. Line Voltage Selection with Power Module PC Board

2-10. Cable Connections

2-11. Power Cable. In accordance with international safety standards this instrument is equipped with a three-wire power cable. When connected to an appropriate power line outlet, this cable grounds the instrument cabinet. Table 2-2 shows the styles of mains plugs available on power cables supplied with the HP instruments. The numbers for the plugs are part numbers for complete power cables.

WARNING

If this instrument is to be energized through an autotransformer, make sure the common terminal of the auto transformer is connected to the protective earth contact of the power source outlet socket.

Any interruption of the protective ground, inside or outside of the 8565A can make this instrument a shock hazard.

2-12. Mating Connectors

2-13. A list of connectors on the front and rear panels of the Model 8565A is given in Table 2-1. An industry identification, HP part number, and alternate source for the mating connector is given for each connector on the instrument.

2-14. Operating Environment

2-15. Temperature. The instrument may be operated in temperatures from 0°C to +55°C.

2-16. Humidity. The instrument may be operated in environments with humidity from 5% to 95% at 0° to 40°C. However, the instrument should also be protected from temperature extremes which cause condensation within the instrument.

2-17. Altitude. The instrument may be operated at altitudes up to 4572 metres (15000 feet).

2-18. Bench Operation

2-19. The instrument cabinet has plastic feet and foldaway tilt stands for convenience in bench operation. The tilt stands raise the front of the instrument for easier viewing of the control panel. The Plastic feet are shaped to make full width modular instruments self-aligning when stacked.

2-20. Rack Mounting (Option 908/909)

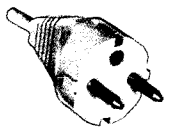
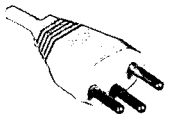
2-21. Instruments with Option 908 contain Rack Flange Kit. This kit supplies necessary hardware and installation instructions for preparing the instrument to be mounted on a rack of 482,6 mm (19 inch) spacing. Installation instructions are also given in Figure 2-2. See Table 2-3 for HP Part Numbers.

2-22. Instruments with Option 909 contain Rack Flange Front Handle Kit. This kit supplies necessary hardware and installation instructions for preparing instrument, with the addition of front handles, to be mounted on a

Table 2-1. Model 8565A Mating Connectors

Connector on Instrument	Mating Connector		
	Industry Identification	HP Part No.	Alternate Source
J11 INPUT 50Ω	Type N, male connector, UG-21G/U	1250-0882	Specialty Connector 25 P117-2
J12, J13 and J3 thru J10	Type BNC, male connector UG-88/U	1250-0256	Specialty Connector 28 P118-1
J1 AUX A	Series D, 24 contact, male connector	1251-2204	TRW Cinch Div. DDM-24W7P
J2 AUX B	Series D, 17 contact, male connector	1251-1285	TRW Cinch Div. DCMF-17W5P

Table 2-2. AC Power Cables Available

Plug Type	HP Part Number	Plug Description	Cable Length (inches)	Cable Color	For Use In Country
	8120-1351 8120-1703	Straight 90°	90 90	Mint Gray Mint Gray	Great Britian Cyprus, Nigeria Rhodesia Singapore So. Africa, India
	8120-1369 8120-0696	Straight 90°	79 87	Gray Gray	Australia New Zealand
	8120-1689 8120-1692	Straight 90°	79 79	Mint Gray Mint Gray	East and West Europe, Saudi Arabia, United Arab Republic (unpolarized in many nations)
	8120-1348 8120-1398 8120-1754	Straight 90° Straight	80 80 36	Black Black Black	United States Canada Japan (100 or 200V) Mexico Phillippines Taiwan
	8120-1378 8120-1521 8120-1676	Straight 90° Straight	80 80 36	Jade Gray Jade Gray Jade Gray	
	8120-2104	Straight	79	Gray	Switzerland

rack of 482,6 mm (19 inch) spacing. Installation instructions are also given in Figure 2-2. See Table 2-3 for HP Part Numbers.

2-23. Front Handles (Option 907)

2-24. Instruments with Option 907 contain front Handle Kit. This kit supplies necessary hardware and installation instructions for mounting front handles on the instrument.

2-25. STORAGE AND SHIPMENT

2-26. Environment

2-27. The instrument may be stored or shipped in environments within the following limits:

Temperature . . . . . −40°C to +75°C
Humidity . . . . . 5% to 95% at 0° to 40°C
Altitude . . . . . Up to 15240 metres (50000 feet)

The instrument should also be protected from temperature extremes which cause condensation within the instrument.

2-28. Packaging

2-29. Original Packaging. Containers and materials identical to those used in factory packaging are available through Hewlett-Packard offices. If the instrument is being returned to Hewlett-Packard for servicing, attach a tag indicating the type of service required, return address, model number, and full serial number. Also, mark the container FRAGILE to assure careful handling. In any correspondence, refer to the instrument by model number and full serial number.

2-30. Other Packaging. The following general instructions should be used for repackaging with commercially available materials.

a. Wrap the instrument in heavy paper or plastic. (If shipping to a Hewlett-Packard office or service center, attach a tag indicating the type of service required, return address, model number, and full serial number.)

b. Use a strong shipping container. A double-wall carton made of 275 pound bursting strength corrugated single-wall box is sufficient.

c. Use enough shock-absorbing material (3 to 4 inch layer) around all sides of the instrument to provide firm cushion and prevent movement inside the container. Protect the control panel with cardboard.

d. Seal the shipping container securely.

e. Mark the shipping container FRAGILE to assure careful handling.

Table 2-3. Rack-Mounting Kits for 8565A

Description	HP Part Number	Quantity
OPTION 908		
Rack Flange	5020-8863	2
Machine Screw, Pan Head, 8-32 x 0.375 inch	2510-0193	8
OPTION 909		
Handle Assembly	5060-9900	2
Rack Flange	5020-8875	2
Machine Screw, Pan Head, 8-32 x 0.625 inch	2510-0194	8

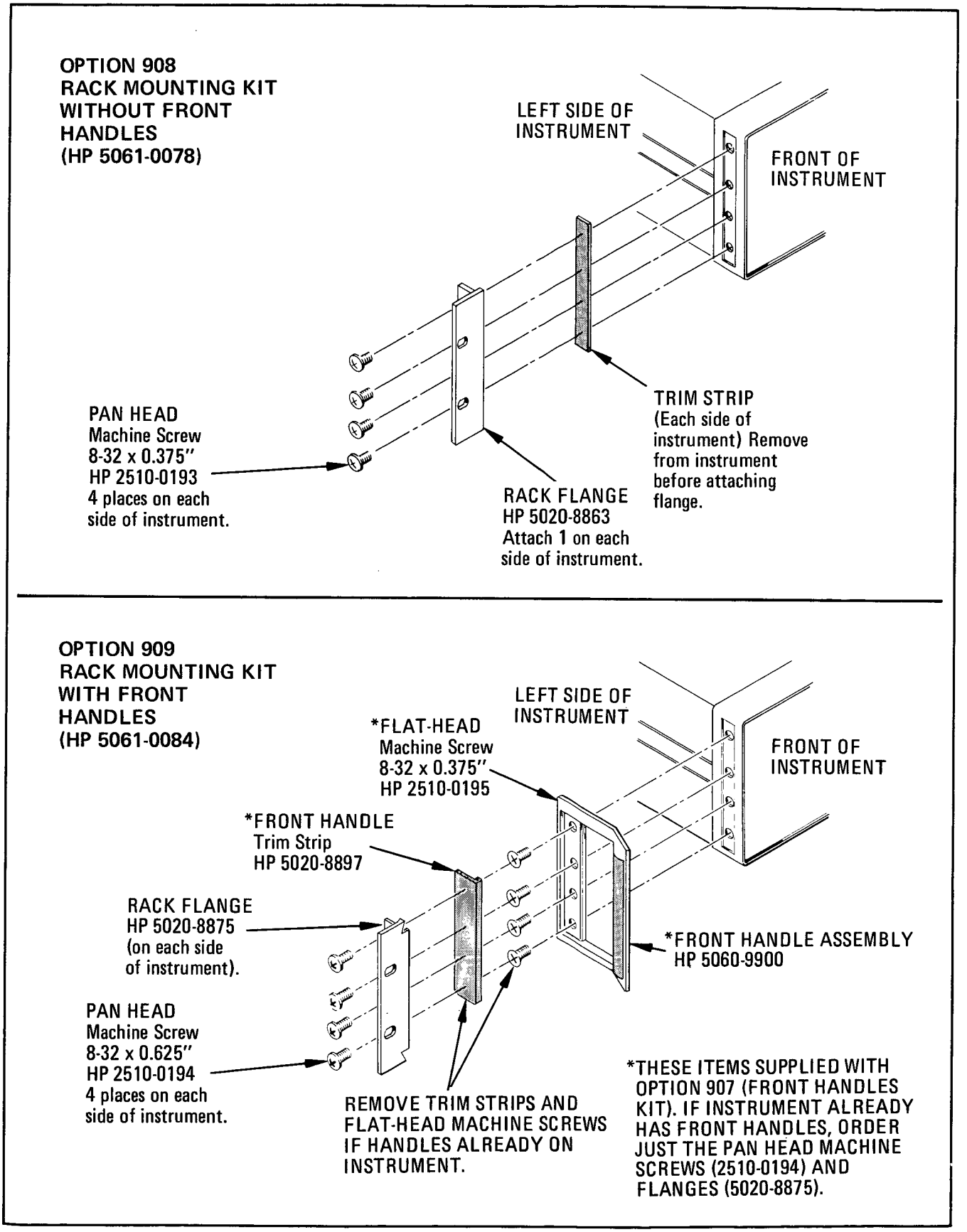


Figure 2-2. Attaching Rack Mounting Hardware and Handles

2-31. INCOMING INSPECTION TESTS

2-32. These tests are designed to meet the needs of incoming inspection. The procedures test only the critical specifications of the HP Model 8565A Spectrum Analyzer. Equipment required to perform the incoming inspection is listed in Table 1-3. If substitution is necessary for any of the equipment, the alternate models must meet or exceed the critical specifications listed in Table 1-3.

2-33. The Incoming Inspection Tests require much less time and equipment than the complete Performance Tests in Section IV. The Incoming Inspection Tests may also be used for verification of overall instrument operation after repair.

INCOMING INSPECTION TESTS

NOTE

Allow at least 30 minutes warmup time.

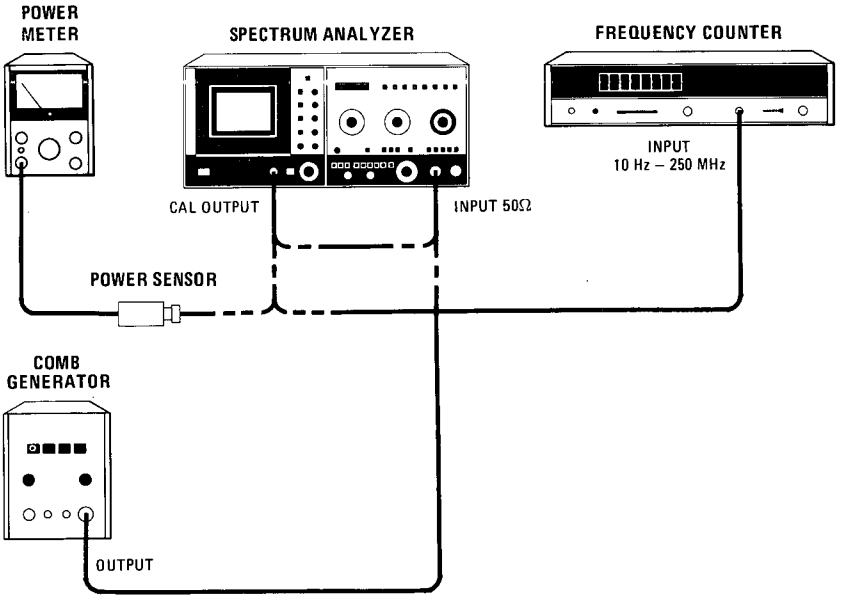


Figure 2-3. Incoming Inspection Test Setup

INCOMING INSPECTION TESTS

EQUIPMENT:

Frequency Counter	HP 5340A
Comb Generator	HP 8406A
Power Meter	HP 435A
Power Sensor	HP 8481A
Step Attenuator (10 dB/Step)	HP 355D

NOTE

If substitution is necessary for any of the above listed equipment, the alternate models must meet or exceed the critical specifications listed in Table 1-3.

2-34. OPERATIONAL FUNCTION CHECK

PROCEDURE:

a. Perform Front Panel Adjustment procedure listed on the pull-out card located under the 8565A.

b. Connect comb generator (100 MHz comb) to the 8565A INPUT 50Ω. Set all Normal Settings. Set FREQUENCY SPAN/DIV to 1 MHz and TUNING to .100 GHz. Set each function to the setting shown in Table 2-4 and verify indication is that noted in Table 2-4.

NOTE

Return to Normal Settings after each Function is checked.

INCOMING INSPECTION TESTS

Table 2-4. Operational Function Check (1 of 3)

Function	Setting	Indication
SWEEP SOURCE	MAN	Rotation of MANUAL SWEEP control varies position of trace on CRT display.
	EXT	No sweep. Bright dot on lower left edge of CRT display.
	INT	Sweep visible on CRT display.
SWEEP TRIGGER	FREE RUN	Sweep visible on CRT display.
	LINE	Sweep visible on CRT display.
	VIDEO	Presence of CRT sweep is dependent on TRIGGER LEVEL setting.
	EXT	No CRT trace is visible.
	SINGLE	One sweep is triggered when START/RESET push-button is pressed.
SWEEP TIME/DIV	Slowly rotate control counterclockwise.	Sweep on CRT display becomes increasingly slower.
BASELINE CLIPPER	Rotate clockwise	Baseline and lower portion of signal is blanked.
PRESELECTOR PEAK	**NOTE** **Select 1.7 – 4.1 FREQUENCY BAND GHz and adjust TUNING control to center signal on CRT display.**	
	Rotate over full range	Signal amplitude varies. (Set control for maximum signal amplitude.)
AUTO STABILIZER	**NOTE** **Set FREQUENCY SPAN/DIV to 100 kHz and adjust TUNING control to center signal on CRT display.**	
	OFF (depressed)	Tuning of signal with coarse TUNING control is continuous.
	ON (out)	Tuning of signal with coarse TUNING control causes signal to jump off CRT display.

INCOMING INSPECTION TESTS

Table 2-4. Operational Function Check (2 of 3)

Function	Setting	Indication
FREQUENCY SPAN MODE	**NOTE** **Set FREQUENCY SPAN/DIV to 100 MHz**	
	PER DIV	Signals are displayed at one division intervals.
	NOTE **Set FREQUENCY SPAN/DIV to .2 MHz and adjust TUNING control to center signal on CRT display.**	
	ZERO SPAN	CRT trace is a straight line and FINE TUNING control affects signal amplitude.
	FULL BAND	Twenty-five comb teeth are visible and baseline marker position is determined by coarse TUNING control.
	1.7–22 GHz SPAN	Baseline rises on CRT display from left to right in five steps (See Section III Figure 11).
AMPLITUDE SCALE (Center signal on CRT display.)	10 dB (LOG/DIV)	10 dB change in REF LEVEL changes signal amplitude by one division ±0.1 division.
	NOTE **Set REF LEVEL and REF LEVEL FINE to position signal peak 0.5 divisions below REFERENCE LEVEL graticule line. Center signal on CRT display with TUNING control.**	
	5 dB (LOG/DIV)	Signal peak one division below REFERENCE LEVEL graticule line (±0.25 division).
	2 dB (LOG/DIV)	Signal peak 2.5 divisions below REFERENCE LEVEL graticule line (±0.6 division).
	1 dB (LOG/DIV)	Signal peak 5 divisions below REFERENCE LEVEL graticule line (±1.2 divisions).
	LIN	Signal peak 3.5 divisions below REFERENCE LEVEL graticule line (±1.0 division).
Display Function	CONV	Conventional CRT trace. No variable persistance control.
	WRITE	CRT trace brightness adjusted by INTENSITY and trace fade rate adjusted by PERSIST.
	ERASE	When depressed, CRT trace is erased, background momentarily brightens, then CRT trace is again displayed.

Table 2-4. Operational Function Check (3 of 3)

Function	Setting	Indication
Display Function (Cont'd)	STORE	Stores trace on CRT display. Rotating STORE INTEN changes brightness and fade rate of stored trace.
	SCALE	CRT trace is erased and graticule is illuminated with uniform background brightness. Background brightness adjusted by SCALE INTEN control.
	NOTE **Set FREQUENCY SPAN/DIV to 1 MHz and center signal on CRT display with TUNING control.**	
SIG IDENT	Depressed	Two signals on CRT display. Signal identifier signal is two divisions to left of comb tooth and is also lower in amplitude.
Bezel Display		Bezel display shows actual settings of major front panel controls.
VIDEO FILTER	Step through each switch position (clockwise)	Each step decreases baseline noise level and decreases sweep speed. Sweep speed increases when switching to NOISE AVG position and CRT trace is a straight line.

2-35. TUNING ACCURACY TEST (INTERNAL MIXING)

SPECIFICATION:

0.01 to 2.5 GHz < ±5 MHz ±20% of Frequency Span/Div.

2.5 to 22 GHz < ±0.2% ±20% of Frequency Span/Div.

DESCRIPTION:

The tuning accuracy of the 8565A is verified in the first three FREQUENCY BAND GHz settings using a comb generator. The CAL OUTPUT frequency is measured and the 8565A is calibrated at 100 MHz. The comb generator is then connected to the 8565A INPUT 50Ω and tuning accuracy is checked.

PROCEDURE:

a. Connect frequency counter to spectrum analyzer CAL OUTPUT as shown in Figure 2-3. Set the controls as follows:

Set all Normal Settings (controls marked in green)
FREQUENCY BAND GHz ..... .01 — 1.8
TUNING ..... 0.100 GHz
INPUT ATTEN ..... 10 dB
REF LEVEL ..... −10 dBm
REF LEVEL FINE 0
FREQUENCY SPAN/DIV ..... 1 MHz
RESOLUTION BW ..... 30 kHz

INCOMING INSPECTION TESTS

2-35. TUNING ACCURACY TEST (INTERNAL MIXING) (Cont'd)

b. Measure the spectrum analyzer CAL OUTPUT frequency using the frequency counter. Reading should be 100 MHz ±0.01 MHz.

c. The calibration of the FREQUENCY GHz display is initially adjusted at 100 MHz. Connect CAL OUTPUT to INPUT 50Ω and tune 8565A to center the signal on the CRT display. If necessary, adjust FREQ CAL for a reading of 0.100 on FREQUENCY GHz display. Check that Bezel Display frequency also indicates 0.100 GHz.

d. The calibration of the FREQUENCY GHz display in the other FREQUENCY BANDs is verified as follows:

1. Tune 8565A for an indication of 1.800 GHz on FREQUENCY GHz digital readout.

2. Connect comb generator to spectrum analyzer INPUT 50Ω and tune 8565A to center 1.8 GHz comb tooth on CRT display. FREQUENCY GHz digital readout must be 1.800 GHz ±0.005 GHz.

3. Select 1.7 — 4.1 FREQUENCY BAND GHz and set TUNING control for an indication of 3.000 GHz on FREQUENCY GHz digital readout.

4. Center 3 GHz comb tooth on CRT display. FREQUENCY GHz digital readout must be 3.000 GHz ±0.006 GHz.

5. Set TUNING control for an indication of 4.000 GHz on FREQUENCY GHz digital readout.

6. Center 4 GHz comb tooth on CRT display. FREQUENCY GHz digital readout must be 4.000 GHz ±0.008 GHz.

7. Select 3.8 — 8.5 FREQUENCY BAND GHz and set TUNING control for an indication of 5.000 GHz.

8. Center 5 GHz comb tooth on CRT display. FREQUENCY GHz digital readout must be 5.000 GHz ±0.010 GHz.

2-36. FREQUENCY SPAN WIDTH AND RESOLUTION BANDWIDTH ACCURACY TEST

SPECIFICATION:

Span Width Accuracy: The frequency error for any two points on the display for spans from 500 MHz to 20 kHz/Div (unstabilized) is less than ±5% of the indicted separation; for stabilized spans 100 kHz/Div to 20 kHz/Div and less, the error is less than ±15%.

Resolution bandwidth Accuracy: Individual resolution bandwidth 3 dB points < ±15%.

Switching between bandwidths: 3 MHz to 300 kHz, ±0.5 dB; 3 MHz to 1 kHz, ±1.0 dB (100 kHz BW limited to 90% RH). (3 MHz to 100 Hz ±1.0 dB for Option 100).

INCOMING INSPECTION TESTS

2-36. FREQUENCY SPAN WIDTH AND RESOLUTION BANDWIDTH ACCURACY TEST (Cont'd)

DESCRIPTION:

A comb generator is used to check the span width and the CAL OUTPUT signal is used to check resolution bandwidth accuracy at different positions of the FREQUENCY SPAN/DIV and RESOLUTION BW controls. By verifying the calibration of these controls, proper operation of the sweep circuits is also verified.

PROCEDURE:

a. Connect comb generator to 8565A INPUT 50Ω.

b. Set controls as follows:

Spectrum Analyzer:

Set all Normal Settings (controls marked in green)

FREQUENCY BAND GHz	.01 — 1.8
FREQUENCY SPAN/DIV	100 MHz
INPUT ATTEN	10 dB
REF LEVEL	−10 dBm
TUNING	0.500 GHz

Comb Generator:

Comb frequency	100 MHz
Output amplitude	Optimum

c. Tune spectrum analyzer to position one comb tooth at graticule reference line (far left).

d. Note position of ninth spectral line (comb tooth). It must be on eighth graticule line ±0.4 division. (See Figure 2-4).

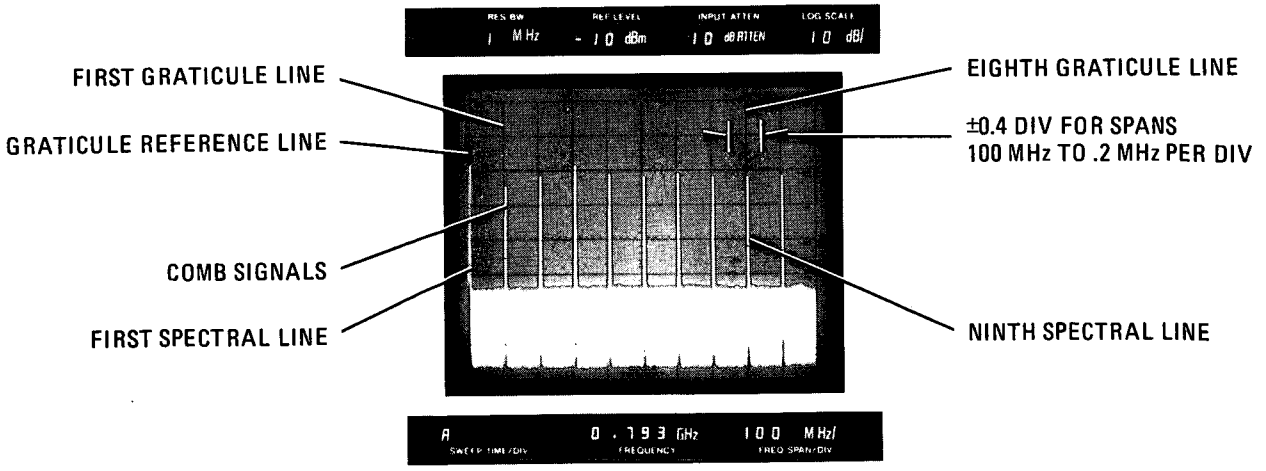


Figure 2-4. Span Width Accuracy Measurement

INCOMING INSPECTION TESTS

2-36. FREQUENCY SPAN WIDTH AND RESOLUTION BANDWIDTH ACCURACY TEST (Cont'd)

e. Set FREQUENCY SPAN/DIVto 10 MHz (with RESOLUTION BW coupled) and comb generator to 10 MHz. Repeat steps c and d.

f. Set FREQUENCY SPAN/DIV to 1 MHz and comb generator to 1 MHz. Repeat steps c and d.

NOTE

The wider FREQUENCY SPAN/DIV settings are checked using a comb generator. The narrow FREQUENCY SPAN/DIV settings are checked by observing RESOLUTION BW accuracy as follows:

g. Set FREQUENCY SPAN/DIV to .2 MHz, RESOLUTION BW to 1 MHz, and AMPLITUDE SCALE to 1 dB.

h. Connect spectrum analyzer CAL OUTPUT to INPUT 50Ω and tune spectrum analyzer to 0.100 GHz. Center signal on display and use REFERENCE LEVEL controls to position peak of signal to REFERENCE LEVEL line.

i. Note width of signal three divisions below REFERENCE LEVEL line. Specification: 5 divisions ±1.0 division. Verification of the 1 MHz RESOLUTION BW setting verifies proper operation of the LC bandwidth filters.

j. Set FREQUENCY SPAN/DIV to 10 kHz and RESOLUTION BW to 30 kHz.

k. Repeat step h and note width of signal three divisions below REFERENCE LEVEL line. Specification: 3 divisions ±0.9 division. Verification of the 30 kHz RESOLUTION BW setting verifies proper operation of the crystal (XTL) bandwidth filters.

l. Set FREQUENCY SPAN/DIV to 20 kHz and RESOLUTION BW to 1 kHz.

m. Center signal on display and adjust REFERENCE LEVEL controls to place peak of signal 1 division (1 dB) below REFERENCE LEVEL line.

n. Step RESOLUTION BW from 1 kHz to 3 MHz. Note change in signal level between bandwidth settings. Specification: 3 MHz to 300 kHz, ±0.5 dB; 3 MHz to 1 kHz, ±1.0 dB (100 kHz BW limited to 90% RH). (Option 100 3 MHz to 100 Hz ±1.0 dB).

NOTE

If amplitudes in step n are within specs, it can be assumed that all bandwidths are proper.

INCOMING INSPECTION TESTS

2-37. AMPLITUDE ACCURACY TEST

SPECIFICATIONS:

Calibrator Output: −10 dBm ±0.3 dB

Reference Level variation (Input Attenuator at 0 dB):
10 dB Steps: < ±0.5 dB (0 to −70 dBm)
< ±1.0 dB (0 to −90 dBm)

Vernier (0 to −12 dB) continuous: Maximum error < ±0.5 dB, when read from Reference Level Fine control.

Input Attenuator (at preselector input, 70 dB range in 10 dB steps):
Step size variation (for steps from 0 to 60 dB): < ±1.0 dB .01 to 18 GHz.

Maximum cumulative error (from 0 to 60 dB): < ±2.4 dB .01 to 18 GHz.

PROCEDURE:

a. Set spectrum analyzer controls as follows:

Set all Normal Settings (controls marked in green)

FREQUENCY SPAN/DIV	1 MHz
RESOLUTION BW	30 kHz (coupled)
FREQUENCY BAND GHz	.01 — 1.8
TUNING	0.100 GHz
INPUT ATTEN	10 dB
REF LEVEL	−10 dBm
REF LEVEL FINE	0
AMPLITUDE SCALE	1 dB LOG/DIV

b. Measure CAL OUTPUT signal level with a power meter. Specification: 10 dBm ±0.3 dB.

c. Connect 100 MHz CAL OUTPUT signal through 355D step attenuator (set to 0 dB) to INPUT 50Ω and tune spectrum analyzer to center signal on CRT display. Position peak of signal at REFERENCE LEVEL line with front-panel REF LEVEL CAL screwdriver adjustment.

d. To verify correct operation of the REF LEVEL FINE (Vernier) control, set 355D step attenuator to 10 dB. Set REF LEVEL FINE to −9. The peak of the signal on the CRT display should be one division below the REFERENCE LEVEL ±0.5 division (<±0.5 dB).

e. Set INPUT ATTEN to 70 dB, REF LEVEL to 0 dBm, REF LEVEL FINE to −8, RESOLUTION BW to 3 kHz, FREQUENCY SPAN/DIV to 1 kHz, and VIDEO FILTER to .03. Center signal on CRT display with TUNING control.

f. Adjust REF LEVEL CAL to position signal peak two divisions below REFERENCE LEVEL line.

g. Step 8565A INPUT ATTEN from 70 to 0 dB while stepping 355D step attenuator from 0 to 70 dB (maintain a total attenuation of 70 dB). For each 10 dB step, the signal amplitude should not change more than ±1 dB from the previous step. The total amplitude variation (difference between maximum and minimum signal levels over entire 70 dB range) should not exceed 2.4 dB.

2-37. AMPLITUDE ACCURACY TEST (Cont'd)

h. Adjust REF LEVEL CAL to position signal peak two divisions below REFERENCE LEVEL line.

i. Step 8565A REF LEVEL from −70 dBm to 0 dBm while stepping 355D step attenuator from 70 dB to 0 dB (maintain signal level approximately two divisions below REFERENCE LEVEL line). For each step, the signal amplitude should be two divisions below REFERENCE LEVEL line ±0.5 divisions (±0.5 dB).

Table 2-5. Incoming Inspection Test Record

Para. No.	Test Description	RESULTS MIN	PASSED	MAX
2-35	TUNING ACCURACY TEST (INTERNAL MIXING)			
	b. CAL OUTPUT frequency	99.99 MHz	☐	100.01 MHz
	d. 1.8 GHz	1.795 GHz	☐	1.805 GHz
	3.0 GHz	2.994 GHz	☐	3.006 GHz
	4.0 GHz	3.992 GHz	☐	4.008 GHz
	5.0 GHz	4.990 GHz	☐	5.010 GHz
2-36	FREQUENCY SPAN WIDTH AND RESOLUTION BANDWIDTH ACCURACY TEST			
	d. 100 MHz FREQUENCY SPAN/DIV	– 0.4 div	☐	+ 0.4 div
	e. 10 MHz FREQUENCY SPAN/DIV	– 0.4 div	☐	+ 0.4 div
	f. 1 MHz FREQUENCY SPAN/DIV	– 0.4 div	☐	+ 0.4 div
	i. 1 MHz RESOLUTION BW	4.0 div	☐	6.0 div
	k. 30 kHz RESOLUTION BW	2.1 div	☐	3.9 div
	n. 3 MHz to 300 kHz		☐	1 dB (±0.5 dB)
	3 MHz to 1 kHz		☐	2 dB (±1.0 dB)
2-37	AMPLITUDE ACCURACY TEST			
	b. CAL output amplitude	– 9.7 dBm	☐	– 10.3 dBm
	d. Reference Level Fine	– 0.5 dB	☐	+ 0.5 dB
	g. Input Attenuator Step Size Variation	– 1.0 dB	☐	+ 1.0 dB
	Maximum Cumulative Error		☐	2.4 dB
	i. Reference Level Variation	– 0.5 dB	☐	+ 0.5 dB

SECTION III
OPERATION

3-1. INTRODUCTION

3-2. This operating section provides a basic introduction to signal analysis as well as detailed descriptions of how to use the HP Model 8565A. The information is presented in four chapters and five appendixes as follows:

a. Chapter 1: Operating the HP 8565A

b. Chapter 2: Detailed Control Operation

c. Chapter 3: Special Topics

d. Chapter 4: Typical Measurements

e. Appendix A: Operating Precautions

f. Appendix B: Control Glossary

g. Appendix C: Front Panel Adjustment Procedure

h. Appendix D: Theory of Operation

i. Appendix E: Amplitude Conversions

3-3. OPERATOR'S MAINTENANCE

3-4. Fuses. The 8565A has nine fuses, eight of which are internal. Only the ac line fuse located at the back of the instrument may be replaced by the operator. The ac line cord should be disconnected from the power source, then the other end disconnected from the instrument. With the power cord removed, access may be gained to the fuse compartment by sliding open the power module cover door. The fuse may be removed by pulling the lever inside the fuse compartment. Replace with fuse of correct rating and type for ac line voltage selected. Fuse ratings for different voltages are indicated below the power module. Access to the other eight fuses requires removing the instrument's covers. The internal fuses should only be replaced by a qualified service technician.

3-5. Air Filter. Inspect the rear-panel air filter frequently and, if necessary, remove and clean it. To clean the filter, wash it in warm water and detergent. Dry the filter thoroughly before reinstalling it on the instrument. Unrestricted air flow gives longest component life. Keep the air filter clean.

3-6. Calibration. To ensure that the 8565A meets specifications listed in Table 1-1, Performance Tests (Section IV) should be performed every six months.

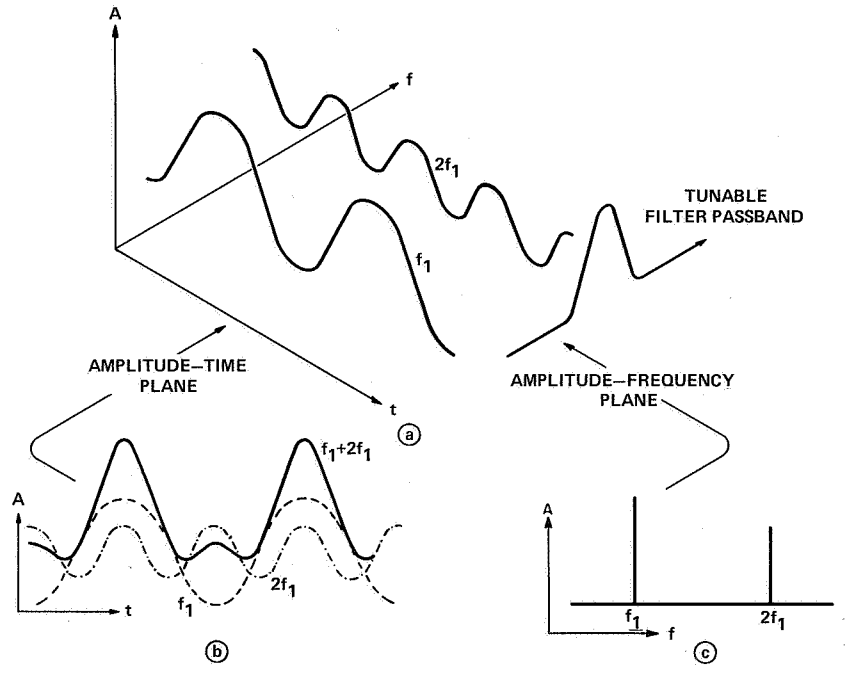
Operating the HP 8565A Spectrum Analyzer

PREFACE

INTRODUCTION TO SIGNAL ANALYSIS

The spectrum analyzer is an instrument that displays signals in the frequency domain. The CRT on the analyzer displays signal amplitude (A) on the vertical axis and frequency (f) along the horizontal axis. A method of visualizing how a spectrum analyzer views the frequency domain is to picture a tunable bandpass filter that scans the frequency axis (see Figure 1). At any instant in time, the analyzer will only view the signal it is tuned to receive and reject all the rest. In this way, all the individual components of a signal are viewed separately. In an oscilloscope, the signals are viewed in the time domain and the amplitude displayed represents the vector sum of all signal components.

The purpose of this application note is to acquaint the reader with the HP 8565A Spectrum Analyzer. Rather than diluting the text with extensive coverage of specific topics, the reader is referred to existing application notes on that topic. These application notes are obtainable by contacting your local Hewlett-Packard Sales Office.



THE FREQUENCY-TIME DOMAINS

a. Three-dimensional coordinates showing time, frequency, and amplitude. The addition of a fundamental and its second harmonic is shown as an example.

b. View seen in the t-A plane. On an oscilloscope, only the composite $f_1 + 2f_1$ would be seen.

c. View seen in the f-A plane. Note how the components of the composite signal are clearly seen here.

Figure 1. Frequency and time domain

CONTENTS

BASIC DESCRIPTION 1

Chapter 1
OPERATING THE HP 8565A SPECTRUM ANALYZER 2
Normal Settings 2
Simplified Signal Analysis 2

Chapter 2
DETAILED CONTROL OPERATION 5
Tuning 5
Frequency Span Modes 5
Resolution Bandwidth 7
Reference Level 8
Video Filter 9
Automatic Sweep Time 9

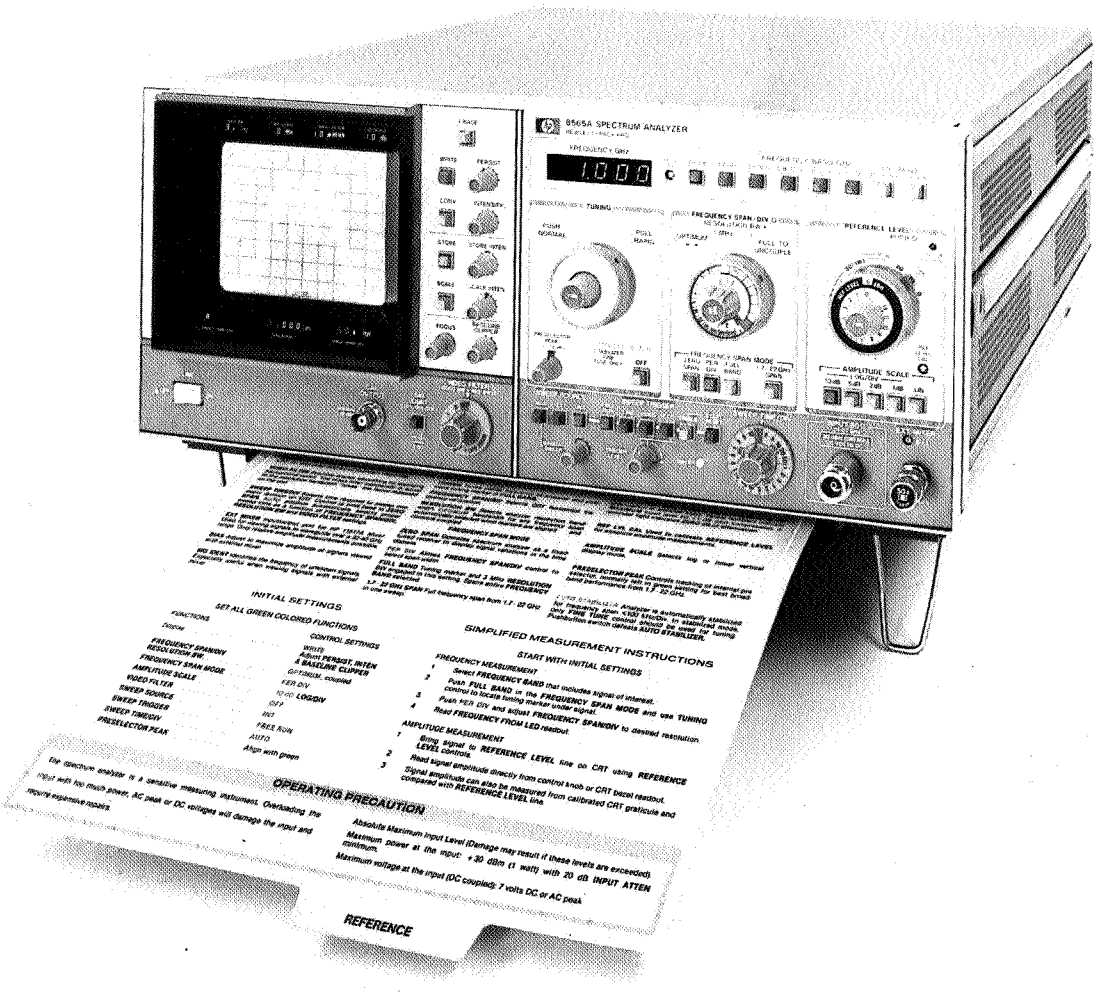
Chapter 3
SPECIAL TOPICS 10
Optimum Dynamic Range 10
Improving Measurement Accuracy 12
CRT Photography and X-Y Recording Techniques 12
External Mixer Operation 13

Chapter 4
TYPICAL MEASUREMENTS 15
Distortion 15
Modulation 16
Noise 19
Electromagnetic Interference (EMI) 19

APPENDIX: 21
A. Operating Precautions 21
B. Control Glossary 22
C. Front Panel Adjustment Procedure 25
D. Theory of Operation 26
E. Amplitude Conversions 29

BASIC DESCRIPTION

The HP 8565A is a high-performance spectrum analyzer designed for ease of use. Most measurements can be made with just three controls once the green Normal Settings are preset. The HP 8565A has absolute amplitude and frequency calibration from 0.01 to 22 GHz. The frequency span, bandwidth, and video filter are all coupled with automatic sweep to maintain a calibrated display and simplify use of the analyzer. Internal preselection eliminates most spurious responses to simplify signal identification. The preselector also extends the dynamic range of the analyzer as well as provides some protection for the input mixer. All major spectrum analyzer settings are displayed on the CRT bezel readout. The frequency range of the HP 8565A is 10 MHz to 22 GHz in direct coaxial input and 14.5 to 40 GHz when used with the HP 11517A External Mixer.



To aid in familiarization of the front panel controls, a fold-out illustration of the HP 8565A is included on page 24. Also any reference to the front panel controls are made in CAPITAL LETTERS.

Chapter I
OPERATING THE HP 8565A

The HP 8565A Spectrum Analyzer is a sensitive measuring instrument. To avoid damage to the instrument, do not exceed the following:

Absolute Maximum Inputs:[1]

Total Power: +30 dBm (1 watt)
DC: 0 V with 0 dB INPUT ATTEN
±7 V with ≥10 dB INPUT ATTEN
AC: (≪50 Ω nominal source impedance):
0 V with 0 dB INPUT ATTEN
10 V peak with ≥10 dB INPUT ATTEN

NORMAL SETTINGS

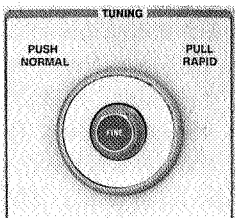
The Normal Settings are those settings which are used for the majority of measurements. For instance, 10 dB/DIV, INT sweep, and AUTO sweep time are most often used so they are classified as Normal Settings. All the Normal Settings on the HP 8565A are colored green so that the user can easily identify and set them initially. Table 1 lists all the green Normal Settings of the HP 8565A.

Table 1. Normal settings

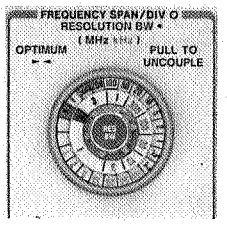
Function	Setting
CRT DISPLAY	WRITE
BASELINE CLIPPER	OFF
FREQUENCY SPAN/DIV RESOLUTION BW	OPTIMUM (Push in to couple)
FREQUENCY SPAN MODE	PER DIV
AMPLITUDE SCALE	10 dB/DIV
VIDEO FILTER	OFF
SWEEP SOURCE	INT
SWEEP TRIGGER	FREE RUN
SWEEP TIME/DIV	AUTO
PRESELECTOR PEAK	Center in green area

With Normal Settings preset, most measurements can be made with just three knobs: TUNING, FREQUENCY SPAN/DIV, and REFERENCE LEVEL.

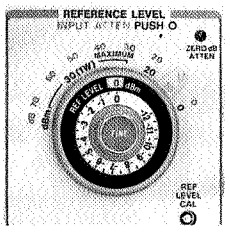
[1] For more detailed information regarding Operating Precautions, please refer to Appendix A.



TUNING adjusts the center frequency of the analyzer. It also positions the marker in the full band modes.

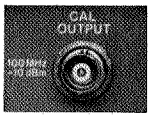


FREQUENCY SPAN/DIV sets the horizontal frequency calibration on the CRT. An optimum RESOLUTION BW is automatically selected for a given frequency span.



The REFERENCE LEVEL control sets the vertical amplitude calibration on the CRT. The REFERENCE LEVEL (top graticule line) on the CRT represents an absolute power level (in dBm). Changes in RF INPUT ATTEN will also change the indicated REFERENCE LEVEL.

SIMPLIFIED SIGNAL ANALYSIS



The internal CAL OUTPUT signal is a convenient source to demonstrate how fast and easy the HP 8565A can measure frequency and amplitude.

Start by presetting the green Normal Settings listed in Table 1, page 2. This sets the analyzer in its normal, three-knob operation mode. Now connect the CAL OUTPUT signal to the INPUT connector of the analyzer and begin the measurement procedure:

Initially, select the FREQUENCY BAND that includes the 100 MHz CAL OUTPUT signal:

Use the TUNING control to tune the 100 MHz signal to the center of the display. The FREQUENCY SPAN/DIV may be increased to facilitate tuning.

Once the signal is centered on the display, adjust the FREQUENCY SPAN/DIV to the desired resolution. Since there is no modulation on the CAL OUTPUT signal, a 1 MHz/DIV span is sufficient. Retune the signal to the center of the display if necessary.

Now position the peak of the signal on the REFERENCE LEVEL (top graticule line) of the CRT with the REFERENCE LEVEL control.

Since the CAL OUTPUT signal is the calibration reference for the analyzer, the center frequency should read 0.100 GHz and the REFERENCE LEVEL should read −10 dBm (Figure 2). If not, adjust the FREQ CAL and the REF LEVEL CAL to obtain the correct reading.[2]

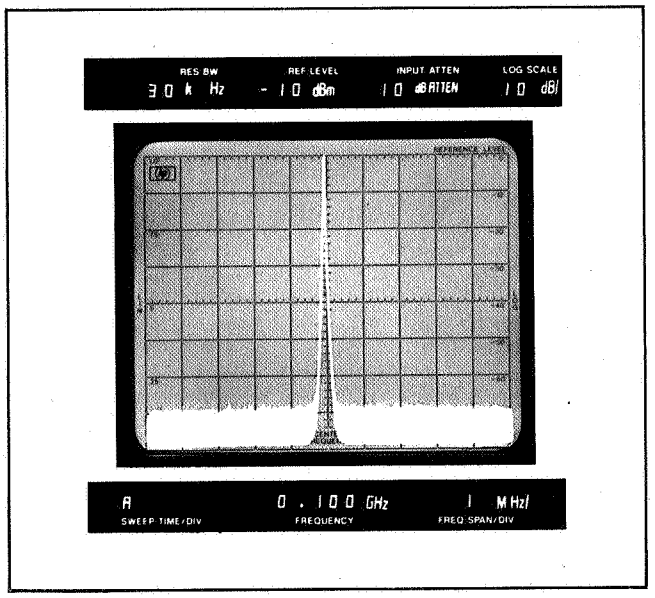


Figure 2. CAL OUTPUT signal

For this next example, let us suppose that the microwave source in the test set-up (Figure 3) operates in C-band (4 to 8 GHz). However, we do not know its exact output frequency. What, then, is the best way for locating a signal?

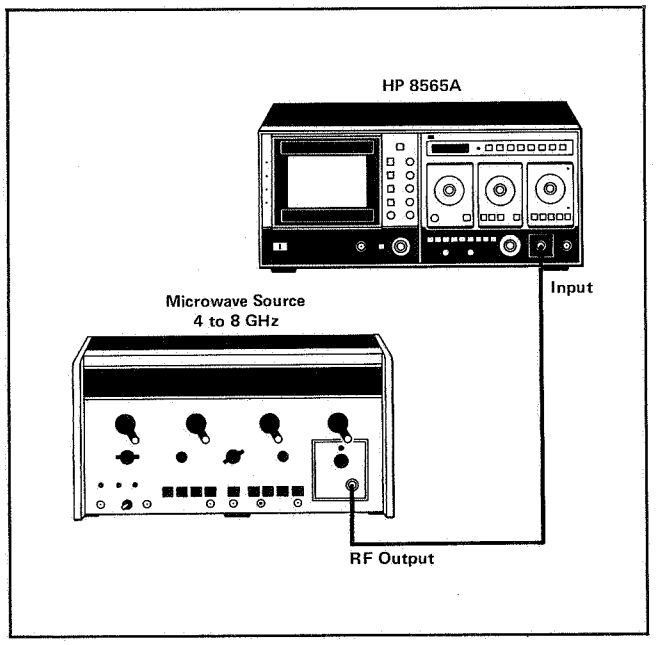


Figure 3. Microwave source test set-up

By using the FULL BAND feature of the HP 8565A, we can sweep an entire frequency band to search for a signal. Since we know that the microwave source in Figure 3 operates in C-band, the 3.8 to 8.5 GHz FREQUENCY BAND would be selected. A tuning marker (which appears in the full band modes) can be located under the signal to identify its frequency (Figure 4). Then by pushing the green PER DIV button, the signal at the marker will become the center frequency of the analyzer (Figure 5). In PER DIV the desired frequency span can be adjusted with the FREQUENCY SPAN/DIV control. Figure 6 graphically illustrates the procedure for locating a signal.

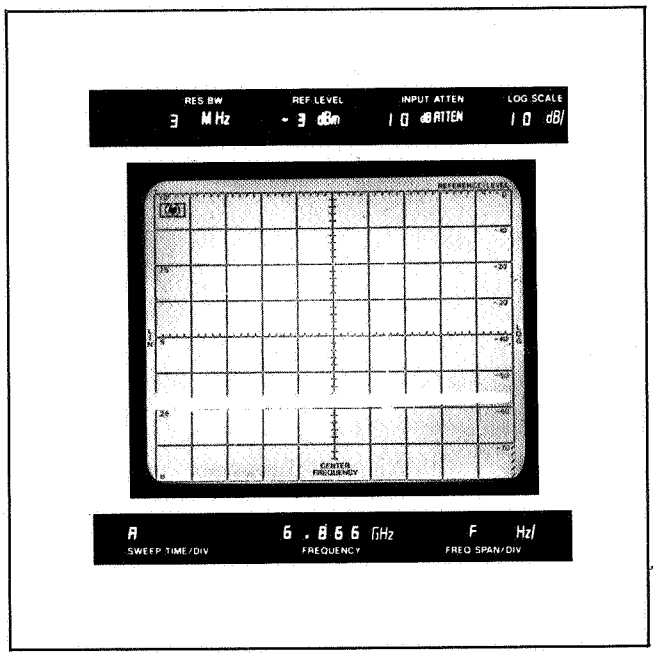


Figure 4. Tuning marker in FULL BAND

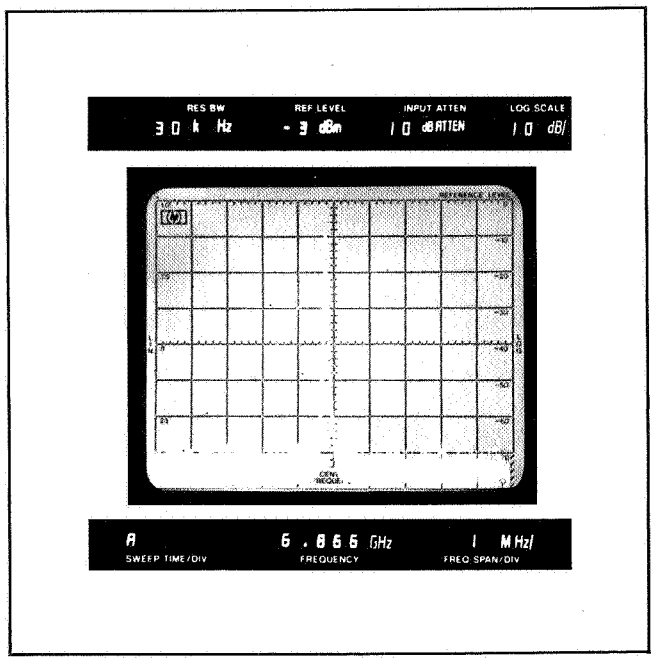
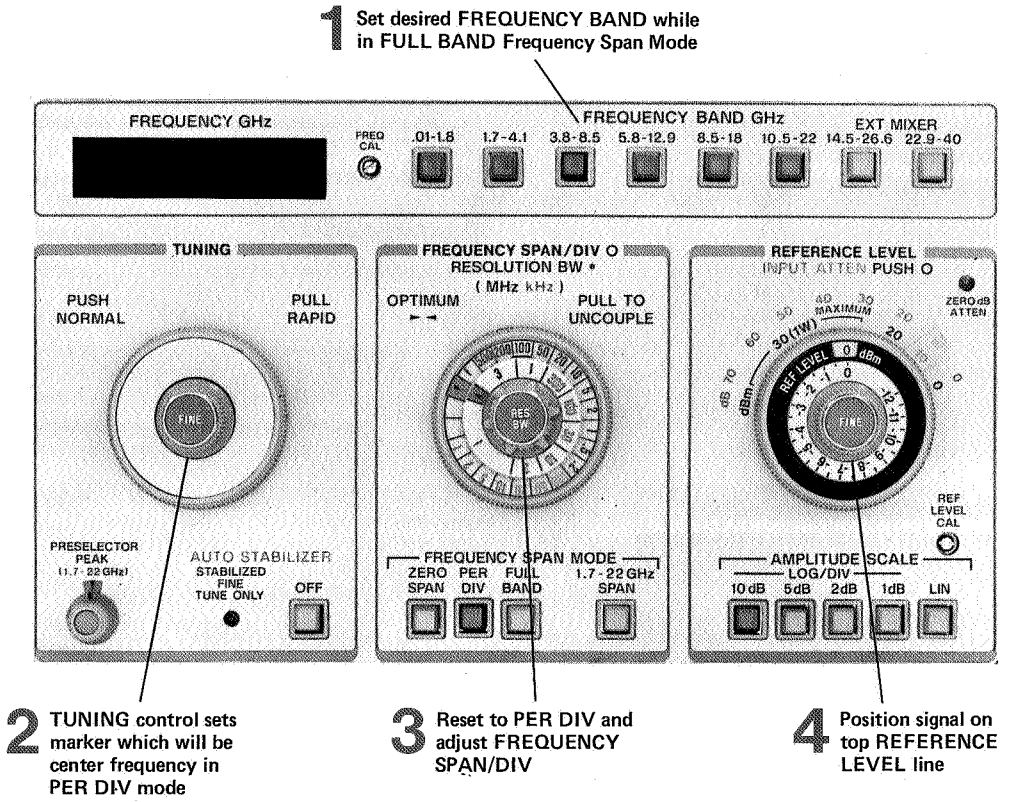


Figure 5. PER DIV mode

[2] A complete Front Panel Adjustment Procedure is included in Appendix C.



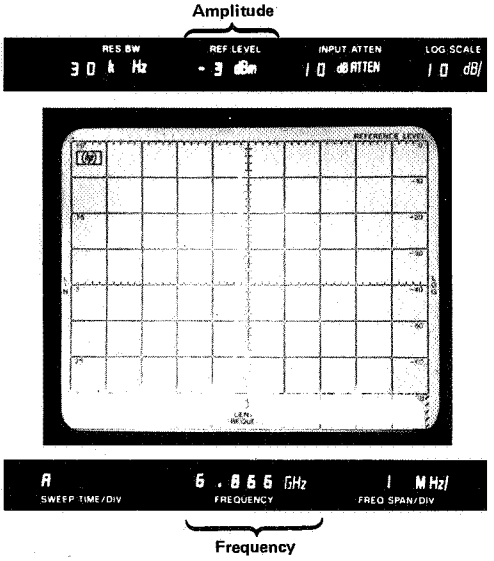
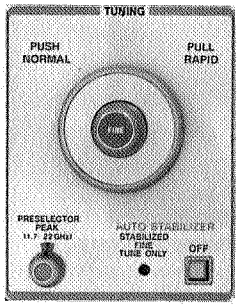


Figure 6. Locating a signal

Chapter 2
DETAILED CONTROL OPERATION

TUNING



The TUNING control adjusts the center frequency of the analyzer. In the full band modes, the TUNING control is used to locate a marker under a particular signal. The FREQUENCY readout indicates the center frequency of the analyzer or the frequency at the tuning marker. By pulling out the outer control knob, *rapid* tuning is enabled. Rapid tuning is especially useful when moving the tuning marker in the full band modes. Normal tuning resumes when the knob is pushed in. When the analyzer is stabilized (frequency span $\leq$100 kHz/Div) only FINE TUNING should be used to tune the analyzer. If coarse tuning is desired, the AUTO STABILIZER can be disabled with the pushbutton switch.

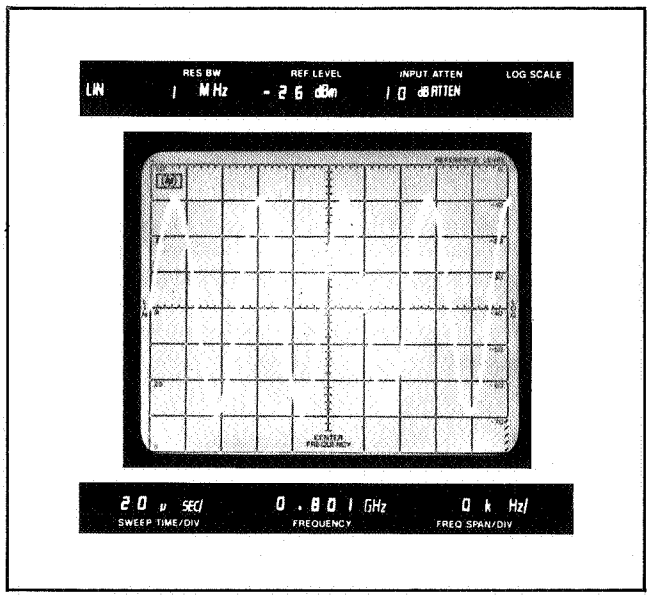
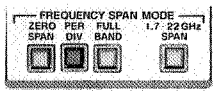


Figure 7. AM carrier demodulated in ZERO SPAN

FREQUENCY SPAN MODES



Four pushbutton span modes are available on the HP 8565A: ZERO SPAN, PER DIV, FULL BAND, and 1.7 - 22 GHz SPAN. Also, an additional F (full-band) setting is available on the FREQUENCY SPAN/DIV control knob. The full band modes, (FULL BAND, F, and 1.7 - 22 GHz SPAN) enable the analyzer to monitor the various frequency bands as well as a multi-octave coverage from 1.7 to 22 GHz. PER DIV is generally used for detailed signal analysis and ZERO SPAN is used for time domain analysis. The following text explains the various FREQUENCY SPAN MODE settings in more detail.

Zero Span

ZERO SPAN is used when it is desired to recover the modulation on a carrier. In ZERO SPAN there is no sweep voltage applied to the LO in the analyzer; hence, it operates as a manually-tuned receiver. Carrier modulation will be displayed in the time domain and the calibrated SWEEP TIME/DIV control can be used manually to read the time variation of the signal. Selecting VIDEO trigger will allow the sweep to be synchronized on the demodulated waveform. Figure 7 is a display of a demodulated AM carrier that was obtained with the analyzer in ZERO SPAN.

Since the analyzer remains calibrated in ZERO SPAN, it is also possible to measure the amplitude and frequency of a CW signal. In this case, the CW signal appears as a horizontal line on the CRT (see Figure 8). Using a wide RESOLUTION BW setting and disabling the AUTO STABILIZER will allow the signal to be tuned to easily.

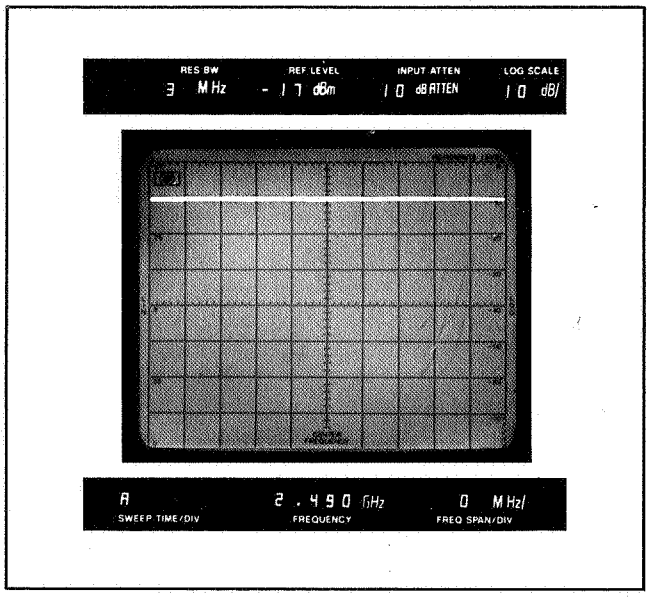


Figure 8. CW measurement in ZERO SPAN

Per Div

The PER DIV mode enables the FREQUENCY SPAN/DIV control to set the horizontal frequency calibration of the CRT. The calibrated FREQUENCY SPAN/DIV control is adjustable from 1 kHz/DIV to 500 MHz/DIV. Also, an F (full band), position is available which allows the entire FREQUENCY BAND selected to be scanned. Normally, the RESOLUTION BW is optimally coupled (▶◀) to the FREQUENCY SPAN/DIV. Then the optimum RESOLUTION BW is automatically selected as the FREQUENCY SPAN/DIV is adjusted.

Full Band

The FULL BAND mode scans the entire FREQUENCY BAND selected in one sweep. A tuning marker, 3 MHz RESOLUTION BW and 0.003 VIDEO FILTER are automatically set in FULL BAND. Different FREQUENCY BANDs can be selected to look for unknown signals. Once a signal is located in a particular FREQUENCY BAND, the tuning marker can be positioned under the signal to identify its frequency (Figure 9). Then, by pushing PER DIV, the signal that was at the marker will be displayed as the

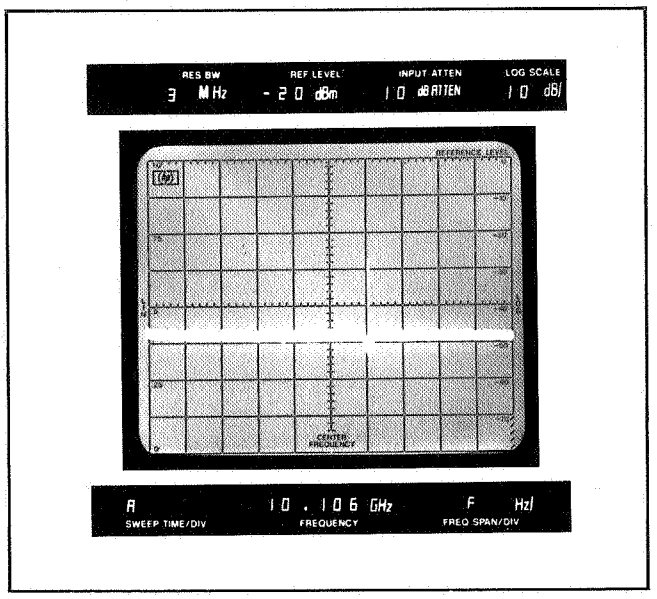


Figure 9. Identifying a signal in FULL BAND

center frequency on the CRT (Figure 10). The F position on the FREQUENCY SPAN/DIV control differs from the FULL BAND pushbutton in that it allows independent adjustment of RESOLUTION BW and VIDEO FILTER.

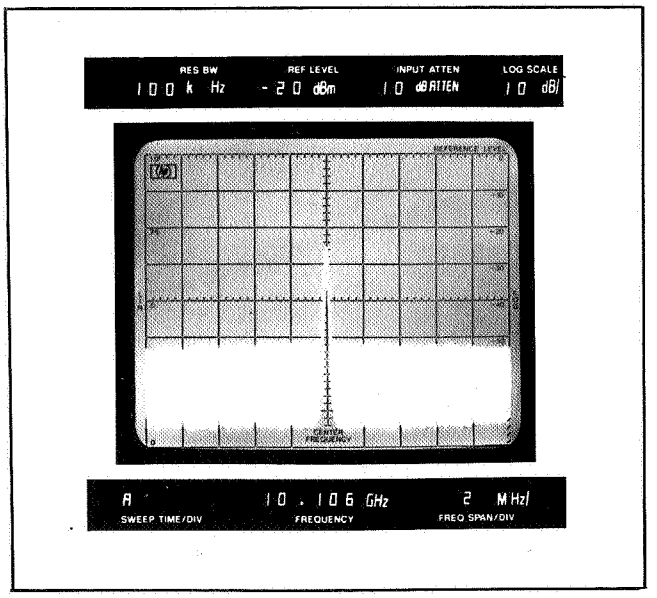


Figure 10. Analysis in PER DIV

1.7 - 22 GHz Span

A multi-band sweep is available when the 1.7 - 22 GHz SPAN pushbutton is depressed. This span mode is useful for observing signal activity within a broad frequency range. A tuning marker can be used with *rapid* TUNING to quickly identify the frequency of any signal in the 1.7 to 22 GHz range. Figure 11 illustrates a typical display using the 1.7 - 22 GHz SPAN mode.

The staircase baseline display is the result of gain compensation applied to the higher frequency bands to maintain a calibrated amplitude display. Gain compensation is required because the higher frequency bands utilize higher LO harmonics which yields reduced sensitivity.[3]

Table 2. Frequency Span Modes

			Full Band Modes		
	ZERO SPAN □ (Time Domain)	**PER DIV** □ (Close Analysis)	(F) **On Freq Span/Div Control**	**FULL BAND** □	**1.7 - 22 GHz SPAN** □
TUNING MARKER	NO	NO	YES	YES	YES
FREQUENCY SPAN	ZERO (Manual Tune)	Selectable from 1 kHz/ DIV to 500 MHz/DIV	Depends on FREQUENCY BAND Selected	Depends on FREQUENCY BAND Selected	1.7 to 22 GHz
RESOLUTION BANDWIDTH	Selectable	OPTIMUM (▶◀) or Selectable	Selectable	Fixed at 3 MHz	Fixed at 3 MHz
VIDEO FILTER	Selectable	Selectable	Selectable	Fixed at 0.003 x 3 MHz = 9 kHz	Fixed at 0.003 x 3 MHz = 9 kHz

3 To obtain the highest sensitivity from the analyzer, use the lowest FREQUENCY BAND available when there is a frequency overlap. For instance, a 7 GHz signal can be measured in the 3.8 to 8.5 GHz band or the 5.8 to 12.9 GHz band. The sensitivity however, is better in the 3.8 to 8.5 GHz band.

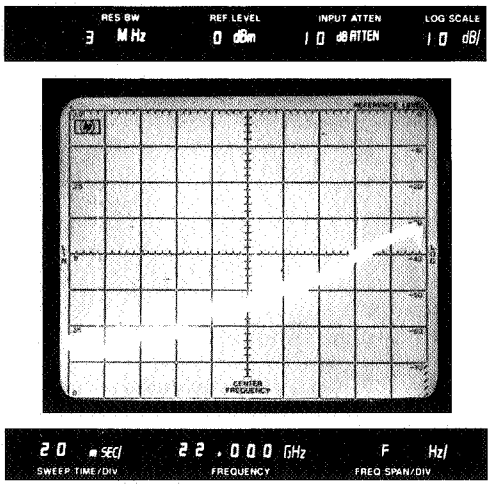
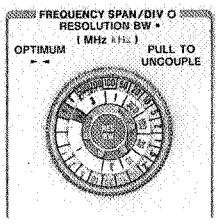


Figure 11. 1.7 - 22 GHz SPAN mode

The five frequency span modes available on the HP 8565A provide the user with maximum flexibility in making measurements. Table 2 summarizes the characteristics of each FREQUENCY SPAN MODE.

RESOLUTION BANDWIDTH



In Normal Setting, the RESOLUTION BW is optimally coupled to the FREQUENCY SPAN/DIV by aligning the green markers (▶ ◀) and pushing the controls in to couple. Once the controls are coupled at OPTIMUM, the best RESOLUTION BW will be automatically chosen for any frequency span selected. The RESOLUTION BW can also be coupled at a position other than OPTIMUM.

For certain applications, independent control of RESOLUTION BW may be desirable. By pulling out either control knob, the RESOLUTION BW will be decoupled thus allowing different RESOLUTION BW settings to be selected. Figure 12 illustrates how an AM signal with 200 kHz sidebands is displayed with various RESOLUTION BW settings. Also, note that the narrower RESOLUTION BW will yield increased sensitivity since random noise decreases 10 dB for every factor of 10 reduction in RESOLUTION BW.

The SWEEP TIME/DIV, when in AUTO position, will automatically select the proper sweep speed whether the RESOLUTION BW is coupled or uncoupled and operated independently.

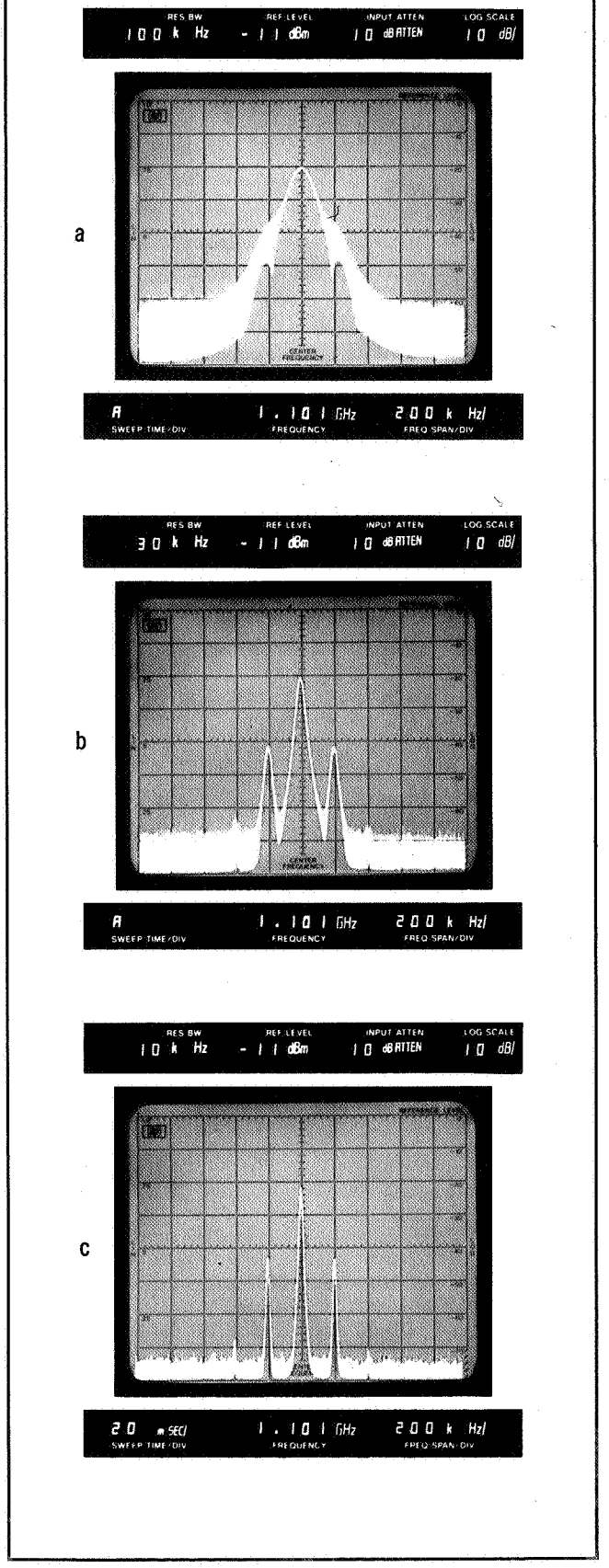
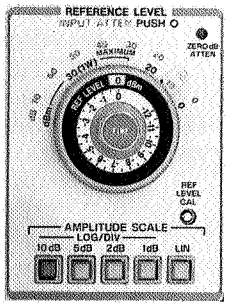


Figure 12. (a) 100 kHz RBW (b) 30 kHz RBW (c) 10 kHz RBW

REFERENCE LEVEL



The main purpose of the REFERENCE LEVEL control is to set the absolute power of the REFERENCE LEVEL (top graticule line) on the CRT. When the peak of a signal is at the REFERENCE LEVEL, its absolute power (in dBm) will be indicated on the bezel readout as well as on the REFERENCE LEVEL control knob.

The REFERENCE LEVEL control, along with the INPUT ATTEN, has a range of 172 dB; from −102 dBm to +70 dBm. Although the REFERENCE LEVEL is calibrated from +30 to +70 dBm, signal levels should never exceed +30 dBm since that is the maximum power the analyzer can withstand without damage. In Figure 13, the REFERENCE LEVEL was adjusted to position f_1 on the REFERENCE LEVEL line of the CRT. The absolute power of f_1 then, is +30 dBm. The level at f_2 can be read from the calibrated CRT display as +30 dBm −50 dB = −20 dBm. If desired, a low-level signal can be positioned on the REFERENCE LEVEL line to read its power level directly on the bezel readout. f_3 in Figure 13 is positioned on the REFERENCE LEVEL line to read −80 dBm direct.

The REFERENCE LEVEL line on the CRT is determined by a combination of IF gain (REFERENCE LEVEL control) and RF attenuation (INPUT ATTEN). The outer control knob adjusts the IF gain in 10 dB steps. A FINE vernier knob provides continuous control from 0 to −12 dB.

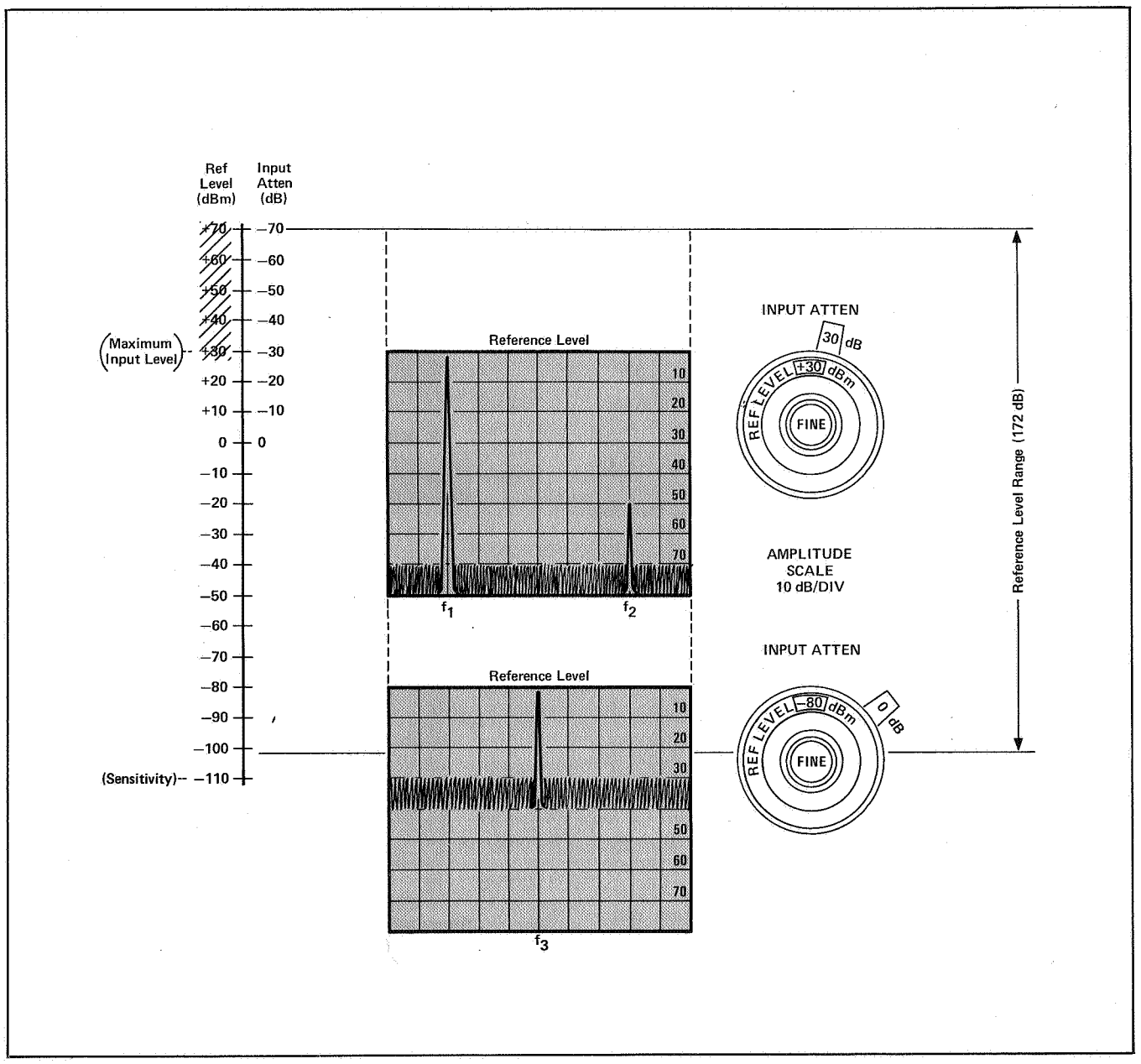
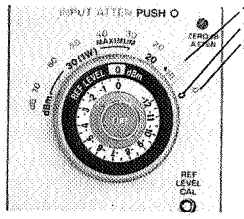


Figure 13. REFERENCE LEVEL control diagram



Pushing the outer knob in allows RF attenuation (blue numbers) from 0 to 70 dB to be selected. The numbers outlined in yellow indicate the MAXIMUM signal input allowable prior to signal compression.

A reminder light is lit whenever 0 dB INPUT ATTEN is selected. Unless making noise measurements or when maximum sensitivity is required, a minimum INPUT ATTEN of 10 dB should always be used. This insures a good input SWR and will minimize uncertainties due to mismatches.

VIDEO FILTER



The VIDEO FILTER control is used to average the noise displayed on the CRT. The VIDEO FILTER bandwidth is equal to the dial factor indicated multiplied by the RESOLUTION BW setting.

i.e. RESOLUTION BW = 30 kHz,
VIDEO FILTER = 0.01
then VIDEO FILTER = 0.01 x 30 kHz = 300 Hz.

If the RESOLUTION BW is changed to 10 kHz the VIDEO FILTER bandwidth will be 100 Hz. Thus, the VIDEO FILTER always varies as a percentage of the RESOLUTION BW.

The VIDEO FILTER is useful when observing a low-level signal that is close to the noise level. Figure 14 illustrates how use of the VIDEO FILTER control enables a low-level signal, close to the noise level, to be seen more clearly.

In addition, a NOISE AVG position on the VIDEO FILTER control allows the analyzer to make noise level measurements or to measure its own sensitivity (in a given RESOLUTION BW). The NOISE AVG position engages a 1 Hz low-pass filter to average the noise displayed on the CRT. Also the sweep time of the analyzer is increased to facilitate making noise level measurements.[4]

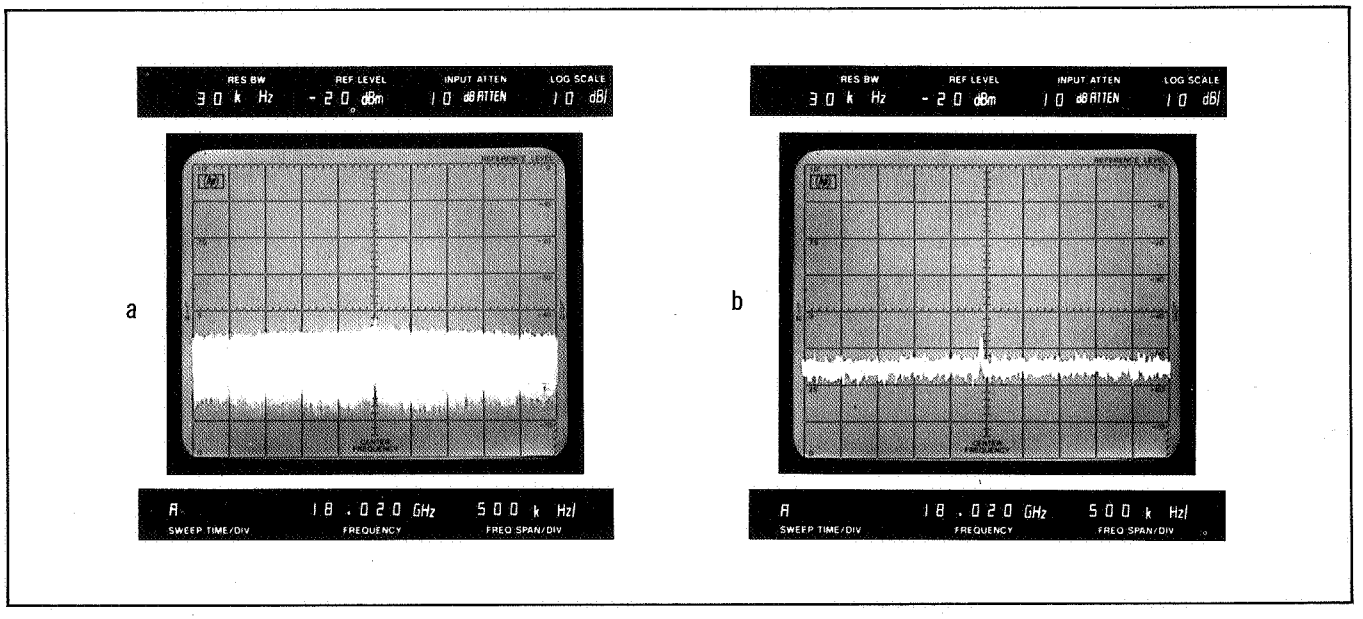
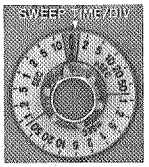


Figure 14. (a) VIDEO FILTER off (b) VIDEO FILTER = 0.003 × 0.10 kHz = 30 Hz

AUTOMATIC SWEEP TIME



In the green AUTO position, the sweep time is automatically adjusted for any FREQUENCY SPAN/DIV, RESOLUTION BW, and VIDEO FILTER selected to maintain a calibrated amplitude display. One way to see the effect of AUTO SWEEP TIME/DIV is by decreasing the VIDEO FILTER bandwidth. The sweep rate will slow down automatically to allow the narrow VIDEO FILTER bandwidths more time to respond. Calibrated sweep times from 2 μsec/DIV to 10 sec/DIV are available when the SWEEP TIME/DIV control is switched out of the AUTO position and operated manually. The faster sweep times (2 μsec/DIV to 1 msec/DIV) are used only to display fast signal variations in the time domain (ZERO SPAN). A word of caution is necessary if the SWEEP TIME/DIV control is operated manually in PER DIV or in any full band modes. To insure that the amplitude calibration in the analyzer is maintained, observe changes in signal amplitude as the SWEEP TIME/DIV is changed. If the signal amplitude does not change, then the SWEEP TIME/DIV chosen is sufficient to allow the analyzer's bandwidth filters to fully respond. Additionally, the SWEEP TIME/DIV (AUTO or manual operation) will operate with any type of SWEEP TRIGGER as long as the INTernal SWEEP SOURCE is selected.

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4 Because of detector and log amplifier characteristics, 2.5 dB should be added to obtain the correct noise power reading. See Hewlett-Packard Application Note 150-4 for details.

Chapter 3
SPECIAL TOPICS

OPTIMUM DYNAMIC RANGE

Dynamic range is defined here as the ratio of the largest signal to the smallest signal that can be at the input simultaneously with no analyzer distortion products. The "optimum" dynamic range is the point where the maximum distortion-free dynamic range can be achieved along with the maximum signal-noise ratio.

The optimum dynamic range on the HP 8565A can be determined by referring to Figure 17 on page 11. Three types of curves are presented on the chart; sensitivity (solid line), second-order distortion (dash line) and third-order distortion (dotted line). The sensitivity curves for the six internal frequency bands (0.01 - 22 GHz) have been normalized to a 1 kHz bandwidth. To use the sensitivity curves for different resolution bandwidths, simply subtract 10 dB from the signal-noise ratio reading for every factor of 10 increase in resolution bandwidth (i.e., a signal-noise ratio of 70 dB for a 1 kHz bandwidth would be 60 dB for a 10 kHz bandwidth). The second-order and third-order distortion curves are dependent on whether the 0.01 to 1.8 GHz or the 1.7 to 22 GHz frequency bands are used. Two vertical axes are used in Figure 17: Signal-Noise Ratio (left side) and Distortion-Free Dynamic Range (right side). The optimum dynamic range occurs at the intersection of the particular sensitivity and distortion curve under consideration. At this point the maximum Distortion-Free Dynamic Range is achieved with the maximum Signal-Noise Ratio.

Three major factors determine the optimum achievable dynamic range of the HP 8565A. They are:

1. Effective signal input
2. Frequency band
3. Signal separation

Let's examine each of these factors separately.

Effective Signal Input

The Effective Signal Input is simply the signal at the input minus the analyzer INPUT ATTEN setting. In equation form:

Effective Signal Input = signal input − INPUT ATTEN.

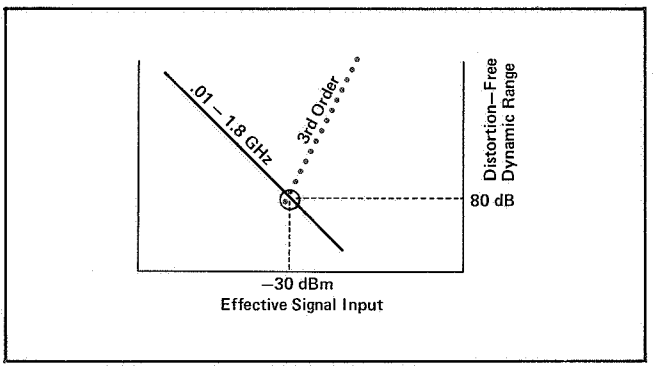
The horizontal axis on the dynamic range chart represents the Effective Signal Input.

Dynamic range varies as a function of Effective Signal Input. This is not as critical in the preselected 1.7 to 22 GHz frequency range. However, in the 0.01 to 1.8 GHz range, the Effective Signal Input (for optimum dynamic range) should be approximately −40 dBm when measuring second-order distortion products. Beyond this level, second-order distortion will increase 20 dB for every 10 dB increase in signal input. For third-order distortion measurements, the Effective Signal Input should be approximately −30 dBm. The optimum dynamic range in the 1.7 to 22 GHz band is achieved with an Effective Signal Input of approximately 0 dBm. This applies for both second-order and third-order distortion products.

Example: (Refer to Figure 17 on page 11.)

It is desired to measure the third-order distortion products from a device. The input signals are at 1456 MHz and 1466 MHz. Find the Effective Signal Input to obtain the optimum dynamic range.

Answer: The Effective Signal Input to achieve this is −30 dBm for each signal. Since this is a third-order measurement, we use the dotted third-order distortion curve applicable to the frequency range. Intersect this curve with the sensitivity curve that covers 0.01 to 1.8 GHz. The optimum dynamic range occurs at the intersection of the curves.



Frequency Bands

It can be seen that the dynamic range for the 1.7 to 22 GHz frequency range is generally much greater than for the 0.01 to 1.8 GHz range. This benefit is possible due to the tracking preselector in the HP 8565A. The preselector extends the dynamic range by allowing the analyzer to measure a low-level signal in the presence of a potentially interfering high-level signal. Since the preselector tracks the tuning of the analyzer, it only allows a signal to pass to the mixer when both preselector and analyzer are tuned to receive it. When the analyzer is tuned to the low-level harmonic, the preselector rejects the high-level fundamental, thus preventing internal distortion products from affecting the measurement.

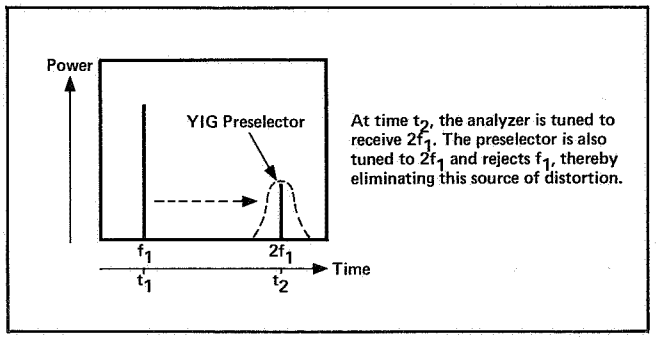


Figure 15. YIG preselector tuning

Signal Separation

In the preselected frequency bands (1.7 to 22 GHz) the tracking bandpass filter has a nominal 50 MHz bandwidth. For signal separation >100 MHz, the tracking filter will only allow one signal to pass to the mixer while simultaneously rejecting the other signal. This is illustrated in Figure 16: Since only one signal enters the analyzer at any instant in time, the analyzer will not generate any third-order distortion products. Also, for larger signal separation, the preselector will have more rejection and hence the dynamic range is greater.

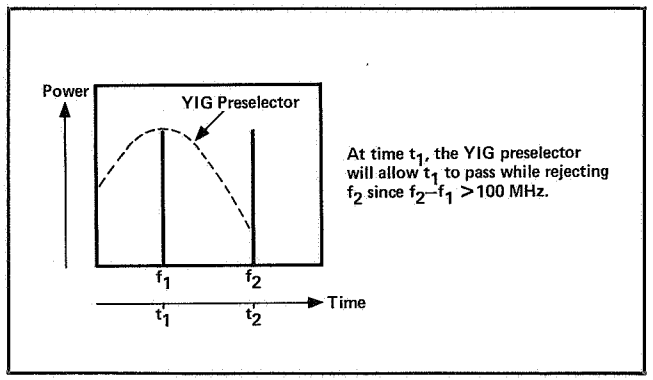
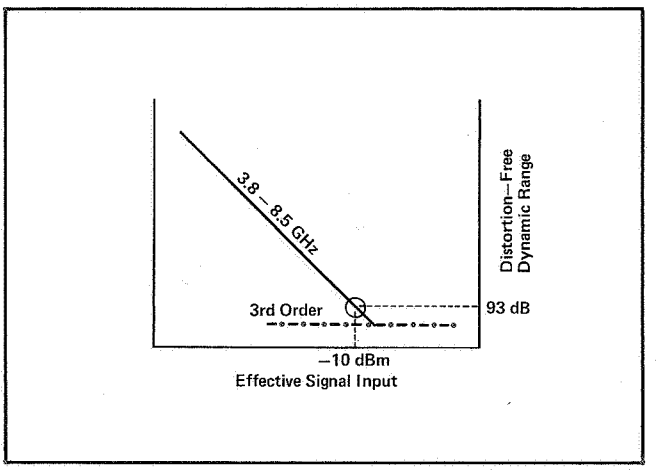


Figure 16. YIG preselector passband

Example:

It is desired to measure the third-order intermodulation products of a microwave amplifier. The two output signals are −10 dBm at 5.9 and 6.1 GHz. What is the dynamic range of the analyzer?

Answer: *93 dB*. Find the sensitivity curve for 3.8 to 8.5 GHz. Intersect this with the effective signal input at −10 dBm. The dynamic range of the analyzer is 93 dB.



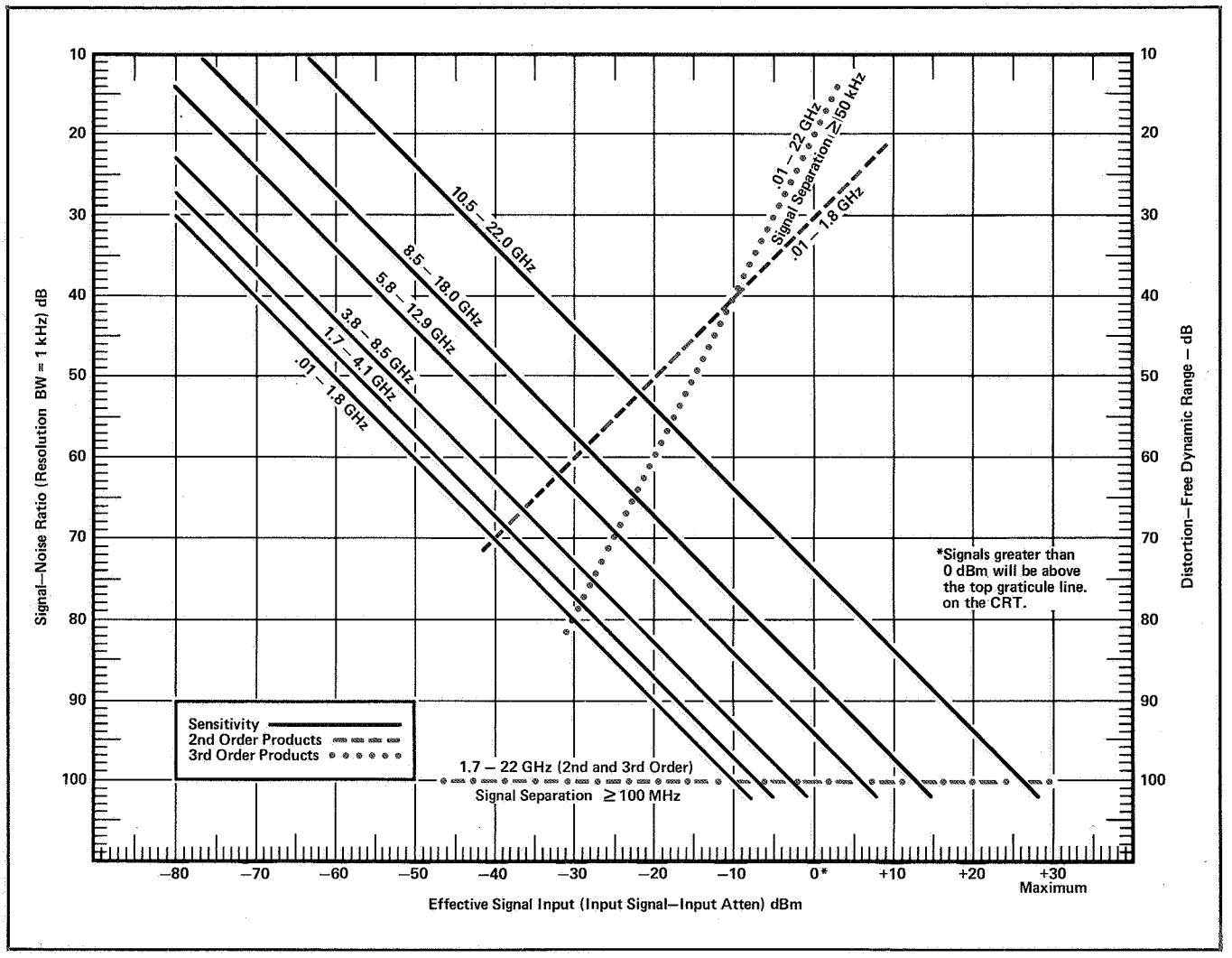


Figure 17. Dynamic range

Other constraints: When measuring distortion products associated with low-level signal inputs, the available signal strength will be the limitation. In this case, find the signal level on the Effective Signal Input (horizontal) axis and go vertically to the appropriate sensitivity curve. The maximum obtainable dynamic range is read from the Signal-Noise Ratio (vertical) axis.

IMPROVING MEASUREMENT ACCURACY

The technique known as IF substitution can be used to improve measurement accuracy on the HP 8565A. IF substitution is a method of using *only* the accurate IF gain of the analyzer to position the signal on the calibrated REFERENCE LEVEL line. In this way, errors due to the CRT non-linearity, log amplifier, input attenuator, and bandwidth filter will be eliminated. The IF gain of the analyzer is controlled with the calibrated REFERENCE LEVEL knob. The steps for achieving accurate amplitude measurements with IF substitution are as follows:

Amplitude Measurement With IF Substitution

1. Set the INPUT ATTEN to 10 dB or greater. This insures a good input SWR to minimize mismatch errors.
2. Set the FREQUENCY SPAN/DIV control to the desired frequency resolution.
3. Connect the CAL OUTPUT signal to the analyzer to verify calibration.
4. Disconnect the CAL OUTPUT signal and connect the signal to be measured.
5. Set the desired FREQUENCY BAND and use *only* the TUNING control to center the signal on the CRT.
6. In the 1.7 to 22 GHz frequency range, adjust the PRESELECTOR PEAK control to maximize the signal level.[5]
7. Now, using only the REFERENCE LEVEL control and FINE vernier, position the peak of the signal on the REFERENCE LEVEL line of the CRT. The signal amplitude is indicated by the REF LEVEL on the CRT bezel readout.

When the IF substitution technique is used for amplitude measurements, the only remaining measurement uncertainties are due to the CAL OUTPUT signal, flatness, and REFERENCE LEVEL control of the analyzer. Uncertainties due to RESOLUTION BW, INPUT ATTEN, log amplifier, and CRT non-linearities have been eliminated because they were left unchanged throughout the measurement.

[5] Normally, the best broadband tracking performance of the preselector is obtained with the PRESELECTOR PEAK control centered in the green area. However, for accurate power measurement, the PRESELECTOR PEAK control should be adjusted to maximize signal level.

Further accuracy improvement can be achieved by calibrating the analyzer at the same frequency to which the measurement will be made. This would eliminate any flatness uncertainties and the measurement accuracy would only be dependent upon the accuracy of the calibration signal and the REFERENCE LEVEL control.

CRT PHOTOGRAPHY AND X-Y RECORDING

CRT Photography

The CRT bezel readout on the HP 8565A provides an excellent means of information retention with use of any compatible scope camera. Since the display has readouts for all major spectrum analyzer settings, the need for additional writing on the photograph is largely eliminated. Also, interference between trace and characters is not a problem since the LED's are built into the CRT bezel. (See Figure 18.)

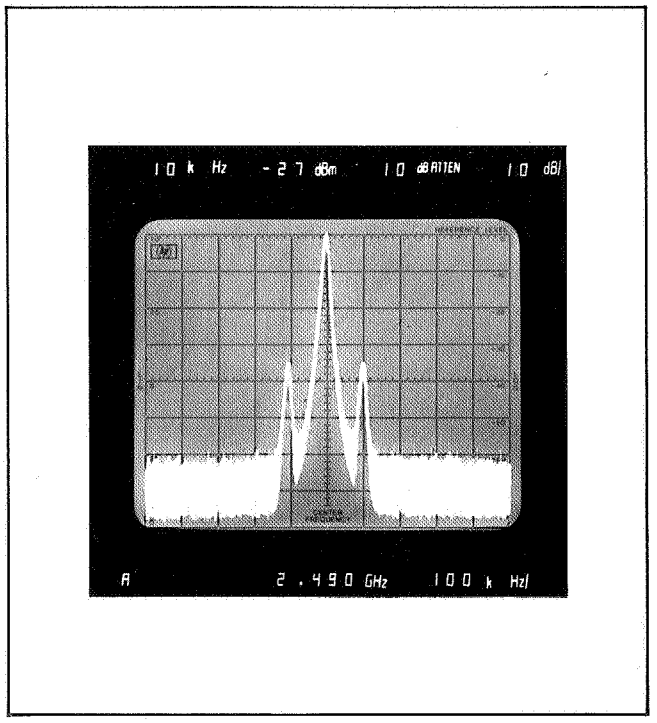


Figure 18. CRT display with bezel readout

The photo in Figure 18 is a double exposure which was taken with a camera that has variable shutter speed and f-stop. A double exposure provides the best contrast between signal trace, graticule lines, and CRT bezel readout. A step-by-step procedure for double-exposure photography is given below. These steps are applicable with the HP 197A or other compatible scope cameras:

Double Exposure Photography

1. Set the HP 8565A STORE INTEN and SCALE INTEN to the calibrated blue markings.
2. Set the camera shutter speed to 1 second and the f-stop to 16.

3. Push the STORE button on the analyzer to store the trace.[6] Press shutter on camera to take first exposure.

4. Push the SCALE button on the analyzer to illuminate the graticule lines.[7] Wait 2 seconds for display to fully erase. Press shutter on camera to take second exposure.

X-Y Recording

The HP 8565A is directly compatible with HP's line of X-Y recorders as well as strip-chart, digital, or magnetic tape recorders. The VERTICAL OUTPUT, BLANK OUTPUT, and HORIZONTAL SWEEP OUTPUT are all available from the rear panel of the analyzer. X-Y recorders can provide full-size (up to 11" x 14") copies with high resolution that are more applicable for folders or lab reports. Also, they can be reproduced easier than photographs and thus provide additional copies at minimal cost. Figure 19 illustrates a typical set-up used for X-Y recording.

The bandwidth of most X-Y recorders is very narrow; typically 1 to 2 Hz. This narrow bandwidth requires a sweep rate that is slow enough for the recorder to fully respond to a signal. In general, a sweep rate of 2 sec/div is sufficient for the majority of X-Y recorders. The SINGLE or the MANUAL sweep mode on the HP 8565A can be used to control the sweep.

Additional detailed information on CRT Photography and X-Y recording can be obtained from Hewlett-Packard Application Note 150-5.

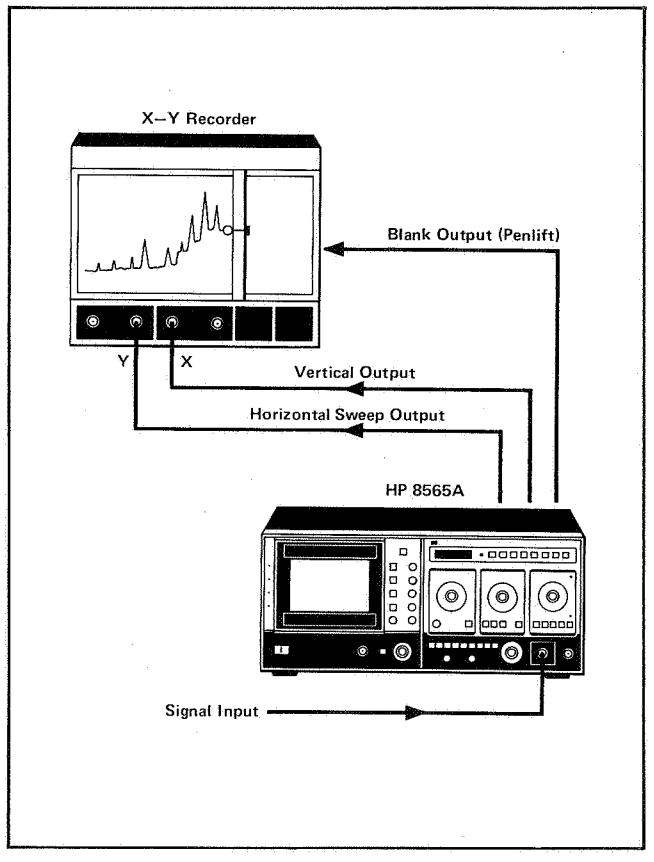


Figure 19. X-Y recording

6 When the STORE or SCALE button is pushed, the FREQUENCY readout on the CRT bezel is fixed in its last reading. This insures that the FREQUENCY reading will not change while the camera shutter is opened.

7 The SCALE button simultaneously erases the trace and illuminates the graticule lines.

EXTERNAL MIXER OPERATION

Calibrated frequency coverage from 14.5 to 40 GHz can be achieved by using the HP 11517A External Mixer with the appropriate waveguide adapter listed in Table 3. The external mixer connects to the EXT MIXER port on the front panel of the HP 8565A with a BNC coaxial cable. Setting the corresponding FREQUENCY BAND will allow frequency coverage in two ranges: 14.5 to 26.6 GHz or 22.9 to 40 GHz.

Table 3. External mixer components

HP Model Number	Description	HP Band Designation
11517A	12.4 - 40 GHz Mixer	
11518A	12.4 - 18 GHz Adapter	P
11519A	18 - 26.5 GHz Adapter	K
11520A	26.5 - 40 GHz Adapter	R

A connection diagram of the HP 8565A with the HP 11517A External Mixer and adapter is illustrated in Figure 20.

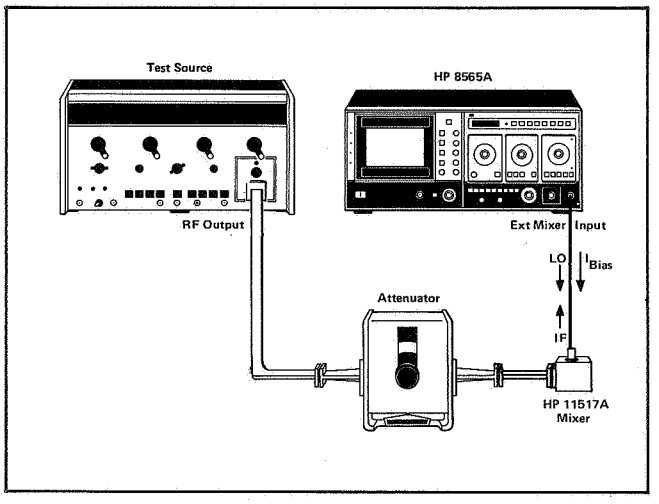


Figure 20. External mixer test set-up

The EXT MIXER port is somewhat unique in that it transceives three signals. The LO and a bias current (I_{bias}) exit to the HP 11517A and the IF is received back at the EXT MIXER port. Filter networks at the EXT MIXER port separate the unwanted RF signals from the desired IF product. The BIAS control is adjusted to optimize the signals viewed with the external mixer.

In operation, the HP 11517A External Mixer bypasses the input attenuator, preselector, and the calibrated internal mixer of the analyzer. Hence, three things must be remembered when using the external mixer:

1. The INPUT ATTEN has no effect on input signals.

2. Harmonic mixing responses must be properly identified since there is no preselection in the EXT MIXER bands.

3. Amplitude measurements are uncalibrated unless steps are taken to calibrate the analyzer.

Signal Identification

To properly identify a signal on the CRT, the SIG IDENT on the HP 8565A is used. To use the SIG IDENT, center the unknown response on the CRT and set the FREQUENCY SPAN/DIV to 1 MHz. Then depress the SIG IDENT pushbutton and note if the response resembles Figure 21. If the response moves two divisions to the left and drops in amplitude, then it is the correct signal and its frequency is indicated on the LED display. If the response does not identify correctly, then tune to another response and use the SIG IDENT once again to identify it.

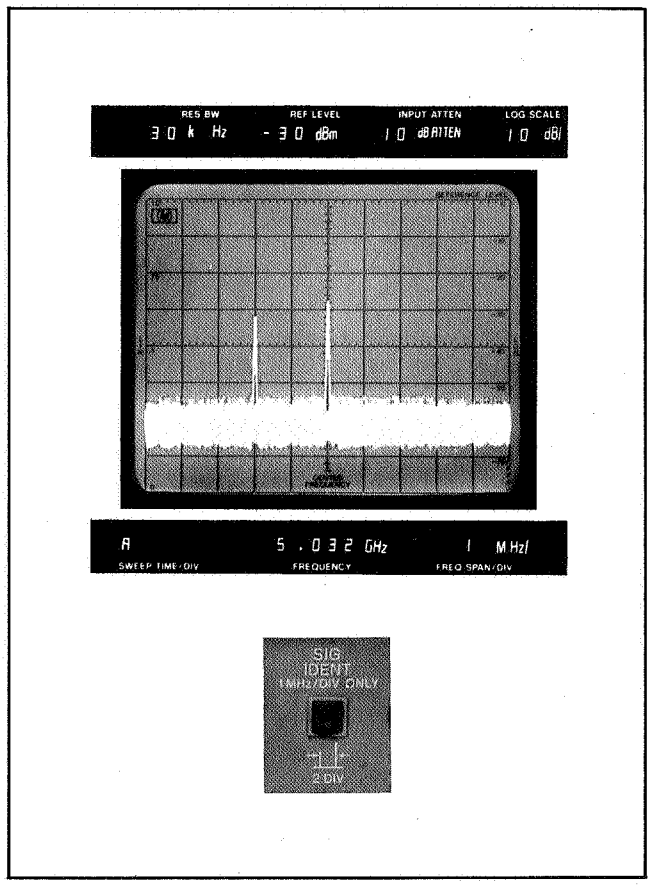


Figure 21. Signal identifier

Amplitude Calibration of External Mixer

The analyzer can easily be calibrated to read absolute power if a reference signal is available in the frequency range of interest. This is done by using both the INPUT ATTEN control and the REF LEVEL CAL adjustment on the analyzer. Since the INPUT ATTEN is bypassed in EXT MIXER operation, it has no effect on the signal but will change the REF LEVEL readout. Thus the INPUT ATTEN control provides a method of calibrating the analyzer to within ±5 dB (attenuator has 10 dB steps) of the reference signal. To adjust between the ±5 dB limit, use the REF LEVEL CAL adjustment to bring the display into an absolute power calibration. A step-by-step procedure for calibrating the analyzer to measure absolute power up to 40 GHz with the HP 11517A mixer follows:

Procedure

1. Set up equipment as shown in Figure 20.
2. Connect reference signal to external mixer and select corresponding EXT MIXER frequency band to be calibrated.
3. Use SIG IDENT to verify that reference signal is correct response.
4. Peak the reference signal displayed on the analyzer with the BIAS control. Adjust to the maximum peak since it is normal to see more than one peak occur.
5. Set the INPUT ATTEN to 0 dB and the REF LEVEL FINE control to 0 dB.
6. Position the reference signal as close as possible to the REFERENCE LEVEL line using only the coarse REFERENCE LEVEL control.
7. Since the amplitude of the reference signal is known, adjust the INPUT ATTEN to obtain the correct amplitude reading on the CRT bezel readout. If the reference signal is not in *even* 10 dB increments (i.e., −20 dBm, −30 dBm) then it will be necessary to adjust the REF LEVEL FINE control to obtain the correct REF LEVEL readout.
8. At this point, the REF LEVEL readout on the bezel should read the amplitude of the reference signal. Also, the signal should be positioned within ±5 dB of the REFERENCE LEVEL line. The final step is to position the reference signal on the REFERENCE LEVEL line by using the REF LEVEL CAL adjustment.

Once the reference signal is at the REFERENCE LEVEL line and the REF LEVEL reading equals the absolute value of the reference signal, the analyzer will be amplitude calibrated for that particular EXT MIXER band.

Note: If the REF LEVEL CAL adjustment was used to calibrate the EXT MIXER band, then the analyzer must be recalibrated to its internal CAL OUTPUT signal for the 0.01 to 22 GHz frequency range.

Additional information on external mixer measurements can be obtained from AN 150-12.

Chapter 4
TYPICAL MEASUREMENTS

DISTORTION

Distortion measurement is an area where the spectrum analyzer makes a significant contribution. There are two basic types of distortion that are usually specified by the manufacturer: harmonic distortion and two-tone, third-order intermodulation distortion. The third-order intermodulation products are represented by: $2f_1 - f_2$ and $2f_2 - f_1$ where f_1 and f_2 are the two-tone input signals.

The HP 8565A can measure harmonic distortion products up to 100 dB down in the 1.7 to 22 GHz frequency range. Third-order intermodulation products can also be measured up to 100 dB down, depending on signal separation and frequency range. In all, the HP 8565A is capable of making a wide variety of distortion measurements with speed and precision.

Amplifiers

All amplifiers generate some distortion at the output and these distortion products can be significant if the amplifier is overdriven with a high-level input signal. The test set-up in Figure 22 was used to measure the third-order intermodulation products of a microwave FET (Field-Effect Transistor) amplifier. Directional couplers and attenuators were used to provide isolation between sources.

Figure 23 is a CRT photo of a two-tone, third-order intermodulation measurement. The third-order products ($2f_1 - f_2$ and $2f_2 - f_1$) are 50 dB below the two-tone signals (f_1 and f_2).

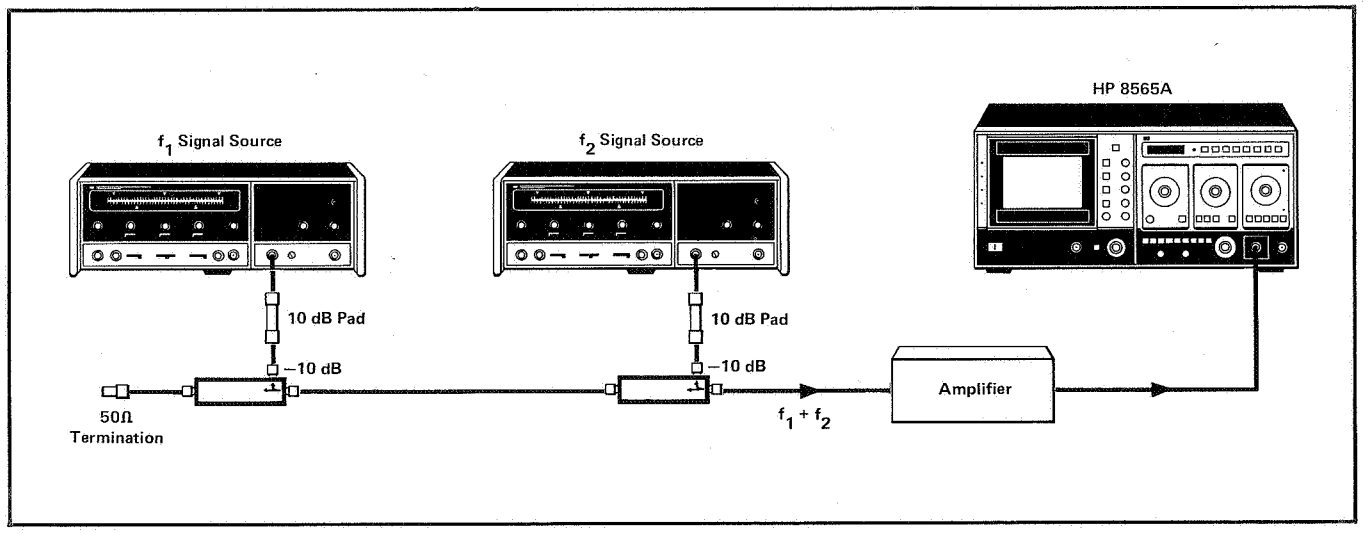


Figure 22. Two-tone test set-up

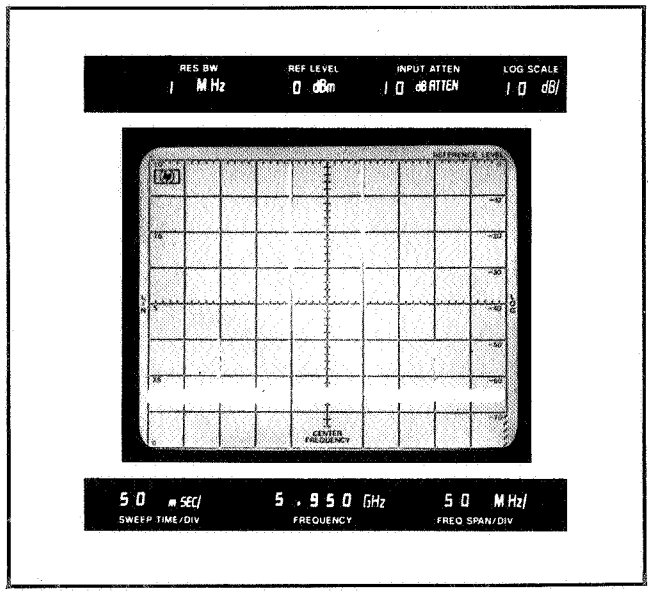


Figure 23. Two-tone, third-order intermodulation products

Mixers

Mixers utilize the non-linear characteristics of an active or passive device to achieve a desired frequency conversion. This results in some distortion at the output due to the inherent non-linearity of the device. Figure 24 illustrates the test set-up and CRT photograph of a typical mixer measurement.

From a single display, the following information was determined:

Conversion loss (SSB):
$(RF_{in}) - (IF) = (-30) - (-40) = 10$ dB

LO to IF Isolation:
$LO_{in} - LO_{out(IF)} = (+5) - (-25) = 30$ dB

RF to IF Isolation:
$RF_{in} - RF_{out(IF)} = (-30) - (-57) = 27$ dB

Third-Order Distortion Product (2 LO – RF):
–64 dBm @ 600 MHz.

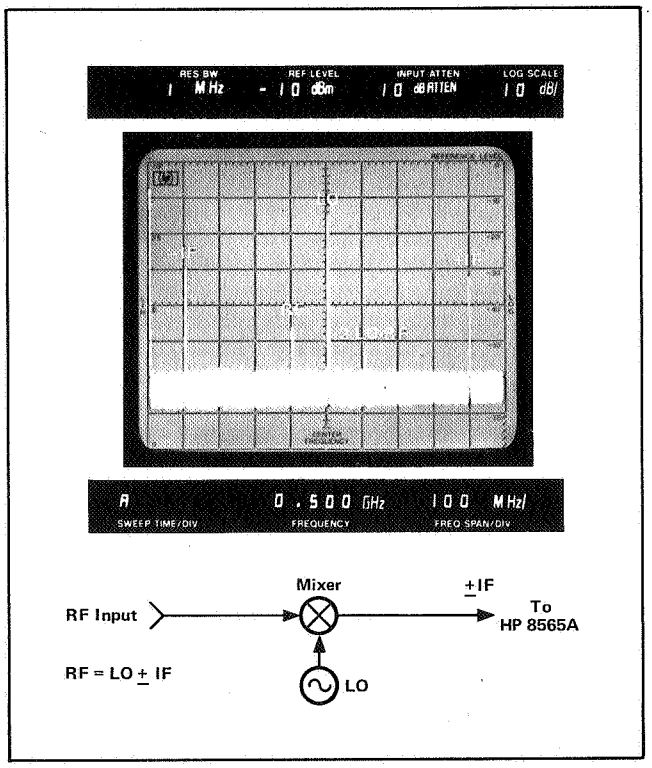


Figure 24. Mixer measurement

Oscillators

Distortion in oscillators may be harmonically or non-harmonically related to the fundamental frequency. Non-harmonic oscillator outputs are usually termed spurious. Both harmonic and spurious outputs of an oscillator can be minimized with proper biasing and filtering techniques. The HP 8565A can monitor changes in distortion levels while modifications to the oscillator are made. In the full-band modes, a tuning marker can be located under any signal response to determine its frequency and hence its relationship to the oscillator's fundamental frequency. Figure 25 is a CRT photo of the fundamental and second harmonic of an S-Band (2 to 4 GHz) YIG oscillator. The internal preselector of the HP 8565A enables the analyzer to measure a low-level harmonic in the presence of a high-level fundamental. The photo was obtained by adjusting the PERSIST control to allow storage of the trace and then tuning the oscillator over a narrow band.

Note: Consult AN 150-11 for more information on distortion measurements.

MODULATION

AM

The wide dynamic range of the spectrum analyzer allows accurate measurement of modulation levels. A 0.06% modulation is a logarithmic ratio of 70 dB, which is easily measured with the HP 8565A. Figure 26 is a signal with 2% AM; a log ratio of 40 dB.

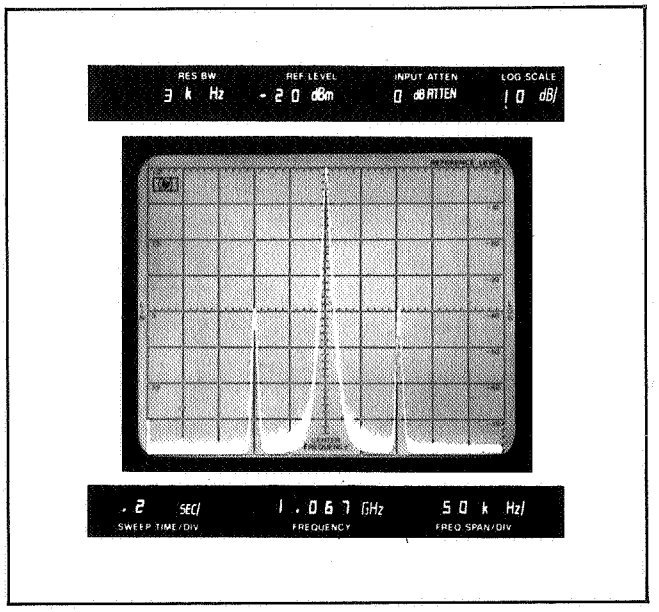


Figure 26. 2% AM

When the analyzer is used as a manually-tuned receiver (ZERO SPAN), the AM is demodulated and viewed in the time domain. To demodulate an AM signal, uncouple

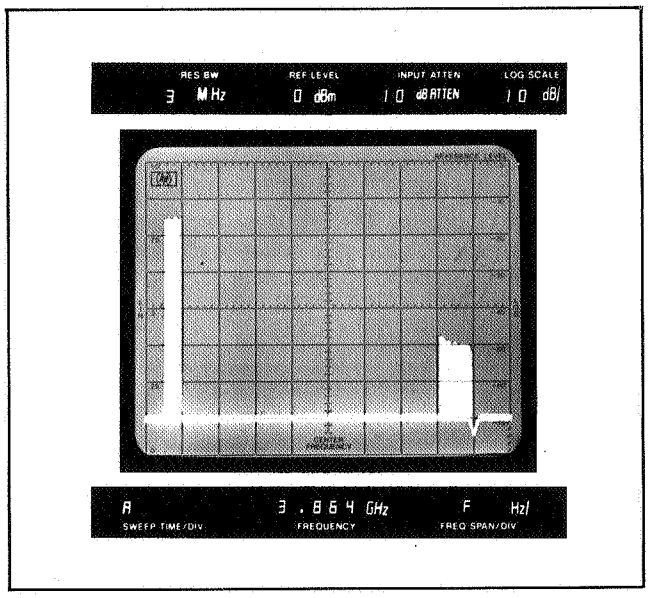


Figure 25. Oscillator fundamental and second harmonic

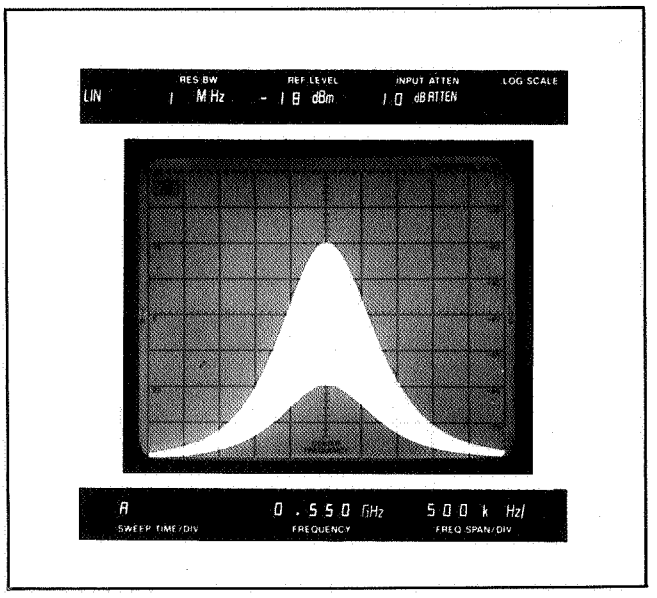


Figure 27. Linear amplitude display

the RESOLUTION BW and set it to a value at least twice the modulation frequency. Then set the AMPLITUDE SCALE to LIN and center the signal, horizontally and vertically, on the CRT. (See Figure 27)) By pushing ZERO SPAN and VIDEO triggering, the modulation will be displayed in the time domain. (See Figure 28.) The time variation of the modulation signal can then be measured with the calibrated SWEEP TIME/DIV control.

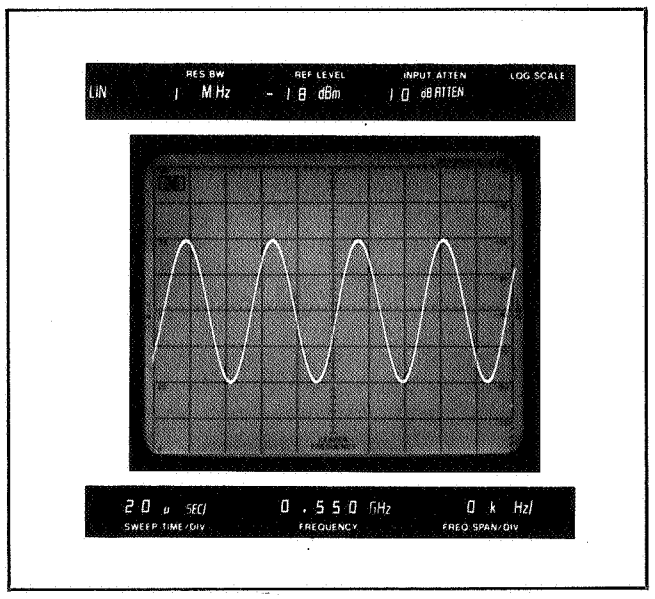


Figure 28. Demodulated AM signal in ZERO SPAN

FM

For frequency modulated signals, parameters such as modulation frequency (f_m), modulation index (m), peak frequency deviation of carrier (Δf peak) are all easily measured with the HP 8565A. The FM signal in Figure 29 was adjusted for the carrier null which corresponds to m = 2.4 on the *Bessel* function. The modulation frequency, f_m, is simply the frequency separation of the sidebands which is 50 kHz. From this, we can calculate the peak frequency deviation of the carrier (Δf peak) with the following equation:

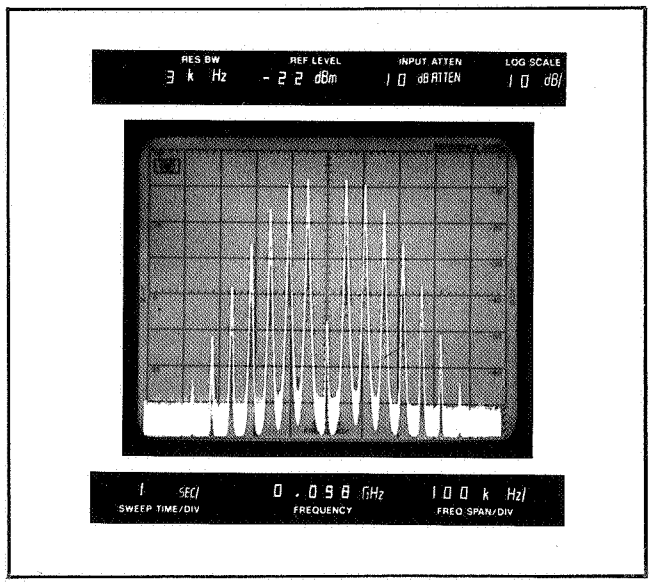


Figure 29. FM signal

$$m = \frac{\Delta f \text{ peak}}{f_m} \text{ or } \Delta f \text{ peak} = 2.4 \times 50 \text{ kHz} = 120 \text{ kHz}.$$

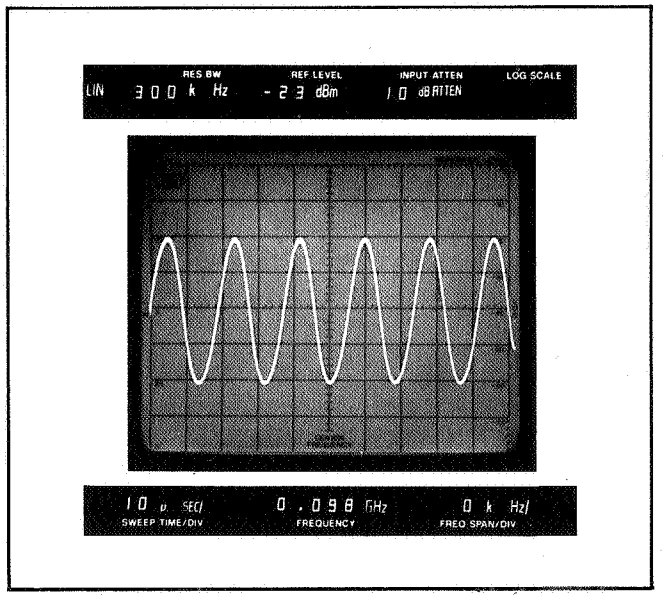


Figure 30. Demodulated FM signal in ZERO SPAN

Although the HP 8565A does not have a built-in discriminator, FM signals can be demodulated by slope detection. Rather than tuning the signal to the center of the CRT as in AM, the slope of the IF filter is tuned to the center of the CRT instead. At the slope of the IF filter, the frequency variation is converted to amplitude variation. When ZERO SPAN is selected, the amplitude variation is detected by the analyzer and displayed in the time domain as shown in Figure 30. In FM, the RESOLUTION BW must be increased to yield a display similar to Figure 31 before switching to ZERO SPAN.

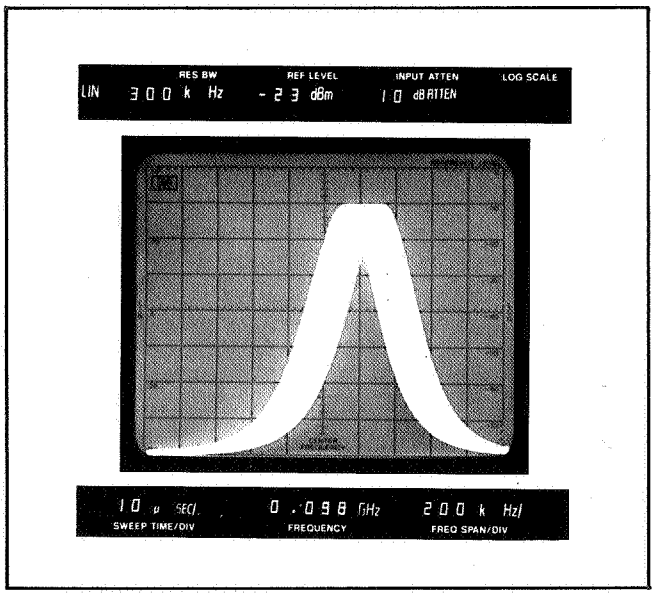


Figure 31. Slope detection of FM signal

Note: Consult AN 150-1 for more information on AM-FM.

Pulsed RF

A pulsed RF signal is a train of RF pulses having constant amplitude. Some parameters to be determined in measuring pulsed RF signals are PRF (pulse repetition frequency), pulse width, duty cycle, peak and average pulse power, and the on-off ratio of the modulator. Figure 32 illustrates a *line* spectrum presentation of a pulsed RF signal.

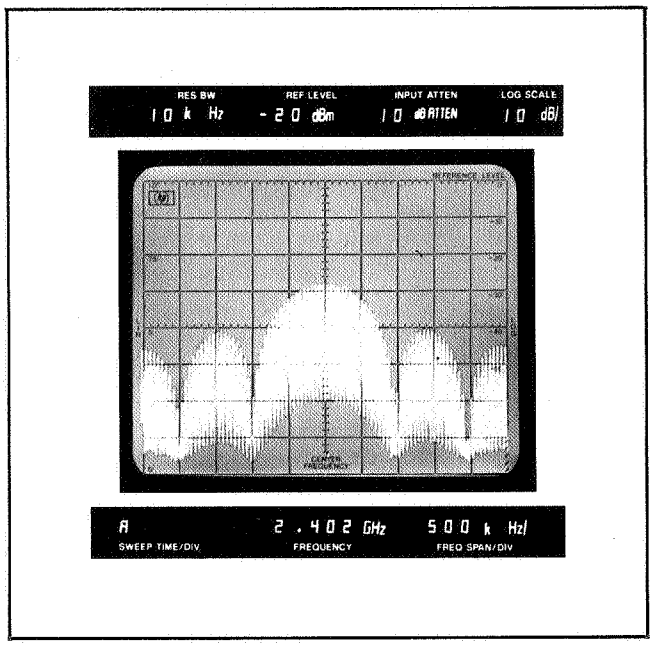


Figure 32. Line spectrum

A *line* spectrum (as opposed to a *pulsed* spectrum) is an actual Fourier representation of a pulsed RF signal; all the spectral components of the signal are fully resolved. To obtain a *line* spectrum on the analyzer, the "rule of thumb" to follow is that the RESOLUTION BW be less than 0.3 x PRF. This insures that individual spectral lines will be resolved. From the line spectrum shown in Figure 32, it is possible to measure the following parameters:

PRF = 50 kHz (spacing between spectral lines)

lobe width = 1 MHz

mainlobe power = −48 dBm

Then from the above measurement the following data can be calculated:

$$\text{Pulse width} = \frac{1}{\text{lobe width}} = \frac{1}{1\text{ MHz}} = 1\mu\text{s}$$

$$\text{Duty Cycle} = \frac{\text{PRF}}{\text{lobe width}} = \frac{50\text{ kHz}}{1\text{ MHz}} = 0.05$$

A factor to consider when measuring the amplitude of a pulsed RF signal is the pulse desensitization factor. The mainlobe power of a pulsed RF signal does not represent the actual peak power of the signal. This is because a pulsed signal has its power distributed over a number of spectral components and each component represents a fraction of the peak pulse power. The HP 8565A measures the absolute power of each spectral component. To determine the peak pulse power in a line spectrum, a pulse desensitization factor (α_L) must be added to the measured mainlobe power. The desensitization factor is a function of the duty cycle and is represented by the following equation:

$$\alpha_L = 20 \log (\text{duty cycle})$$

For a duty cycle of 0.05, $\alpha_L = -26$ dB. Hence the peak pulse power in Figure 33 is −22 dBm (−48 dBm +26 dB).

An alternate method of measuring a pulsed RF signal is in the *pulse* spectrum mode. In a *pulse* spectrum, the individual spectral lines are not resolved. If the RESOLUTION BW of the analyzer is greater than 1.7 x PRF, then the pulsed RF signal is being viewed in the *pulse* spectrum. Using the pulse spectrum enables a wider resolution bandwidth to be used. Two benefits result from this: first, the signal-noise ratio is increased because the pulse amplitude increases linearly with the resolution bandwidth (BW) whereas random noise increases only proportionally to the $\sqrt{BW}$. Hence the signal-noise ratio of the analyzer is effectively increased. Secondly, faster sweep times can be used because of the wider resolution bandwidths. The HP 8565A has a 3 MHz RESOLUTION BW which enables it to effectively display pulsed RF signals in the pulse spectrum. The 3 MHz bandwidth, along with fast sweep times, also enables narrow pulse widths to be measured in the time domain. Figure 33 illustrates a signal in the pulse spectrum. The same signal is demodulated with the analyzer in Figure 34.

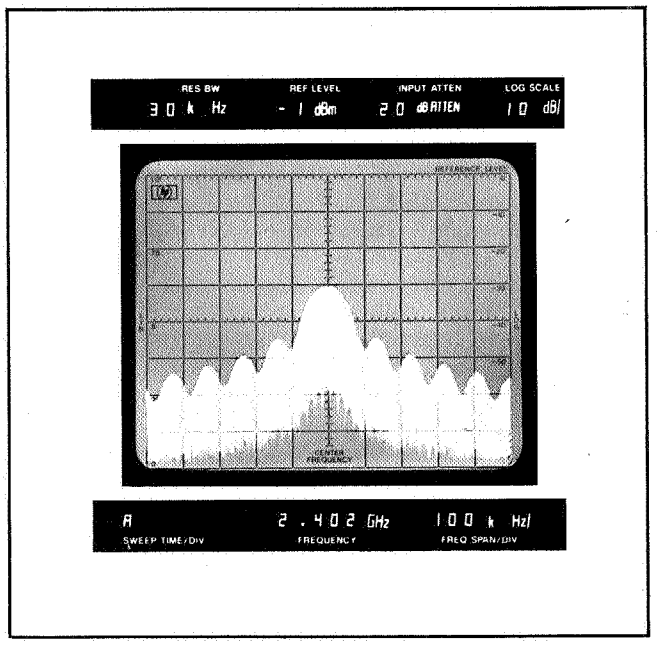


Figure 33. Pulse spectrum

An additional factor to consider when measuring pulsed RF signals is the VIDEO FILTER control. In general, the VIDEO FILTER should be left in the OFF position when measuring pulsed RF signals. Adding video filtering will desensitize a pulsed signal and limit its displayed amplitude. Hence, when monitoring pulsed signals in a full-band mode, it is important to use the F mode rather than

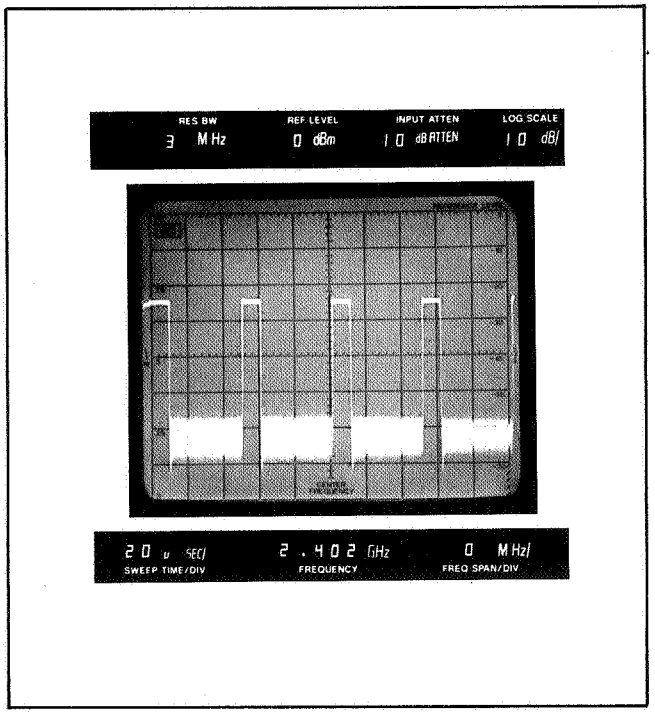


Figure 34. Demodulated pulsed RF signal in ZERO SPAN

the FULL BAND pushbutton mode. The FULL BAND mode automatically engages a 9 kHz VIDEO FILTER (0.003 x 3 MHz) which will limit the displayed amplitude of the pulse.

Note: Consult AN 150-2 for more information on pulsed RF.

NOISE

Applications involving noise measurements include oscillator noise (spectral purity), signal-noise ratio, and noise figure. The NOISE AVG position of the VIDEO FILTER control can be used to measure the analyzer sensitivity or noise power from 0.01 to 22 GHz.

The test set-up in Figure 35 is used to make a swept noise figure measurement of an amplifier. In general, this measurement involves determining the total gain of the amplifier under test and the pre-amp. Then the input of the amplifier is terminated and its noise power is measured. The noise figure of the amplifier will then be the theoretical noise power (KTB) minus the total gain and the amplifier noise power. Figure 36 is a photo of an amplifier's noise power output from 0.01 to 1.3 GHz.

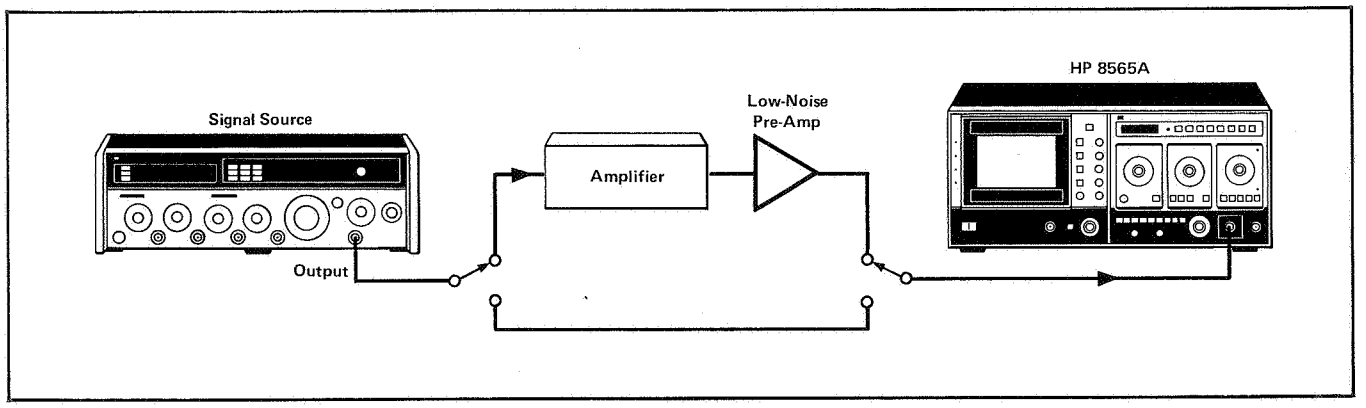


Figure 35. Swept noise figure test set-up

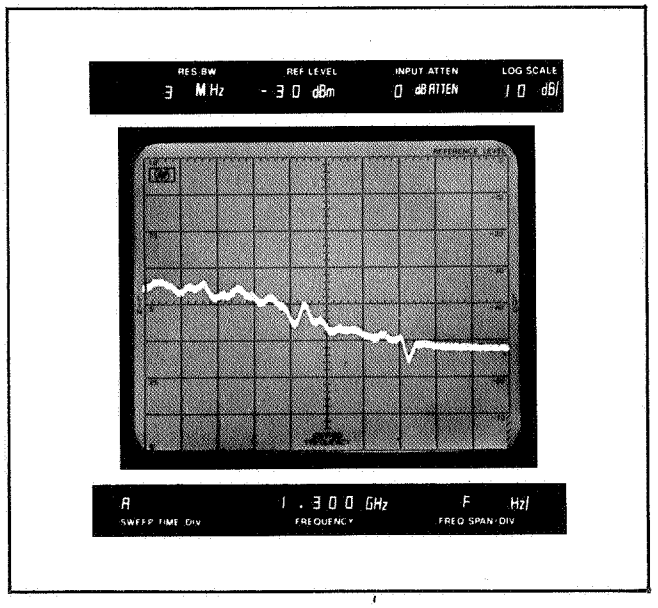


Figure 36. Noise power measurement

Note: Consult AN 150-4, AN 150-7 and AN 150-9 for more information on noise measurements.

ELECTROMAGNETIC INTERFERENCE (EMI)

The overall objective of EMI measurements is to assure compatibility between devices operating in the same vicinity. The HP 8565A, along with an appropriate transducer, is capable of measuring either conducted or radiated EMI. Figure 37 illustrates a simple set-up used for measuring radiated field strength.

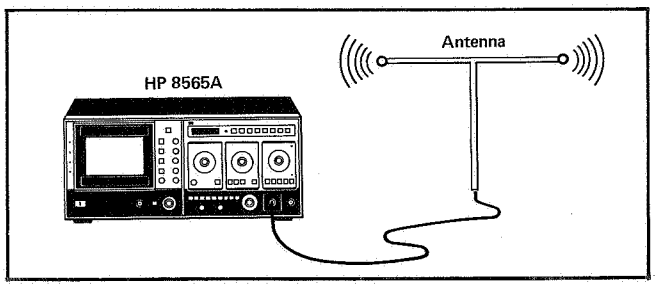


Figure 37. Field strength test set-up

The antenna is used to convert the radiated field to a voltage for the analyzer to measure. The field strength will be the analyzer reading plus the antenna correction factor. Figure 38 illustrates a typical signal generated by a DUT (Device Under Test) with spurious radiation.

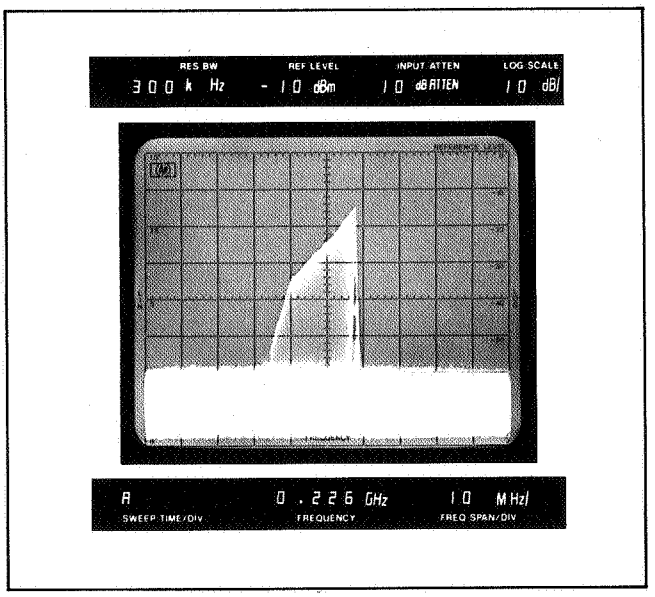


Figure 38. Spurious radiation

Compatibility is also important for high-frequency circuits which are in close proximity to each other. In a multi-stage circuit, parasitic oscillation from one stage can couple to a nearby stage and cause unpredictable behavior. A popular technique used to search for spurious radiation is with an inductive loop probe. The loop probe is simply a few turns of wire that attaches to the spectrum analyzer with a flexible coaxial cable. (See Figure 39.)

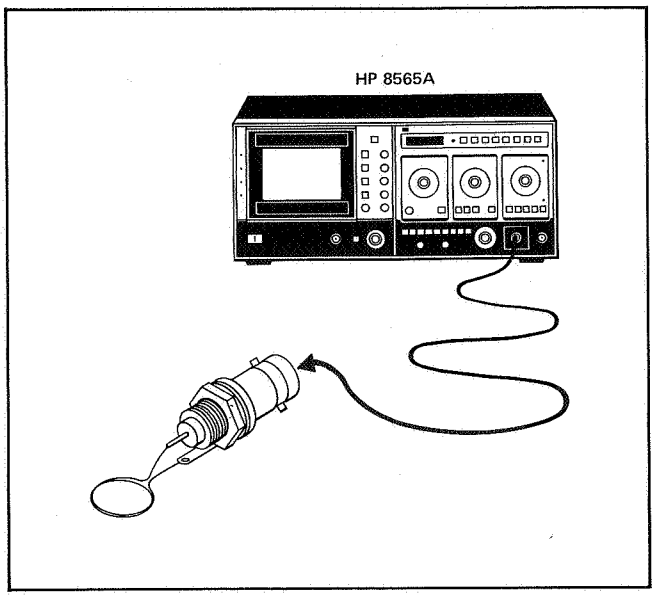


Figure 39. Loop probe

Various parts of the circuit can then be "probed" to identify the location as well as the frequency and relative amplitude of a spurious signal. Once the spurious signal has been identified, design techniques can be implemented to reduce or eliminate the cause of interference.

Note: Consult AN 150-10 and AN 63E for more information on EMI measurements.

Appendix A
OPERATING PRECAUTIONS

The spectrum analyzer is a sensitive measuring instrument. To avoid damage to the instrument, do not exceed the following **Absolute Maximum Inputs:**

Total Power: +30 dBm (1 watt)
DC: 0 V with 0 dB INPUT ATTEN
±7 V with ≥10 dB INPUT ATTEN
AC: (≪50 Ω nominal source impedance):
0 V with 0 dB INPUT ATTEN
10 V peak with ≥10 dB INPUT ATTEN

Overloading the input with too much power, peak voltages or dc voltages will damage the input circuit and require expensive repairs.

LOW IMPEDANCE AC

A source with less than 50 Ω nominal output impedance can produce excessive current which may damage the input circuit of the analyzer.

DC PRECAUTIONS

The HP 8565A *cannot* accept DC voltages in *0 dB* INPUT ATTEN. With 10 dB or greater INPUT ATTEN, small DC voltages (≤ ±7 V) can be accepted without damage if the total power (AC and DC) does not exceed 1 watt.

The input is direct-coupled and its DC input resistance varies from 0 to 87 Ω depending on the INPUT ATTEN and FREQUENCY BAND selected. (Refer to Figure 40.)

If large DC components are present with AC signals, a blocking capacitor should be used at the INPUT of the analyzer to eliminate the DC components.

Note: Input signal distortion may occur if DC voltages are applied in excess of those shown in the table below:

INPUT ATTEN	MAXIMUM DC Voltage (without distortion)
0 dB	0 V
10 dB	220 mV
20 dB	700 mV
30 dB	2.2 V
≥40 dB	7 V

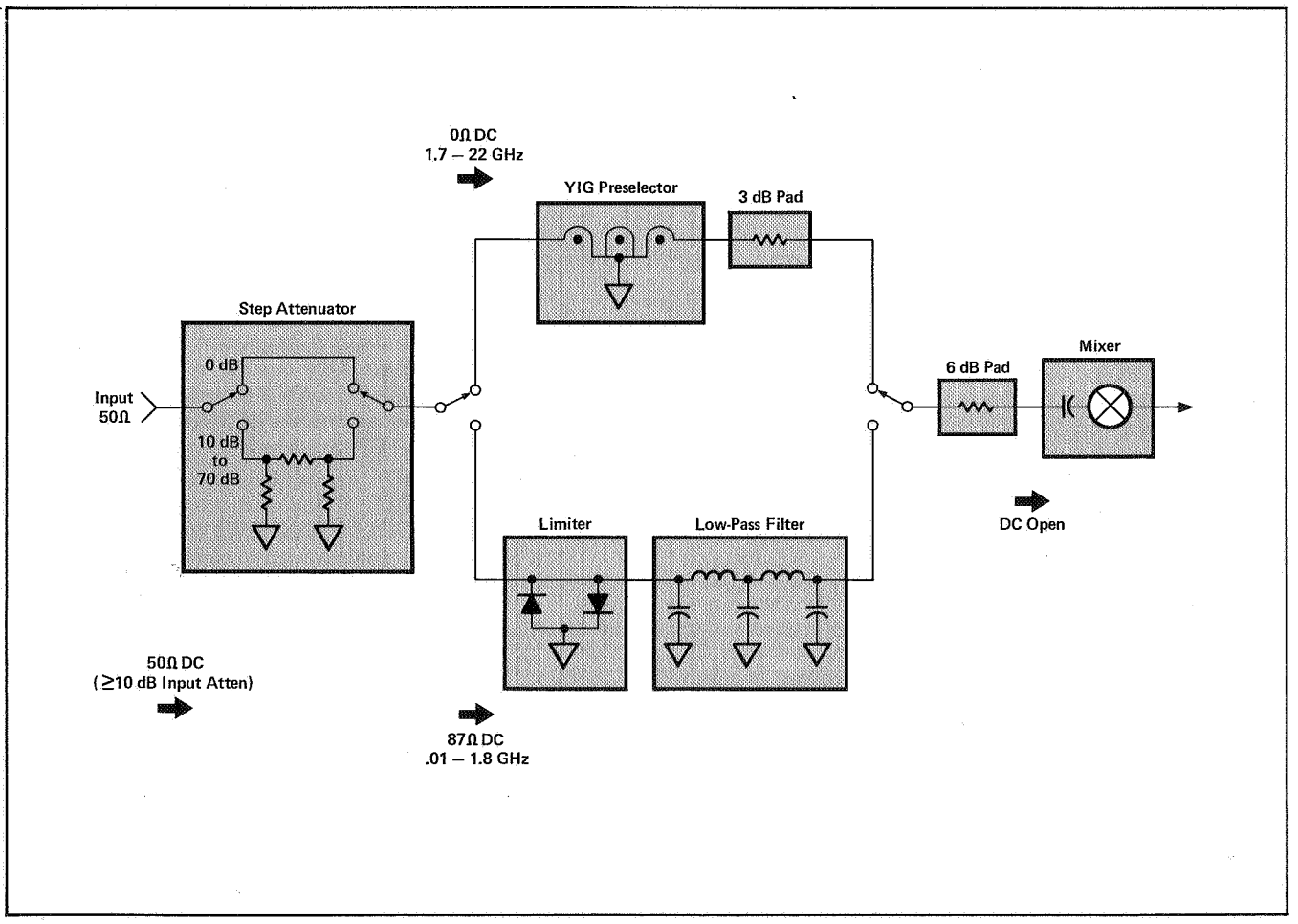


Figure 40. DC block diagram

Appendix B
CONTROL GLOSSARY

FRONT PANEL

1. **LINE:** AC line switch. Turns instrument ON-OFF.
2. **ASTIG:** Used with FOCUS to obtain smallest spot size on CRT.
3. **TRACE ALIGN:** Rotates trace about center of CRT.
4. **HORIZ POSN:** Adjusts horizontal position of CRT trace.
5. **VERT POSN:** Adjusts vertical position of CRT trace.
6. **ERASE:** Removes trace from CRT. Operates in WRITE mode only.
7. **WRITE:** Allows CRT to write with variable persistence. Used for most applications.
8. **PERSIST:** Adjusts fade rate of trace in WRITE mode. Used to eliminate trace flickering.
9. **CONV:** Conventional (non-storage, short persistence) CRT display. Useful for observing fast sweeps in ZERO SPAN.
10. **INTENSITY:** Adjusts brightness of CRT trace.
11. **STORE:** Retains CRT trace at reduced intensity for photography or extended viewing. CRT does not write or erase in STORE mode. FREQUENCY readout is frozen.
12. **STORE INTEN:** Adjusts stored trace intensity for photography or viewing. Minimum intensity yields longest storage time.
13. **SCALE:** Sequentially erases trace, blanks CRT, and turns on scale illumination for photography. FREQUENCY readout is frozen.
14. **SCALE INTEN:** Adjusts scale illumination for photography.
15. **FOCUS:** Adjusts sharpness of CRT trace.
16. **BASELINE CLIPPER:** Adjusts the vertical level below which the CRT is blanked. Helps prevent blooming by blanking the bright baseline of area of CRT. Especially useful for pulsed RF and transient signals.
17. **CAL OUTPUT:** An internal 100 MHz, −10 dBm calibration signal.
18. **SIG IDENT:** Used to verify frequency of unknown signals. With FREQUENCY SPAN/DIV at 1 MHz, correct response will shift two divisions to the left and be lower in amplitude. Especially useful in EXT MIXER bands or when small signals present with large signals (ratio ≥70 dB). Note: SIG IDENT does not properly identify internal 100 MHz CAL OUTPUT signal.
19. **VIDEO FILTER:** Selects post-detection, low-pass filters which smooth the trace by averaging random noise. The VIDEO FILTER bandwidth is equal to the RESOLUTION BW times the factor indicated on the control knob. The NOISE AVG position is a fixed 1 Hz low-pass filter used for noise measurements only.
20. **FREQ CAL:** Calibrates the FREQUENCY readout to a known frequency reference.
21. **FREQUENCY:** Displays the tuned center frequency of analyzer in PER DIV and ZERO SPAN. In full-band modes, display reads frequency at the tuning marker.
22. **FREQUENCY BAND:** Selects frequency range.
23. **TUNING:** Tunes center frequency of analyzer or positions marker in full-band modes. Coarse tuning provided by large knob; push for *normal* and pull for *rapid*. Smaller knob provides FINE tuning.
24. **PRESELECTOR PEAK:** Adjusts tracking of internal YIG preselector. Normally centered in green area for best broadband performance from 1.7 to 22 GHz. Used to maximize signals for more accurate amplitude measurements.
25. **AUTO STABILIZER:** Analyzer is automatically stabilized for narrow frequency spans (≤100 kHz/DIV). In stabilized mode, light is on and only FINE tuning should be used. Pushbutton switch (when depressed) disables AUTO STABILIZER to allow coarse tuning in narrow spans.
26. **FREQUENCY SPAN/DIV:** Selects CRT horizontal frequency calibration in PER DIV mode. Each major division on CRT (total of 10) represents frequency span selected.
27. **RESOLUTION BW:** Selects analyzer 3 dB IF bandwidth. Optimum resolution bandwidth for any frequency span automatically selected when markers are aligned (▶ ◀) and controls pushed in to couple. RESOLUTION BW can also be coupled at settings other than OPTIMUM or it can be operated independently (uncoupled).
28. **FREQUENCY SPAN MODE:** Selects desired span mode.
    a. **ZERO SPAN:** Analyzer operates as a manually-tuned receiver to display detector output in time domain. The SWEEP TIME/DIV control is a calibrated time base when switched out of AUTO position.
    b. **PER DIV:** Allows FREQUENCY SPAN/DIV control to select desired frequency span. With FREQUENCY SPAN/DIV control in F (full band), entire FREQUENCY BAND selected is displayed. A tuning marker, selectable RESOLUTION BW, and VIDEO FILTER are available in the F position.
    c. **FULL BAND:** Spans the entire FREQUENCY BAND selected. A tuning marker is available and 3 MHz RESOLUTION BW and 0.003 VIDEO FILTER are automatically selected.
    d. **1.7 - 22 GHz SPAN:** Analyzer spans 1.7 to 22 GHz in one sweep. A tuning marker is available and 3 MHz RESOLUTION BW and 0.003 VIDEO FILTER are automatically selected.
29. **REFERENCE LEVEL:** Controls power level (in dBm) represented by top graticule line of CRT. Adjustable in calibrated 10 dB steps with continuous calibrated 0 to −12 dB FINE vernier.
30. **INPUT ATTEN:** Push and turn to select desired RF input attenuation indicated by blue numbers. Yellow outlined numbers indicate MAXIMUM input level for <1 dB signal compression. A reminder light indicates ZERO dB input attenuation. (≥10 dB INPUT ATTEN provides best input match).

31. **AMPLITUDE SCALE:** Selects log (dB/DIV) or linear vertical scale calibration. REFERENCE LEVEL remains constant at top graticule line.

32. **REF LEVEL CAL:** Calibrates REFERENCE LEVEL to a known amplitude reference.

33. **SWEEP SOURCE:** Selects desired sweep source.
    a. **MAN:** Sweep controlled with MANUAL SWEEP knob.
    b. **EXT:** Allows analyzer to be swept with external source.
    c. **INT:** Analyzer sweeps repetitively with internal source. Synchronization selected by SWEEP TRIGGER.

34. **SWEEP TRIGGER:** Selects desired trigger source for INT sweep.
    a. **FREE RUN:** Sweep triggered repetitively by internal source.
    b. **LINE:** Sweep triggered by ac line frequency.
    c. **VIDEO:** Sweep internally triggered by detected waveform of RF signal. Normally used for time domain analysis in ZERO SPAN.
    d. **EXT:** Sweep triggered by external signal.
    e. **SINGLE:** Sweep triggered by START/RESET pushbutton.
    f. **START/RESET:** Dual function pushbutton; can start a single sweep or reset *any* internal sweep back to left edge of CRT.
    g. **TRIGGER LEVEL:** Adjusts trigger level in VIDEO or EXT trigger mode. DC coupled, positive slope triggering. In VIDEO, + or − indicates trigger level relative to center horizontal graticule line.
    h. **SWEEP:** Light is on while analyzer is sweeping.

35. **SWEEP TIME/DIV:** Selects time required to sweep one major horizontal division on CRT. AUTO position automatically selects proper sweep time as a function of FREQUENCY SPAN/DIV, RESOLUTION BW, and VIDEO FILTER settings to maintain a calibrated amplitude display. AUTO feature is retained when FREQUENCY SPAN/DIV and RESOLUTION BW are uncoupled. Control is calibrated time base when switched out of AUTO. Sweep times $\leq$1 msec/DIV are used for time domain analysis (ZERO SPAN) only.

36. **INPUT 50Ω:** Type N female connector with 50Ω input impedance. Used for signals from 0.01 to 22 GHz. CAUTION: Maximum input is +30 dBm (1 watt) and 0 volts DC. (See Operating Precautions.)

37. **EXT MIXER:** Input/output port for use with HP 11517A External Mixer. Used for measurements from 14.5 to 40 GHz in waveguide. The BNC connector supplies LO signal and DC bias to external mixer and receives IF signal from mixer. Terminate in 50Ω load when not in use. CAUTION: Maximum input level to HP 11517A is 0 dBm (1 mW).

38. **EXT MIXER BIAS:** Controls amount of dc bias to HP 11517A mixer diode. Adjust to maximize signal amplitude.

39. **INFORMATION CARD:** Pull out to use. Card provides basic HP 8565A operating instructions and reference information.

40. **CRT BEZEL READOUT:** Displays all major spectrum analyzer settings.

REAR PANEL

41. **HORIZONTAL SWEEP OUTPUT** (X-axis): A −5 V to +5 V output which is proportional to horizontal CRT deflection from left to right, respectively. 0.0 V corresponds to center of CRT. Output impedance is 5 kΩ. Used for driving horizontal channel of X-Y recorder or other external monitors.

42. **VERTICAL OUTPUT** (Y-axis): A 0 to +0.8 V detected video output which is proportional to vertical deflection on CRT. 0 V corresponds to bottom graticule line and +0.8 V corresponds to top graticule line. Output impedance is 50Ω. Used for driving vertical channel of X-Y recorder or other external monitors. Also useful in ZERO SPAN for listening to detected output with headphones.

43. **BLANK OUTPUT (PENLIFT)** (Z-axis): A 0 or +15 V output which corresponds to CRT blanking during retrace and oversweeping of band edges. During unblank period (pen down) output is 0 V with 10Ω output impedance. Caution: Maximum current sink 150 ma. During blank (pen up) output is +15 V with 10 kΩ output impedance. Used to control pen lift of X-Y recorder or blanking of other external monitor.

44. **EXT SWEEP INPUT:** With SWEEP SOURCE in EXT, a 0 to +10 V ramp will sweep analyzer across frequency span selected. Caution: Maximum input level is ±40 V. Input impedance is 100 kΩ.

45. **EXT TRIGGER INPUT:** With SWEEP TRIGGER in EXT, a positive voltage >1 V will trigger internal sweep source. TRIGGER LEVEL adjusts point (from 1 to 10 V) on trigger waveform which starts sweep. DC coupled, positive-slope triggering. Caution: Maximum input is ±40 V. Input impedance is 100 kΩ.

46. **BLANKING INPUT:** Permits external blanking control of CRT. TTL compatible; high (>2 V) blanks CRT, low (<0.5 V) or an open circuit retains normal CRT operation. Caution: Maximum input is ±40 V. Input impedance is 10 kΩ.

47. **1ST LO OUTPUT:** A 2.0 to 4.46 GHz, +8 dBm nominal output coupled from first local oscillator. Terminate with 50Ω load when not in use. (See Appendix D for information on LO for each FREQUENCY BAND.)

48. **21.4 MHz IF OUTPUT:** A 21.4 MHz output linearly related to the RF input to analyzer. Bandwidth controlled by analyzer RESOLUTION BW setting. Amplitude controlled by INPUT ATTEN, REF LEVEL FINE and first six REFERENCE LEVEL step gain positions (0 to −50 dBm with 0 dB INPUT ATTEN). Output is approximately −10 dBm for full-scale signals on CRT. Output impedance is 50Ω.

49. **AUX A:** Interconnection jack for interfacing HP 8750 Storage-Normalizer to analyzer.

50. **AUX B:** Interconnection jack for factory calibration of analyzer.

51. **POWER LINE MODULE:** Line voltage selector card allows choice of 100, 120, 220, or 240 volts (+5%, −10%). Line fuse contained in power line module. Warning: A 2 amp normal blow fuse must be used for 100 or 120 V operation and a 1 amp normal blow fuse must be used for 220 or 240 V operation.

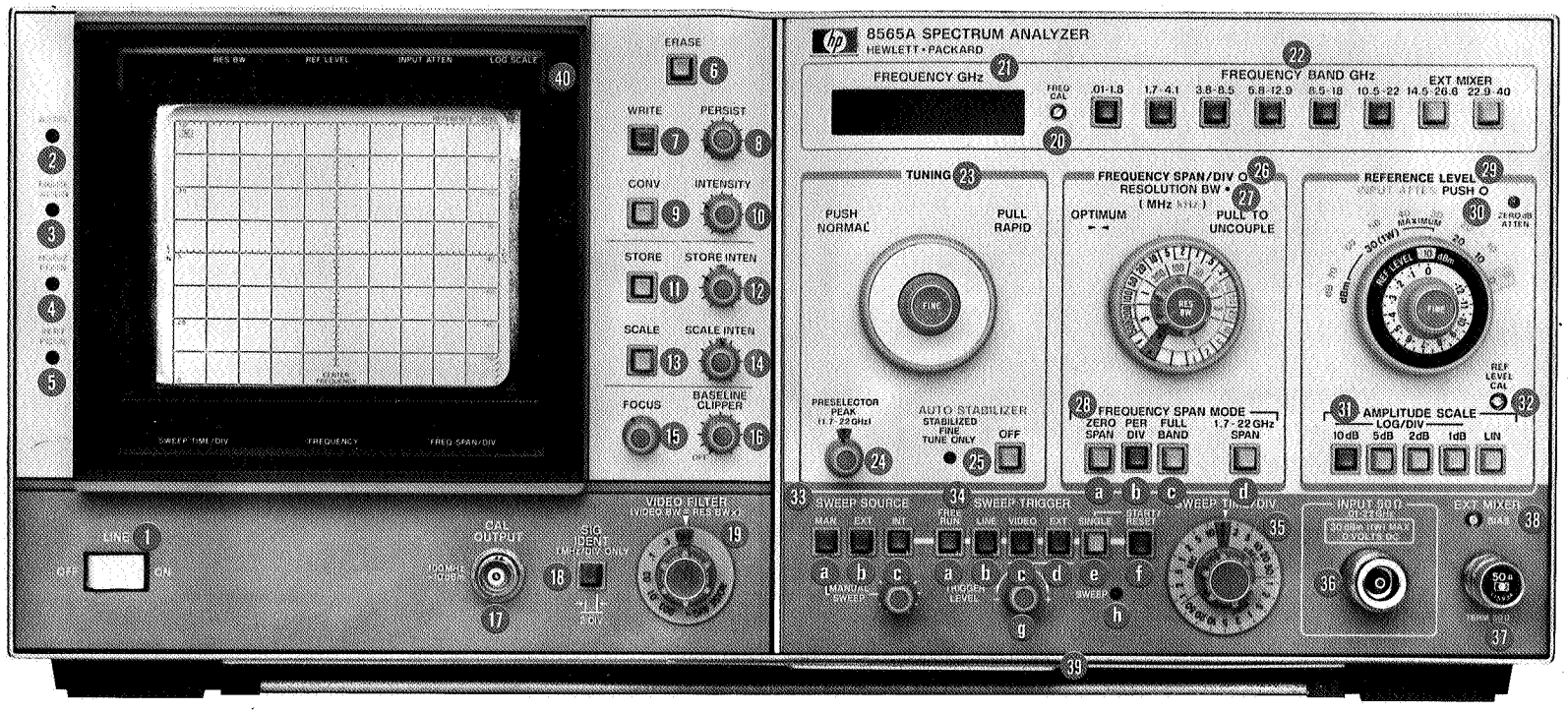


Figure 41. Front panel diagram

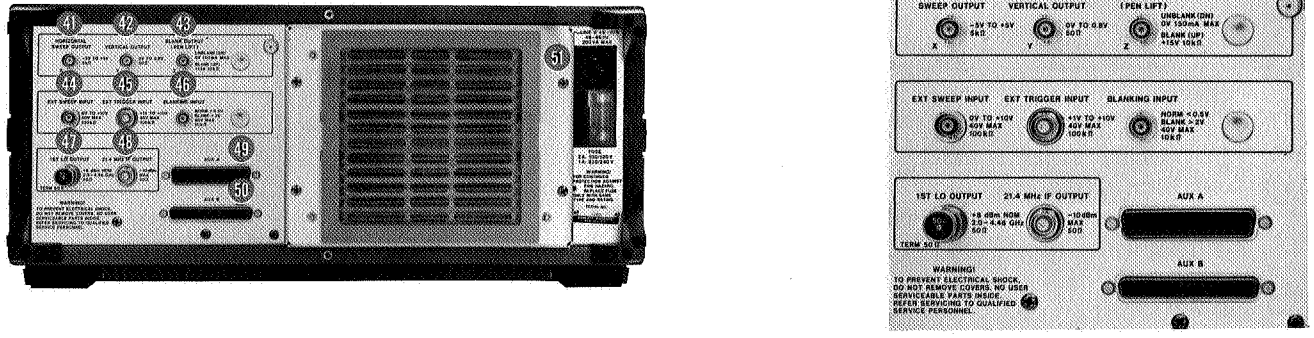


Figure 42. Rear panel diagram

Appendix C
FRONT PANEL ADJUSTMENT PROCEDURE

The Front Panel Adjustment optimizes the performance of the HP 8565A Spectrum Analyzer to obtain its specified accuracy. The following step-by-step procedure is recommended for adjusting the HP 8565A. A condensed procedure is also located on a pull-out INFORMATION CARD attached to the analyzer.

Table 4. Normal settings

Function	Setting
CRT DISPLAY	WRITE
BASELINE CLIPPER	OFF
FREQUENCY SPAN/DIV RESOLUTION BW	OPTIMUM (Push in to couple)
FREQUENCY SPAN MODE	PER DIV
AMPLITUDE SCALE	10 dB/DIV
VIDEO FILTER	OFF
SWEEP SOURCE	INT
SWEEP TRIGGER	FREE RUN
SWEEP TIME/DIV	AUTO
PRESELECTOR PEAK	Center in green area

PRE-ADJUSTMENT SETTINGS

1. Set Normal Settings on analyzer (Table 1).
2. Set FREQUENCY BAND to 0.01 - 1.8 GHz □ .
3. Set FREQUENCY SPAN/DIV to 0.2 MHz (200 kHz).
4. Set INPUT ATTEN to 10 dB.
5. Set REFERENCE LEVEL to −10 dBm and REF LEVEL FINE to 0 dB.
6. Set AMPLITUDE SCALE to LIN □ .

DISPLAY ADJUSTMENTS

1. Adjust VERT POSN ⊘ to place the CRT trace on a horizontal graticule line near center of CRT.
2. Reduce INTENSITY and depress both INT ▣ and EXT □ SWEEP SOURCE to produce a dot on the CRT. Caution: Leaving a dot on the CRT for prolonged periods at high intensity may burn the phosphor.
3. Adjust ASTIG ⊘ and FOCUS for the smallest round dot.
4. Adjust HORIZ POSN ⊘ to center dot on the CRT. Reset to INT ▣ SWEEP SOURCE.
5. Adjust TRACE ALIGN ⊘ so that the trace is parallel to a horizontal graticule line.
6. Adjust VERT POSN ⊘ to re-position baseline on the bottom graticule line.

FREQUENCY ADJUSTMENT

Connect 100 MHz CAL OUTPUT signal to INPUT and center signal on CRT with TUNING control. Adjust FREQ CAL ⊘ to indicate 0.100 GHz on FREQUENCY readout.

AMPLITUDE ADJUSTMENT

Set AMPLITUDE SCALE to 1 dB/DIV □ .

Adjust REF LEVEL CAL ⊘ to position the peak of the signal on the REFERENCE LEVEL (top graticule line) of the CRT.

Once the Front Panel Adjustment Procedure is completed, the CRT display should look similar to Figure 43.

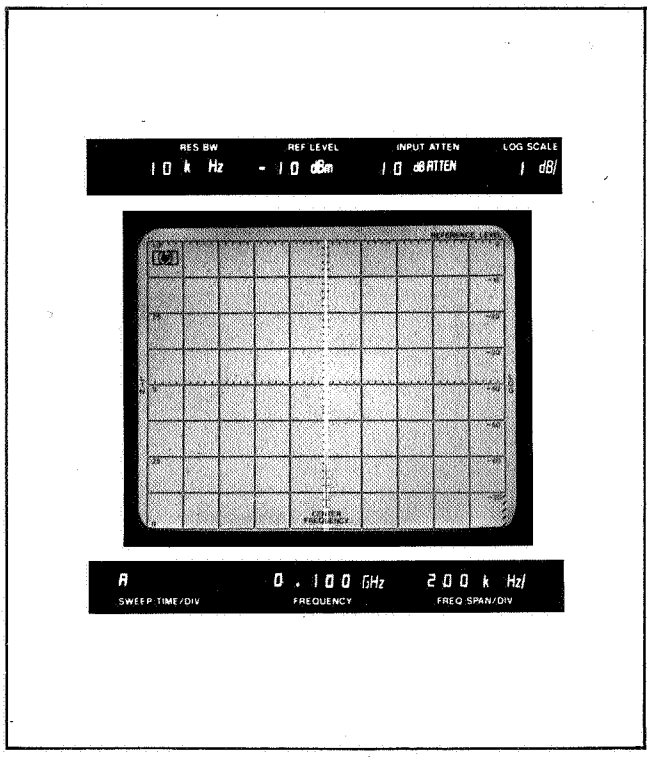


Figure 43. CAL OUTPUT signal

Reset the AMPLITUDE SCALE to 10 dB/DIV ▣ . The HP 8565A is now calibrated for absolute frequency and amplitude measurement.

Appendix D
THEORY OF OPERATION

SYSTEMS DESCRIPTION

The HP 8565A Spectrum Analyzer is basically an electronically-swept superheterodyne receiver. It has high sensitivity and selectivity, a wide distortion-free dynamic range, and excellent flatness from 10 MHz to 22 GHz. With external mixing, frequency coverage can be extended up to 40 GHz. The HP 8565A consists of an RF and IF section, an automatic stabilization and control section, and a display section. Each of these sections will be discussed separately in this appendix. A simplified block diagram (Figure 44) is shown below for reference.

RF SECTION

The RF section is composed of a 0-70 dB step attenuator, an automatic preselector, a tunable local oscillator (LO), and a broadband mixer. The step attenuator at the input to the spectrum analyzer is used to control the signal level to the mixer for optimum dynamic range and signal-noise ratio. The automatic preselector consists of a low-pass filter from 0.01 to 1.8 GHz and a YIG-tuned filter (YTF) from a 1.7 to 22 GHz. Coaxial switches are used to switch to the proper filter depending on frequency band chosen. The automatic preselector eliminates most image, multiple, and spurious responses of the analyzer and thus enhances its dynamic range. A transistorized YIG-tuned oscillator (YTO) with a fundamental tuning range of 2.05 to 4.46 GHz is used as the LO in this superheterodyne system.

The basic frequency conversion equation for a heterodyne system is given by equation 1:

(1): $f_s = f_{lo} \pm f_{if}$

where: f_s = signal frequency

f_{lo} = local oscillator frequency

f_{if} = intermediate frequency

The first IF in the HP 8565A is set at 321.4 MHz and the first LO sweeps from 2.0 to 4.46 GHz. Therefore, from equation 1, f_s would cover approximately 1.68 to 4.14 GHz in fundamental operation. With harmonic mixing, given by equation 2:

(2): $f_s = nf_{lo} \pm f_{if}$

where:

n (harmonic number) = 1–, 2–, 3–, 4+, 5+, 6+, 10+

the frequency range is extended to 40 GHz. Each harmonic number creates a tuning curve which is illustrated in Figure 45, page 28. Signal frequencies from 0.01 to 1.8 and 1.7 to 22 GHz are converted to a 2050 MHz and 321.4 MHz IF respectively with the broadband internal mixer. In the 1.7 to 22 GHz frequency range, the YIG-tuned filter tracks a particular tuning curve and thus eliminates spurious responses resulting from harmonic mixing. From 14.5 to 40 GHz, an external waveguide mixer is used to convert the input signals to a 2050 MHz IF which is then further processed by the analyzer.

AUTOMATIC STABILIZATION SECTION

Many factors can limit the resolution of the spectrum analyzer. Among these are the local oscillator's stability and spectral purity, and the IF filter's bandwidth and shape factor. Of these limitations, the most significant one for microwave analyzers is usually the stability (residual FM or drift) of an oscillator. For this reason, the HP

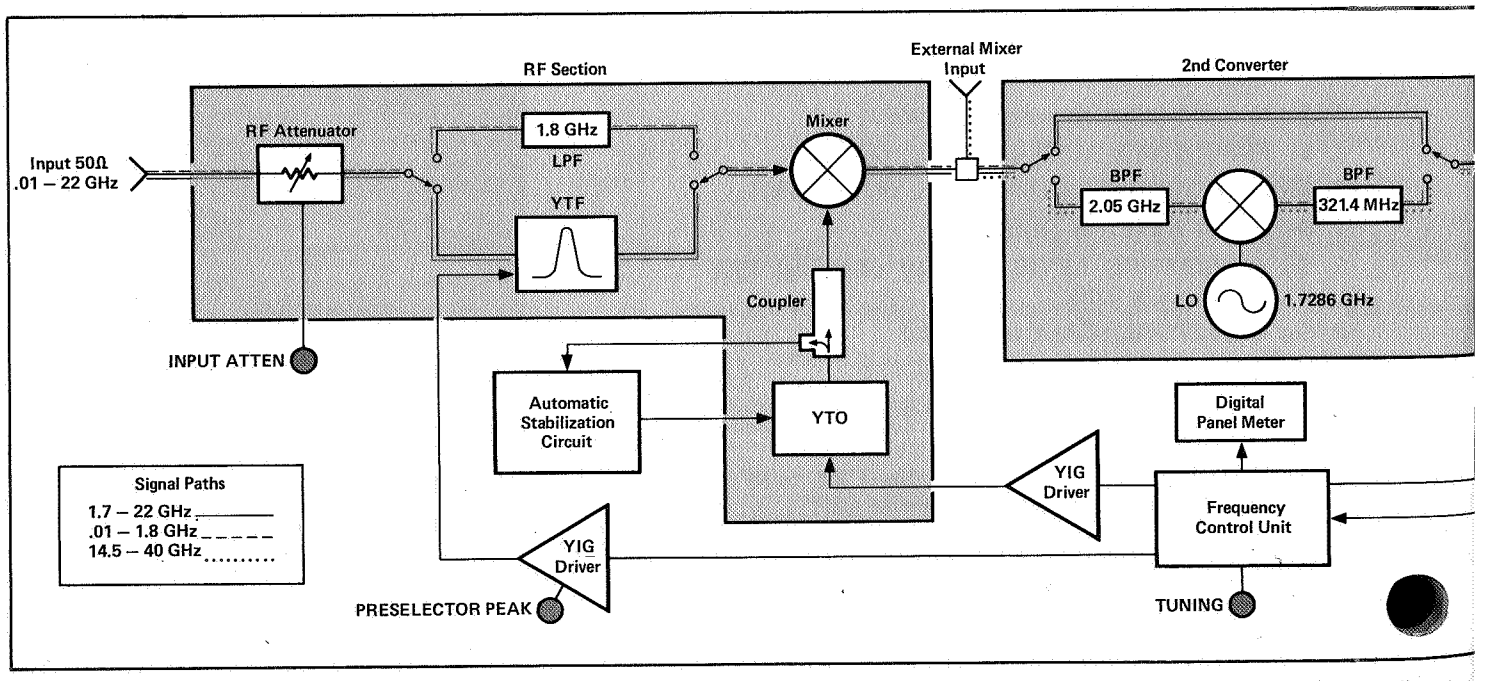


Figure 44. HP 8565A block diagram

8565A utilizes an automatic stabilization circuit that locks the YTO to a 1 MHz crystal reference oscillator. The lock is automatically engaged when frequency spans of 100 kHz/DIV or less are selected. The AUTO STABILIZER can be disabled by a pushbutton switch located on the front panel. An added feature to the automatic stabilization circuit is the use of offset compensation to maintain the signal of interest fixed on the CRT during stabilization. The circuit is designed such that the YTO is not moved when it is locked to the reference oscillator. Since there is no frequency shift in the YTO, the displayed signal will not shift either. This eliminates the need for the user to retune the signal on the CRT once it has been stabilized.

IF SECTION

The IF section consists of components in the signal path after the first mixer. The output from the first mixer is either 321.4 MHz or 2050 MHz. Signals at 321.4 MHz bypass the second converter whereas a 2050 MHz signal would mix with the second LO at 1.7286 GHz to also produce a 321.4 MHz IF. At the third converter, the 321.4 MHz IF is amplified, filtered, and mixed with the third LO at 300 MHz to produce a final IF of 21.4 MHz. The output of the third converter goes to a variable gain amplifier, selectable bandpass filters, variable gain logarithmic, and linear amplifiers, and is then detected. The detected video signal goes through a selectable video filter and a vertical amplifier to be processed for the display. The IF bandpass filter, log and linear amplifiers, and video filter are all controllable from the front panel of the spectrum analyzer.

DISPLAY SECTION

The sweep voltage that is used to tune the YTO is simultaneously applied to the horizontal deflection amplifiers in the CRT. The video output of the IF section is then synchronously applied to the vertical deflection amplifier and a plot of frequency vs. amplitude results on the CRT.

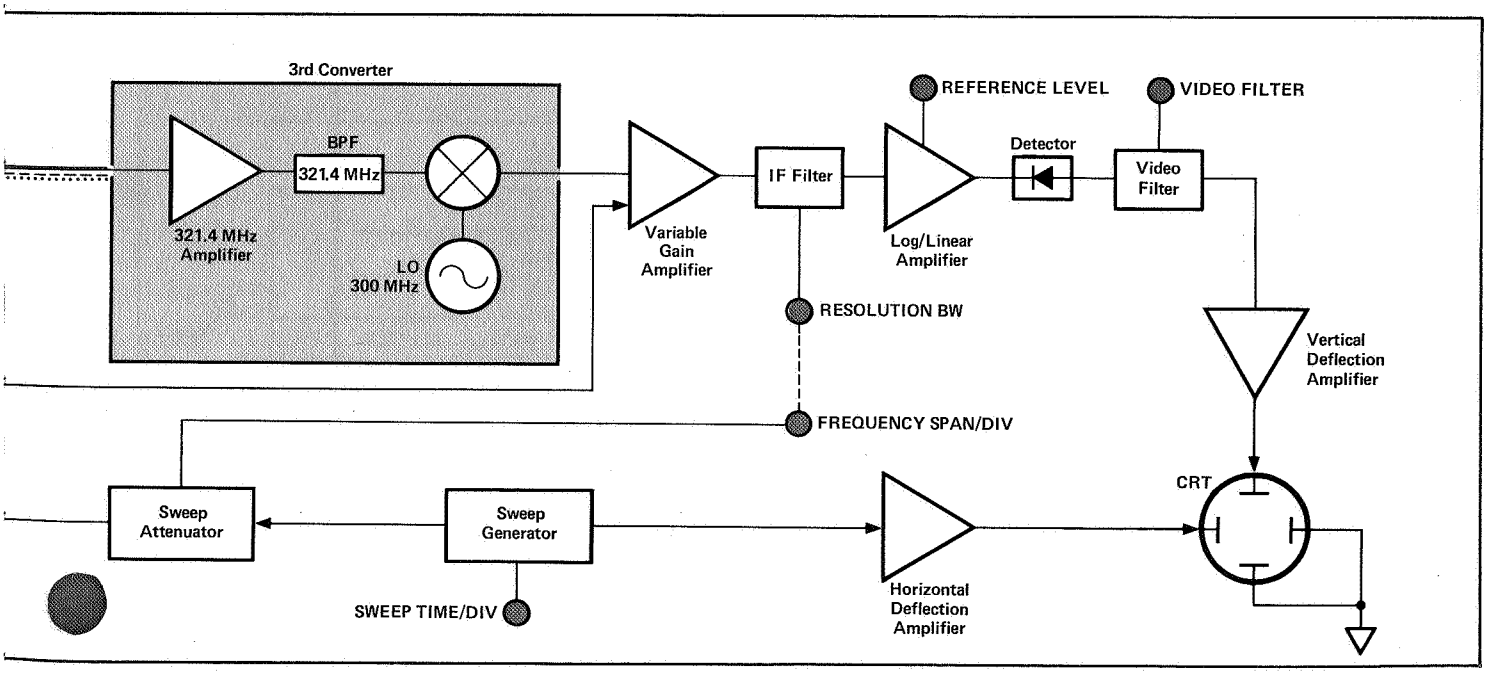
LED's are embedded in the CRT bezel to allow easy readout of control settings and also to extend the usefulness of CRT photography. The CRT bezel readout displays all pertinent information related to the amplitude, frequency, and sweep time of the analyzer.

Because some combinations of resolution bandwidth, frequency span, and video filtering require slow sweep times, a variable persistence CRT is used to provide a flicker-free display of the signal. The CRT also has storage capability which is useful for extended viewing or photography.

TUNING CONTROL SECTION

The tuning control section contains the Frequency Control Board, YIG driver, Digital Panel Meter (DPM), sweep attenuator, and sweep generator.

The sweep generator provides a sweep voltage that is simultaneously applied to the horizontal deflection amplifier and the sweep attenuator. The sweep attenuator, controlled by the FREQUENCY SPAN/DIV control, reduces the sweep voltage to the Frequency Control Board to maintain a calibrated horizontal scale on the CRT. In addition, the tuning control voltage, which sets the center frequency of the analyzer, is also applied to the Frequency Control Board. The tuning control voltage and the sweep attenuator voltage are summed and scaled in the Frequency Control Board. The resultant signal is then applied to the YIG drivers. Both the YTF and the YTO have separate YIG drivers which are basically voltage-to-current converters. A preselector peak adjustment is used to control the offset of the YTF's YIG driver circuit. It is adjusted to eliminate any amplitude uncertainty due to mis-tracking between the YTF and the YTO. A DPM readout displays the frequency represented by the center of the CRT display.



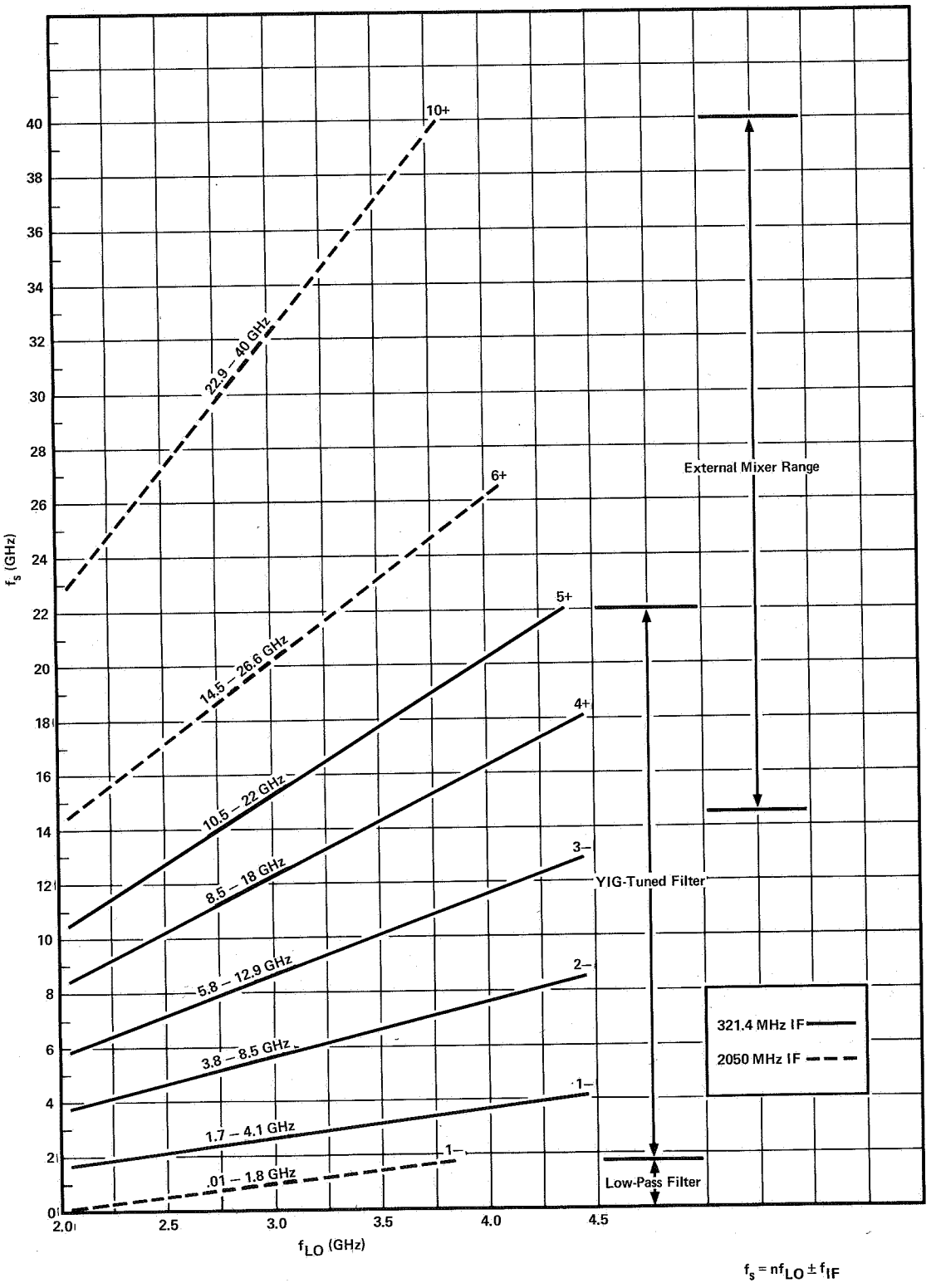


Figure 45. HP 8565A tuning curves

Appendix E
AMPLITUDE CONVERSIONS

The HP 8565A Spectrum Analyzer reads signal levels in dBm. The following equations allow conversion from dBm to dBmV or dBμV in a 50 Ω system.

CONVERSION EQUATIONS

$$\text{dBm} + 107\ \text{dB} = \text{dB}\mu\text{V}$$
$$\text{dBm} + 47\ \text{dB} = \text{dBmV}$$
$$\text{dBmV} + 60\ \text{dB} = \text{dB}\mu\text{V}$$

If it is desired to convert from logarithmic units to linear units, then the equations given below will be useful. Keep in mind that the logarithmic levels are all referenced to linear units.

i.e., 0 dBm referenced to 1 mw
0 dBmV referenced to 1 mV
0 dBμV referenced to 1 μV

Therefore, to calculate a linear level, simply take the antilog of the logarithmic level.

dBm to P(mW)

$$\text{dBm} = 10 \log \frac{P}{1\ \text{mW}},\ P = \log^{-1} \frac{\text{dBm}}{10}$$

dBmV to V(mV)

$$\text{dBmV} = 20 \log \frac{V}{1\ \text{mV}},\ V = \log^{-1} \frac{\text{dBmV}}{20}$$

dBμV to V(μV)

$$\text{dB}\mu\text{V} = 20 \log \frac{V}{1\ \mu\text{V}},\ V = \log^{-1} \frac{\text{dB}\mu\text{V}}{20}$$

Figure 46 below converts from dBm to voltage in a 50 Ω system.

Conversion from dBm to volts can be made whether the AMPLITUDE SCALE is in LOG/DIV or LINear. To read voltage on the HP 8565A, position the signal on the REFERENCE LEVEL line of the CRT. Read the REF LEVEL in dBm and find its equivalent voltage from the Conversion Chart.

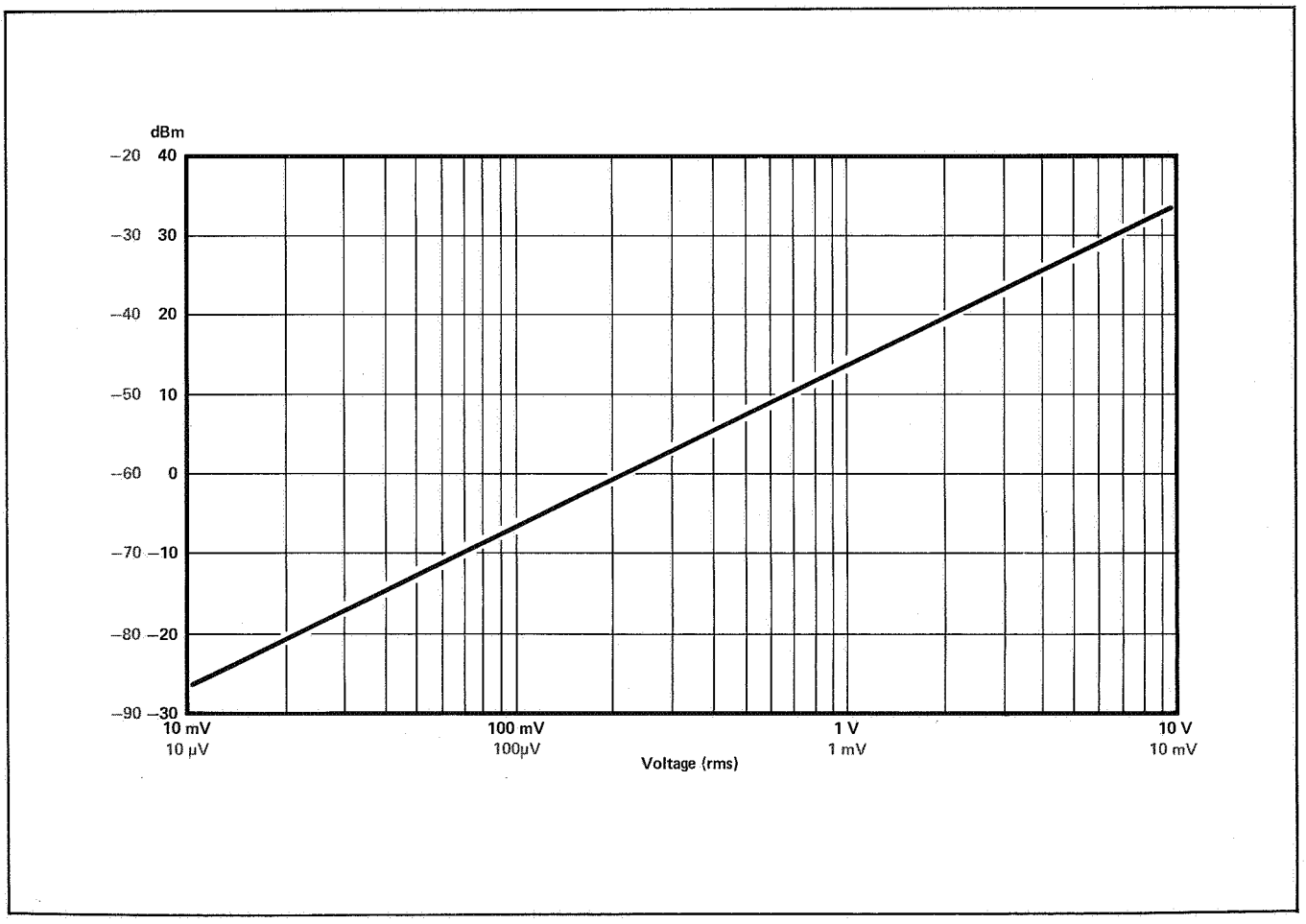


Figure 46. Conversion chart—converts from dBm to voltage in 50 Ω

SECTION IV
PERFORMANCE TESTS

4-1. INTRODUCTION

4-2. The procedures in this section test the electrical performance of the instrument using the specifications of Table 1-1 as the performance standards. Performance tests are designed to verify each specification in Table 1-1. All tests can be performed without access to the interior of the instrument.

4-3. The performance test procedures must be performed in the sequence given, since some procedures rely on satisfactory test results in preceding steps. If a test measurement is marginal, go to Section V and perform adjustment procedures. If a function fails to operate, go to Section VIII and perform troubleshooting.

NOTE

To ensure that the 8565A meets specifications listed in Table 1-1, Performance Tests should be performed every six months.

4-4. EQUIPMENT REQUIRED

4-5. Equipment required for the performance tests is listed in the Recommended Test Equipment, Table 1-3, in Section I. Any equipment that satisfies the critical specifications given in the table may be substituted for the recommended model.

4-6. ABBREVIATED PERFORMANCE VERIFICATION

4-7. The Incoming Inspection Tests of Section II are designed to test only the most critical specifications and operating features of the instrument. The Incoming Inspection Tests require much less time and equipment than the complete Performance Tests in this section and are recommended for verification of overall instrument operation after repair.

PERFORMANCE TESTS

NOTE

Allow one hour warm-up time for 8565A Spectrum Analyzer and perform the front-panel adjustments described on the pull-out card (located under the instrument) before beginning Performance Tests.

4-8. TUNING ACCURACY TEST

SPECIFICATION

Overall tuning accuracy of the digital Frequency readout in any span mode:

Internal Mixing:

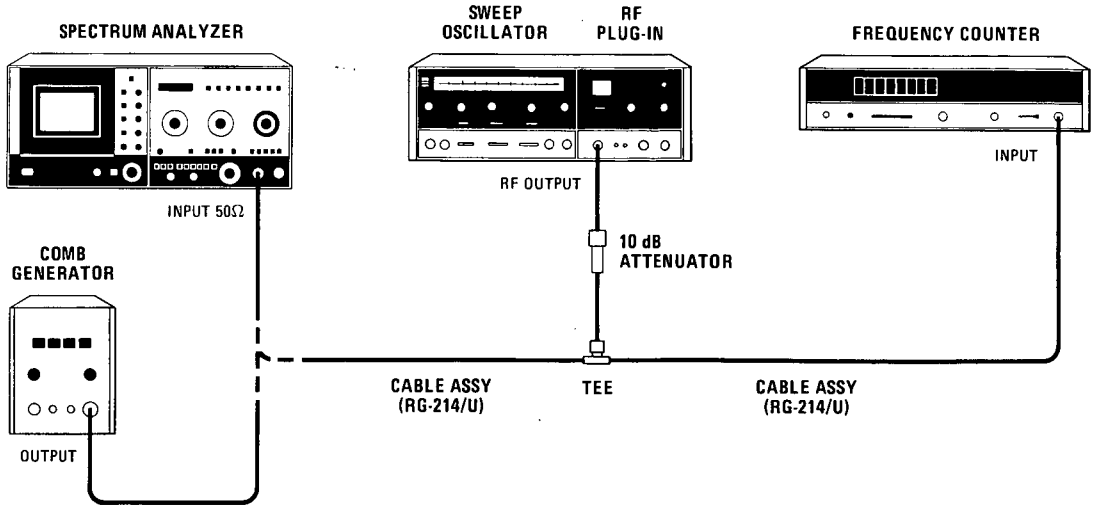
.01 to 2.5 GHz < ± 5 MHz ± 20% of FREQUENCY SPAN/DIV.
2.5 to 22 GHz < ± 0.2% ±20% of FREQUENCY SPAN/DIV.

External Mixing:

14.5 to 40 GHz < ± 0.7% of FREQUENCY SPAN/DIV.

4-8. TUNING ACCURACY TEST (Cont'd)

CONFIGURATION A



CONFIGURATION B

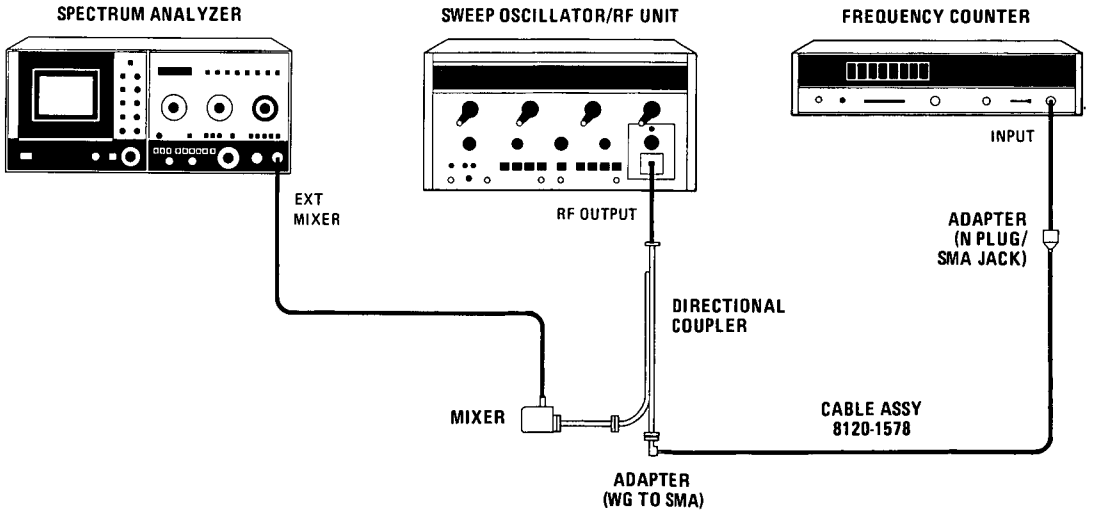


Figure 4-1. Tuning Accuracy Test Setup

4-8. TUNING ACCURACY TEST (Cont'd)

DESCRIPTION:

A comb generator is used to check the tuning accuracy in the low frequency bands (.01 GHz to 4.1 GHz; internal mixing). In the higher frequency bands (3.8 GHz to 22 GHz, internal mixing, and 14.5 GHz to 40 GHz, external mixing) a sweep oscillator is used and the frequencies are accurately tuned using a frequency counter. The signal, in each case, is tuned to the center graticule line of the spectrum analyzer using the TUNING control. The tuning accuracy is then indicated by the FREQUENCY readout.

In the two external mixing bands (14.5 — 26.6 GHz and 29.9 — 40 GHz) the tuning accuracy is checked at 23 GHz. An external mixer is used and the EXTernal MIXER BIAS is adjusted to produce the highest displayed signal level.

EQUIPMENT:

Sweep Oscillator/RF Plug-in	HP 8620C/86290A
Sweep Oscillator/RF Unit	HP 8690B/8696A
Frequency Counter	HP 5340A Opt. H10
Comb Generator	HP 8406A
Mixer	HP 11517A
Adapter, K-band to R-band	HP 11519A
Adapter, Waveguide to SMA Jack	Narda 4608
Directional Coupler (10 dB)	HP K752C
10 dB Attenuator	HP 8491B Opt. 010
Cable Assembly, SMA Plugs	HP 8120-1578
Cable Assembly, RG-214/U with Type N Connectors (2 required)	HP 11500A

PROCEDURE:

.01 to 4.1 GHz FREQUENCY BANDs (Internal Mixing):

a. Set spectrum analyzer controls as follows:

Set all Normal Settings (controls marked with green)	
FREQUENCY BAND GHz	.01 — 1.8
INPUT ATTEN	10 dB
REF LEVEL	−10 dBm
REF LEVEL FINE	0
RESOLUTION BW	Coupled (pushed in)
FREQUENCY SPAN/DIV	1 MHz

b. Connect 100 MHz CAL OUTPUT signal to INPUT 50Ω of spectrum analyzer and center signal on CRT with TUNING control.

c. Adjust FREQ CAL to indicate 0.100 GHz on FREQUENCY readout.

d. Connect equipment as shown in Configuration A of Figure 4-1 with comb generator connected to INPUT of spectrum analyzer.

4-8. TUNING ACCURACY TEST (Cont'd)

e. Set comb generator for 10 MHz comb output. Adjust spectrum analyzer TUNING control for an indication of 0.010 GHz on FREQUENCY readout.

f. Set 10 MHz comb tooth on center graticule line using TUNING control. FREQUENCY readout should indicate:

Min.	Actual	Max.
.005 GHz	_____	.015 GHz

g. Set comb generator for 100 MHz comb output. Adjust spectrum analyzer TUNING control for an indication of 1.000 GHz on FREQUENCY readout.

h. Set 1 GHz comb tooth on center graticule line using TUNING control. FREQUENCY readout should indicate:

Min.	Actual	Max.
.995 GHz	_____	1.005 GHz

i. Adjust spectrum analyzer TUNING control for an indication of 1.800 GHz on FREQUENCY readout.

j. Set 1.8 GHz comb tooth on center graticule line using TUNING control. FREQUENCY readout should indicate:

Min.	Actual	Max.
1.795 GHz	_____	1.805 GHz

k. Set spectrum analyzer FREQUENCY BAND GHz to 1.7 — 4.1. Adjust TUNING control for an indication of 1.700 GHz on FREQUENCY readout (pull for rapid tuning).

l. Set 1.7 GHz comb tooth on center graticule line using TUNING control. FREQUENCY readout should indicate:

Min.	Actual	Max.
1.695 GHz	_____	1.705 GHz

m. Adjust spectrum analyzer TUNING control for an indication of 3.000 GHz on FREQUENCY readout. Set 3 GHz comb tooth on center graticule line using TUNING control. FREQUENCY readout should indicate:

Min.	Actual	Max.
2.994 GHz	_____	3.006 GHz

4-8. TUNING ACCURACY TEST (Cont'd)

n. Adjust spectrum analyzer TUNING control for an indication of 4.100 GHz on FREQUENCY readout. Set 4.1 GHz comb tooth on center graticule line using TUNING control. FREQUENCY readout should indicate:

Min.	Actual	Max.
4.092 GHz	_____	4.108 GHz

3.8 to 22 GHz FREQUENCY BANDs (Internal Mixing)

o. Disconnect comb generator from spectrum analyzer input. Connect sweep oscillator and frequency counter as shown in Configuation A of Figure 4-1.

p. Check tuning accuracy at frequencies listed in Table 4-1. Set each frequency using the frequency counter. Adjust spectrum analyzer TUNING control to position signal on center graticule line. Indication on FREQUENCY GHz digital readout must be within the test limits given in Table 4-1.

Table 4-1. Tuning Accuracy Test Limits, 3.8 to 22 GHz Bands

Spectrum Analyzer		RF Source	FREQUENCY GHz Digital Readout Test Limits	
FREQUENCY BAND GHz	FREQUENCY SPAN/DIV (MHz)	FREQUENCY (GHz)*	Min.	Max.
3.8 – 8.5	1	3.800	3.793	3.807
3.8 – 8.5	1	6.000	5.988	6.012
3.8 – 8.5	1	8.500	8.483	8.517
5.8 – 12.9	1	5.800	5.789	5.811
5.8 – 12.9	1	8.000	7.984	8.016
5.8 – 12.9	1	12.900	12.875	12.925
8.5 – 18	1	8.500	8.483	8.517
8.5 – 18	1	12.500	12.475	12.525
8.5 – 18	1	18.000	17.964	18.036
10.5 – 22	1	10.500	10.479	10.521
10.5 – 22	1	16.500	16.467	16.533
10.5 – 22	1	22.000**	21.956	22.044

*Frequency set to within ±.05%.

**Use HP 8690B/8696A with appropriate adapters in place of 8620C/86290A, Configuration A of Figure 4-1.

14.5 to 40 GHz FREQUENCY BANDs (External Mixing)

q. Connect equipment as shown in Configuration B of Figure 4-1.

r. Set sweep oscillator frequency for indication of 23.000 ±0.010 GHz on frequency counter.

4-8. TUNING ACCURACY TEST (Cont'd)

s. Set FREQUENCY SPAN/DIV to 10 MHz and press 14.5 — 26.6 FREQUENCY BAND GHz pushbutton on spectrum analyzer. Adjust TUNING control for an indication of 23.00 GHz on FREQUENCY readout.

t. Adjust EXT MIXER BIAS for greatest peak (peaking will occur in more than one position of BIAS control).

u. Set FREQUENCY SPAN/DIV to 1 MHz and identify 23 GHz signal using SIG IDENT. Adjust TUNING control to position 23 GHz signal on center graticule line. FREQUENCY readout should indicate:

Min.	Actual	Max.
22.84 GHz	_____	23.16 GHz

v. Set FREQUENCY SPAN/DIV to 10 MHz and press 22.9 — 40 FREQUENCY BAND GHz pushbutton. Adjust TUNING control for an indication of 23.00 GHz on FREQUENCY readout and repeat steps t and u.

4-9. SPAN WIDTH ACCURACY TEST

40
05
.20

SPECIFICATION:

The frequency error for two points on the display for spans from 500 MHz/div to 20 kHz/div (unstabilized) is less than ±5% of the indicated separation; for stabilized spans 100 kHz/div and less, the error is less than ±15%.

DESCRIPTION:

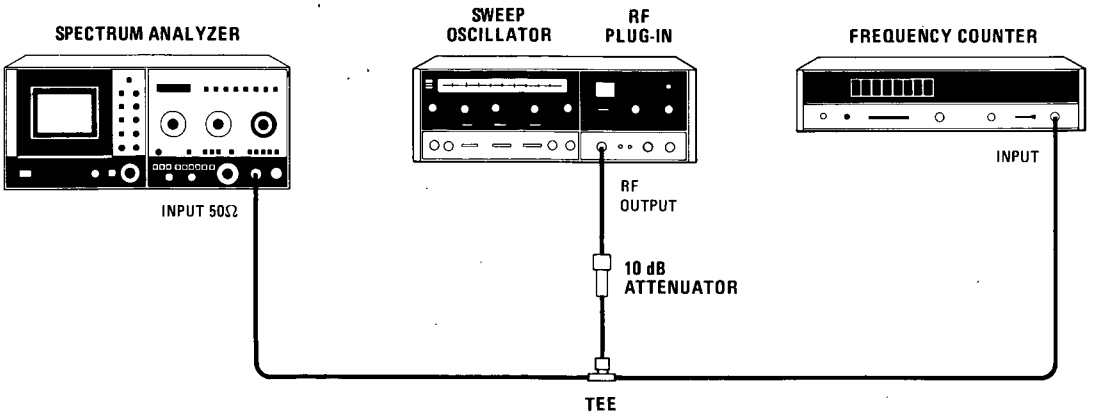
The 500 MHz per division and 200 MHz per division span widths are checked using a wide-band source and a frequency counter. The source is set to 7 GHz and the spectrum analyzer is tuned to place the signal at the far-left graticule line. The source is then tuned to 11 GHz and the span error for 500 MHz per division is checked at the eighth graticule line (not counting the far-left reference graticule line). The 200 MHz per division span width accuracy is checked in the same manner.

The span width accuracy from 100 MHz per division down to 1 kHz per division is tested using a comb generator. Wide span widths (100 MHz to .5 MHz/div) are checked by using the 100 MHz, 10 MHz and 1 MHz comb generator outputs. Narrow span widths (.2 MHz to 1 kHz/div) are checked by using the comb generator output modulated by a function generator. Since the comb generator produces frequency components separated by a precisely determined frequency interval, the resultant spectral lines displayed on the CRT are evenly spaced when no span error exists in the instrument. Thus, span error is the cumulative variance of distance among the spectral line intervals displayed across the CRT. The amount of span error is determined by comparing the distance between the first eight graticule divisions to the display distance of the corresponding spectral line intervals.

PERFORMANCE TESTS

4-9. SPAN WIDTH ACCURACY TEST (Cont'd)

CONFIGURATION A
(500 MHz and 200 MHz/Div.)



CONFIGURATION B
(100 MHz to 1 kHz/Div.)

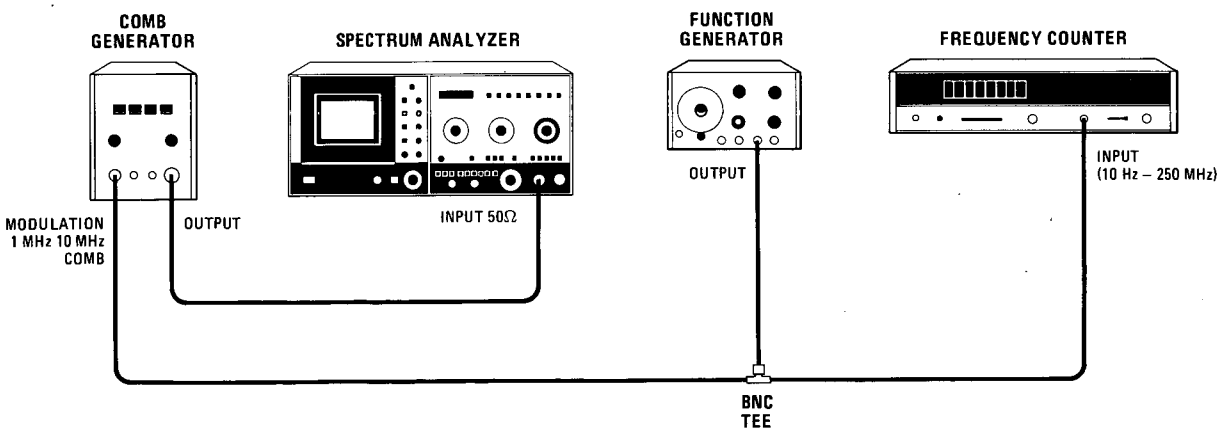


Figure 4-2. Span Width Accuracy Test Setup

EQUIPMENT:

Sweep Oscillator/RF Plug-in	HP 8620C/86290A
Frequency Counter	HP 5340A Opt. H10
Comb Genertor	HP 8406A
Function Genertor	HP 3312A
10 dB Attenuator	HP 8491B, Opt. 010

4-9. SPAN WIDTH ACCURACY TEST (Cont'd)

PROCEDURE:

500 MHz and 200 MHz Per Division

a. Set spectrum analyzer controls as follows:

Set all Normal Settings (controls marked with green)
FREQUENCY BAND GHz ..... 5.8 — 12.9
INPUT ATTEN ..... 10 dB
REF LEVEL ..... −10 dBm
REF LEVEL FINE 0
RESOLUTION BW ..... Coupled (pushed in)
FREQUENCY SPAN/DIV ..... 500 MHz

b. Connect equipment as shown in Configuration A of Figure 4-2.

c. Set sweep oscillator for CW output, 6.0 to 12.4 GHz band, and tune for a frequency counter indication of 7.000 ± .005 GHz.

d. Adjust spectrum analyzer TUNING control to position signal at graticule reference line (far left) of display (Should indicate approximately 9.5 GHz on FREQUENCY readout.)

e. Tune sweep oscillator CW output for a frequency counter indication of 11.000 ±.005 GHz.

f. Measure error between signal peak and eighth graticule line. Error should not exceed ±0.4 division. (See Figure 4-3.)

g. Set spectrum analyzer FREQUENCY SPAN/DIV control to 200 MHz. Set TUNING control for a FREQUENCY readout of approximately 8 GHz.

h. Tune sweep oscillator CW output for a frequency counter indication of 7.000 ± .005 GHz. Adjust spectrum analyzer TUNING control to position signal at graticule reference line (far left) of display.

i. Tune sweep oscillator CW output for a frequency counter indication of 8.600 ± .005 GHz.

j. Measure error between signal peak and eighth graticule line. Error should not exceed ±0.4 division. (See Figure 4-3.)

k. Connect equipment as shown in Configuration B of Figure 4-2 without connecting function generator. Set comb generator for 100 MHz comb output.

l. Set spectrum analyzer FREQUENCY BAND GHz to .01 — 1.8, FREQUENCY SPAN/DIV control to 100 MHz. Set TUNING control for a FREQUENCY readout of 0.800 GHz.

m. Adjust spectrum analyzer TUNING control to position one spectral line (from comb generator) at graticule reference line (first graticule line at far left) of display. Measure error between ninth spectral line and eighth graticule line. Error should not exceed ± 0.4 division. (See Figure 4-4.)

PERFORMANCE TESTS

4-9. SPAN WIDTH ACCURACY TEST (Cont'd)

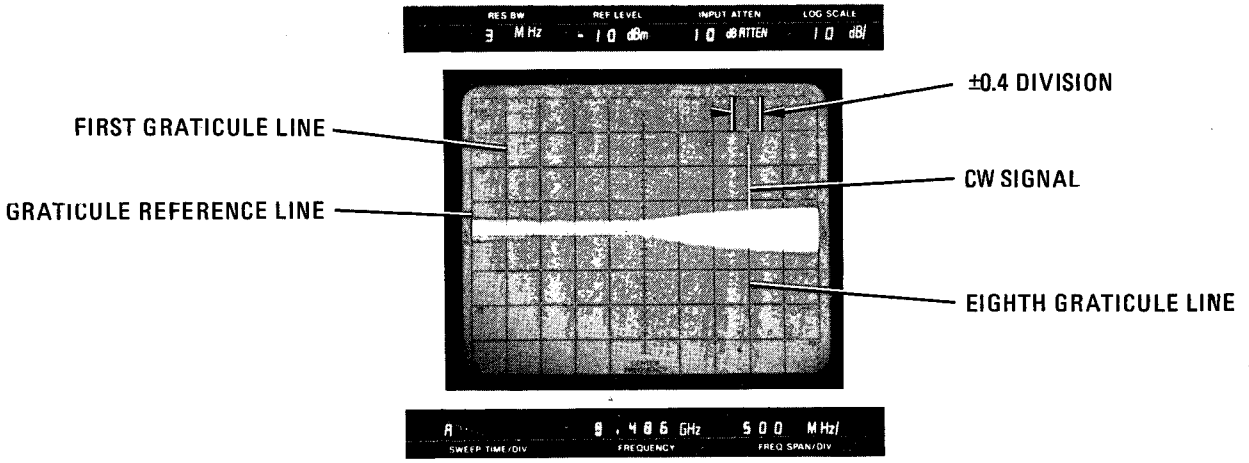


Figure 4-3. Span Width Accuracy Measurement, 500 MHz and 200 MHz per Division

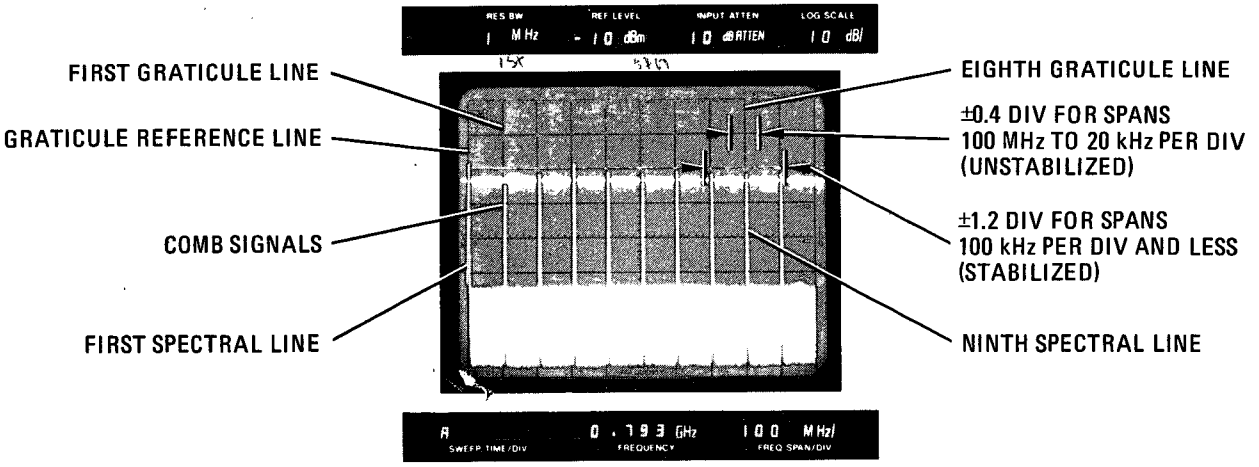


Figure 4-4. Span Width Accuracy Measurement, 100 MHz per Division and Less

n. Set FREQUENCY SPAN/DIV to 50 MHz. Adjust TUNING control to position one spectral line (from comb generator) at graticule reference line (first graticule line at far left) of display. Measure error between fifth spectral line and eighth graticule line. Error should not exceed ±0.4 division.

o. Set comb generator for 10 MHz comb output. Set spectrum analyzer FREQUENCY SPAN/DIV to 20 MHz and RESOLUTION BW to OPTIMUM. Adjust TUNING control to position one spectral line at graticule reference line. Measure error between seventeenth spectral line and eighth graticule line on display. Error should not exceed ±0.4 divison.

4-9. SPAN WIDTH ACCURACY TEST (Cont'd)

p. Set FREQUENCY SPAN/DIV to 10 MHz. Adjust TUNING control to position one spectral line at graticule reference line. Measure error between ninth spectral line and eighth graticule line. Error should not exceed ±0.4 division.

q. Set FREQUENCY SPAN/DIV to 5 MHz. Adjust TUNING control to position one spectral line at graticule reference line. Measure error between fifth spectral line and eighth graticule line. Error should not exceed ±0.4 division.

r. Set comb generator for 1 MHz comb output. Set spectrum analyzer FREQUENCY SPAN/DIV to 2 MHz and VIDEO FILTER to .1. Adjust TUNING control to position one spectral line at graticule reference line. Measure error between seventeenth spectral line and eighth graticule line. Error should not exceed ±0.4 division.

s. Set FREQUENCY SPAN/DIV to 1 MHz. Adjust TUNING control to position one spectral line at graticule reference line. Measure error between ninth spectral line and eighth graticule line. Error should not exceed ±0.4 division.

t. Set FREQUENCY SPAN/DIV to .5 MHz. Adjust TUNING control to position one spectral line at the graticule reference line. Measure error between fifth spectral line and eighth graticule line. Error should not exceed ±0.4 division.

u. Set comb generator for 10 MHz comb output and turn interpolation control on. Connect function generator output level high output to modulate the comb generator. Set function generator frequency to 200 ± 1 kHz, set function to negative pulse, and set output level control for a clean 200 kHz comb (approximately mid-position) on the spectrum analyzer display.

NOTE

It may be necessary to readjust function generator output level control and comb generator interpolation amplitude control to obtain desired presentation of comb.

v. Set spectrum analyzer FREQUENCY SPAN/DIV to .2 MHz. Adjust TUNING control to position one spectral line at graticule reference line. Measure error between ninth spectral line and eighth graticule line. Error should not exceed ±0.4 division.

100 kHz to 5 kHz Per Division:

w. Using procedure of step u and v, change spectrum analyzer FREQUENCY SPAN/DIV and function generator output frequency in accordance with Table 4-2. Adjust spectrum analyzer TUNING control to position one spectral line at graticule reference line. Measure the span error between ninth spectral line and eighth graticule line.

NOTE

It may be necessary to temporarily disable the AUTO STABILIZER to tune the spectrum analyzer TUNING control for best comb presentation.

PERFORMANCE TESTS

4-9. SPAN WIDTH ACCURACY TEST (Cont'd)

Table 4-2. Narrow Span Width Error Measurement

Spectrum Analyzer		Function Generator Output Frequency*	Maximum Allowable Error (Division)	
FREQ SPAN/DIV	RESOLUTION BW		Unstabilized	Stabilized
100 kHz	OPTIMUM	100 kHz	±0.4	±1.2
50 kHz	OPTIMUM	50 kHz	±0.4	±1.2
20 kHz	OPTIMUM	20 kHz	±0.4	±1.2
10 kHz	OPTIMUM	10 kHz		±1.2
5 kHz	OPTIMUM	5 kHz		±1.2

*Check function generator output frequency using an electronic counter. Frequency readout should be within ±0.5% of desired audio frequency.

2 kHz and 1 kHz Per Division

x. Set spectrum analyzer AMPLITUDE SCALE to 5 dB (LOG/DIV), REF LEVEL to −70 dBm, VIDEO FILTER to .03, and FREQUENCY SPAN/DIV to 2 kHz.

y. Set function generator frequency to 4.00 ± .02 kHz. Adjust spectrum analyzer TUNING control to position one spectral line at graticule reference line. Measure error between fifth spectral line and eighth graticule line. Error should not exceed ± 1.2 divisions.

z. Set spectrum analyzer FREQUENCY SPAN/DIV to 1 kHz. Set function generator frequency to 2.00 ± .02 kHz and adjust spectrum analyzer TUNING control to position one spectral line at graticule reference line. Measure error between fifth spectral line and eighth graticule line. Error should not exceed ± 1.2 divisions.

4-10. RESOLUTION BANDWIDTH ACCURACY TEST

SPECIFICATION:

Individual resolution bandwidth 3 dB points:

$< \pm 15\%$

DESCRIPTION:

Resolution bandwidth accuracy is measured in the linear mode to eliminate log amplifier errors. Since half power is represented by a voltage ratio of 1.41, 5 divisions on the spectrum analyzer display represents half power (3 dB) points for a 7.1 division display.

$$\frac{1}{1.41} = \text{(Voltage Ratio)} = \frac{\text{X Div}}{7.1\ \text{DIV}} \rightarrow \text{X DIV} = \frac{7.1\ \text{DIV}}{1.4} = 5.0\ \text{DIV}$$

4-10. RESOLUTION BANDWIDTH ACCURACY TEST (Cont'd)

In the narrow bandwidths (10 kHz and below) a 321.4 MHz signal (first IF) is injected by connecting the output of the signal generator to the external mixer port of the spectrum analyzer. This IF injection method provides the high degree of stability required when measuring narrow resolution bandwidths.

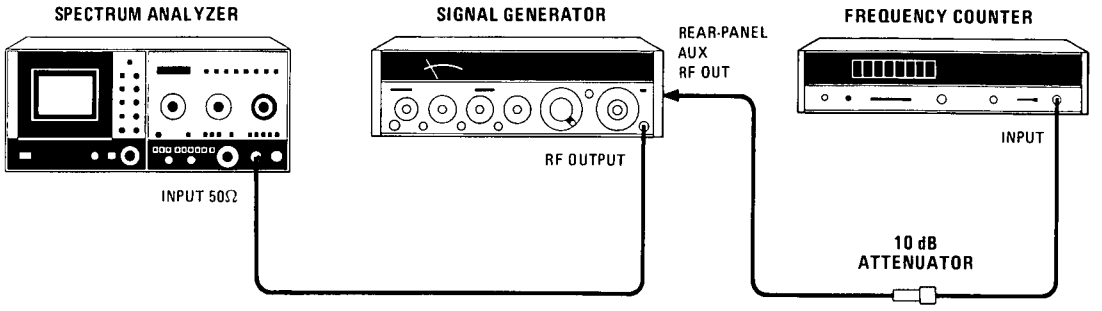


Figure 4-5. Resolution Bandwidth Accuracy Test Setup

EQUIPMENT:

Signal Generator	HP 8640B
Frequency Counter	HP 5340A
10 dB Attenuator	HP 8491 B Opt. 010

PROCEDURE:

a. Set spectrum analyzer controls as follows:

Set all Normal Settings (controls marked with green)

FREQUENCY BAND GHz	.01 — 1.8
INPUT ATTEN	20 dB
REF LEVEL	—10 dBm
REF LEVEL FINE	0
RESOLUTION BW	3 MHz, Uncoupled
FREQUENCY SPAN MODE	ZERO SPAN
AMPLITUDE SCALE	LIN
AUTO STABILIZER	OFF

b. Set signal generator for an unmodulated 100 MHz output at approximately −10 dBm. Set 8640B counter mode to internal.

c. Adjust spectrum analyzer TUNING control to locate peak of 100 MHz signal on CRT. Reduce signal generator output if necessary.

d. Adjust signal generator output level to position trace at 7.1 divisions above graticule baseline.

PERFORMANCE TESTS

4-10. RESOLUTION BANDWIDTH ACCURACY TEST (Cont'd)

e. Tune signal generator frequency until trace drops to 5 divisions above graticule baseline. Record frequency displayed on 8640B.

101.417 _____ MHz

f. Tune signal generator frequency in opposite direction of step e until trace peaks (7.1 divisions) and then drops to 5 divisions above graticule baseline. Record frequency displayed on 8640B. 98.431 _____ MHz

g. The difference between results of steps e and f is the measured resolution bandwidth at 3 dB points.

Min.	Actual	Max.
2.55 MHz	2.98	3.45 MHz

h. Set RESOLUTION BW to 1 MHz. Tune signal generator to 100 MHz and repeat steps c through g.

Min.	Actual	Max.
850 kHz	_____	1.15 MHz

i. Set RESOLUTION BW to 300 kHz. Tune signal generator to 100 MHz and repeat steps c through g.

Min.	Actual	Max.
255 kHz	_____	345 kHz

j. Set RESOLUTION BW to 100 kHz. Tune signal generator to 100 MHz and repeat steps c through g.

Min.	Actual	Max.
85 kHz	_____	115 kHz

k. Set RESOLUTION BW to 30 kHz. Tune signal generator to 100 MHz and press EXPAND X10 pushbutton to provide greater resolution on frequency readout (remember to include overflow when reading frequency). Enable spectrum analyzer AUTO STABILIZER (pushbutton out) and repeat steps c through g.

Min.	Actual	Max.
25.5 kHz	_____	34.5 kHz

l. Set RESOLUTION BW to 10 kHz. Set EXT MIXER BIAS adjustment fully counterclockwise.

m. Tune signal generator to 321.4 MHz. Connect signal generator output to spectrum analyzer EXT MIXER BNC connector. Press 1.7 — 4.1 FREQUENCY BAND GHz pushbutton.

n. Connect frequency counter as shown in Figure 4-5 and set frequency counter resolution to 10 Hz.

o. Tune signal generator FINE TUNE control to peak signal on CRT. Adjust output level to position trace at 7.1 divisions above graticule baseline.

4-10. RESOLUTION BANDWIDTH ACCURACY TEST (Cont'd)

p. Tune signal generator frequency, using FINE TUNE control, until trace drops to 5 divisions above graticule baseline. Record frequency displayed on frequency counter.

_____ MHz

q. Tune signal generator frequency (FINE TUNE) in opposite direction of step p until trace peaks (7.1 divisions) and then drops to 5 divisions above graticule baseline. Record frequency displayed on frequency counter.

_____ MHz

r. The difference between results of steps p and q is the measured resolution bandwidth at 3 dB points.

Min.	Actual	Max.
8.5 kHz	_____	11.5 kHz

s. Set spectrum analyzer RESOLUTION BW to 3 kHz and repeat steps o through r.

Min.	Actual	Max.
2.55 kHz	_____	3.45 kHz

t. Set spectrum analyzer RESOLUTION BW to 1 kHz and repeat steps o through r.

Min.	Actual	Max.
0.85 kHz	_____	1.15 kHz

Option 100 Only

u. Set spectrum analyzer RESOLUTION BW to .3 kHz and repeat steps o through r.

Min.	Actual	Max.
255 Hz	_____	345 Hz

v. Set spectrum analyzer RESOLUTION BW to .1 kHz and repeat steps o through r.

Min.	Actual	Max.
85 Hz	_____	115 Hz

4-11. RESOLUTION BANDWIDTH SELECTIVITY TEST

SPECIFICATION:

(60 dB/3 dB bandwidth ratio) < 15:1 for bandwidths 1 kHz to 3 MHz.
< 11:1 for bandwidths .1 kHz, .3 kHz, and 1 kHz with Option 100.

PERFORMANCE TESTS

4-11. RESOLUTION BANDWIDTH SELECTIVITY TEST (Cont'd)

DESCRIPTION:

The 60 dB bandwidth is measured for all resolution bandwidth settings (1 kHz to 3 MHz). The 60 dB to 3 dB resolution bandwidth ratio (shape factor) is then computed by dividing the 3 dB bandwidth values, obtained in the Resolution Bandwidth Accuracy Test, into the 60 dB bandwidth values for each resolution bandwidth setting.

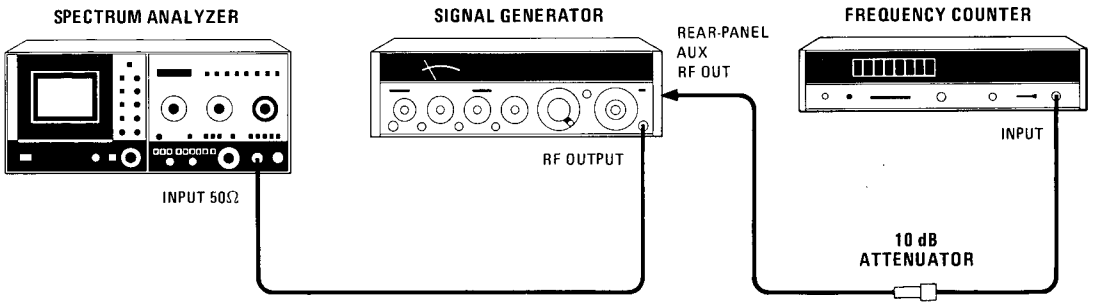


Figure 4-6. Resolution Bandwidth Selectivity Test Setup

EQUIPMENT:

Signal Generator	HP 8640B
Frequency Counter	HP 5340A
10 dB Attenuator	HP 8491B Opt. 010

PROCEDURE:

a. Set spectrum analyzer controls as follows:

Set all Normal Settings (controls marked with green)

FREQUENCY BAND GHz	1.7 — 4.1
INPUT ATTEN	20 dB
REF LEVEL	−10 dBm
REF LEVEL FINE	0
RESOLUTION BW	1 kHz, Uncoupled
FREQUENCY SPAN MODE	ZERO SPAN
AMPLITUDE SCALE	10 dB LOG/DIV
VIDEO FILTER	.03

b. Connect equipment as shown in Figure 4-6. Tune signal generator to 321.4 MHz and set output level to approximately −10 dBm. Connect signal generator output to spectrum analyzer EXT MIXER BNC connector.

c. Tune signal generator FINE TUNE control to peak signal on CRT. Adjust output level to position trace at top graticule line.

PERFORMANCE TESTS

4-11. RESOLUTION BANDWIDTH SELECTIVITY TEST (Cont'd)

d. Tune signal generator frequency (FINE TUNE) until trace drops to two divisions above graticule baseline. Record frequency displayed on frequency counter.

_____ MHz

e. Tune signal generator frequency in opposite direction of step d until trace peaks and then drops to two divisions above graticule baseline. Record frequency displayed on frequency counter.

_____ MHz

f. The difference between results of steps d and e is the measured bandwidth at 60 dB points.

NOTE

If 8565A has Option 100 installed, perform all of the following steps. If Option 100 is not installed, proceed to step j.

g. Record measured bandwidth (difference between results of steps d and e).

_____ Hz (.1 kHz Bw)

h. Set RESOLUTION BW to .3 kHz and repeat steps c through f.

_____ Hz (.3 kHz BW)

i. Set RESOLUTION BW to 1 kHz and repeat steps c through f.

j. Record measured bandwidth (difference between results of steps d and e).

_____ kHz (1 kHz BW)

k. Set RESOLUTION BW to 3 kHz and repeat steps c through f.

_____ kHz (3 kHz BW)

l. Set RESOLUTION BW to 10 kHz and repeat steps c through f.

_____ kHz (10 kHz BW)

m. Connect signal generator output to spectrum analyzer INPUT 50Ω connector. Tune signal generator to 100 MHz and set output level to approximately 0 dBm.

n. Set spectrum analyzer FREQUENCY BAND GHz to .01 — 1.8, INPUT ATTEN to 10 dB, REF LEVEL to 0 dBm, RESOLUTION BW to 30 kHz, and TUNING for an indication of 0.100 GHz on FREQUENCY readout (disable AUTO STABILIZER while using coarse TUNING).

PERFORMANCE TESTS

4-11. RESOLUTION BANDWIDTH SELECTIVITY TEST (Cont'd)

o. Tune signal generator frequency to peak signal on CRT. Adjust output level to position trace at top graticule line.

p. Tune signal generator frequency until trace drops to two divisions above graticule baseline. Record frequency displayed on 8640B.

_____ MHz

q. Tune signal generator frequency in opposite direction of step P until trace peaks and then drops to two divisions above graticule baseline. Record frequency displayed on 8640B.

_____ MHz

r. The difference between results of steps p and q is the measured bandwidth at 60 dB points.

_____ MHz (30 kHz BW)

s. Set RESOLUTION BW to 100 kHz and repeat steps o through r.

_____ MHz (100 kHz BW)

t. Set RESOLUTION BW to 300 kHz and repeat steps o through r.

_____ MHz (300 kHz BW)

u. Set RESOLUTION BW to 1 MHz and repeat steps o through r.

_____ MHz (1 MHz BW)

v. Set RESOLUTION BW to 3 MHz and repeat steps o through r.

_____ MHz (3 MHz BW)

w. Record the measured 3 dB bandwidths from Paragraph 4-10, steps g through k and steps r through t (steps r through v for Option 100).

x. Record the measured 60 dB bandwidths from Paragraph 4-11, steps j through l (steps g through l for Option 100) and steps r through v in Table 4-3.

y. Compute Resolution Bandwidth Selectivity for each RESOLUTION BW setting, dividing the measured 60 dB bandwidth by the measured 3 dB bandwidth for each setting. Ratios should be less than 15:1 for RESOLUTION BW settings 3 MHz to 1 kHz with standard 8565A. With Option 100 instruments, ratios should be less than 15:1 for RESOLUTION BW settings 3 MHz to 3 kHz, and less than 11:1 for RESOLUTION BW settings 1 kHz, .3 kHz, and .1 kHz.

4-11. RESOLUTION BANDWIDTH SELECTIVITY TEST (Cont'd)

Table 4-3. Resolution Bandwidth Selectivity

RESOLUTION BW Setting	MEASURED 3 dB BW	MEASURED 60 dB BW	Resolution Bandwidth Selectivity (60 dB BW/3 dB BW)
3 MHz			
1 MHz			
300 kHz			
100 kHz			
30 kHz			
10 kHz			
3 kHz			
1 kHz			
.3 kHz*			
.1 kHz*			

*Option 100 only.

4-12. RESIDUAL FM TEST

SPECIFICATION:

Total residual FM:

Stabilized: <200 Hz P-P in 0.1 sec. (<100 Hz P-P in 0.1 sec. for Option 100) .01 to 8.5 GHz
Unstabilized: <10 kHz P-P in 0.1 sec. .01 to 4.1 GHz (fundamental mixing)

DESCRIPTION:

A comb generator is used to supply a stable 1.8 GHz signal to the spectrum analyzer. The relationship between amplitude and frequency on the linear portion of the trace is determined for a given frequency span and resolution bandwidth. The residual FM is then slope detected by using the spectrum analyzer as a fixed-tuned receiver (ZERO SPAN). Using the determined relationship between amplitude and frequency, the test limits (in divisions) for the demodulated residual FM are determined.

4-12. RESIDUAL FM TEST (Cont'd)

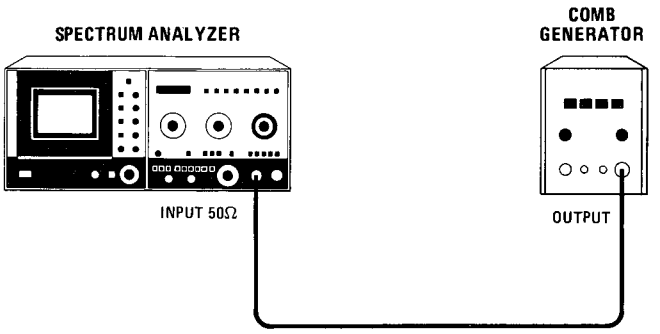


Figure 4-7. Residual FM Test Setup

EQUIPMENT:

Comb Generator ..... HP 8406A

PROCEDURE:

Stabilized:

a. Set spectrum analyzer controls as follows:

Set all Normal Settings (controls marked with green)
FREQUENCY BAND GHz ..... .01 — 1.8
INPUT ATTEN ..... 0 dB
REF LEVEL ..... −30 dBm
RESOLUTION BW ..... Coupled (pushed in)
FREQUENCY SPAN/DIV ..... .2 MHz
AMPLITUDE SCALE ..... LIN
SWEEP TIME/DIV ..... .1 SEC
VIDEO FILTER 1
TUNING ..... 1.800 GHz

b. Connect comb generator output to spectrum analyzer INPUT as shown in Figure 4-7. Set comb generator for maximum output amplitude.

c. Locate 1.8 GHz comb tooth and center it on CRT. Reduce FREQUENCY SPAN/DIV to 2 kHz keeping signal centered on CRT with FINE TUNING control.

d. Adjust REF LEVEL FINE control to place signal peak at top graticule line. Carefully adjust TUNING control so upward slope of signal intersects the CENTER FREQUENCY graticule line one division down from the top as shown in Figure 4-8.

NOTE

With AUTO STABILIZER on, the coarse TUNING control (large knob) can be adjusted in very small increments to "fine tune" the position of the signal displayed. If signal disappears from display, set FREQUENCY SPAN/DIV to .2 MHz and repeat steps c and d.

PERFORMANCE TESTS

4-12. RESIDUAL FM TEST (Cont'd)

e. Note the distance from the signal skirt at the horizontal center graticule line to the CENTER FREQUENCY graticule line at the center of the CRT. (In Figure 4-8 the distance is 0.2 division.)

_____ Div.

f. Determine the test limit by using the following formula:

Test Limit: _____ Div. (P-P per One Horizontal Division)

$$X = \frac{\text{Specification (P-P)}}{\frac{\text{A div}}{\text{k div}} \times \text{FREQ. SPAN/DIV}}$$

Where: X = Test limit (peak-to-peak) in vertical divisions per one horizontal division.
A div = Distance noted in step e or step m.
k div = Linear vertical portion of trace = 3 div.

Typical Example (Stabilized mode): In Figure 4-8, distance A is 0.2 division and distance k (a constant) is 3 divisions. Therefore:

$$X = \frac{200\ \text{Hz}^*}{\frac{0.2\ \text{div}}{3\ \text{div}} \times 2\ \text{kHz/Div}} = \frac{200\ \text{Hz}^*}{.067 \times 2\ \text{kHz/Div}} = 1.5\ \text{Div (P-P per one Horiz Division)}$$

*Use 100 Hz for instrument with Option 100 installed.

g. Press ZERO SPAN pushbutton and adjust TUNING control to place trace between center graticule line and seventh graticule line (linear portion of signal).

NOTE

With AUTO STABILIZER on, the coarse TUNING control (large knob) can be adjusted in small increments to "fine tune" the position of the signal displayed.

h. Adjust PERSIST and INTENSITY controls to provide high persistence with minimum blooming.

i. Set SWEEP TRIGGER to SINGLE and ERASE CRT. Press START/RESET pushbutton to display one sweep as shown in Figure 4-9. The maximum peak-to-peak variation should not exceed the test limit determined in step f for each horizontal division (since SWEEP TIME/DIV is .1 SEC and residual FM is specified in a time interval of 0.1 second).

4-12. RESIDUAL FM TEST (Cont'd)

j. Repeat steps a through i except set FREQUENCY BAND GHz to 3.8 — 8.5 and TUNING to 8.500 GHz. Locate 8.5 GHz comb tooth in step c.

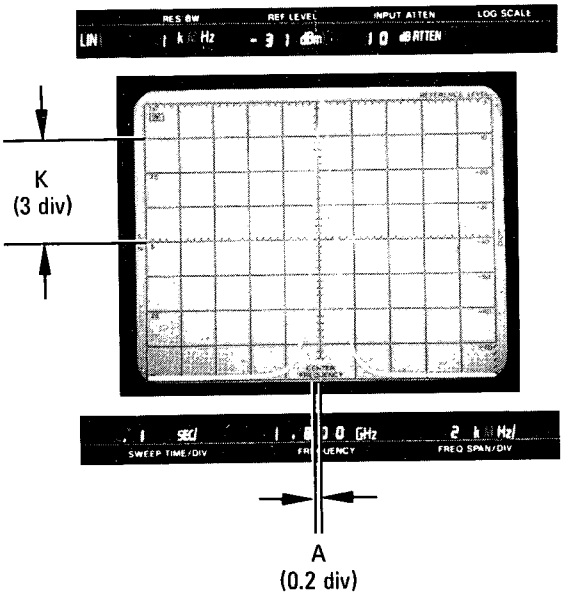


Figure 4-8. Residual FM to AM Conversion Display

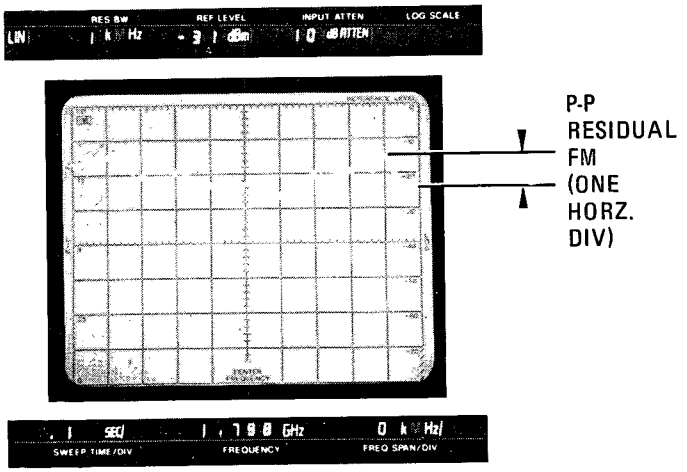


Figure 4-9. Residual FM Display

4-12. RESIDUAL FM TEST (Cont'd)

Unstabilized:

k. Set FREQUENCY SPAN MODE to PER DIV, FREQUENCY SPAN/DIV to 10 kHz (pull to uncouple), and RESOLUTION BW to 30 kHz. Set SWEEP TRIGGER to FREE RUN and press AUTO STABILIZER to OFF (pushbutton in).

l. Locate 1.8 GHz comb tooth and center it on CRT. Press AUTO STABILIZER to ON (pushbutton out) to return to stabilized mode.

m. Adjust REF LEVEL FINE control to place signal peak at top graticule line. Carefully adjust TUNING control so upward slope of signal intersects the CENTER FREQUENCY graticule line one division down from the top as shown in Figure 4-8.

n. Note the distance from the signal skirt at the horizontal graticule center line, to the CENTER FREQUENCY graticule line (should be approximately 1.3 divisions).

_____ Div.

o. Determine the test limit using formula given in step f. Use unstabilized specification (10 kHz) and 10 kHz FREQUENCY SPAN/DIV.

Test Limit: _____ Div. (P-P per One Horizontal Division)

Typical Example (Unstabilized mode):

If A = 1.3 divisions, then:

$$X = \frac{10\ \text{kHz}}{\frac{1.3\ \text{div.}}{3\ \text{div}}\ \text{x}\ 10\ \text{kHz/div.}}$$

$$X = \frac{1}{0.43}\ \text{div.}$$

X = 2.3 div. (P-P per One Horizontal Division)

p. Press AUTO STABILIZER to OFF (pushbutton in for unstabilized mode). Press ZERO SPAN Pushbutton and adjust FINE TUNING control to place trace between center graticule line and seventh graticule line.

q. Adjust PERSIST and INTENSITY controls to provide high persistence with minimum blooming.

4-12. RESIDUAL FM TEST (Cont'd)

r. Set SWEEP TRIGGER to SINGLE and ERASE CRT. Press START/RESET pushbutton to display one sweep as shown in Figure 4-9. The maximum peak-to-peak variation should not exceed the test limit determined in step o.

4-13. NOISE SIDEBANDS TEST

SPECIFICATION:

At least 70 dB down, greater than 30 kHz from center of CW signal when set to a 1 kHz RESOLUTION BANDWIDTH and a 10 Hz (.01) VIDEO FILTER.

DESCRIPTION:

A comb generator is used to supply a stable 1.8 GHz signal to the spectrum analyzer. The analyzer RESOLUTION BW is set to 1 kHz and VIDEO FILTER is set to .01. The peak of the 1.8 GHz signal is set at 20 dB above REFERENCE LEVEL graticule line to allow greater readability of the noise sidebands. The noise-associated sidebands and unwanted responses measured close to the signal must be more than 70 dB down (below −50 graticule line), greater than 30 kHz from center of CW signal.

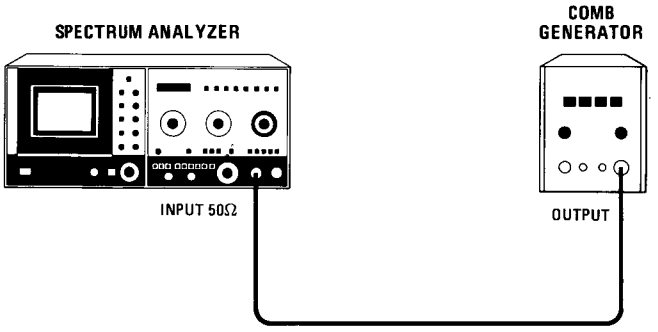


Figure 4-10. Noise Sidebands Test Setup

EQUIPMENT:

Comb Generator ..... HP 8406A

4-13. NOISE SIDEBANDS TEST (Cont'd)

PROCEDURE:

a. Set spectrum analyzer controls as follows:

Set all Normal Settings (controls marked with green)
FREQUENCY BAND GHz ..... .01 — 1.8
INPUT ATTEN ..... 0 dB
REF LEVEL ..... −30 dBm
RESOLUTION BW ..... Coupled (pushed in)
FREQUENCY SPAN/DIV ..... .2 MHz
TUNING ..... 1.800 GHz

b. Connect comb generator output to spectrum analyzer INPUT as shown in Figure 4-10. Set comb generator for maximum output amplitude.

c. Locate 1.8 GHz comb tooth and center it on CRT. Reduce FREQUENCY SPAN/DIV to 10 kHz keeping signal centered on CRT with FINE TUNING control.

d. Adjust REF LEVEL FINE control to place signal peak at top graticule line (REFERENCE LEVEL).

e. Set REF LEVEL control to −50 dBm to place signal peak 20 dB above REFERENCE LEVEL.

f. Set SWEEP TRIGGER to SINGLE and set VIDEO FILTER to .01. Set PERSIST control fully clockwise and press START/RESET pushbutton. If blooming occurs, reduce INTENSITY, ERASE CRT, and press START/RESET pushbutton again.

g. Observe noise level at three divisions (30 kHz) and greater on each side of CW signal. Noise sidebands should be greater than 70 dB below cw signal level (below −50 graticule line).

4-14. RESIDUAL RESPONSES TEST

SPECIFICATION:

Residual Responses (no signal present at input): With 0 dB input attenuation on fundamental mixing (.01 to 4.1 GHz): < -90 dBm.

DESCRIPTION:

Signals present on the display with no input to the analyzer are residual responses. A reference level is selected that will allow the operator to see signals less than −90 dBm. The two fundamental mixing bands (.01 — 1.8 GHz and 1.7 — 4.1 GHz) are slowly swept through their entire ranges in several incremental spans while observing the display. Any residual responses that appear must be less than −90 dBm.

EQUIPMENT:

50Ω Termination ..... HP 909A Opt. 012

PERFORMANCE TESTS

4-14. RESIDUAL RESPONSES TEST (Cont'd)

PROCEDURE:

a. Connect 50-ohm termination to INPUT 50Ω port and set spectrum analyzer controls as follows:

Set all Normal Settings (controls marked with green)

FREQUENCY BAND GHz	.01 — 1.8
INPUT ATTEN	0 dB
REF LEVEL	−60 dBm
REF LEVEL FINE	0
RESOLUTION BW	10 kHz, Uncoupled
FREQUENCY SPAN/DIV	10 MHz
VIDEO FILTER	.1
SWEEP TRIGGER	SINGLE
TUNING	0.060 GHz
PERSIST	Fully Clockwise
INTENSITY	12 O'clock

b. Press START/RESET pushbutton and turn BASELINE CLIPPER control clockwise until just the peaks of the noise are displayed. ERASE CRT and press START/RESET again. Any residual responses that appear must be less than −90 dBm (below the −30 graticule line).

c. Adjust TUNING control for an indication of 0.150 GHz on FREQUENCY readout. Press START/RESET pushbutton and observe display.

d. Continue tuning spectrum analyzer in 100 MHz increments (0.250 GHz, 0.350 GHz, and so on) up to 1.750 GHz. Check for residual responses in each position of the TUNING control by pressing START/RESET pushbutton and observing CRT display. ERASE CRT occasionally to prevent blooming.

e. Set RESOLUTION BW to 3 kHz. Leave FREQUENCY SPAN/DIV set to 10 MHz. Set SWEEP TIME/DIV to 5 SEC and press 1.7 — 4.1 FREQUENCY BAND GHz pushbutton. Adjust TUNING control for an indication of 1.750 GHz on FREQUENCY readout and set BASELINE CLIPPER control ~~fully clockwise~~.

f. Repeat step b.

g. Tune spectrum analyzer in 100 MHz increments (1.850 GHz, 1.950 GHz, and so on) up to 4.050 GHz. Check for residual responses in each position of the TUNING control by pressing START/RESET pushbutton and observing CRT display. ERASE CRT occasionally to prevent blooming.

4-15. AVERAGE NOISE LEVEL TEST

SPECIFICATION:

Maximum average noise level (internal mixer) with 1 kHz IF bandwidth, 0 dB attenuation, and .003 (3 Hz) video filter is given in Table 4-4.

4-15. AVERAGE NOISE LEVEL TEST (Cont'd)

Table 4-4. Average Noise Level Specification

FREQUENCY BAND GHz	First IF (MHz)	Harmonic Mode	Average Noise Level	
			Standard (dBm)	Option 200 (dBμV)
.01 – 1.8	2050	1–	–110	–3
1.7 – 4.1	321.4	1–	–106	+1
3.8 – 8.5	321.4	2–	–102	+5
5.8 – 12.9	321.4	3–	–92	+15
8.5 – 18	321.4	4+	–83	+24
10.5 – 22	321.4	5+	–72	+35

DESCRIPTION:

Maximum average noise level is checked in all internal mixer frequency bands. Each frequency band is slowly swept with FREQUENCY SPAN/DIV control set to F, RESOLUTION BW set to 1 kHz, and VIDEO FILTER set to .003. Maximum persistence is used to store all six internal mixer frequency band traces. The traces are observed and average noise level for each frequency band is recorded.

PROCEDURE:

a. Set spectrum analyzer controls as follows:

Set all Normal Settings (controls marked with green)
FREQUENCY BAND GHz ..... .01 — 1.8
INPUT ATTEN ..... 0 dB
REF LEVEL ..... –70 dBm
REF LEVEL FINE 0
RESOLUTION BW ..... 1 kHz, Uncoupled
FREQUENCY SPAN/DIV ..... F
SWEEP TRIGGER ..... SINGLE
SWEEP TIME/DIV ..... 2 SEC
VIDEO FILTER ..... .003
PERSIST ..... Fully Clockwise
INTENSITY ..... Fully Counterclockwise
TUNING ..... 0.900 GHz

b. Press START/RESET pushbutton and adjust INTENSITY control until trace appears on CRT. Press ERASE pushbutton and again press START/RESET pushbutton.

c. When first sweep is ended, press 1.7 — 4.1 FREQUENCY BAND GHz pushbutton and then START/RESET pushbutton. Continue pressing the next FREQUENCY BAND GHz pushbutton and then START/RESET pushbutton at the end of each sweep until all of the internal mixer frequency bands (dark gray pushbuttons) have been swept.

d. Press STORE and adjust STORE INTEN control as required. Observe the six individual traces and determine the maximum average noise level for each internal mixing FREQUENCY BAND. (See Figure 4-11.) Disregard LO feedthrough signal at beginning of .01 — 1.8 GHz band. Record results in Table 4-5.

4-15. AVERAGE NOISE LEVEL TEST (Cont'd)

Table 4-5. Average Noise Level

FREQUENCY BAND GHz	First IF (MHz)	Harmonic Mode	Average Noise Level		
			Maximum		Actual
			Standard (dBm)	Opt. 200 (dBμV)	
.01 – 1.8	2050	1–	–110	–3	_____
1.7 – 4.1	321.4	1–	–106	+1	_____
3.8 – 8.5	321.4	2–	–102	+5	_____
5.8 – 12.9	321.4	3–	–92	+15	_____
8.5 – 18	321.4	4+	–83	+24	_____
10.5 – 22	321.4	5+	–72	+35	_____

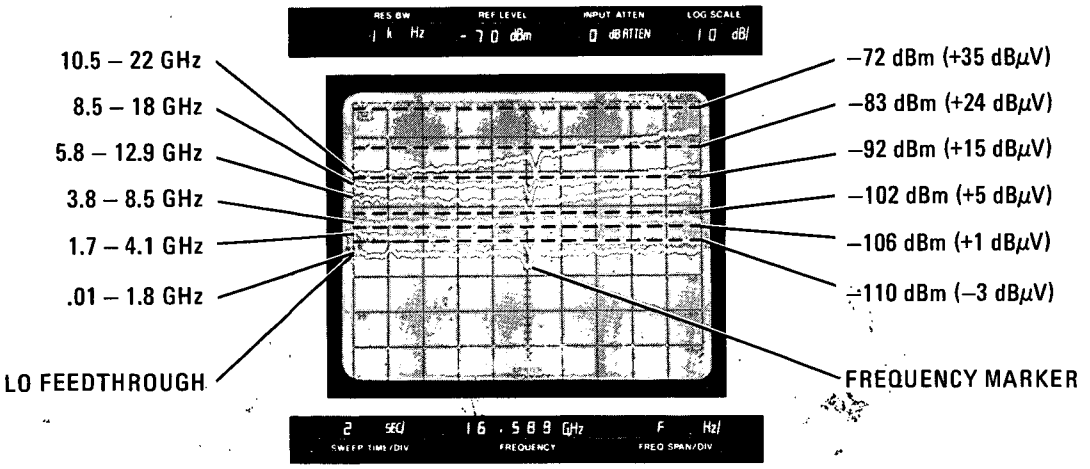


Figure 4-11. Average Noise Level (Sensitivity) Internal Mixing Frequency Bands

e. Set PERSIST control fully counterclockwise and press WRITE pushbutton. Reduce INTENSITY.

4-16. REFERENCE LEVEL VARIATION TEST

SPECIFICATION:

Reference level variation (Input Attenuator at 0 dB):

10 dB steps: $< \pm 0.5$ dB (0 to -70 dBm)
$< \pm 1.0$ dB (0 to -90 dBm)

Vernier (0 to -12 dB) continuous: Maximum error $< \pm$ 0.5 dB, when read from Reference Level Fine control.

DESCRIPTION:

The reference level variation is tested by checking the IF gain steps in 1 dB per division log and in linear scale. Specially calibrated step attenuators (355 C/D Option H80) are used to check the 10 dB steps and the vernier (REF LEVEL FINE control).

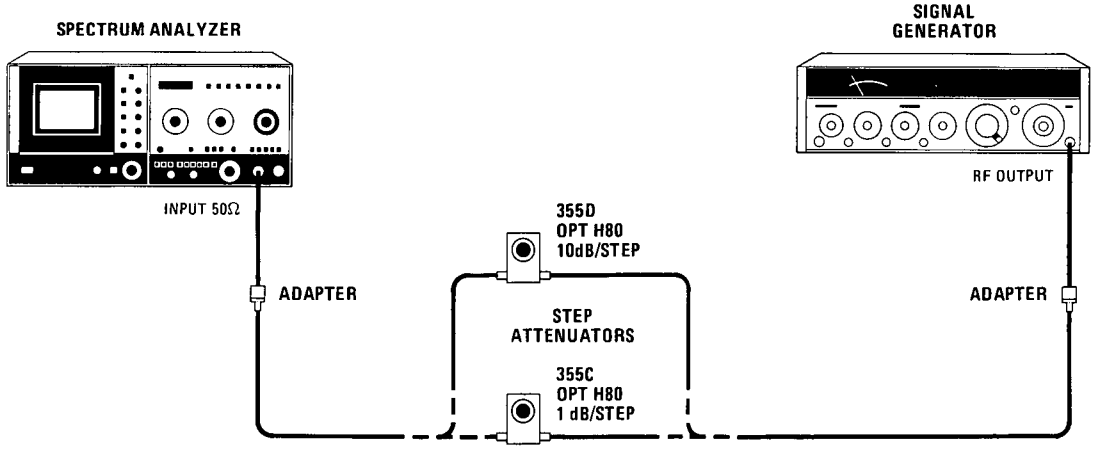


Figure 4-12. Reference Level Variation Test Setup

EQUIPMENT:

Signal Generator	HP 8640B
Step Attenuator (1 dB/Step)	HP 355C Opt. H80
Step Attenuator (10 dB/Step)	HP 355D Opt. H80
Adapter, Type N Male to BNC Female (2 required)	HP 1250-0780

4-16. REFERENCE LEVEL VARIATION TEST (Cont'd)

PROCEDURE:

a. Set spectrum analyzer controls as follows:

Set all Normal Settings (controls marked with green)
FREQUENCY BAND GHz ..... .01 — 1.8
INPUT ATTEN ..... 0 dB
REF LEVEL ..... 0 dBm
REF LEVEL FINE 0
RESOLUTION BW ..... Coupled (pushed in)
FREQUENCY SPAN/DIV ..... 1 MHz
TUNING ..... 0.100 GHz

b. Set signal generator for an unmodulated 100 MHz output at approximately 0 dBm.

Reference Level Variation (10 dB Steps) in Log Mode:

c. Connect equipment as shown in Figure 4-12 using 10 dB/step attenuator. Set step attenuator at 0 dB and adjust spectrum analyzer TUNING control to center signal on CRT. Set VIDEO FILTER to .01.

d. Adjust signal generator output level to place peak of trace at top graticule line. Set spectrum analyzer AMPLITUDE SCALE to 1 dB(LOG/DIV). Set FREQUENCY SPAN/DIV to 10 kHz. Pull to uncouple and set RESOLUTION BW to 10 kHz. Center signal on CRT.

e. Adjust signal generator output level or spectrum analyzer REF LEVEL FINE control until peak of trace is at sixth division (from bottom graticule line). Set the 8565A REF LEVEL control and step attenuator to settings indicated in Table 4-6. Record deviation from the sixth division reference for each setting.

Table 4-6. Reference Level Variation (10 dB steps) in Log Mode

REF LEVEL Setting (dBm)	Step Attenuator Setting (dB)	Deviation from 6th Division (dB)	Step Attenuator Error (Calibration)* (dB)	Corrected Deviation (dB)
0	0	0 (Ref.)	Ref.	0 (Ref.)
−10	10			
−20	20			
−30	30			
−40	40			
−50	50			
−60	60			
−70	70			
−80**	80			
−90**	90			

*Attenuations > dial settings are positive (+). Attenuations < dial settings are negative (−). For example 9.99 dB calibration for a 10 dB attenuator setting represents an error of −0.01 dB.
**Set VIDEO FILTER to .003 for maximum noise averaging.

4-16. REFERENCE LEVEL VARIATION TEST (Cont'd)

f. To compute the corrected deviation, add the step attenuator error to the deviation from 6th division for each setting. The corrected deviation should not exceed +0.5 dB or −0.5 dB from 0 to −70 dBm, and should not exceed +1.0 dB or −1.0 dB from 0 to −90 dBm.

Reference Level Variation (10 dB Steps) in Linear Mode:

g. Set spectrum analyzer AMPLITUDE SCALE to LIN. Set REF LEVEL control to 0 dBm and set step attenuator to 0 dB.

h. Adjust signal generator output level and spectrum analyzer REF LEVEL FINE control until peak of trace is at sixth division. Set the 8565A REF LEVEL control and step attenuator to settings indicated in Table 4-7. Record deviation from sixth division reference for each setting.

i. Using Table 4-8, convert deviation from 6th division in LIN to deviation from 6th division in dB for each setting. Record dB values in Table 4-7.

j. To compute the corrected deviation, add the step attenuator error to the deviation from 6th division in dB. The corrected deviation should not exceed +0.5 dB or −0.5 dB from 0 to −70 dBm, and should not exceed +1.0 dB or −1.0 dB from 0 to −90 dBm.

Table 4-7. Reference Level Variation (10 dB Steps) in Linear Mode

REF LEVEL Setting (dBm)	Step Attenuator Setting (dB)	Deviation from 6th Division in Linear Mode (div.)	Deviation from 6th Division in dB*	Step Attenuator Error (Calibration)** (dB)	Corrected Deviation (dB)
0	0	0 (Ref.)	0 (Ref.)	Ref.	0 (Ref.)
−10	10				
−20	20				
−30	30				
−40	40				
−50	50				
−60	60				
−70	70				
−80	80				
−90	90				

*Use Table 4-8 to convert deviation in linear mode to deviation in dB.
**Attenuations > dial settings are positive (+). Attenuations < dial settings are negative(−).

4-16. REFERENCE LEVEL VARIATION TEST (Cont'd)

Table 4-8. Conversions from Deviation in Linear Mode to Deviation in dB

POSITIVE DEVIATIONS (Above 6th division from graticule baseline)		NEGATIVE DEVIATIONS (Below 6th division from graticule baseline)	
Linear (divisions)	dB	Linear (divisions)	dB
0	0	0	0
+ .1	+0.14	− .1	−0.15
+ .2	+0.28	− .2	−0.29
+ .3	+0.42	− .3	−0.45
+ .4	+0.56	− .4	−0.60
+ .5	+0.70	− .5	−0.76
+ .6	+0.82	− .6	−0.92
+ .7	+0.96	− .7	−1.08
+ .8	+1.09	− .8	−1.24
+ .9	+1.21	− .9	−1.41
+1.0	+1.34	−1.0	−1.58
+1.1	+1.46	−1.1	−1.76
+1.2	+1.58	−1.2	−1.94
+1.3	+1.70		
+1.4	+1.82		
+1.5	+1.94		

Reference Level Fine (Vernier) variation:

k. Replace 10 dB/step attenuator with 1 dB/step attenuator. Set step attenuator to 0 dB. Set spectrum analyzer REF LEVEL control to 0 dBm, REF LEVEL FINE control to 0, AMPLITUDE SCALE to 1 dB (LOG/DIV), and VIDEO FILTER to OFF.

l. Adjust signal generator output level until peak of trace is at sixth division. Set step attenuator and REF LEVEL FINE control to settings indicated in Table 4-9. Record the deviation from the sixth division for each setting.

m. To compute the corrected deviation, add the step attenuator error to the deviation from 6th division for each setting. The corrected deviation should not exceed +0.5 dB or −0.5 dB.

4-16. REFERENCE LEVEL VARIATION TEST (Cont'd)

Table 4-9. Reference Level Fine (Vernier) Variation

Step Attenuator Setting (dB)	REF LEVEL FINE Setting	Deviation from 6th Division (dB)	Step Attenuator Error (Calibration)* (dB)	Corrected Deviation (dB)
0	0	0 (Ref.)	Ref.	0 (Ref.)
1	−1			
2	−2			
3	−3			
4	−4			
5	−5			
6	−6			
7	−7			
8	−8			
9	−9			
10	−10			
11	−11			
12	−12			

*Attenuations >dial settings are positive (+). Attenuations <dial settings are negative (−).

4-17. GAIN COMPRESSION TEST

SPECIFICATION:

For signal levels below MAXIMUM input setting, gain compression is less than 1 dB.

DESCRIPTION:

Gain compression is checked by changing the input signal from 10 dB less than the MAXIMUM input setting, to the level of the MAXIMUM input setting. The signal will compress (indicate less than a 10 dB change in signal level). The amount of compression must be less than 1 dB.

4-17. GAIN COMPRESSION TEST (Cont'd)

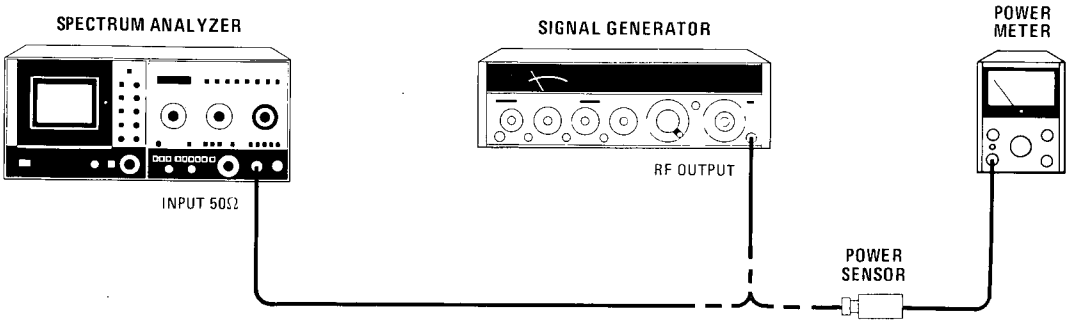


Figure 4-13. Gain Compression Test Setup

EQUIPMENT:

Signal Generator	HP 8640B
Power Meter	HP 435A
Power Sensor	HP 8481A

PROCEDURE:

a. Set spectrum analyzer controls as follows:

Set all Normal Settings (controls marked with green)

FREQUENCY BAND GHz	.01 — 1.8
INPUT ATTEN	20 dB
REF LEVEL	0 dBm
REF LEVEL FINE	0
RESOLUTION BW	Coupled (pushed in)
FREQUENCY SPAN/DIV	.2 MHz
TUNING	0.100 GHz

b. Set signal generator for an unmodulated 100 MHz output at −14 dBm. Adjust spectrum analyzer TUNING control to center signal on CRT.

c. Set FREQUENCY SPAN/DIV to 1 MHz keeping signal centered with FINE TUNING control. Pull to uncouple and set RESOLUTION BW to 1 MHz.

d. Set AMPLITUDE SCALE to 2 dB (LOG/DIV). Center signal on CRT and adjust REF LEVEL FINE control to place peak of signal at next to bottom graticule line.

e. Set INPUT ATTEN to 0 dB and REF LEVEL to 0 dBm. Record deviation of signal from next to bottom graticule line. _____ division error

f. Set signal generator to 0 dBm using power meter.

g. Set spectrum analyzer INPUT ATTEN to 20 dB and REF LEVEL to 0 dBm. Reconnect signal to INPUT 50Ω and adjust REF LEVEL CAL to position signal at top graticule line.

h. Set INPUT ATTEN to 0 dB and REF LEVEL to 0 dBm. Record deviation from top graticule line. _____division

i. Use error recorded in step e to correct the deviation recorded in step h. Corrected deviation (gain compression) should not exceed −0.5 division (1 dB).

4-18. INPUT ATTENUATOR ACCURACY TEST

SPECIFICATION:

Input Attenuator (at preselector input, 70 dB range in 10 dB steps):

Step size variation (for steps from 0 to 60 dB):
< ±1.0 dB .01 to 18 GHz

Maximum cumulative error (from 0 to 60 dB):
< ±2.4 dB .01 to 18 GHz

DESCRIPTION:

The input attenuator accuracy is tested at 100 MHz using RF substitution (external, calibrated attenuator). The accurcy is also checked at 18 GHz using IF substitution. The IF gain reference level variation, previously recorded in Table 4-6, is taken into account when measuring attenuator accuracy at 18 GHz.

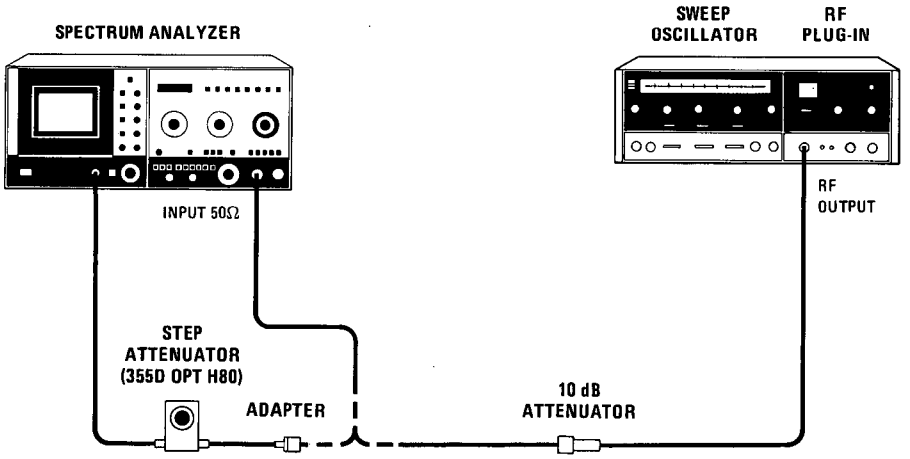


Figure 4-14. Input Attenuator Accuracy Test Setup

EQUIPMENT:

Sweep Oscillator/RF Plug-in	HP 8620C/86290A
Step Attenuator (10 dB/step)	HP 355D Opt. H80
10 dB Attenuator	HP 8491B, Opt. 010
Adapter, Type N Male to BNC Female	HP 1250-0780

4-18. INPUT ATTENUATOR ACCURACY TEST (Cont'd)

PROCEDURE:

a. Set spectrum analyzer controls as follows:

Set all Normal Settings (controls marked with green)
FREQUENCY BAND GHz ..... .01 — 1.8
INPUT ATTEN ..... 60 dB
REF LEVEL ..... 0 dBm
RESOLUTION BW ..... Coupled (pushed in)
FREQUENCY SPAN/DIV ..... .2 MHz
TUNING ..... 0.100 GHz

b. Connect equipment as shown in Figure 4-14 using CAL OUTPUT signal and step attenuator. Set step attenuator to 0 dB. Adjust spectrum analyzer TUNING control to center signal on CRT.

c. Pull to uncouple and set FREQUENCY SPAN/DIV to 10 kHz keeping signal centered with FINE TUNING control. Set RESOLUTION BW to 10 kHz.

d. Set AMPLITUDE SCALE to 1 dB (LOG/DIV) and set VIDEO FILTER to .01. Adjust REF LEVEL FINE control to place peak of signal at sixth division (from bottom graticule line).

e. Set the 8565A INPUT ATTEN (push in to set) and step attenuator to settings indicated in Table 4-10. Record deviation from sixth division for each setting.

Table 4-10. Input Attenuator Accuracy, 100 MHz

INPUT ATTEN Setting (dB)	Step Attenuator Setting (dB)	Deviation from 6th Division (dB)	Step Attenuator Error (Calibration)*	INPUT ATTEN Corrected Deviation (dB)
70	0	0 (Ref.)	Ref.	0 (Ref.)
60	10	_____	_____	_____
50	20	_____	_____	_____
40	30	_____	_____	_____
30	40	_____	_____	_____
20	50	_____	_____	_____
10	60	_____	_____	_____
0	70	_____	_____	_____

*Attenuations > dial settings are positive (+). Attenuations < dial settings are negative (–). For example, 9.99 dB calibration for a 10 dB attenuator setting represents an error of –0.01 dB.

f. To compute the corrected deviation, add the step attenuator error to the deviation from 6th division for each setting. The corrected deviation should not exceed ±1.0 dB between any two adjacent settings of the input attenuator.

4-18. INPUT ATTENUATOR ACCURACY TEST (Cont'd)

g. Record the maximum positive and maximum negative corrected deviation values computed in Table 4-10. The difference between these two values (total deviation) should not exceed ±2.4 dB.

———— dB Max Pos. Corrected Deviation
———— dB Max Neg. Corrected Deviation
———— dB Max Cumulative Error (Total Deviation)

h. Disconnect step attenuator from spectrum analyzer input and connect sweep oscillator output through 10 dB attenuator as shown in Figure 4-14.

i. Set spectrum analyzer to Normal Settings. Set INPUT ATTEN to 0 dB and set REF LEVEL to 0 dBm. Set FREQUENCY BAND GHz to 8.5 — 18. Set FREQUENCY SPAN/DIV (coupled) to 2 MHz and adjust TUNING control for an indication of 18.0 GHz on FREQUENCY readout.

j. Set sweep oscillator for a 18.0 GHz CW signal with maximum internally leveled output power. Adjust sweep oscillator CW and CW vernier controls to center signal on CRT display.

k. Set AMPLITUDE SCALE to 1 dB (LOG/DIV) and adjust REF LEVEL FINE control to place peak of signal at sixth division (from bottom graticule line). Reduce sweep oscillator power if necessary.

l. Press ZERO SPAN Pushbutton and set VIDEO FILTER to NOISE AVG. Adjust FINE TUNING control to peak trace on CRT display and adjust REF LEVEL FINE control to place trace at sixth division.

m. Set INPUT ATTEN to 10 dB and return REF LEVEL control to 0 dBm. Do not adjust REF LEVEL FINE control.

n. Adjust FINE TUNING control to peak trace and record deviation from 6th division in Table 4-11.

o. Set INPUT ATTEN to 20 dB and return REF LEVEL control to 0 dBm. Do not adjust REF LEVEL FINE control. Repeat step n.

p. Set INPUT ATTEN to 30 dB and return REF LEVEL control to 0 dBm. Do not adjust REF LEVEL FINE control. Repeat step n.

q. Remove 10 dB attenuator and connect cable from sweep oscillator output directly to analyzer input. Set REF LEVEL control to +10 dBm. Adjust FINE TUNING control to peak trace and adjust REF LEVEL FINE control to place trace at deviation recorded for 30 dB INPUT ATTEN setting.

r. Set INPUT ATTEN to 40 dB and return REF LEVEL control to +10 dBm. Do not adjust REF LEVEL FINE control. Repeat step n.

s. Set INPUT ATTEN to 50 dB and return REF LEVEL control to +10 dBm. Do not adjust REF LEVEL FINE control. Repeat step n.

t. Set INPUT ATTEN to 60 dB and return REF LEVEL control to +10 dBm. Do not adjust REF LEVEL FINE control. Repeat step n.

4-18. INPUT ATTENUATOR ACCURACY TEST (Cont'd)

Table 4-11. Input Attenuator Accuracy, 18 GHz

INPUT ATTEN Setting (dB)	Deviation from 6th Division (dB)	REF LEVEL Corrected Deviation* (dB)		INPUT ATTEN Corrected Deviation (dB)
0	0 (Ref.)	0 (Ref.)	(0)	0 (Ref.)
10	_____	_____	(–10)	_____
20	_____	_____	(–20)	_____
30	_____	_____	(–30)	_____
40	_____	_____	(–30)	_____
50	_____	_____	(–40)	_____
60	_____	_____	(–50)	_____

*From Table 4-6.

u. Record REF LEVEL corrected deviation from Table 4-6 in Table 4-11. (Note that REF LEVEL corrected deviation for INPUT ATTEN setings of 30 dB and 40 dB are the same.)

v. To compute the corrected deviation, subtract the REF LEVEL corrected deviation from the deviation from the 6th division for each setting (see example). The corrected deviation should not exceed ±1.0 dB between any two adjacent settings of the input attenuator.

Example:

INPUT ATTEN Setting (dB)	Deviation from 6th Division (dB)	REF LEVEL Corrected Deviation* (dB)		Corrected Deviation (dB)
0	0 (Ref.)	0 (Ref.)	(0)	0 (Ref.)
10	–0.1	–0.2	(–10)	+0.1
20	+0.3	–0.1	(–20)	+0.4
30	–0.2	+0.1	(–30)	–0.3
40	+0.2	+0.1	(–30)	+0.1

w. Record the maximum positive and maximum negative corrected deviation values computed in Table 4-11. The difference between these two values should not exceed ±2.4 dB.

_____ dB Max Pos. Corrected Deviation
_____ dB Max Neg. Corrected Deviation
_____ dB Max Cumulative Error (Total Deviation)

PERFORMANCE TESTS

4-19. CALIBRATOR OUTPUT ACCURACY TEST

SPECIFICATION:

Calibrator output:
−10 dBm ± 0.3 dB
100 MHz ± 10 kHz

DESCRIPTION:

The calibrator output level is measured using a power meter. The frequency of the calibrator output signal is measured using the counter input of the HP 8640B.

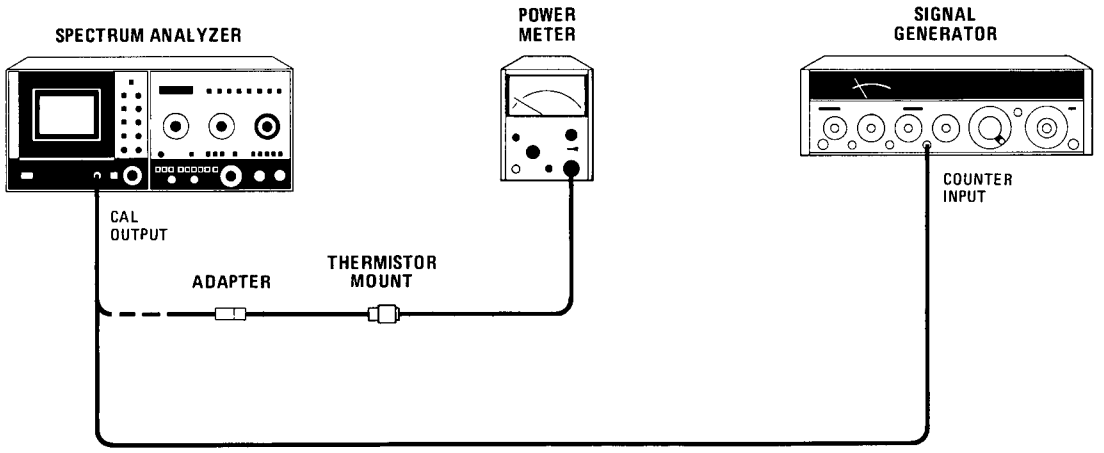


Figure 4-15. Calibrator Output Accuracy Test Setup

EQUIPMENT:

Power Meter	HP 432A
Thermistor Mount	HP 8478B
Signal Generator	HP 8640B
Adapter, Type N Female to BNC Male	HP 1250-0077

PROCEDURE:

a. Zero and calibrate the power meter. Connect thermistor mount, through adapter, directly to CAL OUTPUT port and measure power level. Calibrator output level should be −10 dBm ±0.3 dB.

b. Disconnect thermistor mount/adapter and connect CAL OUTPUT to counter input of HP 8640B. Set counter mode to expand X10 and external. Calibrator output frequency should be 100 MHz ± 10 kHz.

PERFORMANCE TESTS

4-20. FREQUENCY RESPONSE TEST

SPECIFICATION:

Frequency Response (with 0 or 10 dB of Input Attenuation): Frequency response includes input attenuator, preselector and mixer response plus mixing mode gain variation (band to band).

DESCRIPTION:

Frequency response is checked in each internal mixing band. The spectrum analyzer is internally swept in FULL BAND mode and the RF input signal is very slowly swept across the entire FREQUENCY BAND selected. The resulting display is a "picket fence" which varies in heighth across the CRT. Since the RF source is leveled and held quite flat across each frequency band, variations in amplitude on the display represent the frequency response of the spectrum analyzer. The 10.5 to 22 GHz FREQUENCY BAND requires two different test setups but is performed in the same manner. Since leveling within reasonable limits becomes difficult from 18 GHz to 22 GHz, the RF output at the power splitter is characterized and compensated for when making the measurement from 18 GHz to 22 GHz.

CONFIGURATION A

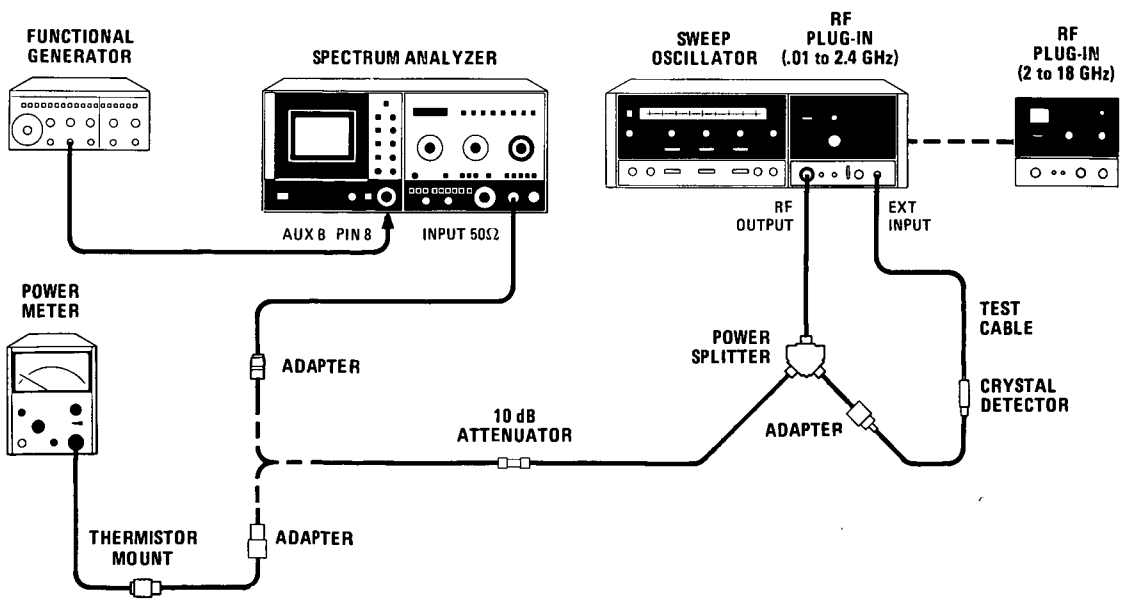


Figure 4-16. Frequency Response Test Setup (1 of 2)

PERFORMANCE TESTS

4-20. FREQUENCY RESPONSE TEST (Cont'd)

CONFIGURATION B

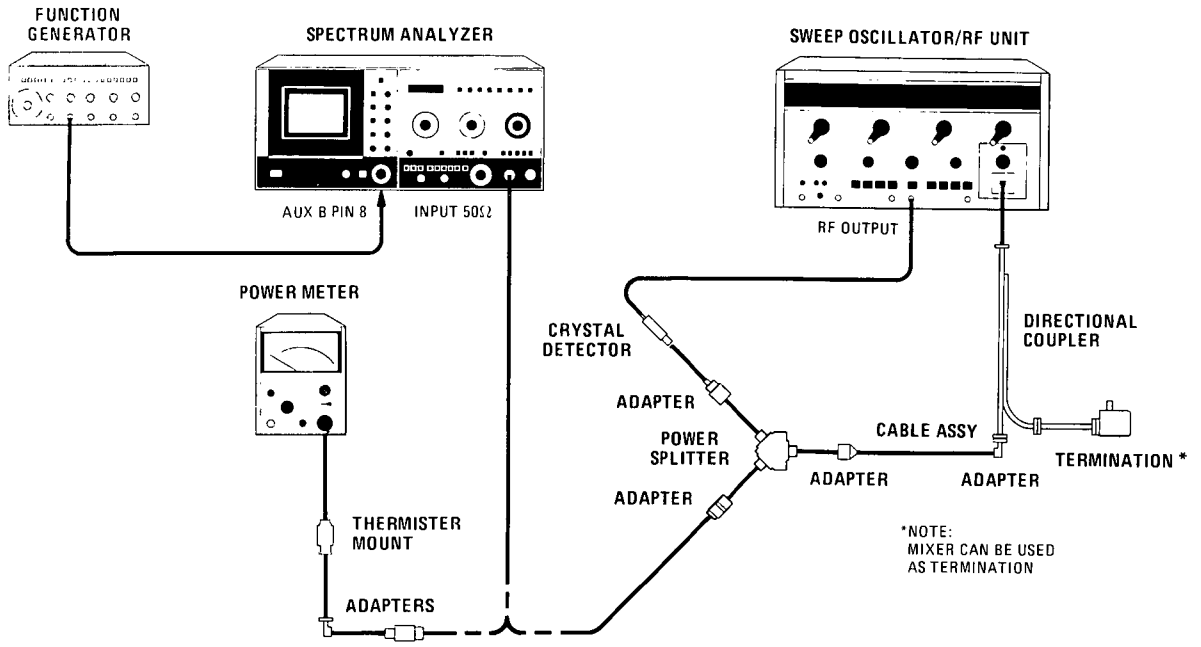


Figure 4-16. Frequency Response Test Setup (2 of 2)

EQUIPMENT:

Sweep Oscillator	HP 8620C/86222A/86290A
Sweep Oscillator/RF Unit	HP 8690B/8696A
Power Meter	HP 432A
Thermistor Mount	HP K486A
Thermistor Mount	8478B
Power Splitter	HP 11667A Opt. 002
Crystal Detector	HP 33330C
10 dB Attenuator	HP 8492A
Test Cable, SMA Female to BNC Male (Part of Service Package, HP P/N 08565-60100)	HP 11592-60001
Adapter, APC-7 to Type N Male	HP 11525A
Adapter, APC-7 to Type N Female	HP 11524A
Adapter, APC-7 to SMA Female	HP 11534A
Adapter, Waveguide to SMA Jack (2 required)	Narda 4608
Adapter, N Plug/SMA Jack	HP 1250-1250
Adapter, Type N Female to SMA Female	HP 86290-60005
Cable Assembly	HP 8120-1578
Function Generator	HP 3312A

4-20. FREQUENCY RESPONSE TEST (Cont'd)

PROCEDURE:

a. Set spectrum analyzer controls as follows:

Set all Normal Settings (controls marked with green)

FREQUENCY BAND GHz	.01 — 1.8
INPUT ATTEN	0 dB
REF LEVEL	0 dBm
REF LEVEL FINE	0
RESOLUTION BW	3 MHz, Uncoupled
FREQUENCY SPAN/DIV	2 MHz
TUNING	0.100 GHz
AMPLITUDE SCALE	.2 dB LOG/DIV

Frequency Response, .01 to 18 GHz Bands

b. Using .01 to 2.4 GHz source, connect equipment as shown in Configuration A of Figure 4-16. Connect output of power splitter, through 10 dB attenuator and adapter, to thermistor mount. With RF power off, zero the power meter. Turn RF power on.

c. Set sweep oscillator for 100 MHz and adjust RF power level for a power meter indiction of −8 dBm. Connect output of power splitter through 10 dB attenuator and adapter directly (do not use cable) to INPUT 50Ω of spectrum analyzer. Peak of signal should be at center horizontal graticule line ± one minor division (±0.3 dB). If not, recheck sweep oscillator output level making sure that power meter has been properly calibrated and zeroed before making the measurement.

d. Adjust REF LEVEL CAL to place peak of 100 MHz signal at center horizontal graticule line.

e. Set spectrum analyzer FREQUENCY SPAN MODE to FULL BAND and set TUNING control fully counterclockwise (lowest frequency). Set BASELINE CLIPPER to 12 o'clock position. Set sweep oscillator to cover entire FREQUENCY BAND selected.

NOTE

To properly set band edges using HP 8620C, use marker sweep and set sweep oscillator to manual sweep mode. Set manual sweep control fully counterclockwise and adjust start marker control until signal is at left-hand edge of spectrum analyzer display. Set sweep oscillator manual sweep control fully clockwise and adjust stop marker until signal is at right-hand edge of spectrum analyzer display.

f. Set spectrum analyzer PERSIST control fully clockwise. Set sweep oscillator for automatic internal sweep at slowest sweep time (100 seconds). Slowly adjust sweep oscillator sweep time vernier for display similar to that of Figure 4-17. Read greatest positive and greatest negative deviations from center horizontal graticule line. Frequency response (deviation from center horizontal graticule line) should not exceed ± 1.2 dB.

4-20. FREQUENCY RESPONSE TEST (Cont'd)

NOTE

If the frequency response appears to be out of specification near a band edge, use a frequency counter to ensure the frequency in question is within the specified band. This may be necessary as the FULL BAND mode frequency span is slightly beyond the specified band edges.

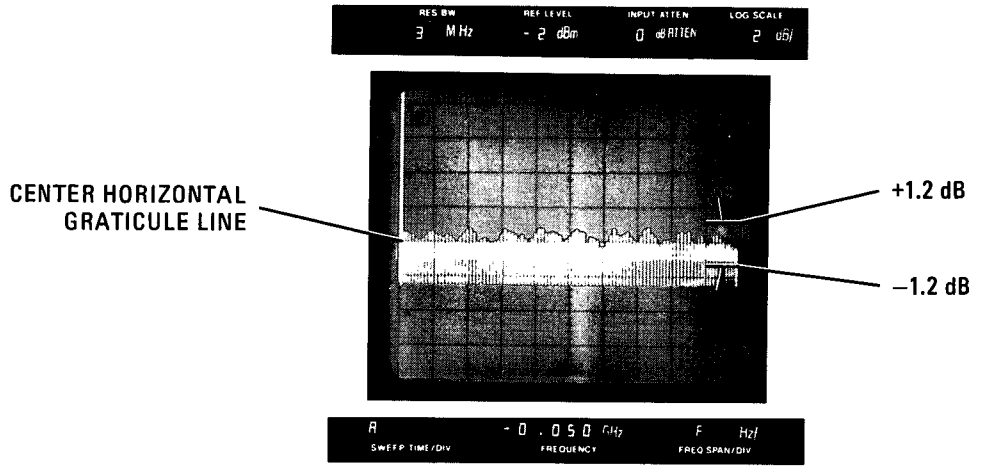


Figure 4-17. Typical Frequency Response, .01 to 1.8 GHz

g. Set spectrum analyzer INPUT ATTEN control to 10 dB and set REF LEVEL control to 0 dBm. Press ERASE pushbutton. Record level with respect to center horizontal graticule line at 100 MHz. This level is the reference for frequency response measurements with 10 dB INPUT ATTENuation. Read greatest positive and negative deviations from the 100 MHz reference. Frequency response should not exceed ±1.2 dB.

100 MHz Reference _____dB from center horizontal graticule line

h. Remove .01 to 2.4 GHz RF plug-in from mainframe and replace with 2 to 18 GHz RF plug-in. Remove 10 dB attenuator and connect power splitter directly to spectrum analyzer INPUT 50Ω. Select band 4 (2.0 – 18 GHz) on 8620C sweep oscillator.

i. Set spectrum analyzer INPUT ATTEN control to 0 dB, REF LEVEL control to 0 dBm, and FREQUENCY BAND GHz to 1.7 — 4.1. Set PERSIST control fully counterclockwise. Set sweep oscillator to CW mode and adjust CW control to center signal on CRT CENTER FREQUENCY line. Set sweep oscillator to ΔF x 10. Set mode switch to manual sweep and set manual sweep control fully counterclockwise. Adjust ΔF control until signal is at left-hand edge of CRT display. Set manual sweep control fully clockwise. Signal should be at right-hand edge of CRT display. If necessary, readjust ΔF and CW controls slightly to cover entire FREQUENCY BAND (1.7 to 4.1 GHz).

4-20. FREQUENCY RESPONSE TEST (Cont'd)

j. Set PRESELECTOR PEAK control to center of green region. Apply a 1 kHz 1V peak-to-peak sine wave from a function generator to AUX B pin 8. This signal modulates the YTF (YIG tuned filter) and is equivalent to peaking the PRESELECTOR PEAK at all frequencies.

k. Disconnect power splitter from spectrum analyzer input and measure output at power splitter port with power meter. Slowly tune through the entire frequency band using the sweep oscillator manual sweep control. Note the maximum and minimum excursions and set manual sweep control for a power meter indication midway between the maximum and minimum excursions. Turn RF power off and zero the power meter. Turn RF power on and adjust RF plug-in power level control for a power meter indication of −8 dBm. Reconnect power splitter to spectrum analyzer input.

l. Set spectrum analyzer PERSIST control fully clockwise. Set sweep oscillator mode switch to automatic sweep and press spectrum analyzer ERASE pushbutton. Read greatest positive and negative deviations from center horizontal graticule line. Frequency response should not exceed ±1.7 dB.

m. Set spectrum analyzer INPUT ATTEN control to 10 dB and set REF LEVEL control to 0 dBm. Press ERASE pushbutton. Read greatest positive and negative deviations from 100 MHz reference (step g). Frequency response should not exceed ±1.7 dB.

n. Set spectrum analyzer INPUT ATTEN control to 0 dB, REF LEVEL control to 0 dBm, and FREQUENCY BAND GHz to 3.8 — 8.5. Set PERSIST control fully counterclockwise. Set sweep oscillator mode switch to manual and set controls to cover entire FREQUENCY BAND selected (refer to note in step e). Repeat steps k through l. Frequency response should not exceed ±2.2 dB.

o. Set spectrum analyzer INPUT ATTEN control to 10 dB and set REF LEVEL control to 0 dBm. Press ERASE pushbutton. Read greatest positive and negative deviations from 100 MHz reference (step g).

p. Set spectrum analyzer INPUT ATTEN control to 0 dB, REF LEVEL control to 0 dBm, and FREQUENCY BAND GHz to 5.8 — 12.9. Set PERSIST control fully counterclockwise. Set sweep oscillator mode switch to manual sweep and set controls to cover entire FREQUENCY BAND selected (refer to note in step e). Repeat steps k through l. Frequency response should not exceed ±2.5 dB. Repeat step o. Frequency response should not exceed ±2.5 dB.

q. Set spectrum analyzer INPUT ATTEN control to 0 dB, REF LEVEL control to 0 dBm, and FREQUENCY BAND GHz to 8.5 — 18. Set PERSIST control fully counterclockwise. Set sweep oscillator mode switch to manual sweep and set controls to cover entire FREQUENCY BAND selected (refer to note in step e). Repeat steps k through l. Frequency response should not exceed ±3.0 dB. Repeat step o. Frequency response should not exceed ±3.0 dB.

Frequency Response, 10.5 to 22 GHz Band

r. With INPUT ATTEN control set at 10 dB and REF LEVEL control set at 0 dBm, set spectrum analyzer FREQUENCY BAND GHz to 10.5 — 22. Set PERSIST control fully counterclockwise. Set BASELINE CLIPPER Fully counterclockwise. Set sweep oscillator mode switch to manual and set controls to cover 10.5 to 18 GHz.

4-20. FREQUENCY RESPONSE TEST (Cont'd)

s. Disconnect power splitter from spectrum analyzer input and measure output at power splitter with power meter. Set sweep oscillator to 18 GHz (manual sweep control fully clockwise) and adjust RF plug-in power level control for a power meter indication of −8 dBm. Reconnect power splitter to spectrum analyzer input.

t. Set spectrum analyzer PERSIST control fully clockwise. Set sweep oscillator mode switch to automatic sweep and press spectrum analyzer ERASE pushbutton. STORE display after one full plot as shown in Figure 4-18. Record the greatest positive and negative deviations from center horizontal graticule line.

_____ Pos. Deviation

_____ Neg. Deviation

u. Connect equipment as shown in Configuration B of Figure 4-16 with power meter connected to measure output of power splitter. Set sweep oscillator for CW output at 18 GHz. Set line switch to standby and zero the power meter. Turn RF on and set output of sweep oscillator to −8 dBm. Slowly tune the CW source from 18 GHz to 22 GHz and note all of the peak deviations (positive and negative) from −8 dBm reference, and frequencies at which they occur. Record frequencies and peak deviations in Table 4-12. (See example.)

Table 4-12. Correcting for Frequency Response of Signal Source

Frequency (GHz)	Peak Deviation (dB)	CRT Horizontal Displacement (div)	Actual Deviation (dB)	Corrected Deviation (dB)

Example:

Frequency (GHz)	Peak Deviation (dB)	CRT Horizontal Displacement (div)	Actual Deviation (dB)	Corrected Deviation (dB)
18.6	− 1.0	7	− 1.0	0
19.6	− 0.5	7.8	− 1.0	− 0.5
20.1	+ 1.0	8.3	0	− 1.0
20.6	− 1.5	8.7	− 2.0	− 0.5
21.2	+ 0.5	9.2	+ 1.5	+ 1.0
21.8	− 1.0	9.7	− 0.4	+ 0.6

4-20. FREQUENCY RESPONSE TEST (Cont'd)

v. Disconnect thermistor mount from power splitter and connect measured port of power splitter to spectrum analyzer INPUT 50Ω.

w. Set AMPLITUDE SCALE to 10 dB (LOG/DIV). Set TUNING control to each frequency recorded in Table 4-12 and record CRT Horizontal Displacement of marker (number of divisions from far left graticule line) for each setting. (See example.)

x. Set AMPLITUDE SCALE to 2 dB (LOG/DIV). Set TUNING control for any frequency less than 18 GHz. Set sweep oscillator to manually triggered sweep function and adjust band edges to cover 18 GHz to 22 GHz. Set sweep time for slowest sweep (100 seconds).

y. Press spectrum analyzer ERASE pushbutton and set PERSIST control fully clockwise. Trigger the sweep oscillator and slowly adjust sweep time vernier for display similar to that of Figure 4-19. STORE display and read greatest positive and negative deviations from center horizontal graticule line.

——— Pos. Deviation

——— Neg. Deviation

z. Read deviation from horizontal graticule line at each CRT Horizontal Displacement and record Actual Deviations in Table 4-12. Algebraically subtract Peak Deviation from CRT Actual Deviation for each setting in Table 4-12. Record results in Corrected Deviation column. (See example.) Including results from steps t and y and Corrected Deviation from Table 4-12, record the greatest positive and negative deviations. Frequency response (deviation from center horizontal graticule line) should not exceed ± 4.5 dB.

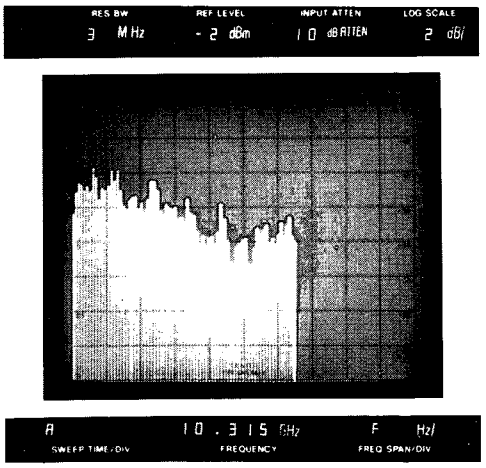


Figure 4-18. Typical Frequency Response, 10.5 to 18 GHz

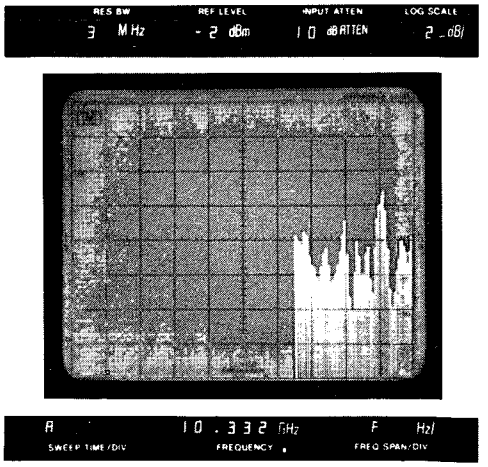


Figure 4-19. Typical Frequency Response, 18 to 22 GHz.

PERFORMANCE TESTS

4-21. AMPLITUDE ACCURACY SWITCHING BETWEEN BANDWIDTHS TEST

SPECIFICATION:

Switching between bandwidths: 3 MHz to 300 kHz, ±0.5 dB; 3 MHz to 1 kHz (3 MHz to .1 kHz for Option 100), ± 1.0 dB (100 kHz BW limited to 90% relative humidity).

DESCRIPTION:

The spectrum analyzer 100 MHz CAL OUTPUT signal is applied to the INPUT 50Ω and displayed on the CRT. The peak of the displayed 100 MHz signal is centered on the CRT and adjusted for a vertical deflection of seven divisions. The amplitude variation of the 100 MHz signal is measured for each RESOLUTION BW control setting.

PROCEDURE:

a. Set spectrum analyzer controls as follows:

Set all Normal Settings (controls marked with green)
FREQUENCY BAND GHz ..... .01 — 1.8
INPUT ATTEN ..... 10 dB
REF LEVEL ..... 0 dBm
REF LEVEL FINE ..... −8
RESOLUTION BW ..... 1 MHz, Uncoupled
FREQUENCY SPAN/DIV ..... .2 MHz
TUNING ..... 0.100 GHz

b. Connect spectrum analyzer CAL OUTPUT signal to INPUT 50Ω.

c. Set AMPLITUDE SCALE to 1 dB (LOG/DIV) and center signal on CRT.

d. Adjust REF LEVEL FINE control to position peak of 100 MHz signal at seventh division (from bottom graticule line).

e. Change the RESOLUTION BW and FREQUENCY SPAN/DIV controls in accordance with Table 4-13. Record the change in amplitude for each RESOLUTION BW setting. Changes in amplitude above reference level set in step d are positive (+). Changes below reference level are negative (−).

f. To find the overall variation in Table 4-13, algebraically subtract the greatest negative change in amplitude from the greatest positive change in amplitude. If all changes in amplitude are of the same sign, the overall variation is the largest positive or largest negative change in amplitude. The overall variation between 3 MHz and 300 kHz RESOLUTION BW settings should be ≤1.0 dB (±0.5 dB). The overall variation between 3 MHz and 1 kHz (3 MHz and .1 kHz for Option 100) RESOLUTION BW settings should be ≤2.0 dB (± 1.0 dB).

4-21. AMPLITUDE ACCURACY SWITCHING BETWEEN BANDWIDTHS TEST (Cont'd)

Table 4-13. Amplitude Accuracy Switching Between Bandwidths

RESOLUTION BW Setting	FREQUENCY SPAN/DIV Setting	Change in Amplitude (dB)	Overall Variation Between 3 MHz and 300 kHz RESOLUTION BW Settings	Overall Variation Between 3 MHz and 1 kHz RESOLUTION BW Settings
3 MHz	1 MHz	0 (Ref.)		
1 MHz	.2 MHz	_____	_____	_____
300 kHz	50 kHz	_____		
100 kHz	20 kHz	_____		
30 kHz	5 kHz	_____		
10 kHz	2 kHz	_____		
3 kHz	2 kHz	_____		
1 kHz	1 kHz	_____		
Opt. 100 .3 kHz	1 kHz	_____		
Opt. 100 .1 kHz	1 kHz	_____		

4-22. DISPLAY ACCURACY TEST

SPECIFICATION:

Display accuracy:
Log: $< \pm 0.1$ dB/dB but not more than ± 1.5 dB over full 70 dB display range.
Linear: $< \pm 0.1$ division over full 8 division deflection.

DESCRIPTION:

The display accuracy is tested by connecting a DVM to the rear-panel VERTICAL OUTPUT connector of the spectrum analyzer. ZERO SPAN mode is selected so the signal appears as a straight horizontal line on the CRT display. The DVM is used to provide good resolution for this measurement.

4-22. DISPLAY ACCURACY TEST (Cont'd)

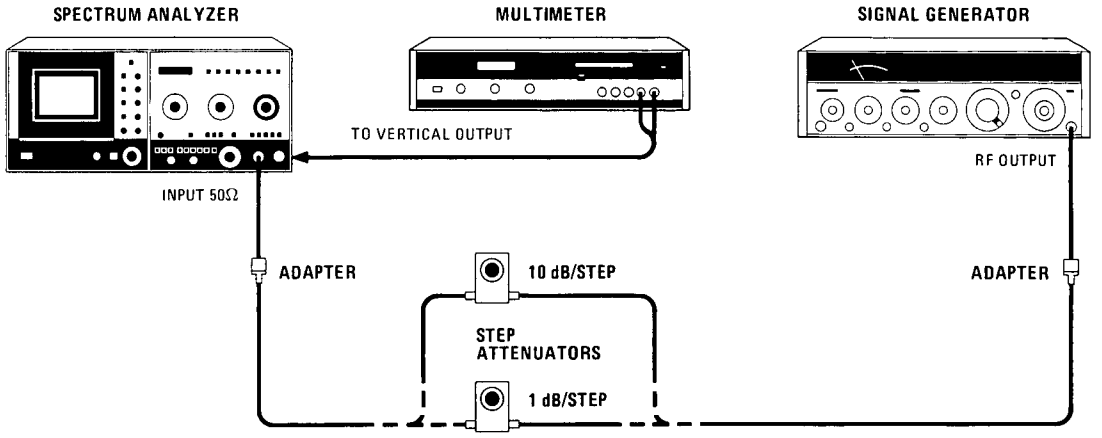


Figure 4-20. Display Accuracy Test Setup

EQUIPMENT:

Signal Generator	HP 8640B
Multimeter (DVM)	HP 3490A
Step Attenuator (10 dB/Step)	HP 355D
Step Attenuator (1 dB/Step)	HP 355C
Adapter, Type N Male to BNC Female (2 required)	HP 1250-0780

PROCEDURE:

a. Set spectrum analyer controls as follows:

Set all Normal Settings (controls marked with green)

FREQUENCY BAND GHz	.01 — 1.8
INPUT ATTEN	10 dB
REF LEVEL	0 dBm
REF LEVEL FINE	0
RESOLUTION BW	Coupled (pushed in)
FREQUENCY SPAN/DIV	2 MHz
TUNING	0.030 GHz
AMPLITUDE SCALE	LIN

Log Display Accuracy

b. With no signal at INPUT, measure and record the VERTICAL OUTPUT offset of the spectrum analyzer.

_____ mV

c. Connect equipment as shown in Figure 4-20 using 10 dB/step attenuator. Set step attenuator to 0 dB. Set signal generator for an unmodulated 30 MHz output at approximately 0 dBm.

4-22. DISPLAY ACCURACY TEST (Cont'd)

d. Set spectrum analyzer AMPLITUDE SCALE to 10 dB (LOG/DIV) and adjust TUNING control to center signal on CRT. Set FREQUENCY SPAN MODE to ZERO SPAN. Adjust FINE TUNING control to peak signal on CRT and DVM. If there is not enough tuning range, turn AUTO STABILIZER OFF while using TUNING control.

e. Set spectrum analyzer REF LEVEL FINE for a DVM indication of +800 mV plus the offset (step b) ±0.5 mV. The trace should be approximately at the top graticule line.

f. Increase the attenuation of the step attenuator and record the DVM reading for each step (up to 70 dB) in Table 4-14.

Table 4-14. Log Display Accuracy

Attenuator Setting (dB)	DVM Reading (mV)	Corrected DVM Reading * (mV)	Theoretical Reading (mV)	Theoretical Reading Subtracted from DVM Reading (mV)	Difference Between Adjacent Readings (mV)
0	_____	+800 (Ref.)	+800	0	
10	_____	_____	+700	_____	_____
20	_____	_____	+600	_____	_____
30	_____	_____	+500	_____	_____
40	_____	_____	+400	_____	_____
50	_____	_____	+300	_____	_____
60	_____	_____	+200	_____	_____
70	_____	_____	+100	_____	_____

*DVM Reading minus offset recorded in step b.

Example 1 (+5mV offset)

Attenuator Setting (dB)	DVM Reading (mV)	Corrected DVM Reading * (mV)	Theoretical Reading (mV)	Theoretical Reading Subtracted From DVM Reading (mV)	Difference Between Adjacent Readings (mV)
0	+805	+800	+800	0	
10	+811	+703	+700	+3	−3
20	+599	+594	+600	−6	+9
30	+497	+492	+500	−8	+2
40	+406	+401	+400	+1	−9

4-22. DISPLAY ACCURACY TEST (Cont'd)

g. Having recorded the DVM readings for all of the attenuator settings from 0 to 70 dB, subtract the theoretical reading from the corrected DVM reading (DVM reading minus offset) in each case and record results in Table 4-14.

h. Subtract each converted reading (theoretical reading subtracted from DVM reading) from the previous converted reading. This subtraction must be performed algebraically. Record results in Table 4-14 (see Example 1).

i. The difference between adjacent readings (Table 4-14) should not exceed ±10 mV (±0.1 dB/dB).

j. Note the highest positive and negative value recorded under "Theoretical Reading Subtracted from DVM Reading." Add their absolute values (disregarding their signs). If all of the signs are negative or all of the signs are positive, subtract the lowest absolute value from the highest absolute value. (See Exmple 2). The sum or difference of the absolute values should not exceed 30 mV (±1.5 dB).

Example 2

Observing the table in Example 1, note that −8 mV is the highest negative value and +3mV is the highest positive value. Their absolute values being 8 mV and 3 mV: 8 plus 3 = 11 mV (1.1 dB).

Linear Display Accuracy

k. Replace 10 dB/step attenuator with 1 dB/step attenuator. Set step attenuator to 0 dB.

l. Set spectrum analyzer AMPLITUDE SCALE to LIN and adjust REF LEVEL FINE control for a DVM indication of +800 mV ± 0.5 mV.

m. Set step attenuator to 6 dB. DVM should indicate +400 mV ± 10 mV (±0.1 division).

n. Set step attenuator to 12 dB. DVM should indicate +200 mV ± 10 mV (± 0.1 division).

4-23. SWEEP TIME ACCURACY TEST

SPECIFICATION:

Calibrated sweep times: 21 internal sweep times from 2 μsec/Div to 10 sec/Div in 1, 2, 5, 10 sequence. Sweep time accuracy ±10% except for 2, 5, and 10 sec/Div which are ±20%.

DESCRIPTION:

A time mark generator is used to modulate a 500 MHz signal which is applied to the INPUT 50Ω of the spectrum analyzer. ZERO SPAN is used to demodulate the signal, displaying markers at very accurate time intervals. The sweep time accuracy of the spectrum analyzer is checked by observing the marker displayed near the center graticule line. This marker (peak) must be within ±0.5 division (±10%) of center graticule line for sweep times up to and including 1 second per division, and ±1.0 division (±20%) for 2, 5, and 10 second per division sweeps.

4-23. SWEEP TIME ACCURACY TEST (Cont'd)

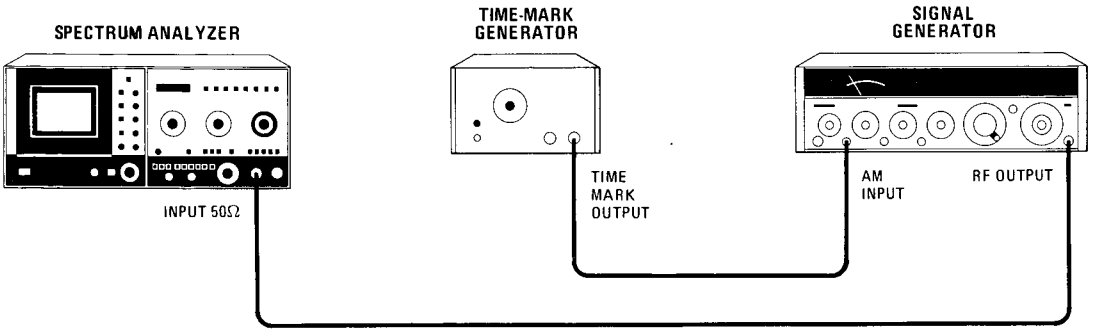


Figure 4-21. Sweep Time Accuracy Test Setup

EQUIPMENT:

Signal Generator	HP 8640B
Time Mark Generator	HP 226A

PROCEDURE:

a. Set spectrum analyzer controls as follows:

Set all Normal Settings (controls marked with green)

FREQUENCY BAND GHz	.01 — 1.8
INPUT ATTEN	10 dB
REF LEVEL	+10 dBm
REF LEVEL FINE	0
RESOLUTION BW	3 MHz, Uncoupled
FREQUENCY SPAN/DIV	10 MHz
TUNING	0.500 GHz

b. Set signal generator for an unmodulated 500 MHz output at approximately 0 dBm.

c. Connect equipment as shown in Figure 4-21 leaving 8640B AM switch in OFF position.

d. Adjust spectrum analyzer TUNING control to center signal on CRT. Set FREQUENCY SPAN MODE to ZERO SPAN and set SWEEP TRIGGER to VIDEO.

e. Set 8640B AM switch to PULSE. Set time mark generator to 5 μsec and spectrum analyzer SWEEP TIME/DIV switch to 2 μsec.

f. Adjust TRIGGER LEVEL so the first peak is at the graticule reference line (see Figure 4-22). The third peak should be at the center graticule line ± 0.5 division (± 10%).

g. Set SWEEP TIME /DIV to 5 μsec and adjust TRIGGER LEVEL so first peak is at graticule reference line. The sixth peak should be at the center grticule line ±0.5 division (± 10%).

4-23. SWEEP TIME ACCURACY TEST (Cont'd)

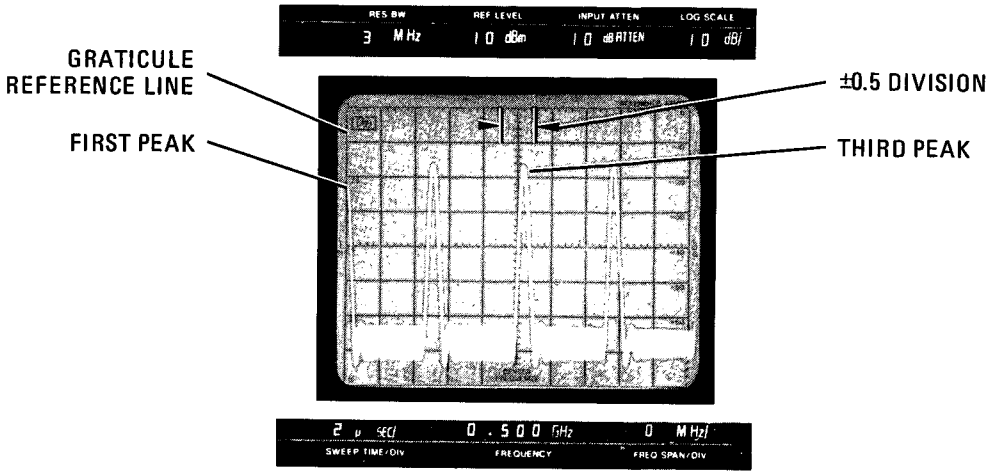


Figure 4-22. Sweep Time Accuracy, 2μ SEC/DIV

h. Continue increasing SWEEP TIME/DIV and setting time mark generator to match the sweep times of the spectrum analyzer. Adjust TRIGGER LEVEL as necessary to place first peak at graticule reference line. The sixth peak should be at center graticule line ±0.5 division for each setting up to and including 1 SEC per division.

NOTE

When 10 mSEC SWEEP TIME/DIV setting is reached, set BASELINE CLIPPER control clockwise until baseline completely disappears. Set PERSIST control fully clockwise and adjust INTENSITY control as necessary to reduce blooming. Continue checking SWEEP TIME/DIV up to and including 1 SEC per division. Press ERASE pushbutton before checking position of sixth peak for each setting. (See Figure 8-23.)

i. Continue increasing SWEEP TIME/DIV and time mark generator settings to measure sweep time accuracy at 2, 5, and 10 second per division sweeps. START/RESET pushbutton can be used to reset start of trace for each setting. The sixth peak should be at center graticule line ±1.0 division (±20%).

4-23. SWEEP TIME ACCURACY TEST (Cont'd)

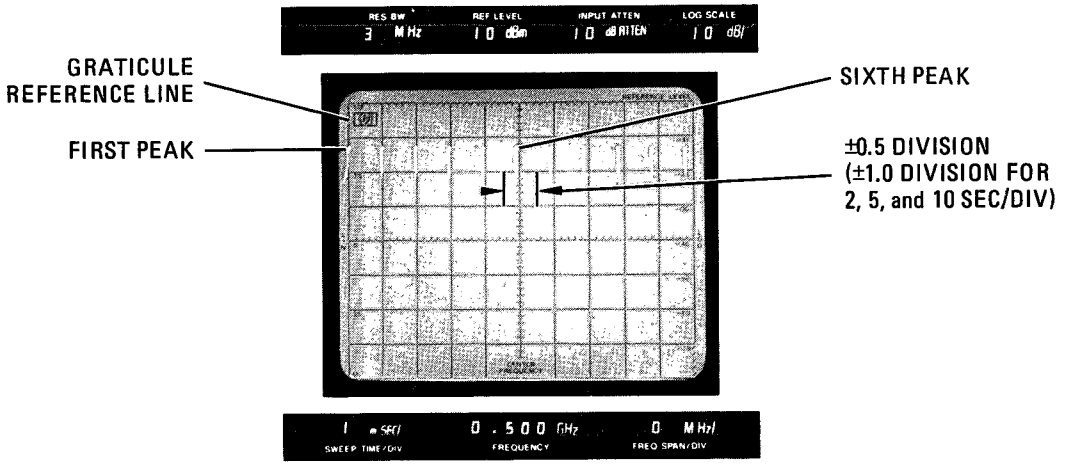


Figure 4-23. Sweep Time Accuracy, 1 mSEC/DIV

SECTION V
ADJUSTMENTS

5-1. INTRODUCTION

5-2. This section describes adjustments required to return the Spectrum Analyzer to peak operating condition when repairs are required. Table 5-1 lists all of the adjustments by adjustment name, reference designator, adjustment paragraph, service sheet number, and description. Included in this section are test setups, and check and adjustment procedures.

5-3. Data taken during adjustments should be recorded in the spaces provided. Comparison of initial data with data taken during periodic adjustments assists in preventive maintenance and troubleshooting.

WARNING

With the covers removed, terminals are exposed that have voltages capable of causing death. The adjustments in this section should be performed only by a skilled person who knows the hazard involved.

NOTE

Before performing any adjustments, allow 1 hour warmup time for the instrument.

5-4. EQUIPMENT REQUIRED

5-5. Table 1-3 contains a tabular list of test equipment and test accessories required in the adjustment procedures. In addition, the table contains the required minimum specifications and a suggested manufacturers model number.

5-6. Blade Tuning Tools

5-7. For adjustments requiring a non-metallic tuning tool, use fiber tuning tool, HP Part Number 8710-0033. In situations not requiring non-metallic tuning tools, an ordinary small screwdriver or other suitable tool is sufficient. No matter what tool is used, never try to force any adjustment control in the analyzer. This is especially critical when tuning variable slug-tuned inductors, and variable capacitors.

5-8. FACTORY SELECTED COMPONENTS

5-9. Table 5-2 contains a list of factory selected components by reference designation, schematic diagram location, and basis of selection. Factory selected components are designated by an asterisk (*) on the schematic diagrams in Section VIII.

5-10. RELATED ADJUSTMENTS

5-11. Interactive control adjustments are noted in the procedures. Table 5-3 indicates by paragraph numbers the adjustments that must be performed if an assembly has been replaced or repaired, or if an adjustment has been made on an assembly.

Table 5-1. Adjustable Components (1 of 8)

Reference Designator	Adjustment Name	Adjustment Paragraph	Service Sheet	Performance Tests	Description
A3R1	ASTIG	5-13	27		Adjusts astigmatism of CRT display.
A3R2	TRACE ALIGN	5-14	27		Aligns X and Y axes with graticule display.
A4C8	HF ADJUST	5-15	30		Adjusts risetime of Z-axis gate.
A4R18	HF GAIN	5-15	30		Adjusts high frequency gain of Z-axis driver.
A5R27	GAIN	5-17	29		Adjusts gain of Y-axis deflection ampl.
A6R27	GAIN	5-17	28		Adjusts gain of X-axis deflection ampl.
A7R17	WRITE DEPTH	5-16	31		Adjusts storage mesh potential
A7R59	PAT	5-14	31		Corrects for curvature in CRT trace.
A7R63	FLG	5-16	31		Adjusts Flood Gun grid voltage.
A7R64	COLLIMATOR	5-16	31		Adjusts dispersion of flood gun beam.
A7R70	INT	5-16	31		Adjusted to keep intensity constant with changes in persistence.
A7R71	ORTHOG	5-14	31		Adjusts for perpendicular X and Y axes.
A8R13	FOCUS LIMIT	5-13	32		Sets limit of front panel FOCUS control.
A9R2	HV	5-13	32		Adjusts High Voltage Power Supply.
A9R4	INT	5-13	32		Sets maximum CRT trace intensity.
A12R18	REF ADJ	5-23	17	4-8	Adjusts negative reference voltage used in DVM.
A12R37	INPUT BAL	5-23	17	4-8	Balances DVM input amplifier.
A12R53	HYST	5-23	17	4-8	Adjusts scale offset of DVM near zero.
A12R56	ZERO ADJ	5-23	17	4-8	Adjusts point where DVM polarity change occurs.
A14R57	TICK SWP	5-28	15	4-9	Adjusts sweep voltage to YTO tickler coil.
A14R68	FET OFF	5-28	15	4-9	Nulls offset in VCXO sweep voltage.
A14R71	VCXO SWP	5-28	15	4-9	Adjusts sweep voltage to VCXO.

Table 5-1. Adjustable Components (2 of 8)

Reference Designator	Adjustment Name	Adjustment Paragraph	Service Sheet	Performance Tests	Description
A15R53	MAIN SWP OFFSET	5-27	11		Compensates for offset between wide and narrow frequency span widths.
A16R9	+10VTV	5-22	10	4-21	Adjusts +10 volt temperature variable supply.
A16R15	1MS	5-22	10	4-23	Calibrates 1 ms per division sweep time.
A16R19	2MS	5-22	10	4-23	Calibrates 2 ms per division sweep time.
A16R25	AST LIMIT	5-22	10		Adjusts AUTO sweep time current limit.
A16R74	SWP STOP	5-22	10	4-23	Sets maximum positive sweep ramp voltage.
A17R11	+10VR	5-23	12	4-8	Adjusts +10 volt reference supply.
A17R43	YTF OFFSET N2	5-30	12		Adjusts YTF sweep offset on 3.8 – 8.5 GHz FREQUENCY BAND.
A17R50	YTF OFFSET N3	5-30	12		Adjusts YTF sweep offset on 5.8 – 12.9 GHz FREQUENCY BAND.
A17R57	YTF OFFSET N4	5-30	12		Adjusts YTF sweep offset on 8.5 – 18 GHz FREQUENCY BAND.
A17R64	YTF OFFSET N5	5-30	12		Adjusts YTF sweep offset on 10.5 – 22 GHz FREQUENCY BAND.
A17R125	CF OFF	5-23	12	4-8	Nulls offset in center frequency analog voltage.
A19R5	YTO OFFSET	5-24	14	4-8	Adjusts YTO lower frequency to 2.05 GHz.
A19R8	YTO GAIN	5-24	14	4-8	Adjusts YTO upper frequency to 4.4 GHz.
A19R14	YTF OFFSET	5-24, 5-30	14		Adjusts YTF tracking at 2 GHz
A19R17	YTF GAIN	5-24, 5-30	14		Adjusts YTF tracking at 10 GHz
A19R39	YTF LIN 13	5-30	14		Adjusts YTF tracking at 13 GHz.
A19R42	YTF LIN 16	5-30	14		Adjusts YTF tracking at 16 GHz.
A19R45	YTF LIN 18	5-30	14		Adjusts YTF tracking at 18 GHz.

Table 5-1. Adjustable Components (3 of 8)

Reference Designator	Adjustment Name	Adjustment Paragraph	Service Sheet	Performance Tests	Description
A19R48	YTF LIN 20	5-30	14		Adjusts YTF tracking at 20 GHz.
A19R51	YTF LIN 22	5-30	14		Adjusts YTF tracking at 22 GHz.
A20R1	V3	5-29, 5-31	19	4-20	Adjusts mixer diode bias, 3.8 – 8.5 GHz
A20R2	V5	5-29, 5-31	19	4-20	Adjusts voltage mixer diode bias, 8.5 – 18 GHz.
A20R3	V4	5-29, 5-31	19	4-20	Adjusts mixer diode bias, 0.01 – 4.1 GHz, 5.8 – 12.9 GHz.
A20R5	R5	5-31	19	4-20	Adjusts output resistence for mixer diode bias, 8.5 – 18 GHz.
A20R6	V6	5-29, 5-31	19	4-20	Adjusts mixer diode bias, 10.5 – 22 GHz.
A20R7	B1A	5-31	19	4-20	Frequency response compensation, lower part of .01 – 1.8 GHz band.
A20R8	B1B	5-31	19	4-20	Frequency response compensation, upper part of .01 – 1.8 GHz band.
A20R9	B2A	5-31	19	4-20	Frequency response compensation, lower part of 1.7 – 4.1 GHz band.
A20R10	B2B	5-31	19	4-20	Frequency response compensation, middle part of 1.7 – 4.1 GHz band.
A20R11	B2C	5-31	19	4-20	Frequency response compensation, upper part of 1.7 – 4.1 GHz band.
A20R12	B3A	5-31	19	4-20	Frequency response compensation, lower part of 3.8 – 8.5 GHz band.
A20R13	B3B	5-31	19	4-20	Frequency response compensation, upper part of 3.8 – 8.5 GHz band.
A20R14	B4A	5-31	19	4-20	Frequency response compensation, lower part of 5.8 – 12.9 GHz band.
A20R15	B4B	5-31	19	4-20	Frequency response compensation, middle part of 5.8 – 12.9 GHz band.
A20R16	B5A	5-31	19	4-20	Frequency response compensation, lower part of 8.5 – 18 GHz band.

Table 5-1. Adjustable Components (4 of 8)

Reference Designator	Adjustment Name	Adjustment Paragraph	Service Sheet	Performance Tests	Description
A20R17	B5B	5-31	19	4-20	Frequency response compensation, middle part of 8.5 – 18 GHz band.
A20R18	B5C	5-31	19	4-20	Frequency response compensation, upper part of 8.5 – 18 GHz band.
A20R19	B6A	5-31	19	4-20	Frequency response compensation, lower part of 10.5 – 22 GHz band.
A20R20	B6D	5-31	19	4-20	Frequency response compensation, lower middle part of 10.5 – 22 GHz band.
A20R21	B6C	5-31	19	4-20	Frequency response compensation, upper middle part of 10.5 – 22 GHz band.
A20R22	B6B	5-31	19	4-20	Frequency response compensation, upper part of 10.5 – 22 GHz band.
A20R100	B4C	5-31	19	4-20	Frequency response compensation, upper part of 5.8 – 12.9 GHz band.
A21R52	1 kHz	5-20	25	4-10	Adjusts IF bandwidth for RESOLUTION BW of 1 kHz. (Not used for Option 100).
A21R55	3 kHz	5-20	25	4-10	Adjusts IF bandwidth for RESOLUTION BW of 3 kHz.
A21R58	10 kHz	5-20	25	4-10	Adjusts IF bandwidth for RESOLUTION BW of 10 kHz.
A21R71	300 kHz	5-20	25	4-10	Adjusts IF bandwidth for RESOLUTION BW of 300 kHz.
A21R74	1 MHz	5-20	25	4-10	Adjusts IF bandwidth for RESOLUTION BW of 1 MHz.
A21R77	3 MHz	5-20	25	4-10	Adjusts IF bandwidth for RESOLUTION BW of 3 MHz.
A21R92	OFFSET	5-19	25		Nulls offset between LIN and 1 dB AMPLITUDE SCALE at top screen.
A22R1	LOG GAIN	5-18	24	4-16	Adjusts dc offset circuitry at output of Log amplifier for 10 dB steps in Log mode.

Table 5-1. Adjustable Components (5 of 8)

Reference Designator	Adjustment Name	Adjustment Paragraph	Service Sheet	Performance Tests	Description
A22R2	LOG/LIN	5-18	24	4-16, 4-22	Adjusts for Log to linear full screen display translations.
A22R3	LIN GAIN	5-18	24	4-16, 4-22	Adjusts Log Amplifier for 10 dB gain steps when in Linear Mode.
A23C15	SYM	5-20	23	4-10, 4-21	Adjusts symmetry of first stage of crystal bandwidth filter.
A23C23	LC CTR	5-20	23	4-10, 4-21	Adjusts centering of first stage of LC bandwidth filter.
A23C25	CTR	5-20	23	4-10, 4-21	Adjusts centering of first stage of crystal bandwidth filter.
A23C38	SYM	5-20	23	4-10, 4-21	Adjusts symmetry of second stage of crystal bandwidth filter.
A23C45	LC CTR	5-20	23	4-10, 4-21	Adjusts centering of second stage of LC bandwidth filter.
A23C54	CTR	5-20	23	4-10, 4-21	Adjusts centering of second stage of crystal bandwidth filter.
A23C73	C73	5-20	23	4-10, 4-21	Compensates for capacitance of CR3.
A23C74	C74	5-20	23	4-10, 4-21	Compensates for capacitance of CR11.
A23R26	LC	5-20	23	4-10, 4-21	Adjusts feedback in LC circuit of bandpass filter.
A23R31	XTAL	5-20	23	4-10, 4-21	Adjusts feedback in crystal circuit of bandpass filter.
A24R1	40 dB	5-21	22	4-16	Adjusts second 20 dB gain step.
A24R2	20 dB	5-21	22	4-16	Adjusts first 20 dB gain step.
A24R3	10 dB	5-21	22	4-16	Adjusts 10 dB gain step.
A24R4	GAIN	5-21	22	4-16	Adjusts overall gain of IF Assembly.
A24R5	0 dB	5-21	22	4-16	Adjusts to calibrate 0 dB position of REF LEVEL FINE control.
A24R6	−12 dB	5-21	22	4-16	Adjusts to calibrate −12 dB position of REF LEVEL FINE control.

Table 5-1. Adjustable Components (6 of 8)

Reference Designator	Adjustment Name	Adjustment Paragraph	Service Sheet	Performance Tests	Description
A24C35 (Opt. 100)	F_0 100 Hz BW	5-33	39	4-21	Sets frequency of the 18.4 MHz oscillator.
A25C24 (Opt. 100)	LO NULL	5-33	37	4-21	Nulls fundamental and harmonics of the 18.4 MHz oscillator in the 21.4 MHz signal path.
A25R20 (Opt. 100)	DC GAIN	5-33	37	4-21	Sets the amplitude of the 1 kHz, .3 kHz and .1 kHz resolution bandwidth to agree with the 1 MHz amplitude.
A26C2 (Opt. 100)	SYM	5-33	38	4-10, 4-21	SYM adjustments adjust the shape of the filter skirts. CTR adjustments optimize centering and minimize amplitude of the filter shape.
A26C3 (Opt. 100)	CTR	5-33	38	4-10, 4-21	
A26C12 (Opt. 100)	SYM	5-33	38	4-10, 4-21	
A26C13 (Opt. 100)	CTR	5-33	38	4-10, 4-21	
A26C19 (Opt. 100)	SYM	5-33	38	4-10, 4-21	
A26C20 (Opt. 100)	CTR	5-33	38	4-10, 4-21	
A26C25 (Opt. 100)	SYM	5-33	38	4-10, 4-21	
A26C26 (Opt. 100)	CTR	5-33	38	4-10, 4-21	
A26C32 (Opt. 100)	SYM	5-33	38	4-10, 4-21	
A26C33 (Opt. 100)	CTR	5-33	38	4-10	
A26R53 (Opt. 100)	100 Hz GAIN	5-33	38	4-21	Sets the gain of the 100 Hz resolution bandwidth.

Table 5-1. Adjustable Components (7 of 8)

Reference Designator	Adjustment Name	Adjustment Paragraph	Service Sheet	Performance Tests	Description
A27C15	SYM	5-20	21	4-10, 4-21	Adjusts symmetry of first stage of crysal bandwidth filter.
A27C23	LC CTR	5-20	21	4-10, 4-21	Adjusts centering of first stage of LC bandwidth filter.
A27C25	CTR	5-20	21	4-10, 4-21	Adjusts centering of first stage of crystal bandwidth filter.
A27C38	SYM	5-20	21	4-10, 4-21	Adjusts symmetry of second stage of crystal bandwidth filter.
A27C45	LC CTR	5-20	21	4-10, 4-21	Adjusts centering of second stage of LC bandwidth filter.
A27C54	CTR	5-20	21	4-10, 4-21	Adjusts centering of second stage of crystal bandwidth filter.
A27C73	C73	5-20	21	4-10, 4-21	Compensates for capacitance of CR3.
A27C74	C74	5-20	21	4-10, 4-21	Compensates for capacitance of CR11
A27R26	LC	5-20	21	4-10, 4-21	Adjusts feedback in LC circuit of bandpass filter.
A27R31	XTAL	5-20	21	4-10, 4-21	Adjusts feedback in crystal circuit of bandpass filter.
A28R7	PIN RES	5-31	20	4-20	Compensates for variations in PIN diode resistance.
A35C1	C1	5-25	7	4-10	Adjust bandpass of 2050 MHz bandpass filter.
A35C2	C2	5-25	7	4-10	Adjust bandpass of 2050 MHz bandpass filter.
A35C3	C3	5-25	7	4-10	Adjust bandpass of 2050 MHz bandpass filter.
A35C4	2ND LO FREQUENCY	5-25	7		Adjusts second L.O. frequency to 1728.60 MHz.
A35L1	2ND MIXER MATCH	5-25	7		Adjusts for optimum match between second converter output and third converter input.

Table 5-1. Adjustable Components (8 of 8)

Reference Designator	Adjustment Name	Adjustment Paragraph	Service Sheet	Performance Tests	Description
A36A2C2	1.3 MHz NULL	5-28	16	4-9	Adjust to balance out stray capacitance.
A36A2C3	LINEARITY	5-28	16	4-9	Adjust for linear frequency change with linear sweep input.
A36A2C16	1 MHz PEAK	5-28	16	4-9	Adjusts center frequency of variable frequency filter.
A37C1	321.4 MHz BP ADJUST	5-26	8	4-10	Adjust bandpass of 321.4 MHz bandpass filter.
A37C2	321.4 MHz BP ADJUST	5-26	8	4-10	Adjust bandpass of 321.4 MHz bandpass filter.
A37C3	321.4 MHz BP ADJUST	5-26	8	4-10	Adjust bandpass of 321.4 MHz bandpass filter.
A37C4	321.4 MHz BP ADJUST	5-26	8	4-10	Adjust bandpass of 321.4 MHz bandpass filter.
A37C5	300 MHz BP ADJUST	5-26	8		Adjust bandpass of 300 MHz bandpass filter.
A37C6	300 MHz BP ADJUST	5-26	8		Adjust bandpass of 300 MHz bandpass filter.
A37A3L4	OSC PEAK	5-26	8		Peaks 100 MHz crystal oscillator.
A37A3R27	CAL OUT LEVEL	5-26	8	4-19	Adjsuts 100 MHz CAL OUT to −10 dBm power out.
A39R40	DIG INT	5-23	35		Adjusts intensity of digits on bezel digital readout.
A40A2R17	+15VR ADJ	5-12	36		Adjusts +15 volt power supply.

Table 5-2. Factory Selected Components (1 of 3)

Reference Designator	Adjustment Paragraph	Service Sheet	Performance Test	Basis of Selection
A17R9	5-23	12		Selected so A17R11 + 10 VR can be adjusted to give +10V at A17TP1.
A20R29	5-31	19	4-20	Selected for best frequency response on high end of 5.8 – 12.9 GHz FREQUENCY BAND.
A22R8		24	4-16	Selected for best Log fidelity curve at 700 mV and above (upper portion of Log curve).
A22R16	5-18	24		Selected for full screen translation from Log to linear mode.
A22R23		24	4-16	Selected for best Log fidelity curve at 700 mV and above (opposite sense of A22R8).
A22R46		24	4-16	Selected for best Log fidelity curve at 600 mV and above (upper portion of Log curve).
A22R63		24		Selected to compensate Log fidelity curve for temperature (not field selectable).
A22R64		24		Selected to compensate Log fidelity curve for temperature (not field selectable).
A22R65		24		Selected for best Log fidelity curve at 500 mV and above (upper portion of Log curve).
A22R74		24	4-16	Selected for proper gain of Q9/Q10 IF gain in linear mode with –10V at IFG4 (sixth IF gain step).
A22R82		24	4-16	Selected for best Log fidelity curve at 400 mV and below (lower portion of Log curve).
A22R102		24	4-16	Selected for best Log fidelity curve at 300 mV and below (lower portion of Log curve).
A22R119		24	4-16	Selected for best Log fidelity curve at 200 mV and below (lower portion of Log curve).
A22R130		24		Selected to compensate Log fidelity curve for temperature (not field selectable).
A23R19	5-20	23	4-10	Selected to give correct IF bandwidth for RESOLUTION BW of 100 kHz.
A23R23	5-20	23	4-10	Selected to give correct IF bandwidth for RESOLUTION BW of 30 kHz.

Table 5-2. Factory Selected Components (2 of 3)

Reference Designator	Adjustment Paragraph	Service Sheet	Performance Test	Basis of Selection
A23R43	5-20	23	4-10	Selected to give correct IF bandwidth for RESOLUTION BW of 100 kHz.
A23R48	5-20	23	4-10	Selected to give correct IF bandwidth for RESOLUTION BW of 30 kHz.
A24R55 (Option 100)	5-33	39		Selected to give correct 18.4 MHz oscillator power level.
A25R23 (Option 100)	5-33	37	4-21	Selected to shift adjustment range of A25R20 DC GAIN
A26R7 (Option 100)	5-33	38	4-10	Selected to give correct IF bandwidth for RESOLUTION BW of .3 kHz.
A26R9 (Option 100)	5-33	38	4-10	Selected to give correct IF bandwidth for RESOLUTION BW of 1 kHz.
A26R10 (Option 100)	5-33	38	4-10	Selected to give correct IF bandwidth for RESOLUTION BW of 1 kHz.
A26R17 (Option 100)	5-33	38	4-10	Selected to give correct IF bandwidth for RESOLUTION BW of .1 kHz.
A26R18 (Option 100)	5-33	38	4-10	Selected to give correct IF bandwidth for RESOLUTION BW .3 kHz.
A26R19 (Option 100)	5-33	38	4-10	Selected to give correct IF bandwidth for RESOLUTION BW of 1 kHz.
A26R20 (Option 100)	5-33	38	4-10	Selected to give correct IF bandwidth for RESOLUTION BW of 1 kHz.
A26R27 (Option 100)	5-33	38	4-10	Selected to give correct IF bandwidth for RESOLUTION BW of .1 kHz.
A26R28 (Option 100)	5-33	38	4-10	Selected to give correct IF bandwidth for RESOLUTION BW of .3 kHz.
A26R29 (Option 100)	5-33	38	4-10	Selected to give correct IF bandwidth for RESOLUTION BW of 1 kHz.
A26R30 (Option 100)	5-33	38	4-10	Selected to give correct IF bandwidth for RESOLUTION BW of 1 kHz.
A26R36 (Option 100)	5-33	38	4-10	Selected to give correct IF bandwidth for RESOLUTION BW of .1 kHz.

Table 5-2. Factory Selected Components (3 of 3)

Reference Designator	Adjustment Paragraph	Service Sheet	Performance Test	Basis of Selection
A26R37 (Option 100)	5-33	38	4-10	Selected to give correct IF bandwidth for RESOLUTION BW of 1 kHz.
A26R39 (Option 100)	5-33	38	4-10	Selected to give correct IF bandwidth for RESOLUTION BW of 1 kHz.
A26R40 (Option 100)	5-33	38	4-10	Selected to give correct IF bandwidth for RESOLUTION BW of 1 kHz.
A26R45 (Option 100)	5-33	38	4-10	Selected to give correct IF bandwidth for RESOLUTION BW of .1 kHz.
A26R46 (Option 100)	5-33	38	4-10	Selected to give correct IF bandwidth for RESOLUTION BW of 1 kHz.
A26R48 (Option 100)	5-33	38	4-10	Selected to give correct IF bandwidth for RESOLUTION BW of 1 kHz.
A26R49 (Option 100)	5-33	38	4-10	Selected to give correct IF bandwidth for RESOLUTION BW of 1 kHz.
A26R54 (Option 100)	5-33	38	4-21	Selected for .3 kHz RESOLUTION BW signal amplitude same as 1 kHz RESOLUTION BW signal amplitude.
A26R64 (Option 100)	5-33	38	4-10	Selected to give correct IF bandwidth for RESOLUTION BW of .1 kHz.
A27R3	5-21	21		Selected to shift adjustment range of A24R4 RF GAIN.
A27R23	5-20	21	4-10	Selected to give correct IF bandwidth for RESOLUTION BW of 30 kHz.
A27R43	5-20	21	4-10	Selected to give correct IF bandwidth for RESOLUTION BW of 100 kHz.
A27R48	5-20	21	4-10	Selected to give correct IF bandwidth for RESOLUTION BW of 30 kHz.
A28R2	5-32	20	4-16	Selected to shift for correct adjustment range for REF LEVEL CAL.
A28R19	5-31	20	4-20	Selected to provide correct gain compensation of the 5.8 – 12.9 GHz FREQUENCY BAND.
A28R21	5-31	20	4-20	Selected to provide correct gain compensation of the 5.8 – 12.9 GHz FREQUENCY BAND.
A28R23	5-31	20	4-20	Selected to provide correct gain compensation of the 10.5 – 22 GHz FREQUENCY BAND.

Table 5-3. Related Adjustments (1 of 2)

Assembly Changed or Repaired		Perform Adjustments on Following Related Assemblies	Paragraph Number
A1A1	Bezel Display	A39	5-23 step o
A1A2	Display Switch	A1A2	5-16 steps p-q
A3	Display Adjust	A3	Section III Appendix C
A4	Z-Axis Amplifier	A4	5-15
A5	Y Deflection Amplifier	A5	5-17 steps a-b, i-n
A6	X Deflection Amplifier	A6	5-17 steps a-h
A7	Storage Assembly	A7	5-14, 5-16 (except steps p-q)
A8	High Voltage Power Supply	A8, A9	5-13
A9	High Voltage Oscillator	A8, A9	5-13
A12	DVM Analog	A12	5-23 steps a-b, g-n
A14	Tuning Stabilizer Control Assembly	A14	5-28 steps a-m
A15	Sweep Attenuator	A15	5-27
A16	Sweep Generator	A16	5-21
A17	Frequency Control Assembly	A17, A19	5-23 a-f, 5-24, 5-30
A19	YIG Driver	A17, A19	5-24, 5-30
A20	Bias Assembly	A20, A28	5-29, 5-31
A21	Video Assembly	A21	5-19, 5-20 steps a-c, ac-ae
A22	Log Amplifier	A22	5-18
A23	Bandwidth Filter No. 2	A21, A23, A27	5-20

Table 5-3. Related Adjustments (2 of 2)

Assembly Changed or Repaired		Perform Adjustments on Following Related Assemblies	Paragraph Number
A24	Step Gain Amplifier	A24	5-21
A25 (Option 100)	Up-Down Converter	A24, A25	5-21, 5-33 a-b, n-r
A26 (Option 100)	3 MHz Filter	A24, A25, A26	5-33
A27	Bandwidth Filter No. 1	A21, A23, A27	5-20
A28	Variable Gain Assembly	A28	5-31 Check factory selected resistors. A28R2, A28R19, A28R21 and A28R23 are same value as resistors on board being replaced.
A30	First Mixer	A20, A28	5-29, 5-31, 5-32
A31	YTO Assembly	A19	5-24 steps a-h
A32	YTF Assembly	A17, A19, A20, A28	5-24, 5-30, 5-31, 5-32
A34	RF Attenuator	A20, A28	5-31, 5-32
A35	Second Converter	A35	5-25
A36	Tuning Stabilizer	A14, A36	5-28
A37	Third Converter	A37	5-26
A39	Readout Driver	A39	5-23 step o
A40	Power Supply	A40	5-12

ADJUSTMENTS

5-12. LOW VOLTAGE POWER SUPPLY CHECK AND ADJUSTMENT

REFERENCE:

Service Sheet 36

DESCRIPTION:

The +15 volt supply is adjusted for correct output and the remaining low voltage supplies are checked for correct output.

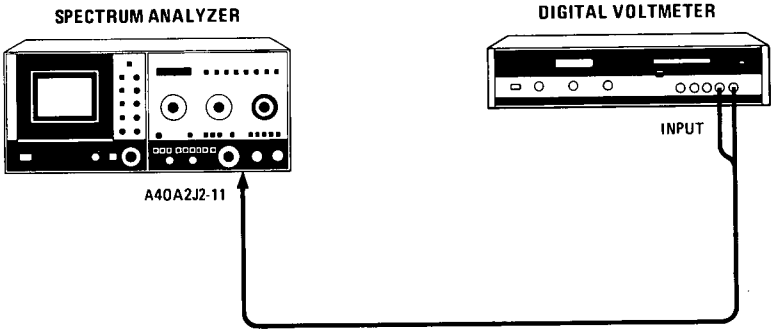


Figure 5-1. Low Voltage Power Supply Check and Adjustment Test Setup

EQUIPMENT:

Digital Voltmeter ..... HP 3490A

BOTTOM VIEW

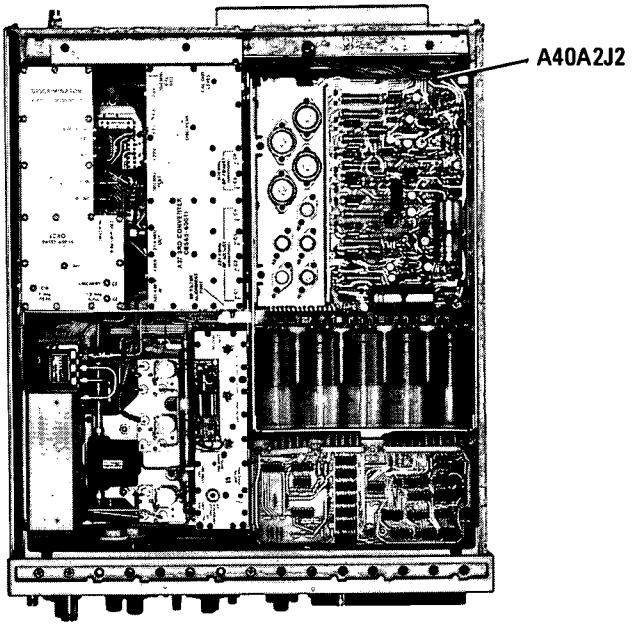


Figure 5-2. A40A2 Adjustment Location

ADJUSTMENTS

5-12. LOW VOLTAGE POWER SUPPLY CHECK AND ADJUSTMENT(Cont'd)

PROCEDURE:

a. Set LINE switch OFF, disconnect power cord, and remove 8565A bottom cover to gain access to low voltage power supplies. Connect equipment as shown in Figure 5-1.

b. Reconnect power cord, set LINE switch ON, and connect digital voltmeter to A40A2J2-11.

NOTE

The +15V supply voltage to A16 Sweep Generator is a critical voltage. Due to the significant voltage drop caused by the printed circuit board trace, this voltage must be adjusted for +15.00V at A40A2J2-11.

c. Adjust +15V REF A40A2R17 for +15.00 Vdc ±0.005 Vdc at A40A2J2-11 (Figure 5-2).

WARNING

The following check probes voltages that, if contacted, may cause personal injury.

d. Check power supply voltages listed in Table 5-4.

Table 5-4. Low Voltage Power Supplies

Test Point	Voltage (Vdc)	Tolerance (Vdc)
TP10	+158	±5.0
TP9	+30	±0.30
TP8	+20	±0.20
TP3	+15	±0.10
TP5	+10	±0.10
TP1	+5.2	±0.05
TP6	−10	±0.10
TP4	−15	±0.15
TP2	−40	±0.4

5-12. LOW VOLTAGE POWER SUPPLY CHECK AND ADJUSTMENT(Cont'd)

e. Adjustment and checks complete. Set LINE switch OFF, disconnect power cord, and replace 8565A bottom cover.

5-13. HIGH VOLTAGE POWER SUPPLY ADJUSTMENT

REFERENCE:

Service Sheet 32

DESCRIPTION:

A high voltage probe is required to measure high voltage CRT cathode supply. First, the probe accuracy is checked by comparing measurements of the +158V supply with, and without, the probe in the test setup. Any error is then calculated into the test setup for setting high voltage CRT cathode supply. The FOCUS LIMIT adjustment is set for a sharply focused display with front panel FOCUS control set at midrange. The Intensity Limit adjustment is then set to limit the CRT control grid voltage and, in effect, limit the maximum CRT trace intensity.

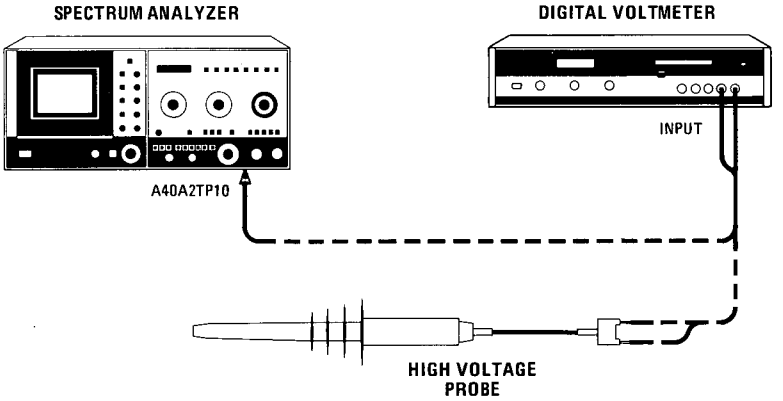


Figure 5-3. High Voltage Power Supply Adjustment Test Setup

EQUIPMENT:

Digital Voltmeter	HP 3490A
High Voltage Probe (1000:1 Divider)	HP 34111A
Oscilloscope	HP 1740A
10:1 Divider Probe	HP 10004D

WARNING

To minimize shock hazard use a non-metallic screwdriver for adjustments on A8 High Voltage Power Supply and A9 High Voltage Oscillator.

WARNING

The following procedure probes voltages that, if contacted, may cause personal injury or death.

5-13. HIGH VOLTAGE POWER SUPPLY ADJUSTMENT (Cont'd)

NOTE

Adjustment of the High Voltage Power Supply should not be a routine-maintenance procedure. Adjustment should only be done when the HV Power Supply or HV Oscillator is repaired or replaced.

NOTE

If an assembly or an adjustable component is replaced, set all adjustments on the replaced assembly to midrange (except A9R1 INT, which should not be changed) before turning the instrument on. If the CRT is replaced, set front panel INTENSITY control fully counterclockwise before applying power.

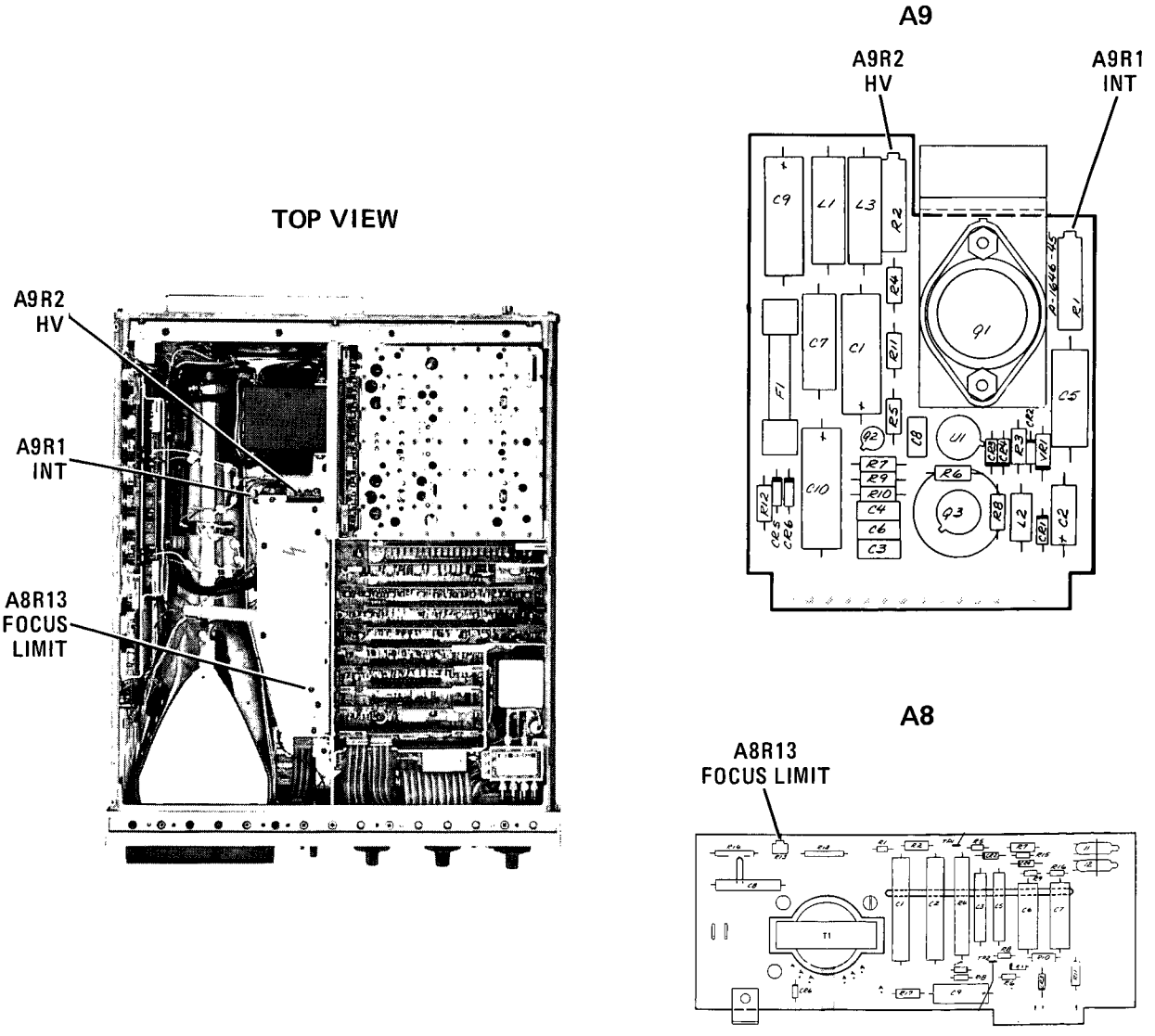


Figure 5-4. High Voltage Power Supply and Oscillator Driver Adjustment Locations

5-13. HIGH VOLTAGE POWER SUPPLY ADJUSTMENT (Cont'd)

PROCEDURE:

WARNING

After disconnecting AC line power cord, allow a minimum of 30 seconds for High Voltage Power Supply to discharge before removing High Voltage Power Supply protective cover.

a. Set LINE switch OFF, disconnect power cord, and remove 8565A top and bottom covers. Remove High Voltage Power Supply protective cover. Connect equipment as shown in Figure 5-3.

b. Reconnect power cord, set LINE switch ON, and set 8565A controls as follows:

Set all Normal Settings (controls marked with green)
INPUT ATTEN ..... 0 dB
REFERENCE LEVEL ..... 0 dBm
AMPLITUDE SCALE ..... LIN
CONVentional ..... Depressed
PERSIST ..... Fully counterclockwise
FOCUS ..... Midrange
INTENSITY ..... Dim CRT trace

High Voltage Power Supply

c. Calibrate High Voltage probe as follows:

1. Measure output of +158V supply at A40A2TP10 and note reading.

+ _____ Vdc

2. Connect 1000:1 divider probe to digital voltmeter and set voltmeter to .1V range.

3. Measure +158V supply through 1000:1 divider probe and note reading.

+ _____ Vdc

4. Divide reading noted in step c-1 into reading noted in step c-3. This gives the calibration factor of the high voltage probe.

d. Set digital voltmeter to 10V range and measure output of high voltage CRT cathode power supply on board assembly A8 HVTP (yellow wire).

e. Adjust A9R2 HV (Figure 5-4) for a reading equal to the calibration factor, calculated in step c-4, times −3000 volts.

Focus Centering

f. Depress both INT and EXT SWEEP SOURCE pushbuttons to produce a dot on the CRT screen.

5-13. HIGH VOLTAGE POWER SUPPLY ADJUSTMENT (Cont'd)

CAUTION

Leaving a dot on the CRT for prolonged periods at high intensity will damage CRT.

g. Adjust front panel INTENSITY, HORIZ POSN and VERT POSN controls for a spot of normal intensity near center of screen.

h. With front panel FOCUS control set to midrange, adjust A8R13 FOCUS LIMIT (Figure 5-4) and front panel ASTIG (A3R1) for a sharply focused round spot.

i. Depress INT SWEEP SOURCE pushbutton to return 8565A to internal sweep.

Intensity Limit

j. Connect oscilloscope, through 10:1 divider probe, to A8TP1 (see Figure 5-5).

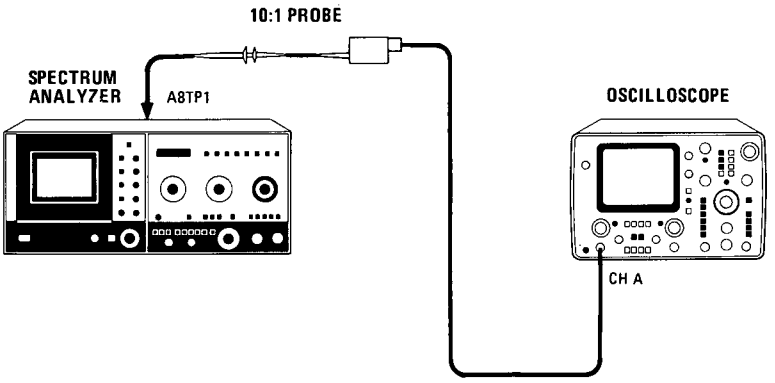


Figure 5-5. Intensity Limit Adjustment Test Setup

k. Set front panel HORIZ POSN and VERT POSN controls fully counterclockwise; then set front panel INTENSITY control fully clockwise.

l. Adjust A9R1 INT (Figure 5-4) for an 8 volts peak-to-peak signal at A8TP1.

m. Disconnect oscilloscope, set front panel INTENSITY control fully counterclockwise, and set front panel HORIZ POSN and VERT POSN controls to midrange.

5-13. HIGH VOLTAGE POWER SUPPLY ADJUSTMENT (Cont'd)

WARNING

After disconnecting ac line power cord, allow a minimum of 30 seconds for High Voltage Power Supply to discharge before replacing High Voltage Power Supply protective cover.

n. Set LINE switch OFF, disconnect power cord, and wait a minimum of 30 seconds before replacing High Voltage Power Supply protective cover. Replace 8565A top and bottom covers.

5-14. ORTHOGONALITY, TRACE ALIGNMENT, AND PATTERN ADJUSTMENT

REFERENCE:

Service Sheet 31

DESCRIPTION:

The CRT trace baseline is positioned on a horizontal graticule line and the 100 MHz CAL OUTPUT signal display is positioned on the right vertical graticule line. Adjustments are performed until both the horizontal and vertical traces are aligned with the respective graticule lines. This results in the horizontal and vertical traces being mutually perpendicular and aligned in the horizontal and vertical axes.

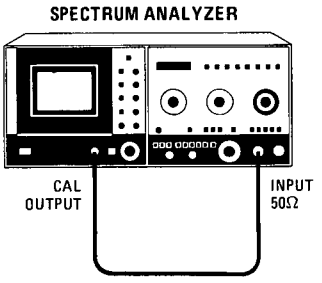


Figure 5-6. Orthogonality, Trace Alignment and Pattern Adjustment Test Setup

5-14. ORTHOGONALITY, TRACE ALIGNMENT AND PATTERN ADJUSTMENT (Cont'd)

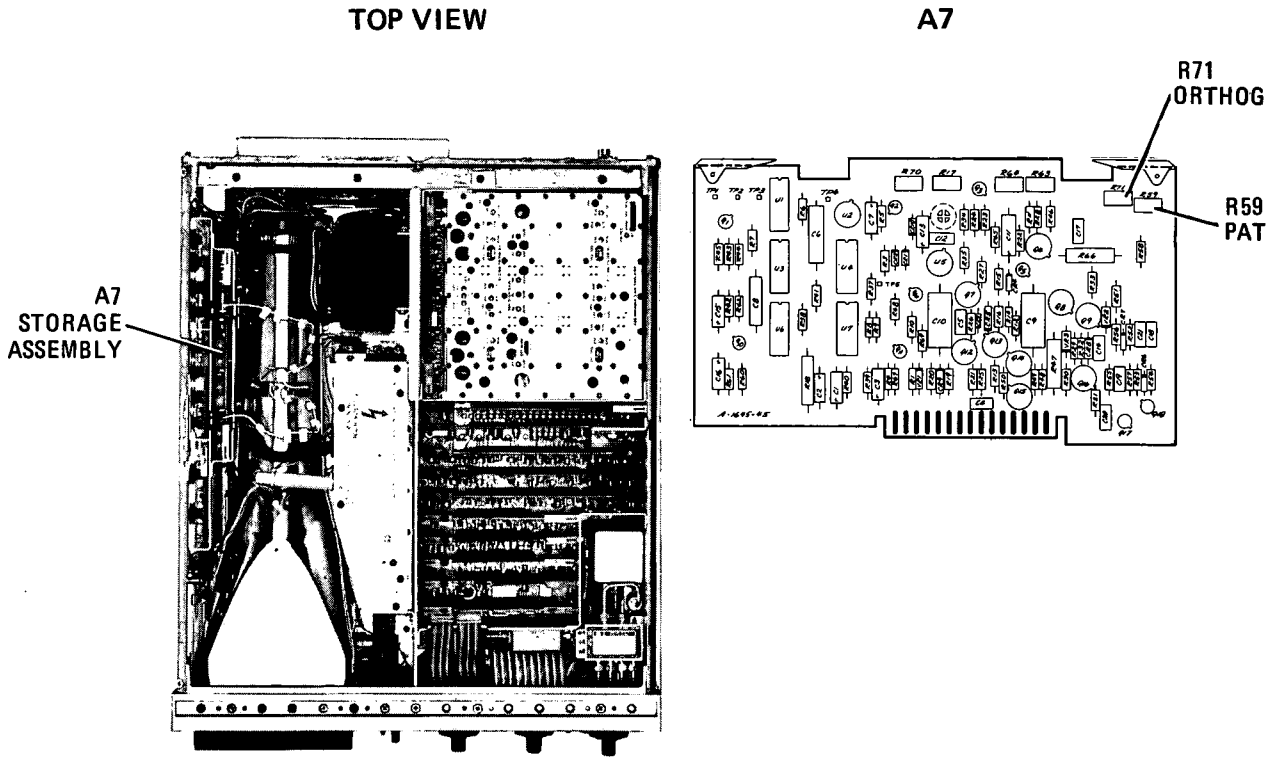


Figure 5-7. Orthogonality and Pattern Adjustment Locations

PROCEDURE:

a. Set LINE switch OFF, disconnect power cord, and remove 8565A top cover.

b. Reconnect power cord, set LINE switch ON, and set 8565A controls as follows:

Set all Normal Settings (controls marked with green)

FREQUENCY BAND GHz	.01—1.8
INPUT ATTEN	10 dB
REF LEVEL	0 dBm
RESOLUTION BW	100 kHz
FREQUENCY SPAN/DIV	10 MHz
AMPLITUDE SCALE	LIN
TUNING	0.050 GHz
CONVentional	Depressed

c. Connect 100 MHz CAL OUTPUT signal to front panel INPUT 50Ω connector (see Figure 5-6).

d. Adjust front panel VERT POSN to position CRT trace baseline one division above bottom horizontal graticule line.

5-14. ORTHOGONALITY, TRACE ALIGNMENT, AND PATTERN ADJUSTMENT (Cont'd)

e. Adjust front panel TUNING control to position 100 MHz CAL OUTPUT display on right edge of graticule display. Adjust REF LEVEL FINE to position peak of 100 MHz signal at REFERENCE LEVEL graticule line.

f. Adjust front panel TRACE ALIGN to align 100 MHz signal parallel with right edge of graticule display.

g. Adjust R71 ORTHOG (Figure 5-7) to align baseline parallel with the horizontal graticule line.

h. Adjust R59 PAT to remove any curvature in the baseline or 100 MHz signal traces.

i. Repeat steps f through h until no further adjustment is necessary.

j. Adjust front panel VERT POSN to position baseline on bottom horizontal graticule line.

k. Adjustment complete. Set LINE switch OFF, remove power cord, and replace 8565A top cover.

5-15. Z-AXIS GATE ADJUSTMENT

REFERENCE:

Service Sheet 30

DESCRIPTION:

A blanking pulse is connected to rear panel BLANKING INPUT connector. A4 Z-Axis Amplifier output (Z-Axis Gate) is checked with an oscilloscope. Z-Axis adjustments, HF ADJUST, HF GAIN, are set for Z-Axis gate output with fastest rise time and minimum ringing.

5-15. Z-AXIS GATE ADJUSTMENT (Cont'd)

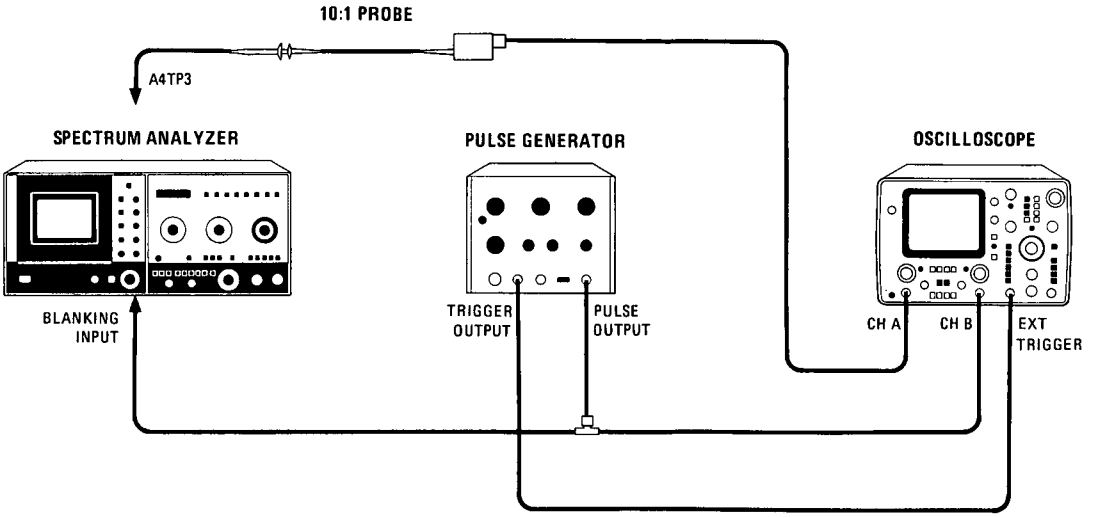


Figure 5-8. Z-Axis Gate Adjustment Test Setup

EQUIPMENT:

Oscilloscope	HP 1740A
Pulse Generator	HP 8002A
10:1 Divider Probe	HP 10004D
BNC Tee	1250-0781

5-15. Z-AXIS GATE ADJUSTMENT (Cont'd)

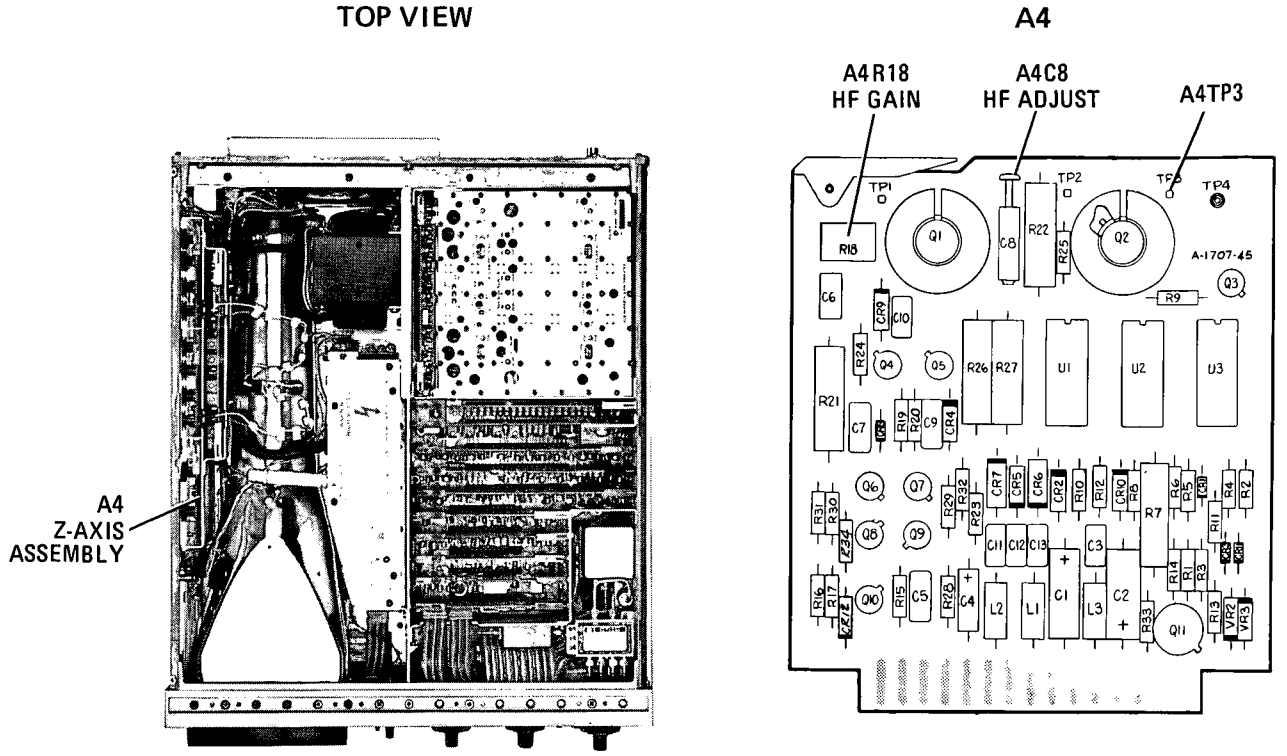


Figure 5-9. Z-Axis Gate Adjustment Locations

PROCEDURE:

a. Set LINE switch OFF, disconnect power cord, and remove 8565A top cover. Connect equipment as shown in Figure 5-8. Adjustment locations are shown in Figure 5-9.

b. Reconnect power cord, set LINE switch ON, and set 8565A controls as follows:

Set all Normal Settings (controls marked with green)
SWEEP SOURCE ..... EXT
CONVentional ..... Depressed

c. Set pulse generator for a 0 to +4 volt pulse with a 10 microsecond pulse width repeating every 100 microseconds (10% duty cycle as shown in Figure 5-10).

d. Set HORIZ POSN and VERT POSN controls fully counterclockwise to put trace off CRT screen.

e. Set front panel INTENSITY control to midrange.

f. Connect oscilloscope (Channel A) to A4TP3 GATE OUT (Figure 5-9).

g. Set oscilloscope controls for a Channel A display as shown in Figure 5-11.

5-15. Z-AXIS GATE ADJUSTMENT (Cont'd)

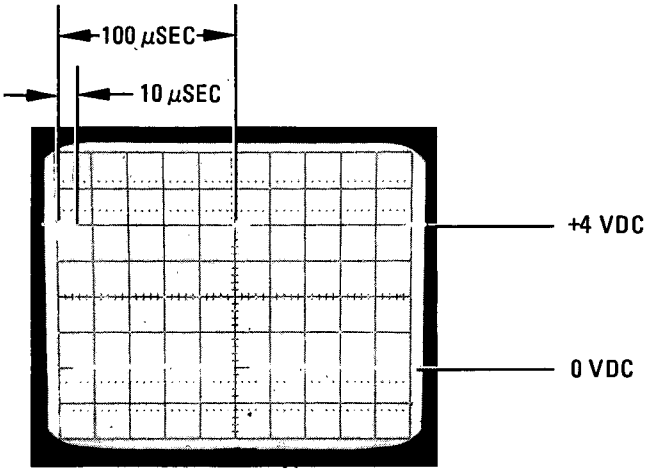


Figure 5-10. Pulse Generator Output for a 10% Duty Cycle

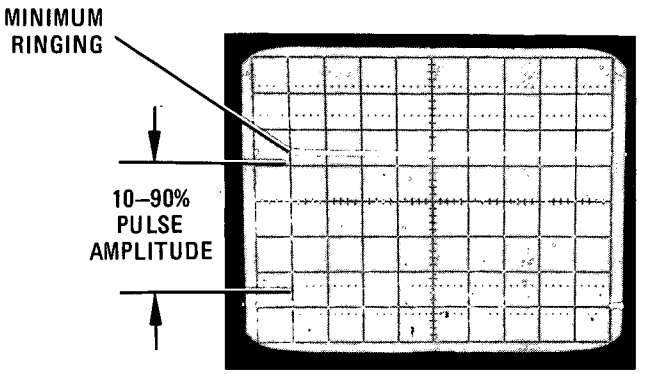


Figure 5-11. Z-Axis Gate Output Oscilloscope Display

h. Adjust A4C8 HF ADJUST and A4R18 HF GAIN (Figure 5-9) for an oscilloscope display with fastest rise time and minimum ringing (Figure 5-11). Check rise time between 10% and 90% of pulse amplitude. Rise time should be less than or equal to 50 nanoseconds.

i. Adjustment complete. Set LINE switch OFF, disconnect power cord, and replace 8565A top cover.

5-16. STORAGE DISPLAY ADJUSTMENTS

REFERENCE:

Service Sheet 31

DESCRIPTION:

The 8565A is operated in WRITE mode with INTENSITY and PERSISTence controls turned fully counterclockwise. The CRT background brightness is set by adjusting the Flood Gun Grid voltage. The Collimation adjustment is then made for a Flood Gun pattern that just covers the CRT screen. WRITE DEPTH is set so the CRT screen turns dark green after the display is erased. The Intensity/Persistence adjustment is set for a trace of approximately the same brightness in either the maximum or minimum persistence settings.

5-16. STORAGE DISPLAY ADJUSTMENTS (Cont'd)

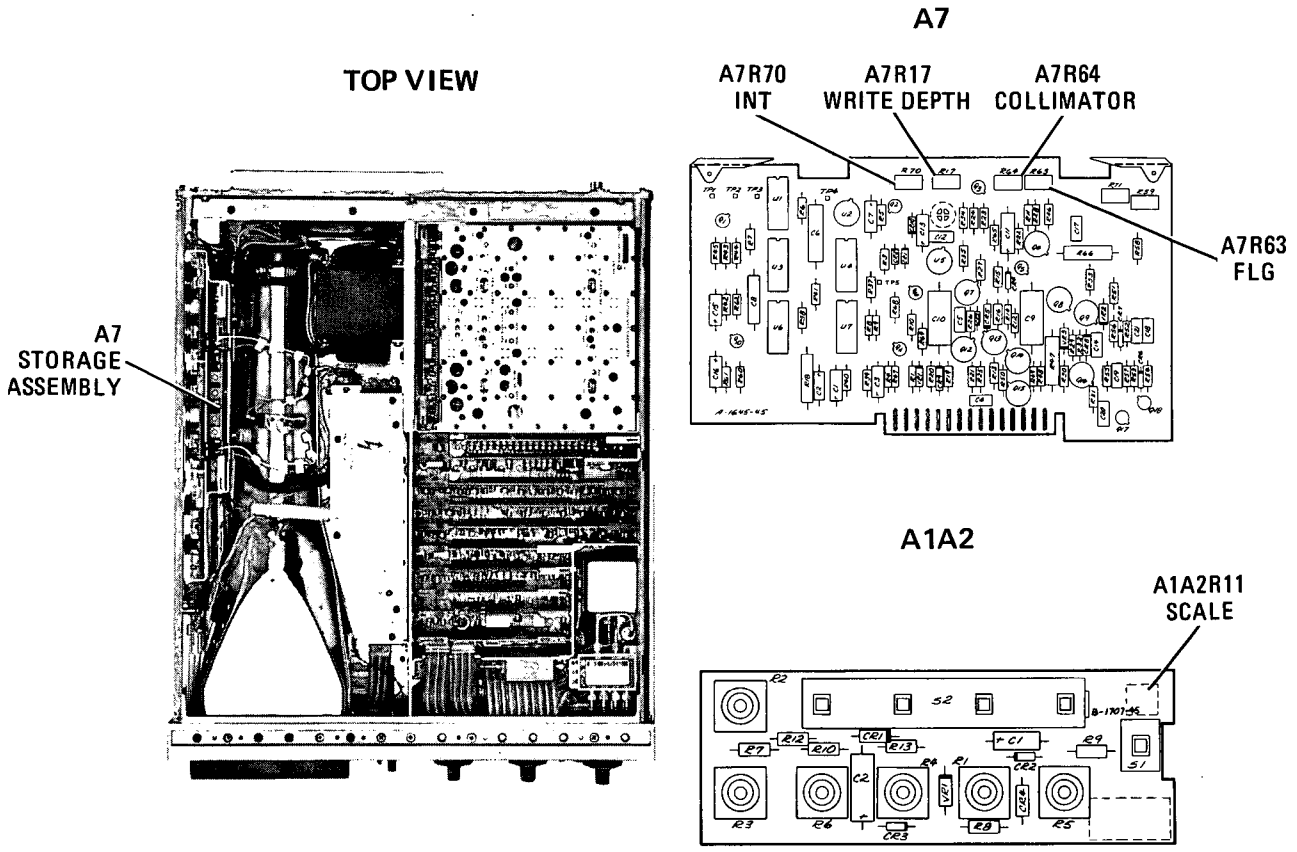


Figure 5-12. Storage Assembly Adjustment Locations

PROCEDURE:

a. Set LINE switch OFF, disconnect power cord, and remove 8565A top cover.

b. Reconnect power cord, set LINE switch ON, and set 8565A controls as follows:

Set all Normal Settings (controls marked with green)

FREQUENCY BAND GHz	.01—1.8
INPUT ATTEN	10 dB
REF LEVEL	−10 dBm
REF LEVEL FINE	0
RESOLUTION BW	100 kHz
FREQUENCY SPAN/DIV	2 MHz
TUNING	0.100 GHz

5-16. STORAGE DISPLAY ADJUSTMENTS (Cont'd)

Collimation

c. Set front panel INTENSITY and PERSIST controls fully counterclockwise.

d. Press and release front panel ERASE pushbutton.

e. Set A7R64 COLLIMATOR adjustment (Figure 5-12) for an overcollimated CRT display as shown in Figure 5-13 (bright green center area with dark edges.)

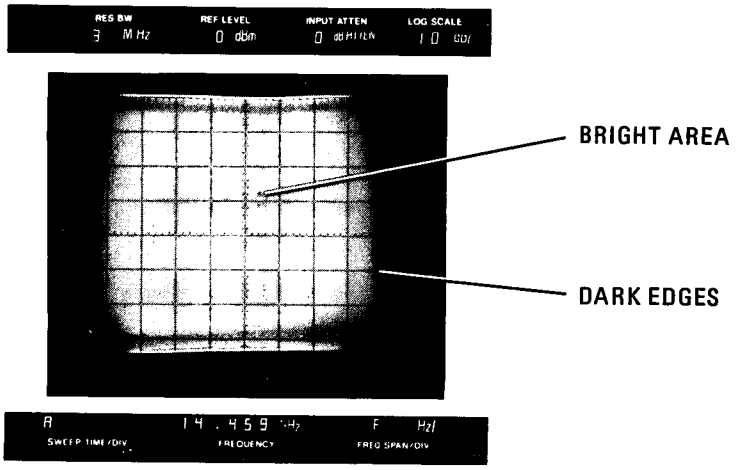


Figure 5-13. Overcollimated CRT Display

f. Set A7R63 FLG (Flood Gun Grid) (Figure 5-12) fully counterclockwise.

NOTE

When adjusting FLG in step g, the background brightness will first increase rapidly, then increase more slowly, then decrease (starting at the edges). Set FLG at point of transition from rapid increase to increasing more slowly in pattern brightness.

g. Slowly adjust A4R63 FLG clockwise until initial rapid increase in pattern brightness is passed.

h. Slowly adjust A7R64 COLLIMATOR (Figure 5-12) clockwise until bright green area just fills CRT screen. (Collimation dimples may protrude as far as 3 millimeters in from the outer edge of CRT).

i. Connect 100 MHz CAL OUTPUT to INPUT 50Ω and adjust INTENSITY and TUNING controls to display the 100 MHz signal at center of CRT screen. If CRT background brightness is changing at the sweep rate, readjust A7R64 COLLIMATOR to eliminate flickering background brightness.

5-16. STORAGE DISPLAY ADJUSTMENTS (Cont'd)

Write Depth

j. Set front panel INTENSITY control fully counterclockwise and front panel PERSIST control fully clockwise.

k. Set A7R17 WRITE DEPTH (Figure 5-12) fully clockwise. Press and release front panel ERASE pushbutton; note that CRT screen remains bright green.

l. Adjust A7R17 WRITE DEPTH counterclockwise until CRT screen turns dark green after pressing and releasing ERASE pushbutton. Then set A7R17 WRITE DEPTH approximately 10 degrees further counterclockwise.

Intensity/Persistence

m. Adjust front panel INTENSITY, and TUNING controls to display 100 MHz signal at center of CRT screen.

n. Set front panel PERSIST control fully clockwise and adjust front panel INTENSITY control for a trace with minimum brightness. (Press ERASE pushbutton as necessary when adjusting INTENSITY).

o. Set PERSIST control fully counterclockwise and adjust A7R70 INT (Figure 5-12) for a trace with minimum brightness.

Scale Intensity

p. Depress front panel SCALE pushbutton and set SCALE INTEN control to midrange (center of blue area).

NOTE

If a photography exposure meter is not available, use an oscilloscope camera (i.e. HP 197A). Set f stop to f16, shutter speed to 1 second, and turn off flash. Adjust A1A2R11 SCALE adjustment so a photograph taken with the camera has approximately the same background brightness as photograph in Figure 5-11. A clockwise adjustment of A1A2R11 decreases background brightness.

q. Position photography exposure meter flush to CRT safety face plate and adjust A1A2R11 SCALE adjustment for an exposure value of 7 E.V. at an ASA of 100.

r. Set LINE switch OFF, disconnect power cord, and install 8565A top cover.

5-17. HORIZONTAL AND VERTICAL GAIN ADJUSTMENTS

REFERENCE:

Service Sheets 28 and 29

DESCRIPTION:

The CRT trace is horizontally centered, then horizontal gain is adjusted for a 10 division wide trace. The trace is positioned on the bottom horizontal graticule line and the 100 MHz CAL OUTPUT is applied as the spectrum analyzer input. REF LEVEL CAL is adjusted for an 800 millivolt output from A21 Video Assembly and the vertical gain is adjusted for eight divisions of CRT trace deflection.

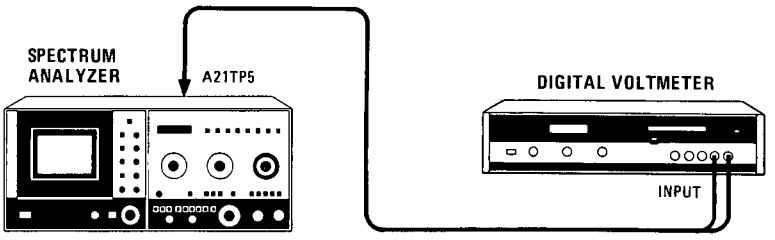


Figure 5-14. Horizontal and Vertical Gain Adjustments Test Setup

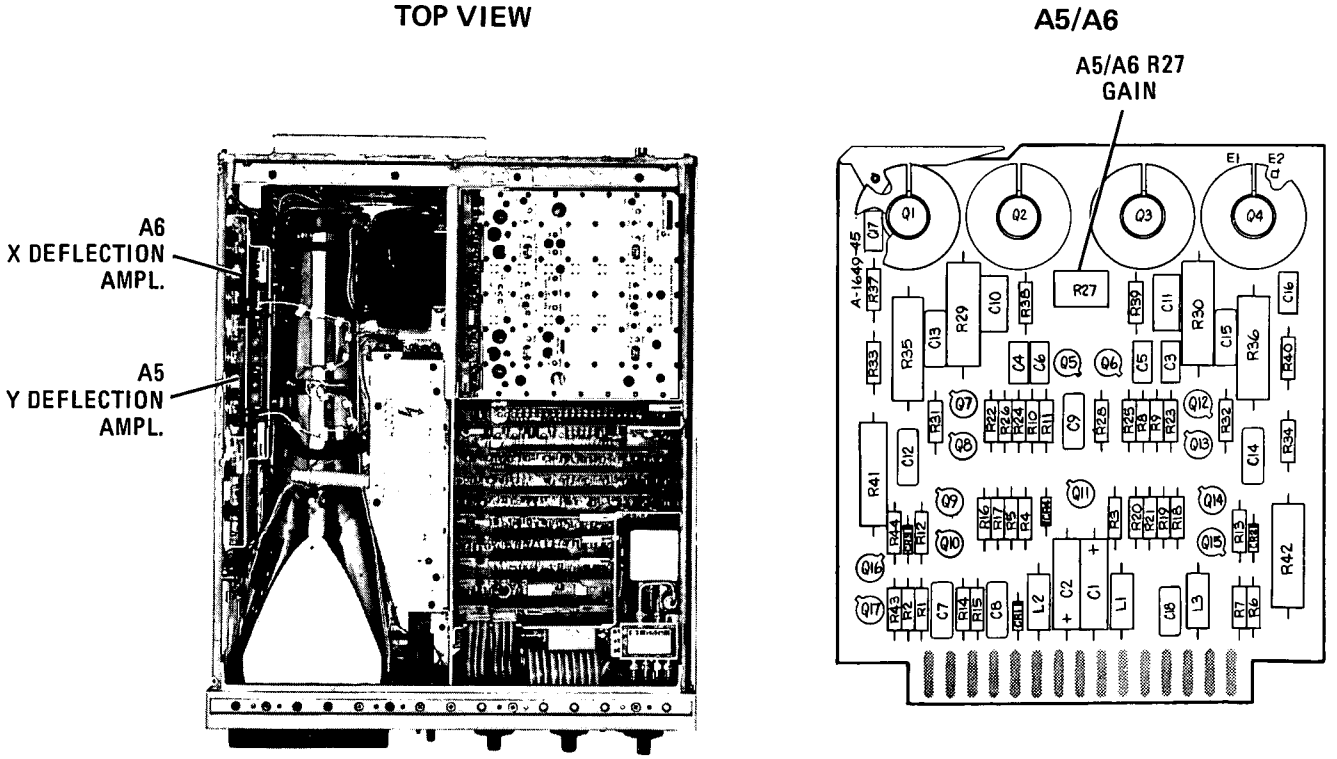


Figure 5-15. Horizontal and Vertical Gain Adjustment Locations

5-17. HORIZONTAL AND VERTICAL GAIN ADJUSTMENTS (Cont'd)

EQUIPMENT:

Digital Voltmeter ..... HP 3490A

WARNING

To minimize shock hazard, use a non-metallic screwdriver for adjustments on A5 and A6 Deflection Amplifiers.

PROCEDURE:

a. Set LINE switch OFF, disconnect power cord and remove 8565A top cover.

b. Reconnect power cord, set LINE switch ON, connect equipment as shown in Figure 5-14, and set 8565A controls as follows:

Set all Normal Settings (controls marked with green)
FREQUENCY BAND GHz ..... .01—1.8
RESOLUTION BW (uncoupled) ..... 1 MHz
FREQUENCY SPAN MODE ..... ZERO SPAN
INPUT ATTEN ..... 10 dB
REF LEVEL ..... 0 dBm
REF LEVEL FINE ..... −10
AMPLITUDE SCALE ..... LIN
AUTO STABILIZER ..... OFF
TUNING ..... 0.100 GHz

Horizontal Gain Adjustment

c. Adjust front panel VERT POSN for CRT trace two divisions above bottom horizontal graticule line.

d. Simultaneously depress EXT and INT SWEEP SOURCE pushbuttons to obtain a dot on CRT display.

e. Adjust front panel HORIZ POSN to set dot on center vertical graticule line.

f. Switch SWEEP SOURCE to INT.

NOTE

Horizontal GAIN adjustment A6R27 (Figure 5-15) assumes the A16 Sweep Generator INT SWP ramp output is a −5 to +5 volts ramp (see Paragraph 5-22 Sweep Generator Adjustments).

g. Adjust A6R27 GAIN for a 10-division wide CRT trace.

h. Repeat steps d through g until no further adjustment is necessary.

Vertical Gain Adjustment

i. Adjust front panel VERT POSN to set CRT trace on bottom horizontal graticule line and note voltage at A21TP5.

5-17. HORIZONTAL AND VERTICAL GAIN ADJUSTMENTS (Cont'd)

j. Connect 100 MHz CAL OUTPUT signal to INPUT 50Ω connector and adjust front panel TUNING control to peak 100 MHz signal on CRT display.

k. Adjust front panel REF LEVEL FINE for 800 millivolts plus offset measured in step i at A21TP5. (Ensure signal is peaked with front panel TUNING control).

l. Adjust A5R27 GAIN to set signal level on top horizontal graticule line.

m. Disconnect 100 MHz CAL OUTPUT signal and repeat steps i through l until no further adjustment is necessary.

n. Adjustment complete. Set LINE switch OFF, disconnect power cord, and install 8565A top cover.

5-18. LOG AMPLIFIER ADJUSTMENT

REFERENCE:

Service Sheet 24

DESCRIPTION:

Step attenuators are used to change spectrum analyzer input signal level in calibrated steps. The A21 Video Assembly output is monitored and adjustments are performed to calibrate the A22 Log Amplifier Assembly.

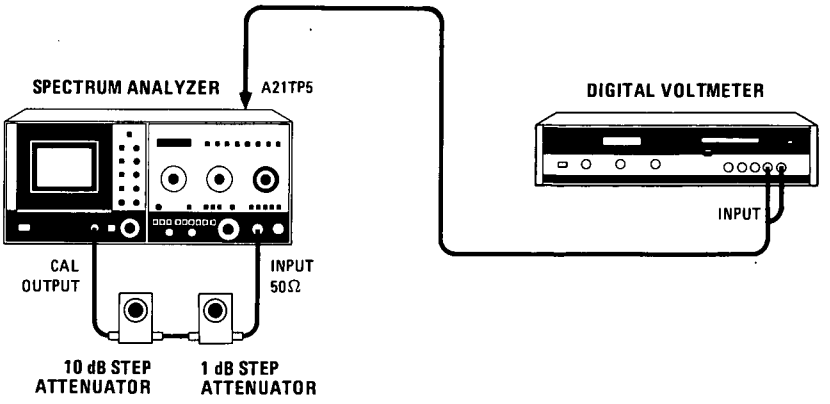


Figure 5-16. Log Amplifier Adjustment Test Setup

EQUIPMENT:

Digital Voltmeter	HP 3490A
10-dB Step Attenuator	HP 355D H80
1-dB Step Attenuator	HP 355C H80

5-18. LOG AMPLIFIER ADJUSTMENT (Cont'd)

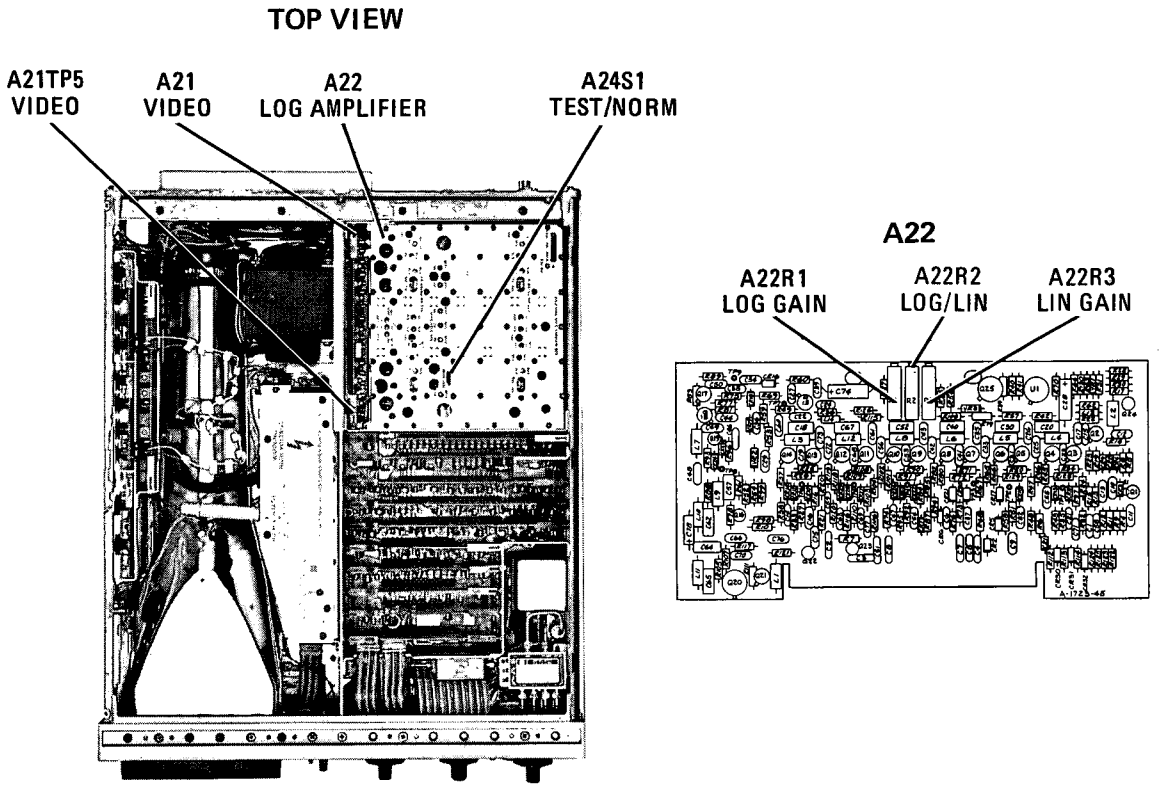


Figure 5-17. Log Amplifier Adjustment Locations

PROCEDURE:

a. Set LINE switch OFF, disconnect power cord, remove 8565A top cover, and set A24S1 TEST-NORM switch to TEST position.

b. Reconnect power cord, set LINE switch ON, connect equipment as shown in Figure 5-16, and set 8565A controls as follows:

Set all Normal Settings (controls marked with green)

FREQUENCY BAND GHz	.01—1.8
INPUT ATTEN	0 dB
REF LEVEL	−50 dBm
REF LEVEL FINE	0
RESOLUTION BW	300 kHz
FREQUENCY SPAN/DIV	10 MHz
AMPLITUDE SCALE	LIN
TUNING	0.100 GHz

5-18. LOG AMPLIFIER ADJUSTMENT (Cont'd)

c. Set REF LEVEL to −50 dBm. Set 10 dB step attenuator to 0 dB and 1 dB step attenuator to 0 dB.

d. Adjust TUNING control to center 100 MHz signal on CRT display. Select ZERO SPAN FREQUENCY SPAN MODE and set VIDEO FILTER to NOISE AVG. Peak signal with FINE TUNING control

e. Adjust front panel REF LEVEL CAL for 700 mV ±1 mV at A21TP5 (VIDEO).

f. Set REF LEVEL control to −80 dBm and 10 dB step attenuator to 30 dB. Adjust A22R3 LIN GAIN (see Figure 5-17) for 700 mV at A21TP5.

g. Step REF LEVEL control from −50 dBm to −90 dBm and 10 dB step attenuator from 0 dB to 40 dB. Check voltage at A21TP5 for each step as shown in Table 5-5. If voltage at A21TP5 is not within limits, readjust A22R3 LIN GAIN for best compromise.

h. Set REF LEVEL to −50 dBM and 10 dB step attenuator to 120 dB. Record offset reading at A21TP5. The offset should be less than ±30 mV.

_____ Offset

i. Set AMPLITUDE SCALE to 10 dB/DIV and set 10 dB step attenuator to 40 dB.

j. Adjust front panel REF LEVEL CAL for a digital voltmeter reading of 400 mV plus offset recorded in step h (algebraic sum). (Example: If offset is −23 mV, adjust REF LEVEL CAL for a DVM reading of 377 mV.)

k. Set 10 dB step attenuator to 0 dB. Digital voltmeter should indicate 800 mV, plus offset (algebraic sum) ±1 mV. If DVM reading is not within limits, adjust A22R2 LOG/LIN adjustment for a digital voltmeter reading of 800 mV, plus offset minus 50 percent of overshoot. Example: If DVM indicates 767 mV and should be indicating 777 mV (−10 mV overshoot), adjust A22R2 for a DVM reading of 777 mV minus −5 mV (782 mV).

Table 5-5. Linear Gain Adjustment Limits

REF LEVEL	10-dB Step Attenuator	Voltage (A21TP5)
−50 dBm	0 dB	700 mV (Reference)
−60 dBm	10 dB	700 mV ±20 mV
−70 dBm	20 dB	700 mV ±20 mV
−80 dBm	30 dB	700 mV ±20 mV
−90 dBm	40 dB	700 mV ±30 mV

5-18. LOG AMPLIFIER ADJUSTMENTS (Cont'd)

l. Repeat steps i, j, and k until digital voltmeter indicates 800 mV plus offset ±1 mV with no further adjustment of A22R2 in step k.

m. Set 10 dB step attenuator to the positions shown in Table 5-6 and record DVM reading for each setting. Correct the DVM readings by algebraically adding the offset recorded in step h. If necessary, readjust A22R2 to meet the limits in Table 5-6.

Table 5-6. Log Fidelity Check

STEP ATTENUATOR SETTING (dB)	DVM READING (mV)	DVM READING CORRECTED FOR OFFSET		
		Min. (mV)	Actual (mV)	Max. (mV)
0	_____	799	_____	801
10	_____	697	_____	703
20	_____	596	_____	604
30	_____	496	_____	504
40	_____	395	_____	405
50	_____	294	_____	306
60	_____	193	_____	207
70	_____	92	_____	108

n. Set 10 dB step attenuator to 0 dB and set front panel REF LEVEL CAL for a digital voltmeter reading of 800 mV plus offset recorded in step h ±1 mV.

o. Set AMPLITUDE SCALE to LIN. The digital voltmeter should indicate the reading set in step n ±25 mV. If it does, go to step q. If it does not, or if Log fidelity is not within limits, go to step p and select A22R16*.

p. Select A22R16* to obtain an output in step o within ±25 mV of the reading set in step n. Decreasing A22R16* 10 percent will increase the DVM reading approximately 30 mV in step o.

5-18. LOG AMPLIFIER ADJUSTMENT (Cont'd)

NOTE

Log fidelity must be considered when selecting A22R16*. That is, if the DVM READING CORRECTED FOR OFFSET in Table 5-6 is greater than 100 mV for a STEP ATTENUATOR SETTING of 70 dB, A22R16* should be selected for a DVM reading greater than the reading set in step n. If the READING CORRECTED FOR OFFSET is less than 100 mV, A22R16* should be selected for a DVM reading less than the reading set in step n.

q. Adjust front panel REF LEVEL CAL for a digital voltmeter reading of 800 mV plus offset (algebraic sum) ±1 mV

r. Set AMPLITUDE SCALE to 10 dB/DIV and adjust A22R2 LOG/LIN adjustment for a digital voltmeter reading of 800 mV plus offset.

s. Repeat step m to recheck the Log fidelity.

t. Set REF LEVEL control to −50 dBm and set AMPLITUDE SCALE to 1 dB/DIV.

u. Set 10 dB step attenuator to 0 dB and adjust front panel REF LEVEL CAL for a digital voltmeter reading of 700 mV (do not include offset).

v. Set REF LEVEL control to −90 dBm and set 10 dB step attenuator to 40 dB. Adjust A22R1 LOG GAIN for a digital voltmeter reading of 700 mV.

w. Change REF LEVEL and 0 dB step attenuator settings as shown in Table 5-7. Deviation from reference should not exceed the given limits.

Table 5-7. Log Gain Adjustment Limits

REFERENCE LEVEL (dBm)	STEP ATTENUATOR SETTING (dB)	DEVIATION FROM REFERENCE
−50	0	Reference
−60	10	±0.3 DIV ±30 mV
−70	20	±0.3 DIV ±30 mV
−80	30	±0.3 DIV ±30 mV
−90	40	±0.3 DIV ±30 mV

x. Adjustment complete. Set A24S1 TEST-NORM switch to NORM position. Set LINE switch OFF, disconnect power cord, and replace 8565A top cover.

5-19. VIDEO OFFSET ADJUSTMENT

REFERENCE:

Service Sheet 25. (For Option 100, see Service Sheet 40)

DESCRIPTION:

First the GAIN is adjusted in the Y Deflection Amplifier Assembly to place the signal on the REFERENCE LEVEL graticule line of the CRT with a specified voltage at the input to the Video Assembly. Then the LOG/LIN is adjusted in the Log Amplifier Assembly so that the signal remains at the REFERENCE LEVEL line as the AMPLITUDE SCALE is switched between LIN and 10 dB/DIV. Finally, the OFFSET is adjusted in the Video Assembly so that the signal remains at the REFERENCE LEVEL line as the AMPLITUDE SCALE is switched between 10 dB/DIV and 5, 2, or 1 dB/DIV.

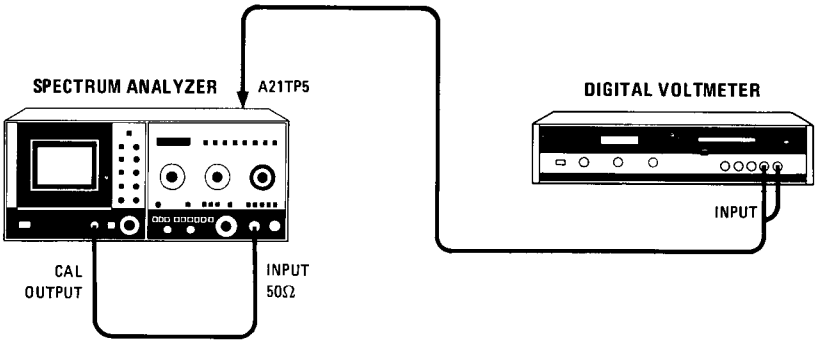


Figure 5-18. Video Offset Adjustment Test Setup

EQUIPMENT:

Digital Voltmeter ..... HP 3490A

5-19. VIDEO OFFSET ADJUSTMENT (Cont'd)

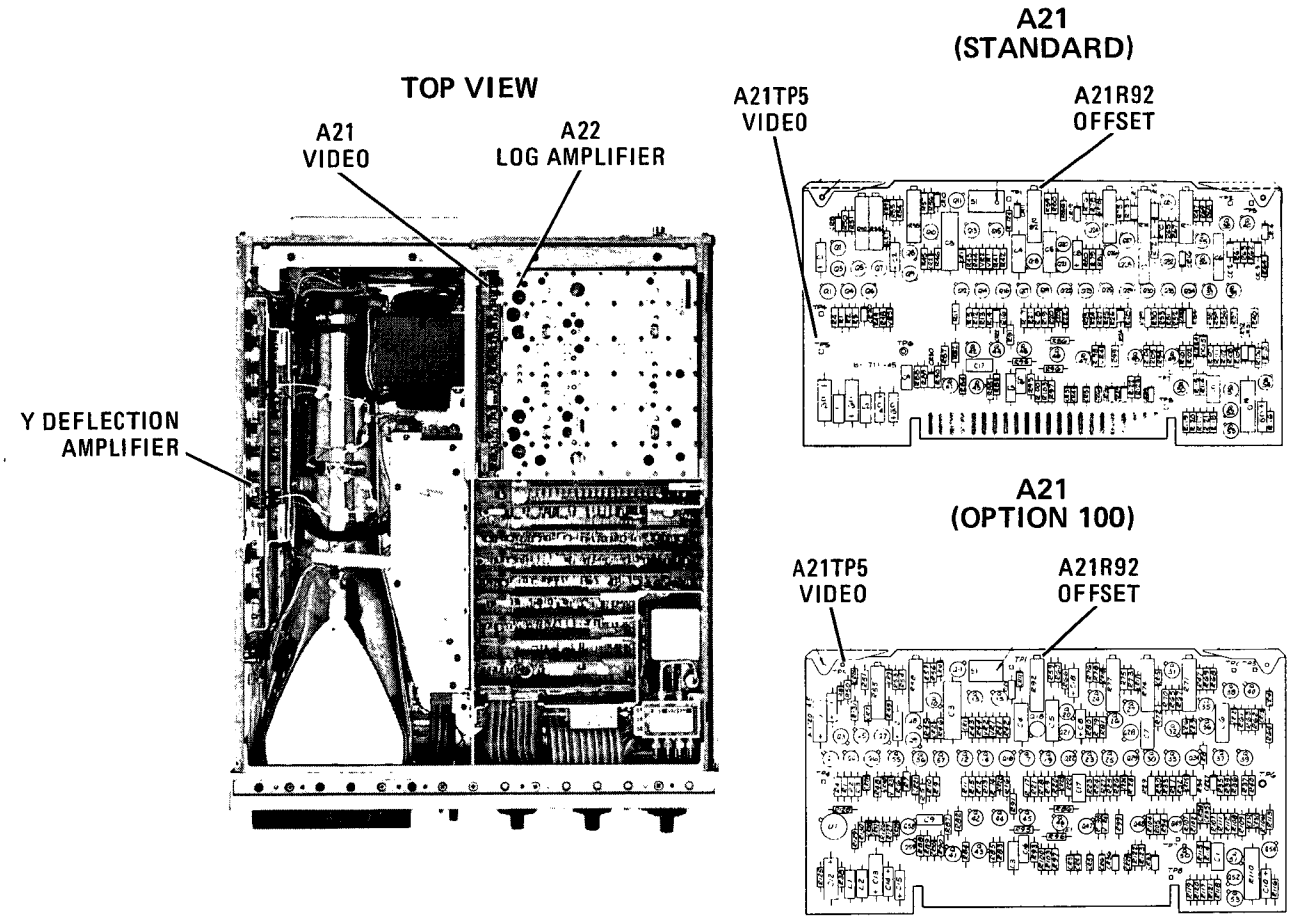


Figure 5-19. Video Offset Adjustment Locations

PROCEDURE:

a. Set LINE switch OFF, disconnect power cord, and remove 8565A top cover.

b. Reconnect power cord, set LINE switch ON, connect equipment as shown in Figure 5-18, and set 8565A controls as follows:

Set all Normal Settings (controls marked with green)

FREQUENCY BAND GHz	.01—1.8
INPUT ATTEN	0 dB
REF LEVEL	0 dBm
REF LEVEL FINE	0
RESOLUTION BW	300 kHz
FREQUENCY SPAN MODE	ZERO SPAN
AMPLITUDE SCALE	LIN
AUTO STABILIZER	OFF
TUNING	0.100 GHz

5-19. VIDEO OFFSET ADJUSTMENT (Cont'd)

c. Adjust front panel VERT POSN to set CRT trace on bottom horizontal graticule line and note offset voltage at A21TP5 VIDEO.

Offset _____ mV

d. Connect 100 MHz CAL OUTPUT signal to INPUT 50Ω connector and adjust front panel TUNING control to peak 100 MHz signal on CRT display.

e. Adjust front panel REF LEVEL FINE control for 800 mV plus offset measured at A21TP5 in step c.

f. Adjust A5R27 GAIN (Figure 5-19) to set signal level on REFERENCE LEVEL graticule line.

g. Disconnect 100 MHz CAL OUTPUT signal and repeat steps c through f until no further adjustment is necessary.

h. Connect 100 MHz CAL OUTPUT signal to INPUT 50Ω connector and set AMPLITUDE SCALE to 10 dB/DIV. Adjust A22R2 LOG/LIN to set signal level on REFERENCE LEVEL graticule line.

i. Adjust A21R92 OFFSET for no signal level change when switching AMPLITUDE SCALE between 10 dB/DIV and 1 dB/DIV positions.

j. Set AMPLITUDE SCALE to 10 dB/DIV and adjust front panel VERT POSN to set signal level on REFERENCE LEVEL graticule line.

k. Disconnect 100 MHz CAL OUTPUT signal and set AMPLITUDE SCALE to LIN. Check that CRT trace is on bottom horizontal graticule line. If not, repeat steps c through g.

l. Connect 100 MHz CAL OUTPUT signal to INPUT 50Ω connector. Select each AMPLITUDE SCALE (10 dB/DIV, 5 dB/DIV, 2 dB/DIV, 1 dB/DIV, and LIN) and check that signal level does not shift more than 0.5 division from REFERENCE LEVEL graticule line.

m. Adjustment complete. Set LINE switch OFF, disconnect power cord, and install 8565A top cover.

5-20 BANDWIDTH FILTER ADJUSTMENTS

NOTE

These adjustments are for bandwidths 3 MHz through 1 kHz. (For Option 100 instruments, these adjustments are for bandwidths 3 MHz through 3 kHz. For bandwidths 1 kHz through 100 Hz, refer to Paragraph 5-33.)

REFERENCE

Service Sheets 21, 23, and 25 (For Option 100, see Service Sheets 40, 23 and 25).

ADJUSTMENTS

5-20. BANDWIDTH FILTER ADJUSTMENTS

DESCRIPTION:

Three of the four crystal filters are disabled with crystal shorts. The fourth crystal filter is then adjusted for a symmetrical and centered bandwidth. The crystal shorts are removed one at a time, and the respective crystal filter is adjusted for a symmetrical and centered bandwidth. The LC filters are adjusted by a similar method. The 3-dB bandwidths are checked for each RESOLUTION BW and, if necessary, adjustments are performed to give correct bandwidths.

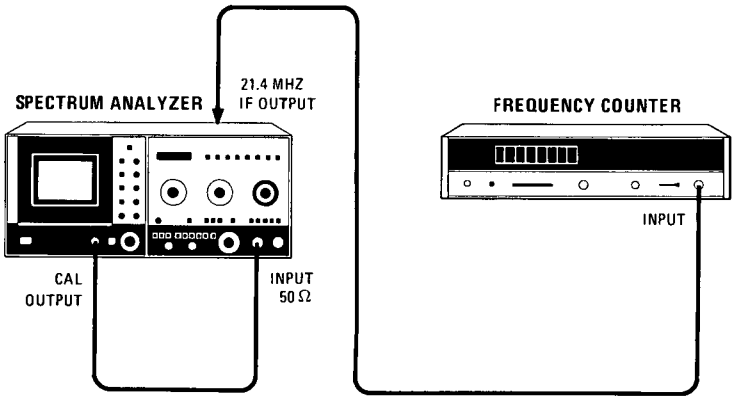


Figure 5-20. Bandwidth Filter Adjustment Test Setup

EQUIPMENT:

Frequency Counter	5340A
Crystal Short (Qty 3)	See Figure 5-19

NOTE

A crystal short consists of a .01 μF capacitor (HP Part No. 0160-0161) and 90.9 ohm resistor (HP Part No. 0757-0400) connected in series. Two square terminal connectors (HP Part No. 0362-0265) are used for connecting the crystal short across the test points.

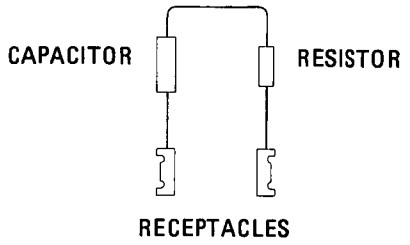


Figure 5-21. Crystal Short Configuration

5-20. BANDWIDTH FILTER ADJUSTMENTS (Cont'd)

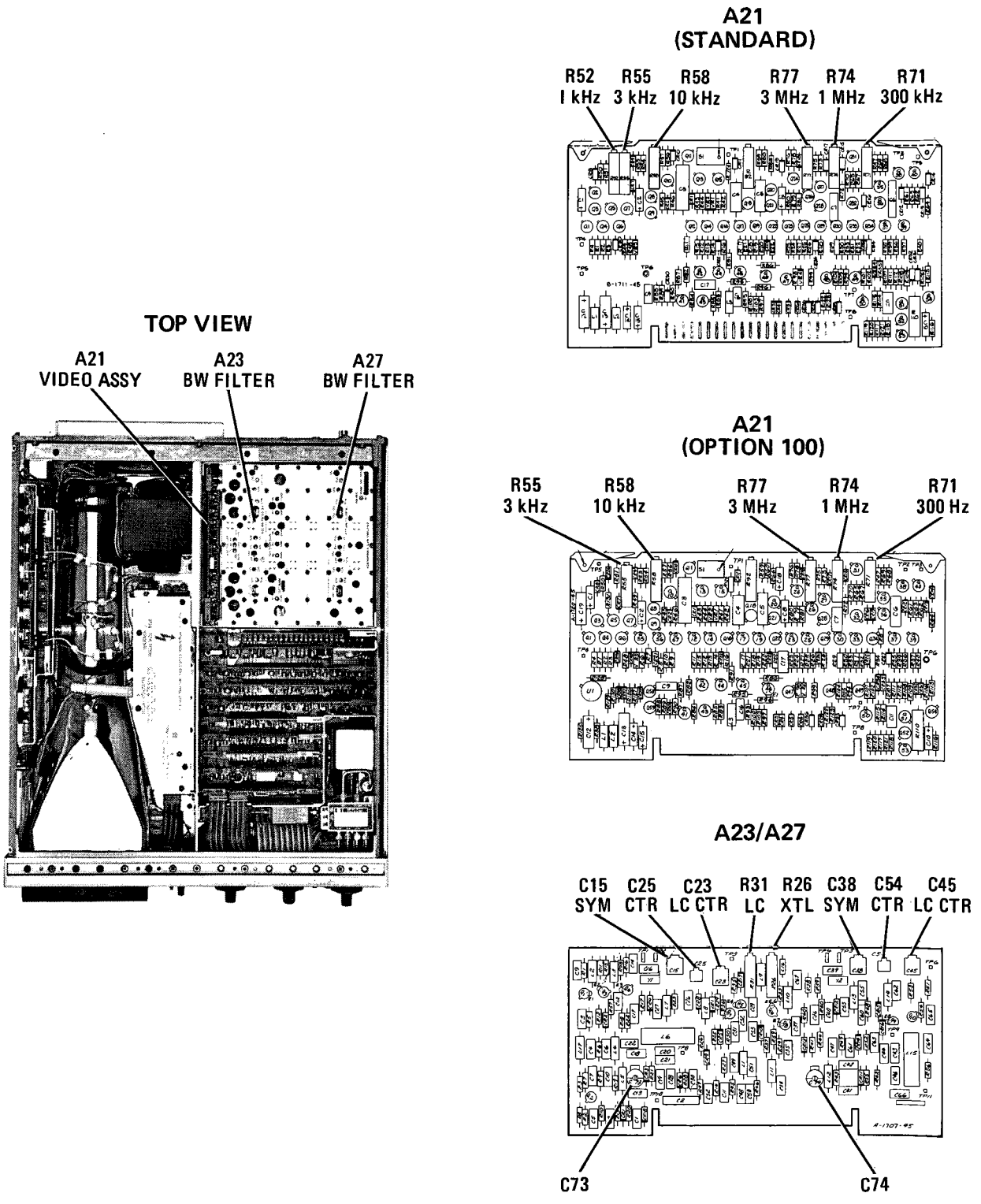


Figure 5-22. Bandwidth Filter Adjustment Locations

5-20. BANDWIDTH FILTER ADJUSTMENTS (Cont'd)

PROCEDURE:

a. Set LINE switch OFF, disconnect power cord, and remove 8565A top cover.

Crystal Alignment

b. Reconnect power cord, set LINE switch ON, connect equipment as shown in Figure 5-20, and set 8565A controls as follows:

Set all Normal Settings (controls marked with green)

FREQUENCY BAND GHz	.01—1.8
INPUT ATTEN	10 dB
REF LEVEL	0 dBm
REF LEVEL FINE	—10
RESOLUTION BW	30 kHz
FREQUENCY SPAN/DIV	20 kHz
AMPLITUDE SCALE	LIN
TUNING	0.100 GHz

c. Connect 100 MHz CAL OUTPUT signal to INPUT 50Ω connector and adjust TUNING control to center 100 MHz signal on CRT display.

d. Connect crystal shorts (through cover access holes) across each pair of the following test points: A23TP1-A23TP2, A27TP1-A27TP2, and A27TP4-A27TP5.

e. Adjust front panel TUNING control to center bandpass spike (Figure 5-23) on CRT display.

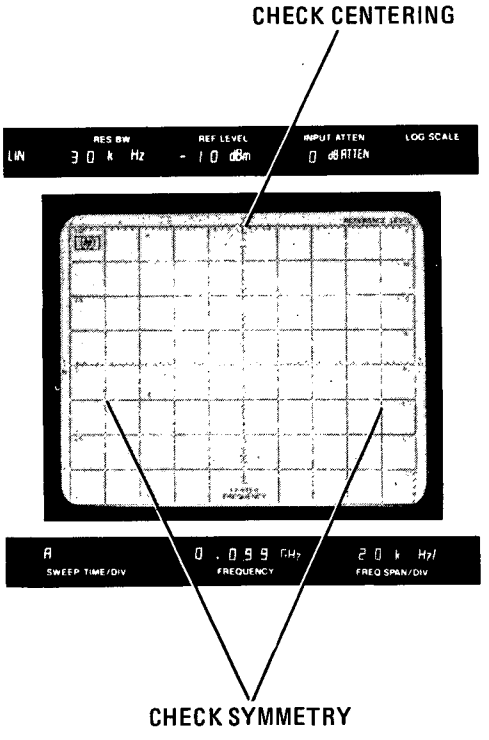


Figure 5-23. Crystal Filter Adjustment CRT Display

5-20. BANDWIDTH FILTER ADJUSTMENTS (Cont'd)

NOTE

A non-metallic tuning tool is required for all crystal filter and LC filter adjustments.

f. Adjust A23C54 CTR and A23C38 SYM (Figure 5-22) for a centered and symmetrical bandpass. Crystal center adjustment A23C54 is adjusted for minimum signal amplitude (Figure 5-23).

g. Remove crystal short across A23TP1 – A23TP2.

h. Adjust A23C25 CTR and A23C15 SYM for a centered and symmetrical bandpass. Crystal center adjust A23C25 is adjusted for minimum signal amplitude (Figure 5-23).

i. Switch AMPLITUDE SCALE to 5 dB and remove crystal short across A27TP4 – A27TP5.

j. Adjust A27C54 CTR and A27C38 SYM for a centered and symmetrical bandpass. Crystal center adjustment A27C54 is adjusted for minimum signal amplitude (Figure 5-23.)

k. Remove crystal short across A27TP1 – A27TP2.

l. Adjust A27C25 CTR and A27C15 SYM for a centered and symmetrical bandpass. Crystal center adjustment A27C25 is adjusted for minimum signal amplitude (Figure 5-23).

LC Alignment

m. Set FREQUENCY SPAN/DIV to 20 kHz and AMPLITUDE SCALE to LIN. Adjust TUNING control to center 100 MHz signal on CRT display, then set RESOLUTION BW control to 3 MHz. Set A21S1 NORM-TEST switch to TEST.

n. Install A23 BW Filter No. 2 Assembly on extender board and perform preliminary LC Filter adjustment as follows:

1. Short to ground the following test points: A23TP6, A27TP3, and A27TP6.

2. Adjust A23C73 for minimum signal amplitude.

3. Disconnect short to ground from A23TP6 and connect short to A23TP3. Adjust A23C74 for minimum signal amplitude.

4. Reinstall A23 and install A27 BW Filter No. 1 Assembly on extender board.

5. Disconnect short to ground from A27TP3 and connect short to A23TP3. Adjust A27C73 for minimum signal amplitude.

6. Disconnect short to ground from A27TP6 and connect short to A27TP3. Adjust A27C74 for minimum signal amplitude.

5-20. BANDWIDTH FILTER ADJUSTMENTS (Cont'd)

7. Remove jumpers to ground and reinstall A27 BW Filter No. 1 Assembly. Replace covers on A23 and A27 BW Filter Assemblies.

NOTE

When A23 and A27 BW Filter Assemblies are installed with covers in place, midget copper alligator clips (HP Part No. 1400-0483) can be used to short test points to the cover.

o. Short to ground A23TP6, A27TP3, and A27TP6. Adjust A23C23 LC CTR to center bandpass display on CRT screen.

p. Disconnect short to ground from A23TP6. Adjust A23C45 LC CTR to center bandpass display on CRT screen.

q. Disconnect short to ground from A27TP3. Short to ground A23TP3 and A23TP6.

r. Adjust A27C23 LC CTR to center bandpass display on CRT screen.

s. Disconnect short to ground from A27TP6. Adjust A27C45 LC CTR to center bandpass display on CRT screen.

t. Disconnect shorts to ground from A23TP3 and A23TP6. Set A21S1 NORM-TEST switch to NORM. Set RESOLUTION BW to 30 kHz and FREQUENCY SPAN/DIV to 2 kHz. Adjust TUNING control to center bandpass display on CRT screen.

u. Switch RESOLUTION BW from 30 kHz to 10 kHz and check signal shift does not exceed 3 kHz (1.5 divisions). If signal shift is out of tolerance, repeat steps b through l. Switch RESOLUTION BW from 30 kHz to 100 kHz and check signal shift does not exceed 10 kHz (5 divisions). If signal shift is out of tolerance, repeat steps m through u.

Bandwidth Amplitude

v. Set RESOLUTION BW to 1 MHz, FREQUENCY SPAN/DIV to 2 kHz, and AUTO STABILIZER on.

w. Adjust FINE TUNING and REF LEVEL FINE for a centered signal with seven division amplitude.

x. Set RESOLUTION BW to 100 kHz and center signal with FINE TUNING control. Adjust A23R26 and A27R26 LC equally to obtain a seven-division amplitude signal.

y. Set RESOLUTION BW to 1 kHz (3 kHz for Option 100) and center signal with FINE TUNING control. Adjust A23R31 and A27R31 XTL equally to obtain a seven-division amplitude signal.

5-20. BANDWIDTH FILTER ADJUSTMENTS (Cont'd)

z. Uncouple RESOLUTION BW and FREQUENCY SPAN/DIV switches. Set FREQUENCY SPAN/DIV to 1 kHz (2 kHz for Option 100) and RESOLUTION BW to 1 kHz (3 kHz for Option 100). (Align green segment on RESOLUTION BW switch with 200 kHz position on FREQUENCY SPAN/DIV switch.) Couple the switches in this positon. Set AMPLITUDE SCALE to 1 dB/DIV.

aa. Center 100 MHz signal with FINE TUNING control and adjust REF LEVEL FINE to obtain a seven-division amplitude signal.

ab. Step RESOLUTION BW switch from 1 kHz (3 kHz for Option 100) to 300 kHz and check amplitude variation from seventh graticule line is less than ±0.5 dB. Check signal amplitude for 300 kHz and 3 MHz RESOLUTION BW positions is within ±0.4 dB of seventh graticule line (1 MHz RESOLUTION BW position was used for amplitude reference in step y and should be on seventh graticule line). If signal amplitude for 300 kHz positon is too low, repeat steps n through u. If signal amplitude for 3 MHz position is too high, check Third Converter bandpass shape according to Paragraph 5-26.

3 dB Bandwidth Adjustments

ac. Set AMPLITUDE SCALE to LIN, RESOLUTION BW to 3 MHz, and FREQUENCY SPAN/DIV to .5 MHz. Adjust REF LEVEL FINE to set signal peak 7.1 divisions above graticule baseline.

NOTE

Adjustment of 3-dB bandwidth for 100 kHz and 30 kHz RESOLUTION BW positions requires changing factory selected resistors. The 100 kHz bandwidth will narrow with an increase in resistor values. The 30 kHz bandwidth will widen with an increase in resistor values. While the resistor values selected for each bandwidth (100 kHz or 30 kHz) do not need to be the same value, they should not vary from each other by more than 10 percent.

NOTE

Option 100 removes the 1 kHz bandwidth adjustment from A21 Video Assembly. For Option 100, the 1 kHz bandwidth adjustment procedure is included with the .3 kHz and .1 kHz bandwidth adjustments in Paragraph 5-33.

ad. Perform 3-dB bandwidth adjustment listed in Table 5-8. Maintain the signal peak 7.1 divisions above graticule baseline, and adjust for correct bandwidth five divisions above graticule baseline. Measure the 3-dB bandwidth with a frequency counter as follows:

1. Set SWEEP SOURCE to MAN, and connect frequency counter to rear panel 21.4 MHz IF OUTPUT connector.

5-20 BANDWIDTH FILTER ADJUSTMENTS (Cont'd)

2. Adjust MANUAL SWEEP control to position CRT trace at lower frequency 3 dB point, then upper frequency 3 dB point. Note frequency difference between 3-dB points is within 15% of selected RESOLUTION BW. If not, repeat corresponding 3-dB bandwidth adjustment. (The 3 dB point is 5 divisions above graticule baseline when signal peak is 7.1 divisions above graticule baseline.)

3. Set SWEEP SOURCE to INT.

Table 5-8. 3-dB Bandwidth Adjustments and Limits

RESOLUTION BW	FREQUENCY SPAN/DIV	ADJUSTMENT	3 dB BANDWIDTH LIMITS
3 MHz	.5 MHz	A21R77 3 MHz	2.55 to 3.45 MHz
1 MHz	.2 MHz	A21R74 1 MHz	0.85 to 1.15 MHz
300 kHz	50 kHz	A21R71 300 kHz	255 to 345 kHz
100 kHz	20 kHz	A23R19*, A23R43*, A27R43*	85 to 115 kHz
30 kHz	5 kHz	A23R23*, A23R48* A27R23*, A27R48*	25.5 to 34.5 kHz
10 kHz	2 kHz	A21R58 10 kHz	8.5 to 11.5 kHz
3 kHz	1 kHz	A21R55 3 kHz	2.5 to 3.5 kHz
1 kHz (Except Option 100)	1 kHz	A21R52 1 kHz	0.8 to 1.2 kHz

ae. Adjustment complete, set LINE switch OFF, remove power cord, and install 8565A top cover.

5-21. STEP GAIN ADJUSTMENTS

REFERENCE:

Service Sheet 22

DESCRIPTION:

0 dB and −12 dB adjustments are set to calibrate front panel REF LEVEL FINE control. The Step Gain Amplifier is then adjusted for calibrated 10 dB steps.

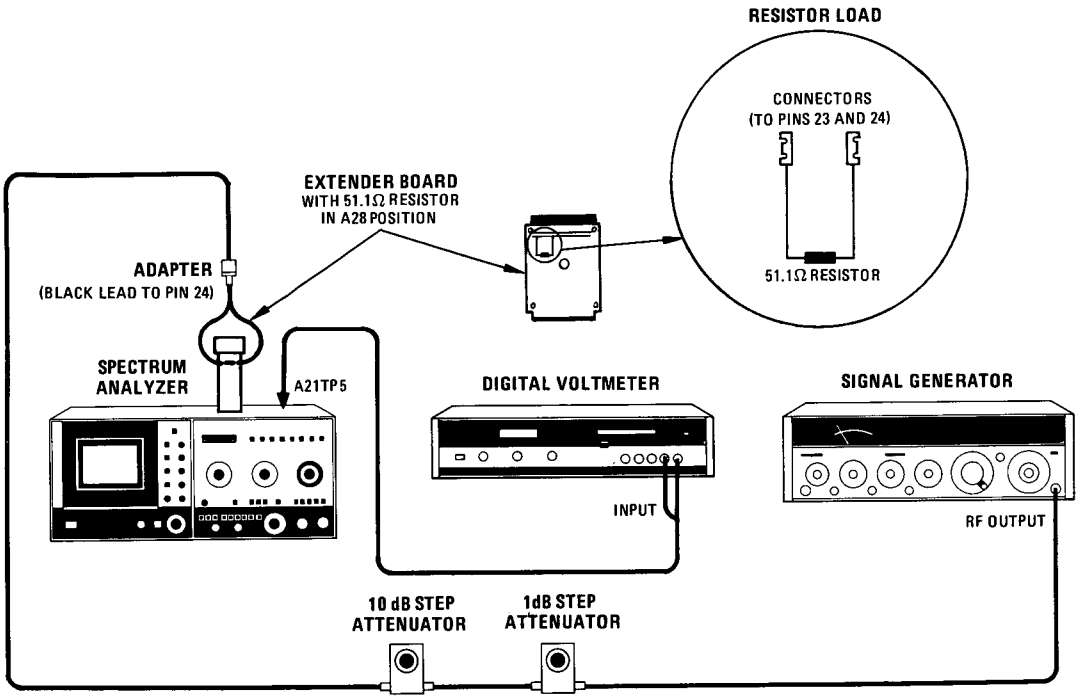


Figure 5-24. Step Gain Adjustment Test Setup

EQUIPMENT:

10 dB Step Attenuator	HP 355D H80
1 dB Step Attenuator	HP 355C H80
Digital Voltmeter	HP 3490A
Signal Generator	HP 8640B
Extender Board (2 x 22 pin)	08565-60107
Resistor 51.1 Ohm	0757-0394
Terminal Connectors (2)	0362-0227
Adapter, BNC Female to Alligator Clips	8120-1292

5-21. STEP GAIN ADJUSTMENTS (Cont'd)

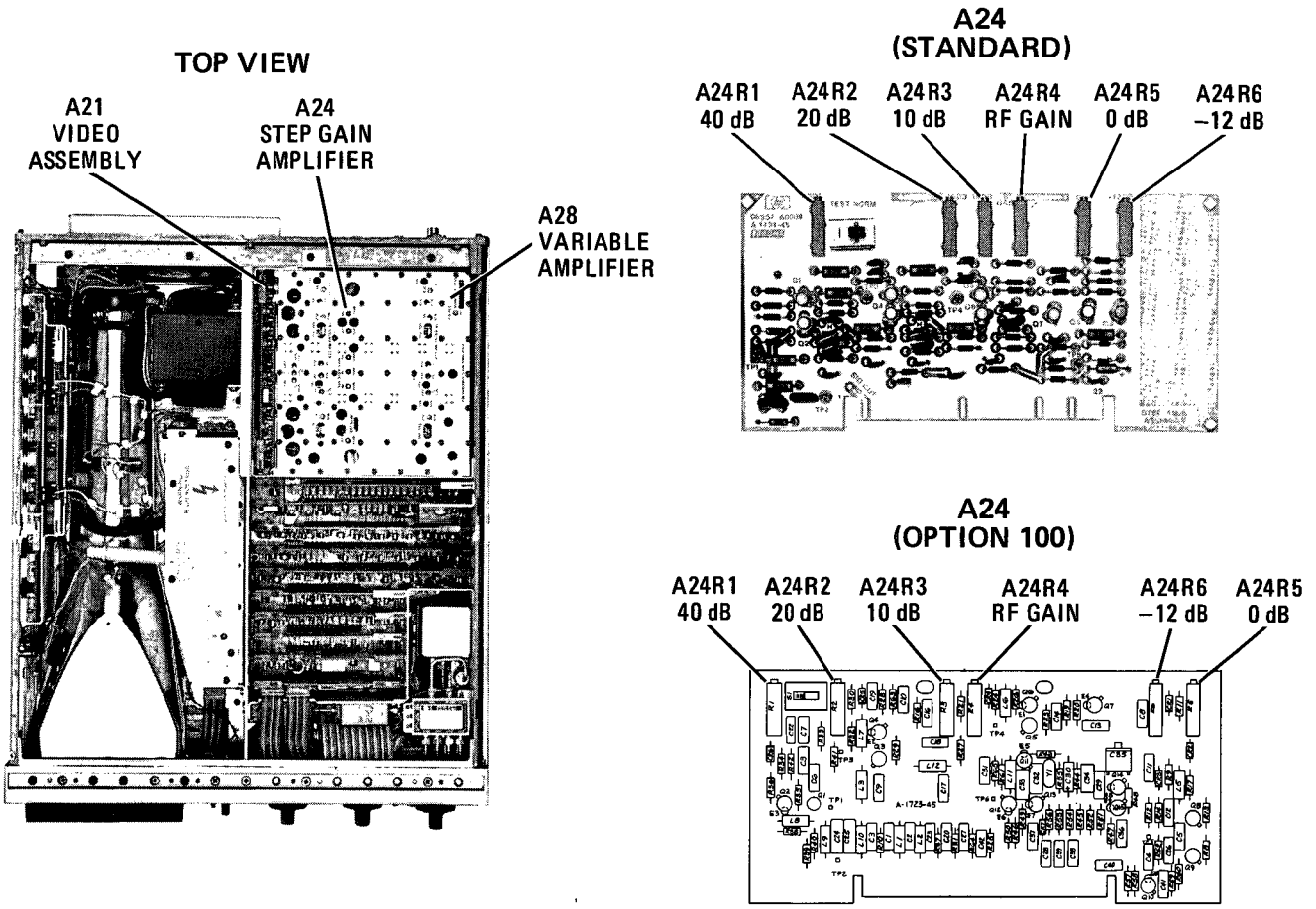


Figure 5-25. Step Gain Adjustment Locations

PROCEDURE:

a. Set LINE switch OFF disconnect power cord, and remove 8565A top cover.

b. Install 51.1 ohm resistor between pins 23 and 24 on extender board (Figure 5-24). Remove A28 Variable Gain Amplifier and install extender board in its place (do not install A28 on extender board).

c. Reconnect power cord, set LINE switch ON, connect equipment as shown in Figure 5-24, and set 8565A controls as follows:

Set all Normal Settings (controls marked with green)

REF LEVEL	0 dBm
REF LEVEL FINE	−12
RESOLUTION BW	1 MHz
AMPLITUDE SCALE	1 dB
VIDEO FILTER	.01

5-21. STEP GAIN ADJUSTMENTS (Cont'd)

d. Set 10 dB step attenuator to 0 dB and 1 dB step attenuator to 12 dB. Set signal generator for a 21.4 MHz, −3 dBm output.

e. Adjust signal generator output frequency for maximum signal level on CRT display.

f. Adjust A24R6 −12 dB (Figure 5-25) for maximum signal level on CRT display. Then adjust A24R6 counterclockwise to set signal level 0.4 division below maximum.

g. Adjust signal generator output level to position CRT trace on REFERENCE LEVEL graticule line.

h. Set REF LEVEL FINE control to 0 dB and 1 dB step attenuator to 0 dB.

i. Adjust A24R5 0 dB to positon CRT trace on REFERENCE LEVEL graticule line.

j. Turn off signal generator RF Power and note offset voltage at A21TP5.

Offset_____mV

k. Turn on signal generator RF power and set output level to 0 dBm. Adjust A24R4 RF GAIN for 800 mV plus the offset measured at A21TP5 in step j. (If A24R4 does not have sufficient adjustment range, change value of A27R3*. An increase in resistance will decrease voltage at A21TP5.)

l. Perform step gain adjustments for each REF LEVEL and 10 dB step attenuator setting in Table 5-9.

m. Adjustment complete. Set LINE switch OFF, disconnect power cord, remove extender board, install A28 Variable Gain Amplifier Assembly, and install 8565A top cover.

Table 5-9. REF LEVEL Step Gain Adjustment

REF LEVEL	10 dB Step Attenuator	Adjustment	Voltage A21TP5
0 dBm	0 dB	A24R4 GAIN	Reference (800 mV + offset)
−10 dBm	10 dB	A24R3 10 dB	Reference ±20 mV
−20 dBm	20 dB	A24R2 20 dB	Reference ±20 mV
−30 dBm	30 dB	None	Reference ±20 mV
−40 dBm	40 dB	A24R1 40 dB	Reference ±20 mV
−50 dBm	50 dB	None	Reference ±20 mV

5-22. SWEEP GENERATOR ADJUSTMENTS

REFERENCE:

Service Sheet 10

DESCRIPTION:

The +10V Temperature Variable Supply (+10VTV) is adjusted during the first five minutes of instrument operation. The sweep generator is then adjusted to start retrace when the sweep ramp reaches plus five volts. Rear panel HORIZONTAL SWEEP OUTPUT is used to externally sweep an oscilloscope, and a time mark generator is used to calibrate the sweep time.

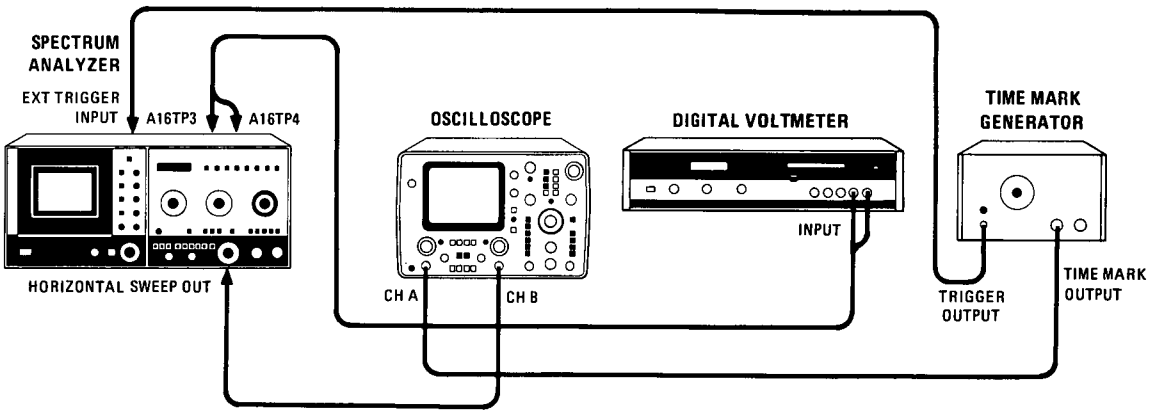


Figure 5-26. Sweep Generator Adjustment Test Setup

EQUIPMENT:

Digital Voltmeter	HP 3490A
Oscilloscope	HP 1740A
Time Mark Generator	HP 226A

5-22. SWEEP GENERATOR ADJUSTMENTS (Cont'd)

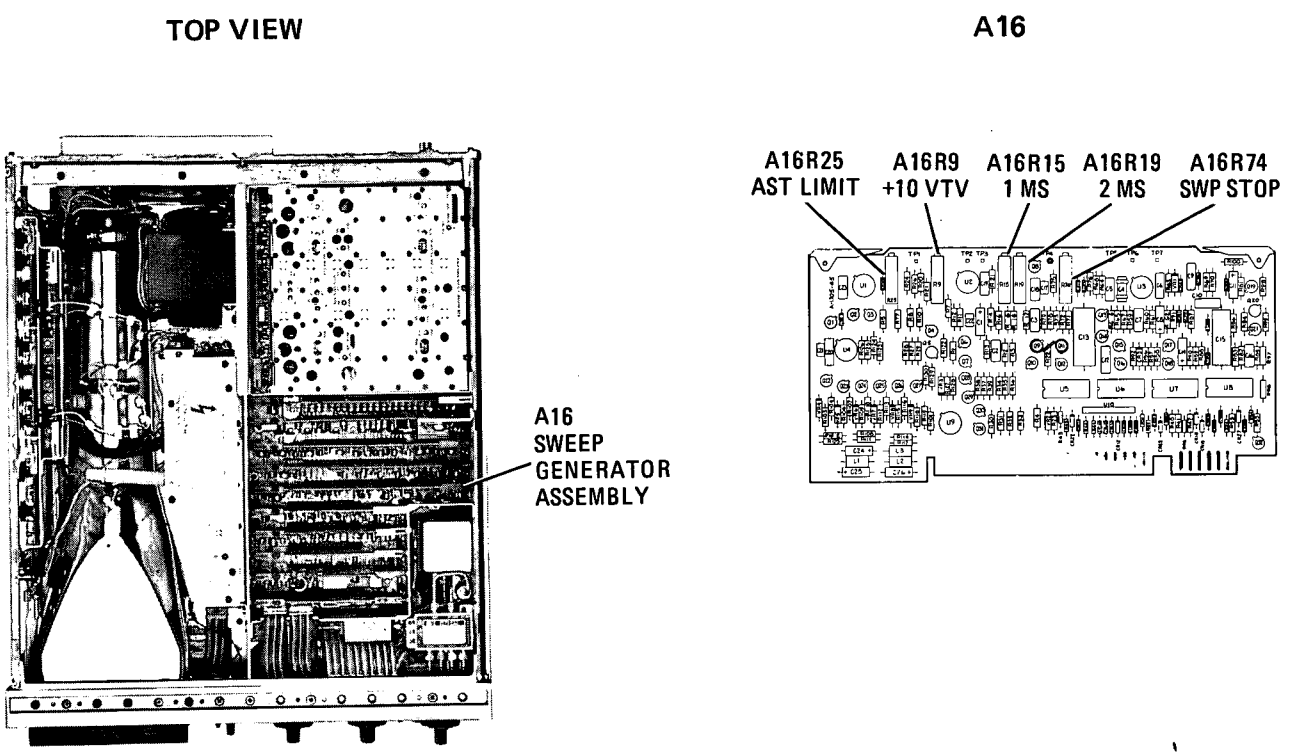


Figure 5-27. Sweep Generator Adjustment Locations

PROCEDURE:

a. Set LINE switch OFF, disconnect power cord, and remove 8565A top cover.

b. Reconnect power cord, set LINE switch ON, connect equipment as shown in Figure 5-26, and set 8565A controls as follows:

Set all Normal Settings (controls marked with green)
RESOLUTION BW ..... 10 kHz
FREQUENCY SPAN/DIV ..... 100 MHz
SWEEP TRIGGER ..... SINGLE

5-22. SWEEP GENERATOR ADJUSTMENTS (Cont'd)

NOTE

The +10V Temperature Variable Supply (+10VTV) must be adjusted while the spectrum analyzer is still cold, during first five minutes of operation. If instrument has been operating, turn off spectrum analyzer and remove A16 Sweep Generator Assembly. Let A16 assembly cool off for 15 Minutes. Replace A16 and proceed with adjustment of A16R9 +10 VTV during first five minutes of operation.

c. Connect digital voltmeter to A16TP3 +10VTV and use A16TP4 for ground return. Adjust A16R9 +10 VTV for +10.00 volts ±0.01 volts.

d. Connect digital voltmeter to A16TP6 INT SWP and use A16TP4 for ground return. Check that voltage at A16TP6 is −5.00 V ±0.02 V. If not, perform +15 volt adjustment in Paragraph 5-12.

NOTE

Adjustment of A16R74 SWP STOP (Figure 5-27) is performed by noting the sweep ramp voltage just prior to sweep retrace. A16R74 is then adjusted to trigger sweep retrace when the sweep ramp reaches +5 volts. To accurately determine sweep ramp voltage, slow sweep time per division by setting VIDEO FILTER to .003 when CRT trace is within one-half division of right graticule edge.

e. Depress START/RESET pushbutton to start sweep. When trace is within one-half division of right graticule edge, set VIDEO FILTER to .003. Note digital voltmeter indication just prior to sweep retrace (maximum positive sweep ramp voltage).

f. Adjust A16R74 SWP STOP for a maximum sweep ramp voltage (step e) of +5.00 volts ±0.01 volts. A clockwise adjustment of A16R74 will increase the sweep ramp voltage required to trigger retrace.

g. Set 8565A controls as follows:

Set all Normal Settings (controls marked with green)

FREQUENCY BAND GHz	.01 – 1.8
INPUT ATTEN	10 dB
REF LEVEL	10 dBm
REF LEVEL FINE	0
RESOLUTION BW	3 MHz
FREQUENCY SPAN/DIV	500 MHz
SWEEP TIME/DIV	1 mSEC

5-22. SWEEP GENERATOR ADJUSTMENTS (Cont'd)

NOTE

The HP 1740A oscilloscope is externally swept by selecting A/B sweep mode and connecting 8565A HORIZONTAL SWEEP OUT to oscilloscope Channel B input connector. Oscilloscope horizontal gain is adjusted with Channel B VOLTS/DIV control.

h. Externally sweep oscilloscope with rear panel HORIZONTAL SWEEP OUT and adjust oscilloscope horizontal gain for a ten division wide trace.

i. Set time mark generator for 1 millisecond marker output and display output on oscilloscope. Externally trigger spectrum analyzer with time marker generator.

j. Adjust spectrum analyzer TRIGGER LEVEL to set first peak on left edge of oscilloscope graticule display (Figure 5-28). Adjust A16R15 1 MS to set eleventh peak on right edge of graticule display.

k. Set spectrum analyzer SWEEP TIME/DIV to 2 mSEC and time mark generator output to 2 milliseconds.

l. Adjust spectrum analyzer TRIGGER LEVEL to set first peak on left edge of oscilloscope graticule display. Adjust A16R19 2 MS to set eleventh peak on right edge of graticule display. Repeat steps i through l until no further adjustment is necessary.

m. Set spectrum analyzer SWEEP TIME/DIV to AUTO and time mark generator output to 50 milliseconds.

n. Adjust spectrum analyzer TRIGGER LEVEL to set first peak on left edge of graticule display. Adjust A16R25 AST LIMIT to set sixth peak on right edge of graticule display.

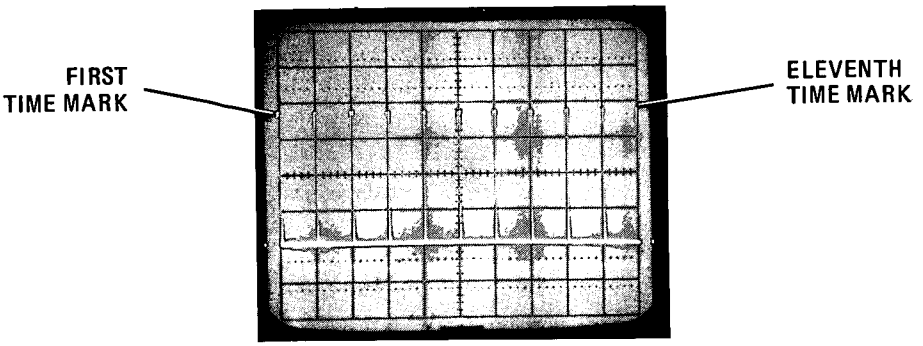


Figure 5-28. Time Mark Oscilloscope Display

o. Adjustment complete. Set LINE switch OFF, disconnect power cord and install 8565A top cover.

ADJUSTMENTS

5-23. + 10 V REFERENCE AND DIGITAL READOUT ADJUSTMENTS

REFERENCE:

Service Sheets 12, 17, and 35

DESCRIPTION:

Adjustment of the A17 Frequency Control Assembly +10V reference supply is performed, and offset in the center frequency output (to A12 DVM Analog Assembly) is adjusted for a null. The A12 DVM Analog Assembly is then adjusted to give a calibrated front panel CENTER FREQUENCY digital readout. Digit intensity on the bezel readout display is adjusted for the same intensity as that of the bezel readout annunciators.

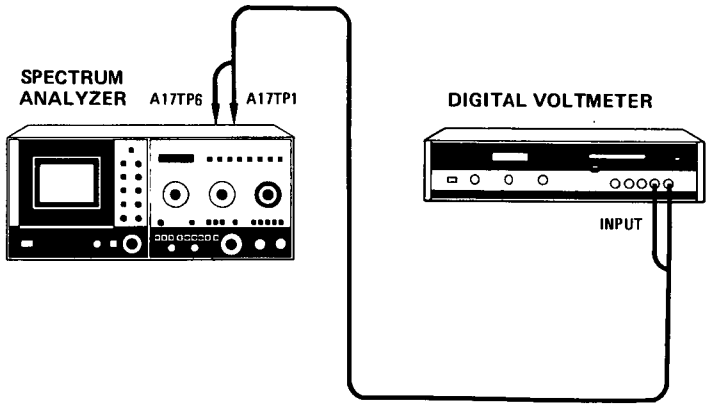


Figure 5-29. +10V Reference and Digital Readout Adjustments Test Setup

EQUIPMENT:

Digital Voltmeter ..... HP 3490A

ADJUSTMENTS

5-23. + 10 V REFERENCE AND DIGITAL READOUT ADJUSTMENTS (Cont'd)

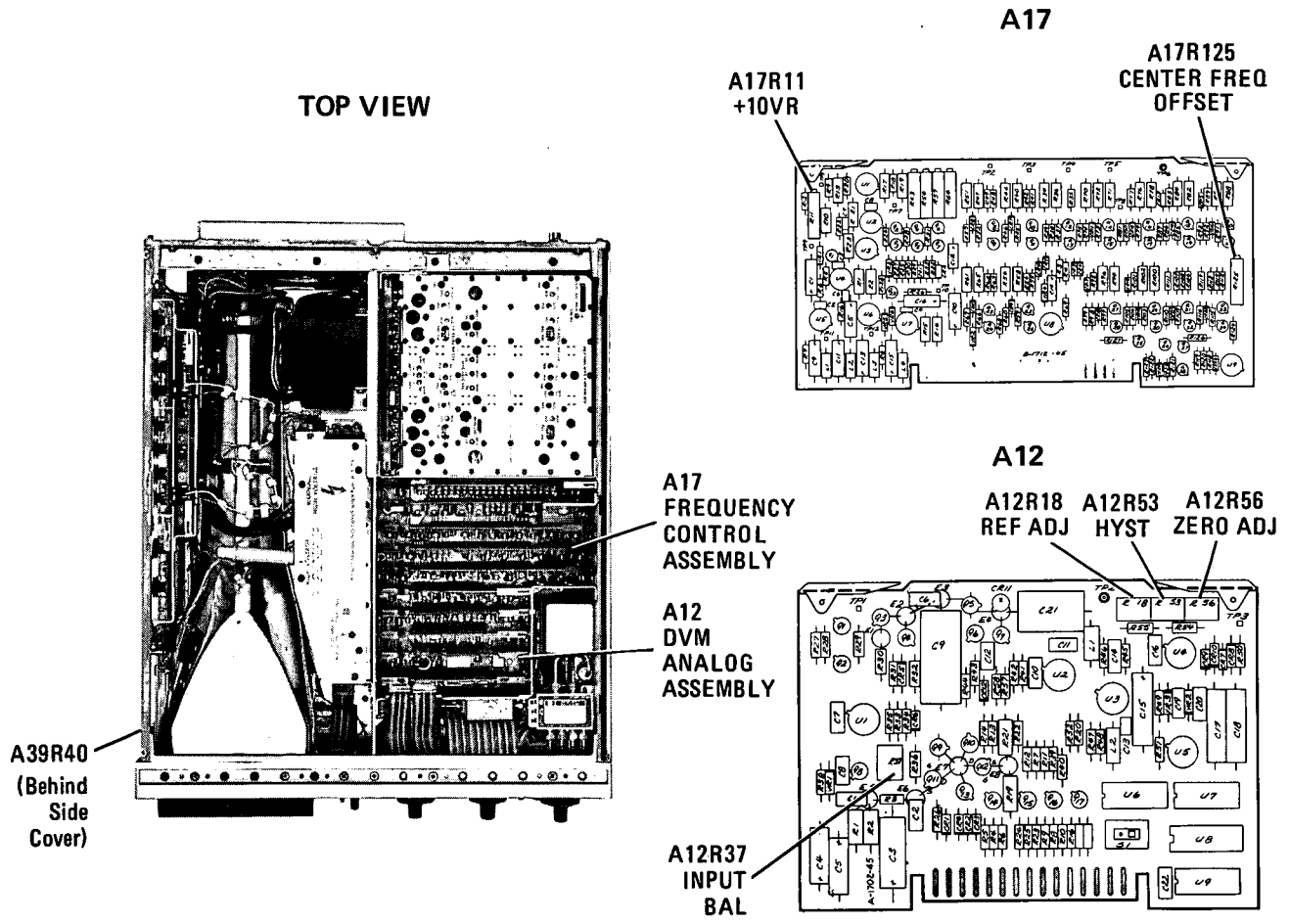


Figure 5-30. +10V Reference and Digital Readout Adjustment Locations

PROCEDURE:

a. Set LINE switch OFF, disconnect power cord, and remove 8565A top cover.

b. Reconnect power cord, set LINE switch ON, connect equipment as shown in Figure 5-29, and set 8565A controls as follows:

Set all normal settings (controls marked with green)

FREQUENCY BAND GHz ..... .01—1.8

5-23. + 10 V REFERENCE AND DIGITAL READOUT ADJUSTMENTS (Cont'd)

NOTE

For all digital voltmeter measurements, use A17TP6 ⏚ for ground return.

+10V Reference Adjustment

c. Connect digital voltmeter to A17TP1 +10VR and adjust A17R11 +10VR (Figure 5-30) for +10.0000V ± 0.0002V. If unable to adjust A17R11 for +10 V, change factory selected resistor A17R9*. Decrease in A17R9* decreases voltage.

d. Jumper A17TP5 CENT FREQ to A17TP8 and connect digital voltmeter to A17TP5 CENT FREQ.

e. Adjust A17R125 CENTER FREQ OFFSET for a digital voltmeter reading of 0.0000V ±0.0002V.

f. Disconnect jumper between A17TP5 CENT FREQ and A17TP8.

Digital Readout Adjustment

g. Install A12 DVM Analog Assembly on extender board and connect jumper between A12E7 and A12TP2. Connect digital voltmeter to A12TP1.

h. Adjust A12R37 INPUT BAL for a digital voltmeter reading of 0.000V ± 0.001V. Reinstall A12 DVM Analog Assembly.

i. Adjust front panel TUNING control for a 0.0000 V ±0.0001V digital voltmeter reading at A17TP5 CENT FREQ.

j. Adjust A12R56 ZERO ADJ for a flickering minus sign on the front panel CENTER FREQUENCY digital readout.

k. Adjust TUNING control for a 0.0005V ± 0.0001V digital voltmeter reading at A17TP5 CENT FREQ.

l. Adjust A12R53 HYST for a CENTER FREQUENCY display flickering between 0.000 GHz and 0.001 GHz.

m. Switch FREQUENCY BAND to 8.5 – 18 GHz and adjust front panel TUNING control for 10.0000V ±0.0002V at A17TP5 CENT FREQ.

n. Adjust A12R18 REF ADJ for a CENTER FREQUENCY display of 10.000 GHz.

Bezel Readout Digit Intensity Adjustment

o. Adjust A39R40 DIG INT for equal intensity of digits and annunciators on bezel digital readout display. (A39R40 is accessible through vent holes in instrument side cover).

p. Set LINE switch OFF, disconnect power cord, and install 8565A top cover.

5-24. YIG DRIVER ADJUSTMENT

REFERENCE:

Service Sheet 14

DESCRIPTION

The YIG Tuned Oscillator (YTO) output frequency is calibrated by supplying a known tuning voltage and adjusting YTO offset and gain adjustments for the correct 1st Local Oscillator output frequency. The YIG Tuned Filter (YTF) offset and gain adjustments are performed to track the YTF bandpass with the YTO frequency.

NOTE

Allow at least 1 hour warm-up before performing YIG Driver Adjustments.

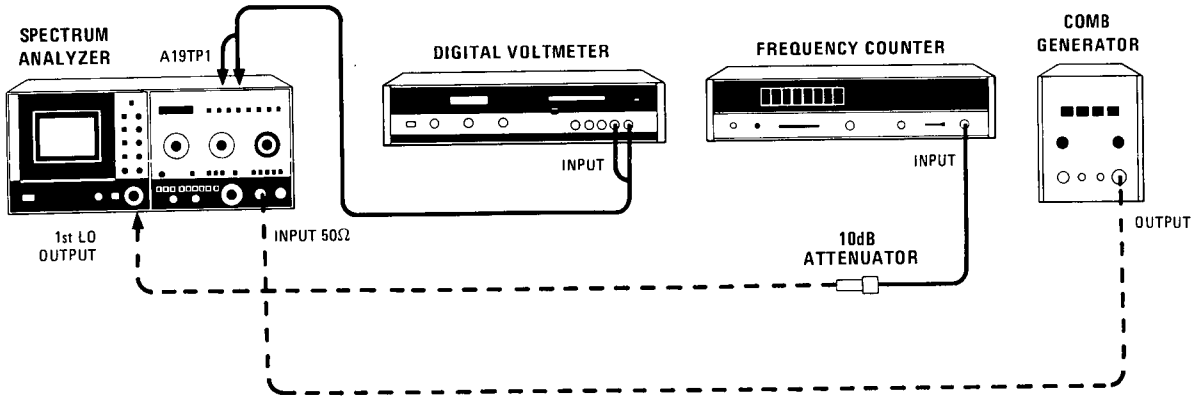


Figure 5-31. YIG Driver Adjustment Test Setup

EQUIPMENT:

Digital Voltmeter	HP 3490A
Frequency Counter	HP 5340A
Comb Generator	HP 8406A
10 dB Attenuator	HP 8491B Option 010

5-24. YIG DRIVER ADJUSTMENT (Cont'd)

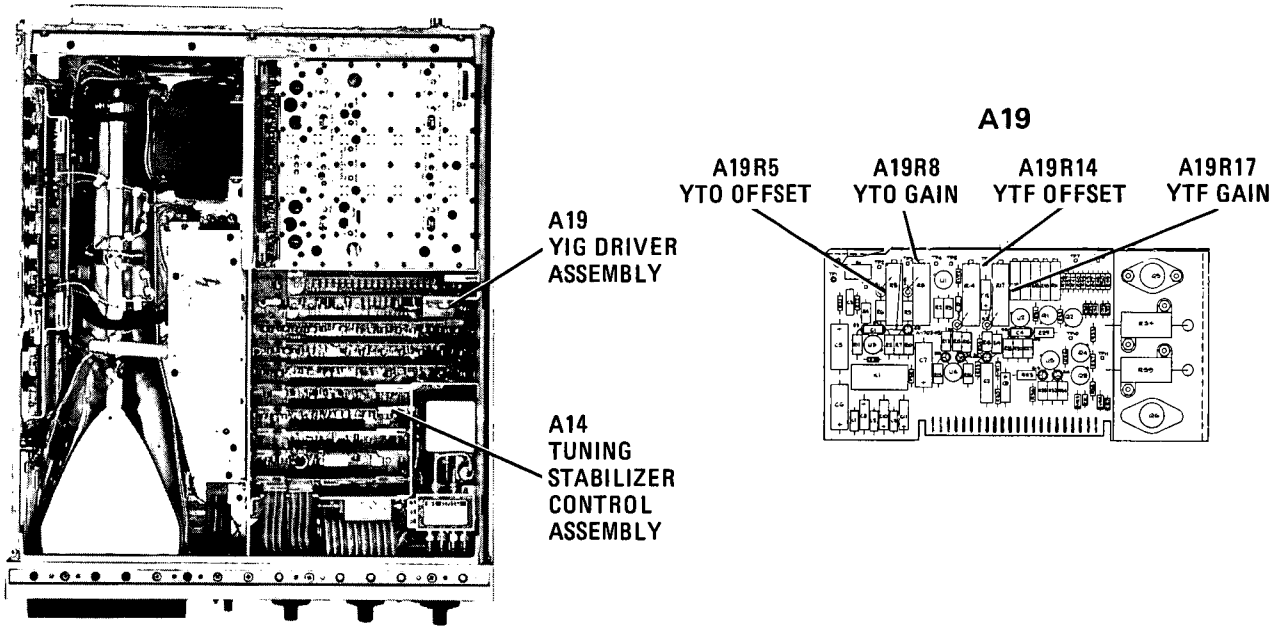


Figure 5-32. YIG Driver Adjustment Locations

PROCEDURE:

a. Set LINE switch OFF, disconnect power cord, remove 8565A top cover, and remove A14 Tuning Stabilizer Control Assembly.

b. Reconnect power cord, set LINE switch ON, connect equipment as shown in Figure 5-31, and set 8565A controls as follows:

Set all Normal Settings (controls marked with green)
FREQUENCY BAND GHz ..... 1.7 – 4.1
FREQUENCY SPAN MODE ..... ZERO SPAN
AUTO STABILIZER ..... OFF

NOTE

For all digital voltmeter measurements, use A19TP1 ⏚ for return.

YTO Adjustments

c. Connect frequency counter through a 10 dB attenuator to rear panel 1ST LO OUTPUT connector.

5-24. YIG DRIVER ADJUSTMENT(Cont'd)

d. Connect digital voltmeter to A19TP4 YTO FA and adjust front panel TUNING control for −10.2500V ±0.0005V.

e. Adjust A19R5 YTO OFFSET (Figure 5-32) for a frequency counter reading of 2.050 GHz ±0.0002 GHz.

f. Adjust front panel TUNING control for −22.000V ±0.001V at A19TP4 YTO FA.

g. Adjust A19R8 YTO GAIN for a frequency counter reading of 4.400 GHz ±0.001 GHz.

h. Adjust front panel TUNING control for −10.2500V ± 0.005V at A19TP4 YTO FA and check frequency at 1ST LO OUTPUT. Frequency should be 2.050 GHz ± 0.001 Ghz. If not within tolerance, repeat steps e through g.

Preliminary YTF Tracking Adjustment

i. Install 50-ohm load on rear panel 1ST LO OUTPUT connector, connect 100 MHz comb generator output to front panel INPUT 50Ω, and set 8565A controls as follows:

Set all Normal Settings (controls marked with green)

FREQUENCY BAND GHz	1.7—4.1
INPUT ATTEN	0 dB
RESOLUTION BW	3 MHz
FREQUENCY SPAN/DIV	200 MHz
FREQUENCY SPAN MODE	ZERO SPAN
AUTO STABILIZER	OFF
VIDEO FILTER	.3
TUNING	2.000 GHz

NOTE

The following procedure is a preliminary YTF tracking check and adjustment. If a tracking adjustment is required, also perform adjustments in Paragraph 5-30 YTF Tracking Adjustment.

j. Set A19S1 YTF TRACK switch to TEST and ensure front panel PRESELECTOR PEAK control is set to center of green area.

k. Adjust front panel TUNING control to peak signal on CRT display. Remove hysteresis by switching to FULL BAND then back to ZERO SPAN (FREQUENCY SPAN MODE) and repeak signal on CRT display.

l. Adjust A19R14 YTF OFFSET to center passband on CRT display (Figure 5-33).

m. Set FREQUENCY BAND GHz to 5.8—12.9. Tune spectrum analyzer to 10.0 GHz and peak signal on CRT display. Remove hysteresis by switching to FULL BAND then back to ZERO SPAN (FREQUENCY SPAN MODE) and repeak signal on CRT display.

n. Adjust A19R17 YTF GAIN to center passband on CRT display (Figure 5-33).

5-24. YIG DRIVER ADJUSTMENT (Cont'd)

o. If tracking adjustment was required, perform adjustments in Paragraph 5-30. If not, set A19S1 YTF TRACK switch to NORM. Set LINE switch OFF, disconnect power cord, and install A14 Tuning Stabilizer Control Assembly. Install 8565A top cover.

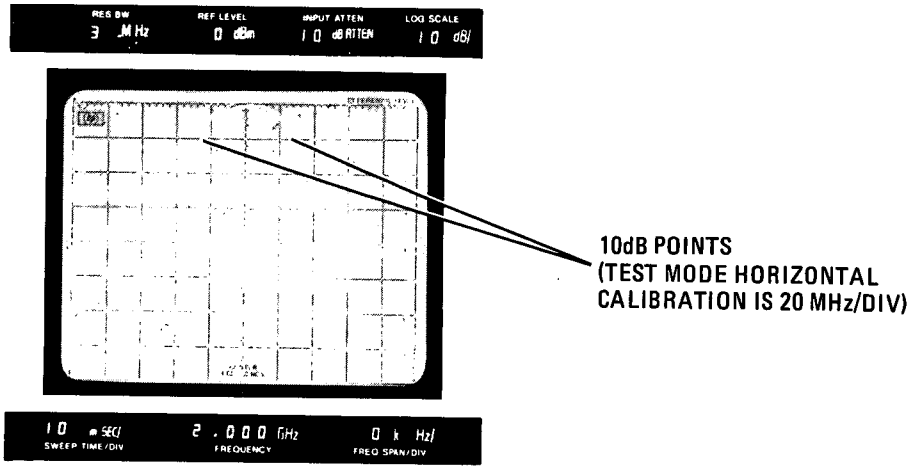


Figure 5-33. YTF Passband Display for YIG Driver Adjustment

5-25. SECOND CONVERTER ADJUSTMENT

REFERENCE:

Service Sheet 7

DESCRIPTION:

The second converter L.O. is adjusted for 1728.60 MHz and the second converter bandpass filter is adjusted for a 2050 MHz bandpass. If the second converter bandpass filter requires significant frequency tuning for correct bandpass adjustment, then the coarse bandpass adjustment must be performed to ensure correct second converter bandpass alignment. Once the second converter bandpass filter is tuned to 2050 MHz, adjustments are performed for compromise of best bandpass shape and minimum conversion loss.

5-25. SECOND CONVERTER ADJUSTMENT (Cont'd)

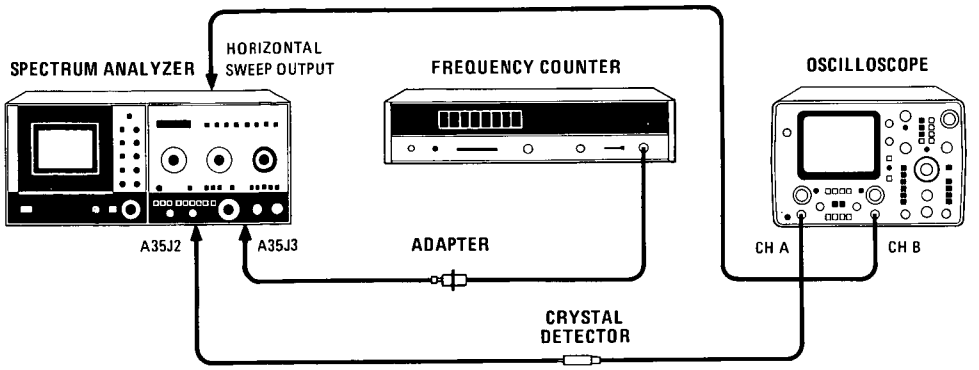


Figure 5-34. Second Converter Adjustment Test Setup

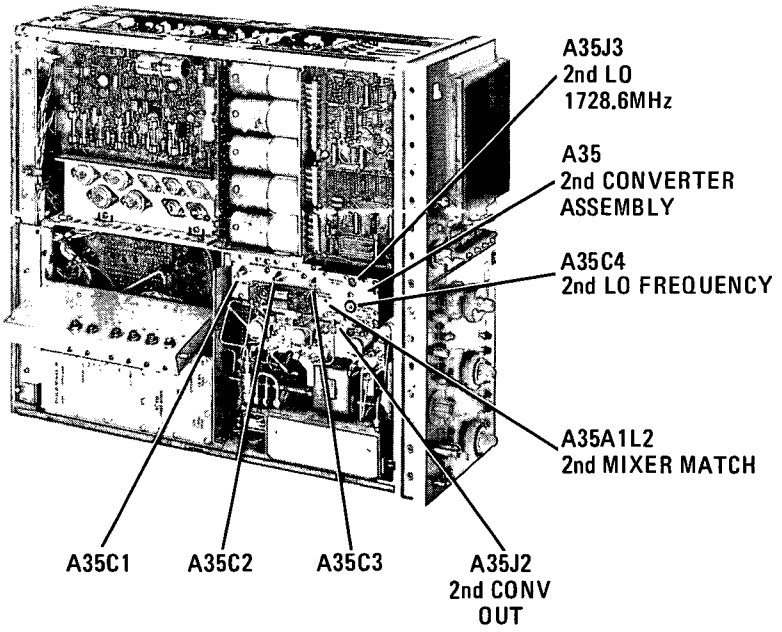


Figure 5-35. Second Converter Adjustment Locations

EQUIPMENT:

Frequency Counter	HP 5340A
Oscilloscope	HP 1740A
Crystal Detector	HP 33330C
Adapter, BNC female to SMC female (modified)	HP Part No. 08565-60087

5-25. SECOND CONVERTER ADJUSTMENT (Cont'd)

PROCEDURE:

a. Set LINE switch OFF, disconnect power cord, connect equipment as shown in Figure 5-34, and remove 8565A bottom cover.

b. Reconnect power cord, set LINE switch ON, and set 8565A controls as follows:

Set all Normal Settings (controls marked with green)

FREQUENCY BAND GHz	.01—1.8
RESOLUTION BW (coupled)	100 kHz
FREQUENCY SPAN/DIV	5 MHz
SWEEP SOURCE	EXT
TUNING	0.000 GHz

c. Connect frequency counter through modified adapter (HP Part No. 08565-60087) to A35J3 2ND LO (Figure 5-35) and adjust A35C4 2ND LO FREQUENCY for 1728.60 MHz ±0.1 MHz.

d. Disconnect frequency counter, set 8565A SWEEP SOURCE to INT, and use TUNING control to center L.O. signal (0.000 GHz) on CRT display.

e. Externally sweep oscilloscope (dc coupled input) with spectrum analyzer HORIZONTAL SWEEP OUTPUT. Adjust oscilloscope horizontal position and gain controls to provide an oscilloscope trace that just fills the 10 horizontal divisions on graticule display.

f. Disconnect W18 from A35J2 2ND CONV OUT and connect oscilloscope (dc coupled input) through a crystal detector to A35J2 2ND CONV OUT. Set oscilloscope sensitivity to 0.01V/DIV.

NOTE

This procedure uses a negative polarity crystal detector. If a positive polarity crystal detector is used the waveforms in Figure 5-36 will be inverted.

g. Check second converter bandpass display on oscilloscope CRT (Figure 5-36a). If center of second converter bandpass is within two divisions of being centered on oscilloscope display, proceed to Second Converter Fine Bandpass Adjustment (step h). If center of bandpass is greater than two divisions from center of oscilloscope display, perform second converter coarse bandpass adjustment as follows:

1. Set FREQ SPAN/DIV to 50 MHz and loosen lock nut on A35C1 and A35C3. Carefully turn tuning screws clockwise until they bottom on cavity.

2. Turn A35C1 and A35C3 one turn counterclockwise and lightly tighten lock nuts.

3. Carefully set A35A1L2 2ND MIXER MATCH fully clockwise, then adjust it two turns counterclockwise.

4. Tune A35C2 to position signal at center of oscilloscope display (this will be a dip of approximately 0.2 divisions).

5-25. SECOND CONVERTER ADJUSTMENT (Cont'd)

5. Set FREQUENCY SPAN/DIV to 5 MHz and adjust A35C1 for maximum negative signal at center of oscilloscope display.

6. Adjust A35C3 and A35A1L2 for maximum negative signal at center of oscilloscope display.

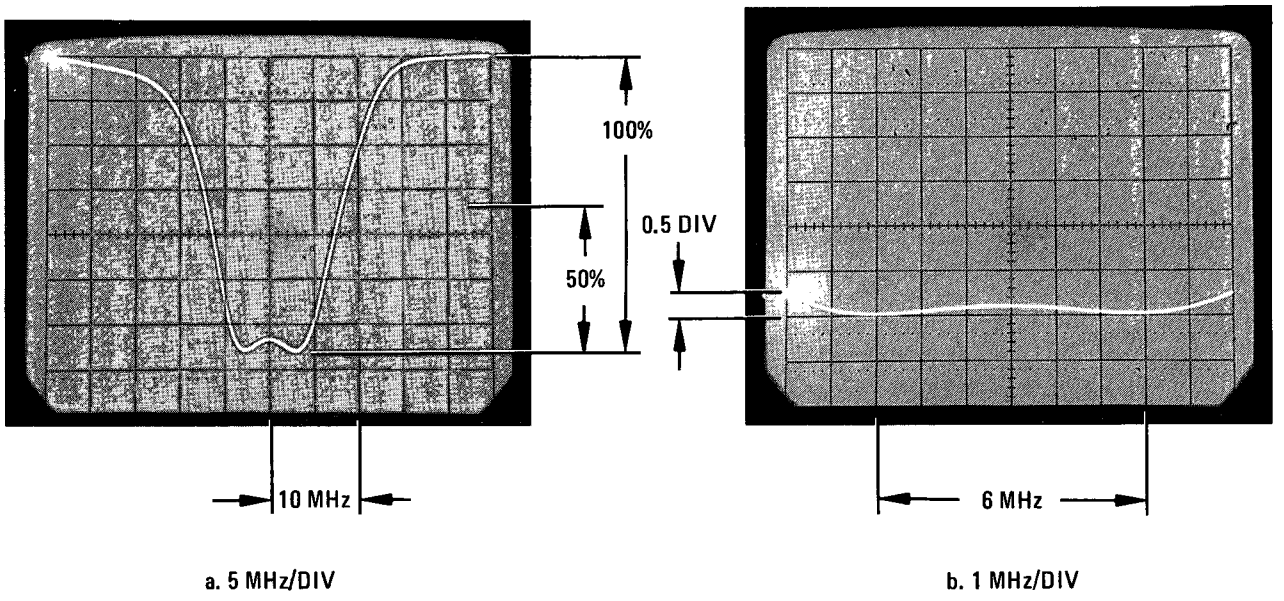


Figure 5-36. Second Converter Bandpass Displays

h. Repetitively adjust in small increments A35C1, A35C2, A35C3, and A35A1L2 for a centered, symmetrical, and flat bandpass display with maximum amplitude as shown in Figure 5-36a. A slight amount of signal amplitude must be sacrificed in order to obtain the desired bandwidth, symmetry, and flatness.

i. Check that right bandpass skirt is at least 50 percent down at a point 10 MHz from center frequency. (See Figure 5-36a.)

j. Adjust oscilloscope vertical gain for a 4-division peak-to-peak display and set FREQUENCY SPAN/DIV to 1 MHz.

k. Check flatness of bandpass within 3 MHz (3 divisions) each side of center. (See Figure 5-36b.) Bandpass should be flat within 0.5 divisions (1 dB).

l. Adjustment complete. Set LINE switch OFF, disconnect power cord, reconnect W18, and install 8565A bottom cover.

5-26. THIRD CONVERTER ADJUSTMENT

REFERENCE:

Service sheet 8

DESCRIPTION:

The third converter L.O. is adjusted for maximum output power and the front panel CAL OUTPUT is calibrated for −10 dBm. A spectrum analyzer is used to display the 300 MHz local oscillator signal at the 21.4 MHz output port, and the 300 MHz bandpass filter is adjusted for maximum 300 MHz local oscillator signal. The 321.4 MHz bandpass filter is checked with an oscilloscope. If the resonant cavities are not closely tuned to 321.4 MHz, the bandpass filter must be detuned and each cavity tuned to 321.4 MHz.

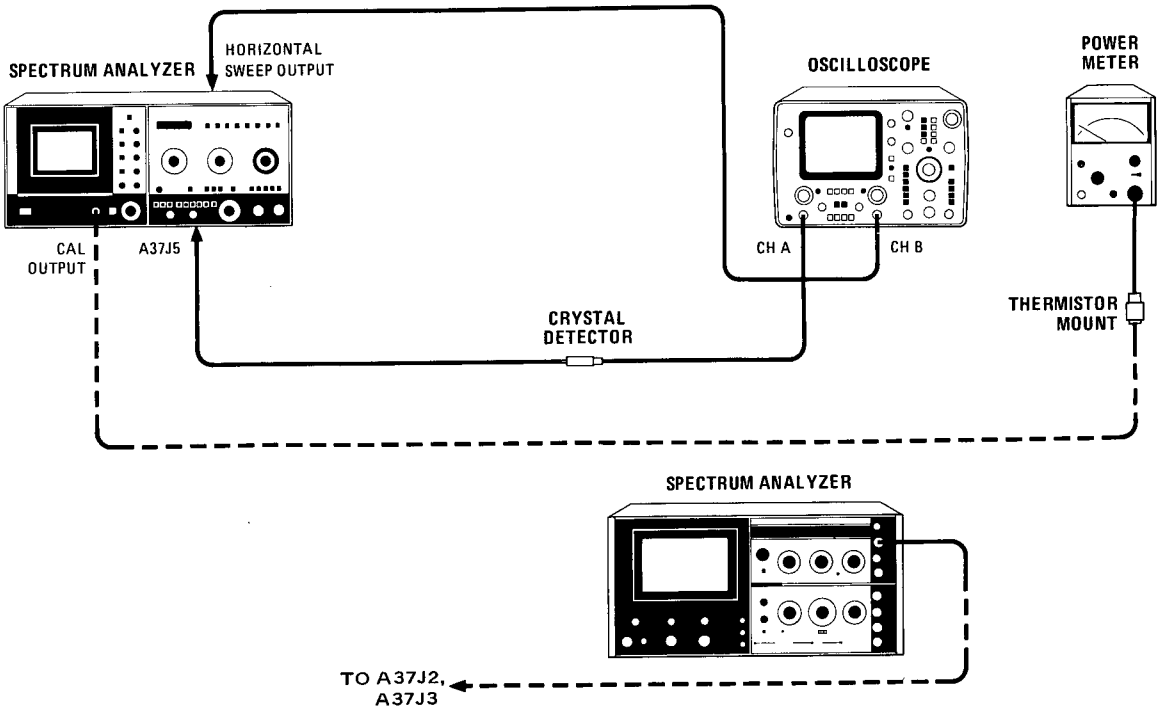


Figure 5-37. Third Converter Adjustment Test Setup

EQUIPMENT:

Oscilloscope	HP 1740A
Spectrum Analyzer	HP 140T/8552B/8554B
Power Meter	HP 432A
Thermistor Mount	HP 8478B
Crystal Detector	HP 33330C

5-26. THIRD CONVERTER ADJUSTMENT (Cont'd)

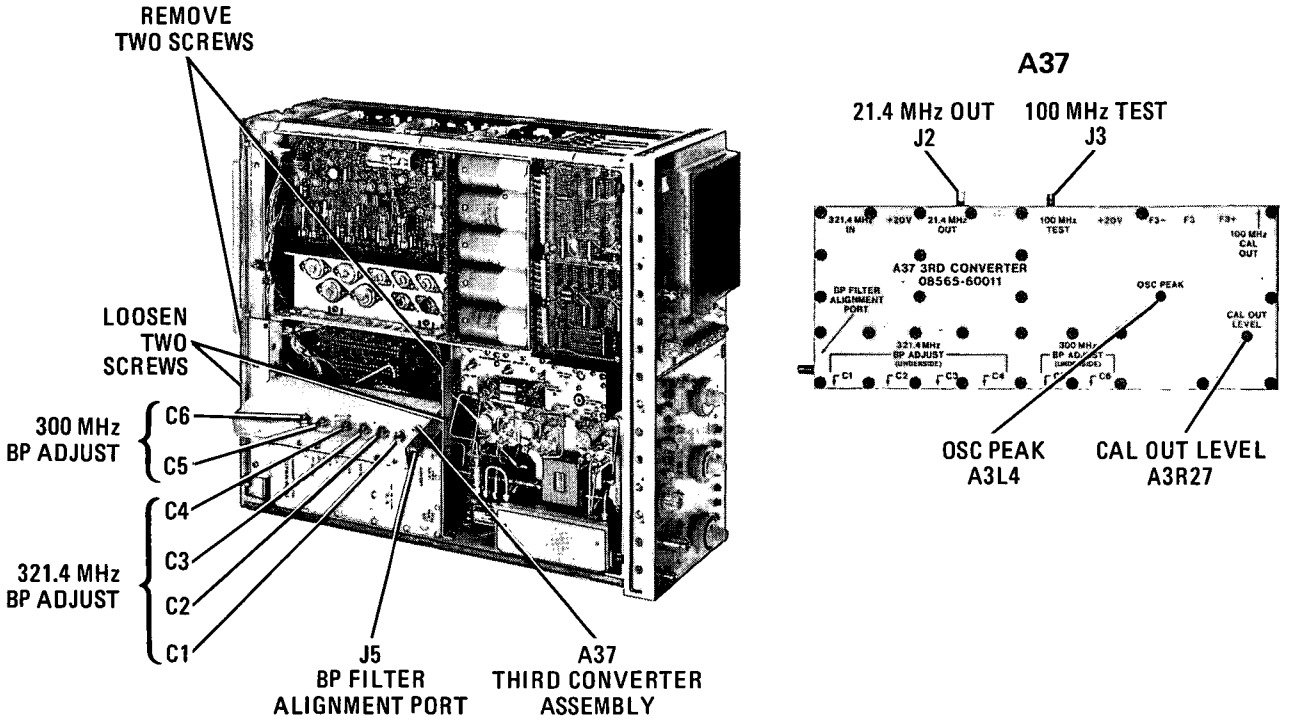


Figure 5-38. Third Converter Adjustment Locations

PROCEDURE:

a. Set LINE switch OFF, disconnect power cord, and remove 8565A top and bottom covers.

b. Remove two screws and loosen two screws (Figure 5-38) and tilt out A37 Third Converter Assembly.

c. Reconnect power cord, set LINE switch ON, connect equipment as shown in Figure 5-37, and set 8565A controls as follows:

Set all Normal Settings (controls marked with green)
FREQUENCY BAND GHz ..... .01 — 1.8
FREQUENCY ..... 0.050 GHz
RESOLUTION BW ..... 100 kHz
FREQ SPAN/DIV ..... 5 MHz

d. Connect test spectrum analyzer to A37J3 100 MHz TEST. Adjust A37A3L4 OSC PEAK for maximum 100 MHz signal level (use non-metallic adjusting tool). Disconnect test spectrum analyzer.

e. Connect power meter to front panel CAL OUTPUT connector. Adjust A37A3R27 CAL OUT LEVEL for −10 dBm. Disconnect power meter.

5-26. THIRD CONVERTER ADJUSTMENT (Cont'd)

f. Disconnect W22 from A37J2 21.4 MHz OUT and connect test spectrum analyzer to A37J2 21.4 MHz OUT.

g. Tune test spectrum analyzer to display 300 MHz local oscillator signal.

h. Iteratively tune A37C5 and A37C6 300 MHz BP ADJUST for maximum 300 MHz signal (Third Converter cover must be installed).

i. Disconnect test spectrum analyzer and reconnect W22 to A37J2 21.4 MHz OUT.

j. Use TUNING control to center L.O. signal (0.000 GHz) on CRT display.

k. Externally sweep oscilloscope (dc coupled input) with spectrum analyzer HORIZONTAL SWEEP OUTPUT. Adjust oscilloscope horizontal position and gain for an oscilloscope trace that just fills the 10-division graticule display. Connect oscilloscope (dc coupled input) through a crystal detector to A37J5 BP FILTER ALIGNMENT PORT connector. Set oscilloscope sensitivity to 0.002V/DIV.

NOTE

This procedure uses a negative polarity crystal detector. If a positive polarity crystal detector is used the waveforms in Figure 5-39 will be inverted.

l. Check oscilloscope display is symmetrical as shown in Figure 5-39d. If not, perform 321.4 MHz coarse bandpass adjustment as follows (Third Converter cover must be installed):

1. Loosen lock nuts on A37C2, A37C3, and A37C4. Carefully turn tuning screws clockwise until they are flush with lock nuts.

2. Adjust A37C1 for a dip at center of oscilloscope display as shown in Figure 5-39a).

3. Adjust A37C2 for a peak at center of oscilloscope display as shown in Figure 5-39b).

4. Adjust A37C3 for dip at center of oscilloscope display as shown in Figure 5-39c).

5. Adjust A37C4 for peak at center of oscilloscope display as shown in Figure 5-39d).

5-26. THIRD CONVERTER ADJUSTMENT (Cont'd)

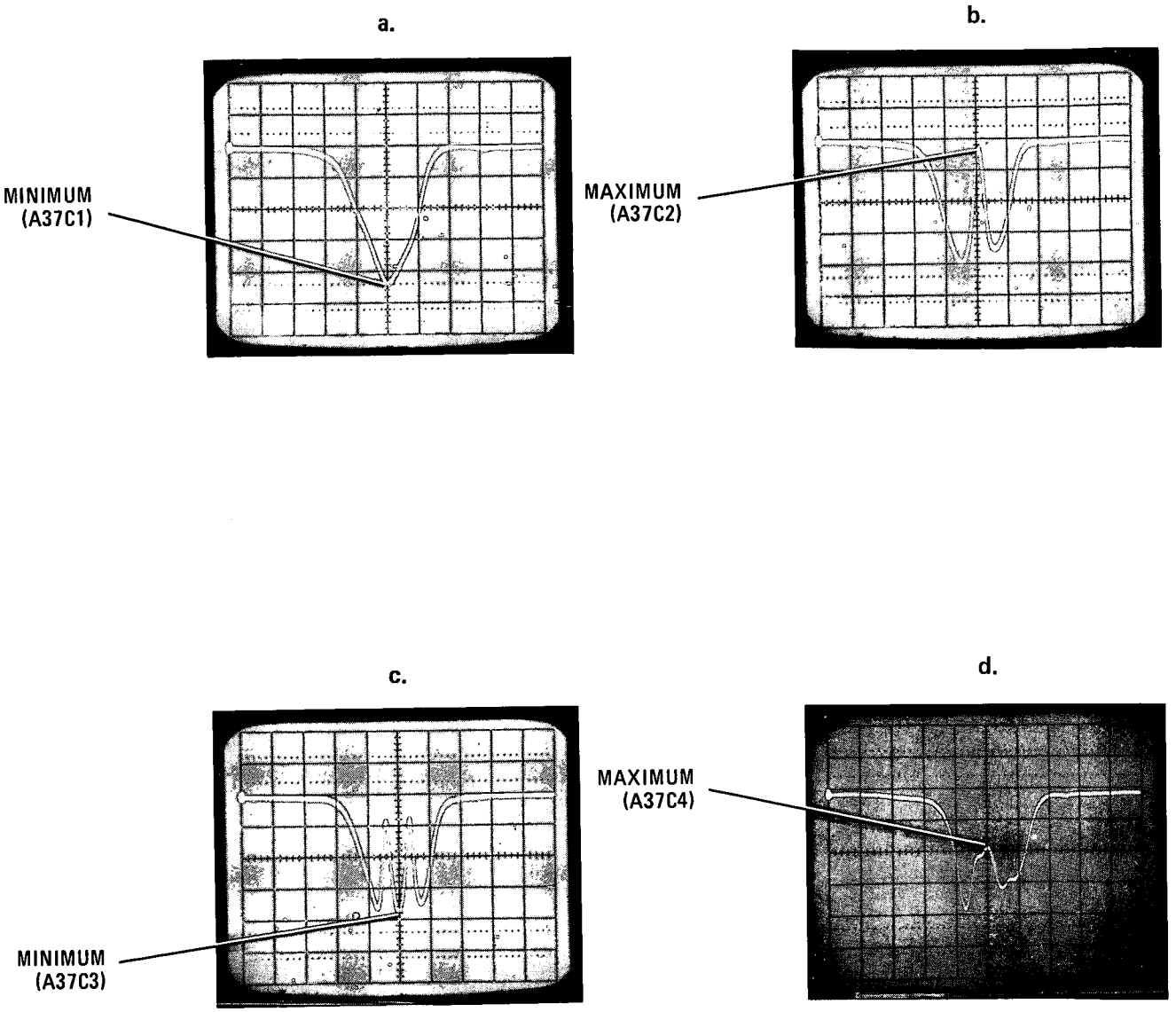


Figure 5-39. 321.4 MHz Bandpass Filter Alignment Oscilloscope Display

m. Connect 100 MHz CAL OUTPUT signal to INPUT 50Ω and set 8565A controls as follows:

RESOLUTION BW	3 MHz
FREQ SPAN/DIV	2 MHz
FREQUENCY	0.100 GHz

5-26. THIRD CONVERTER ADJUSTMENT (Cont'd)

n. Check 100 MHz signal on spectrum analyzer display has a symmetrical bandpass. A typical bandpass shape is shown in Figure 5-40. If bandpass symmetry is worse than shown in Figure 5-40, small adjustments of A37C1 through A37C4 should be performed to improve bandpass shape. However, do not sacrifice more than 1 dB of signal amplitude when adjusting for best bandpass shape (loss of signal amplitude reduces instrument sensitivity).

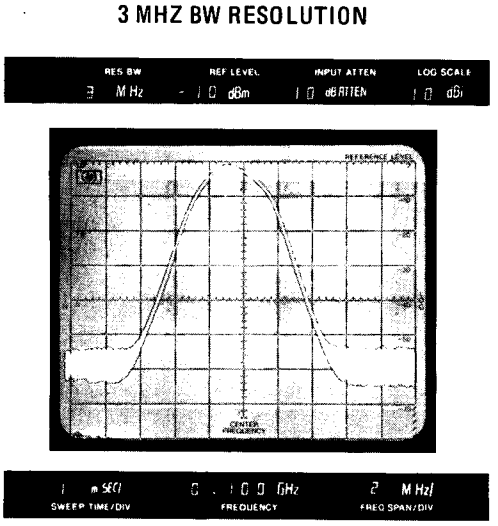


Figure 5-40. 321.4 MHz Bandpass Filter Alignment Spectrum Analyzer Display

o. Adjust 3 dB bandwidth for the 3 MHz RESOLUTION BW switch position according to adjustment procedure in Paragraph 5-20 Bandwidth Filter Adjustment (Table 5-8).

p. Adjustment complete. Set LINE switch OFF, disconnect power cord, and install 8565A top and bottom covers.

5-27. SWEEP ATTENUATOR ADJUSTMENT

REFERENCE:

Service Sheet 11

DESCRIPTION:

The MAIN SWP OFFSET is adjusted in the Sweep Attenuator Assembly so that a signal at center screen does not shift as FREQUENCY SPAN/DIV is switched between 5 MHz and 2 MHz. This adjustment is necessary because the sweep is applied to the YTO Main Coil for frequency spans ≥ 5 MHz/DIV and to the YTO Tickler Coil for frequency spans ≤ 2 MHz/DIV.

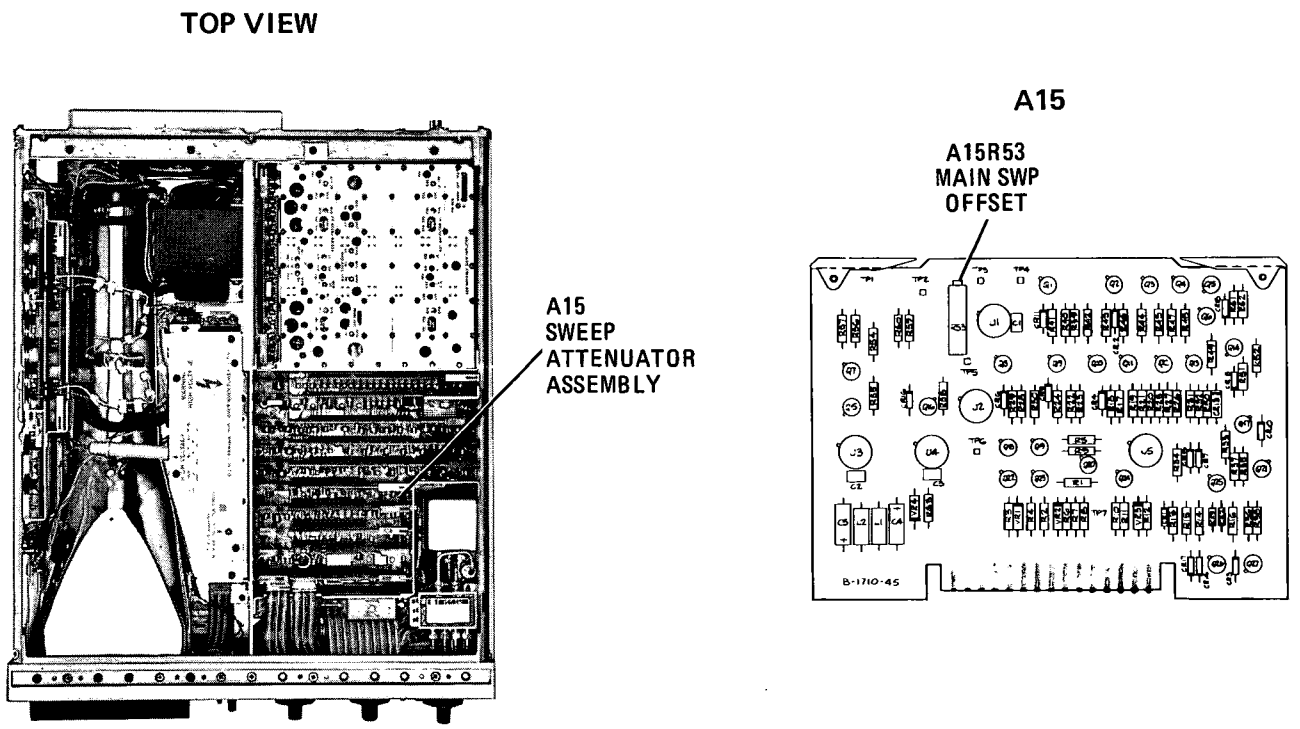


Figure 5-41. Sweep Attenuator Adjustment Location

PROCEDURE:

a. Set LINE switch OFF, disconnect power cord, and remove 8565A top cover.

5-27. SWEEP ATTENUATOR ADJUSTMENT (Cont'd)

b. Reconnect power cord, set LINE switch ON, and set 8565A controls as follows:

Set all Normal Settings (controls marked with green)

FREQUENCY BAND GHz	.01 — 1.8
RESOLUTION BW	100 kHz
FREQUENCY SPAN/DIV	2 MHz
INPUT ATTEN	10 dB
REF LEVEL	0 dBm
REF LEVEL FINE	0

c. Simultaneously depress INT and EXT SWEEP SOURCE pushbuttons to obtain a dot on CRT display. Adjust front panel HORIZ POSN to position dot on center vertical graticule line.

d. Depress INT SWEEP SOURCE pushbutton to obtain swept CRT trace. Connect 100 MHz CAL OUTPUT signal to INPUT 50Ω and adjust TUNING control to center 100 MHz signal on CRT display.

e. Switch FREQUENCY SPAN/DIV to 5 MHz and adjust A15R53 MAIN SWP OFFSET (Figure 5-41) to center 100 MHz signal on CRT display.

f. Adjustment complete. Set LINE switch OFF, disconnect power cord, and install 8565A top cover.

5-28. TUNING STABILIZER CONTROL ADJUSTMENTS

REFERENCE:

Service Sheets 15 and 16

DESCRIPTION:

The A14 Tuning Stabilizer Control assembly adjustments are performed to set up the correct sweep voltages for the YTO tickler coil and Voltage Controlled Crystal Oscillator (VCXO). A14R68 FET OFFSET is adjusted to provide a zero level output to the tuning stabilizer with the spectrum analyzer operating in zero span mode and a zero volt input from front panel FINE TUNING control. A 50 MHz signal with 100 kHz frequency modulation is displayed on the spectrum analyzer and A14R71 TICK SWEEP is adjusted for a modulation peak occuring every division (FREQ SPAN/DIV set to 100 kHz). The spectrum analyzer is then stabilized and A14R57 VCXO SWP is adjusted for the same sweep display as the TICK SWEEP adjustment. The VCXO is then checked for linearity. The VCXO ERROR OUT signal is monitored, and if the variation of the signal is within limits, no adjustments to the VCXO are necessary. If the error signal is out of tolerance, perform the adjustments in the order given. Small adjustments should be made and the AUTO STABILIZER switched OFF then on after each adjustment to remove the dc component introduced by the adjustment.

5-28. TUNING STABILIZER CONTROL ADJUSTMENTS (Cont'd)

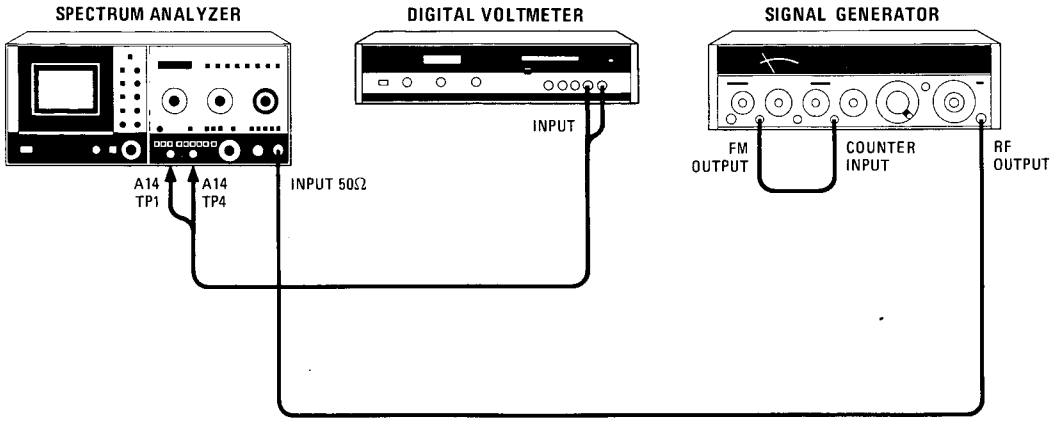


Figure 5-42. Tuning Stabilizer Control Adjustment Test Setup

EQUIPMENT:

Signal Generator	HP 8640B Option 001
Digital Voltmeter	HP 3490A
Oscilloscope	HP 1740A
10:1 Probe	HP 10004D
1:1 Probe	HP 10007D
BNC Tee	HP Part No. 1250-0781

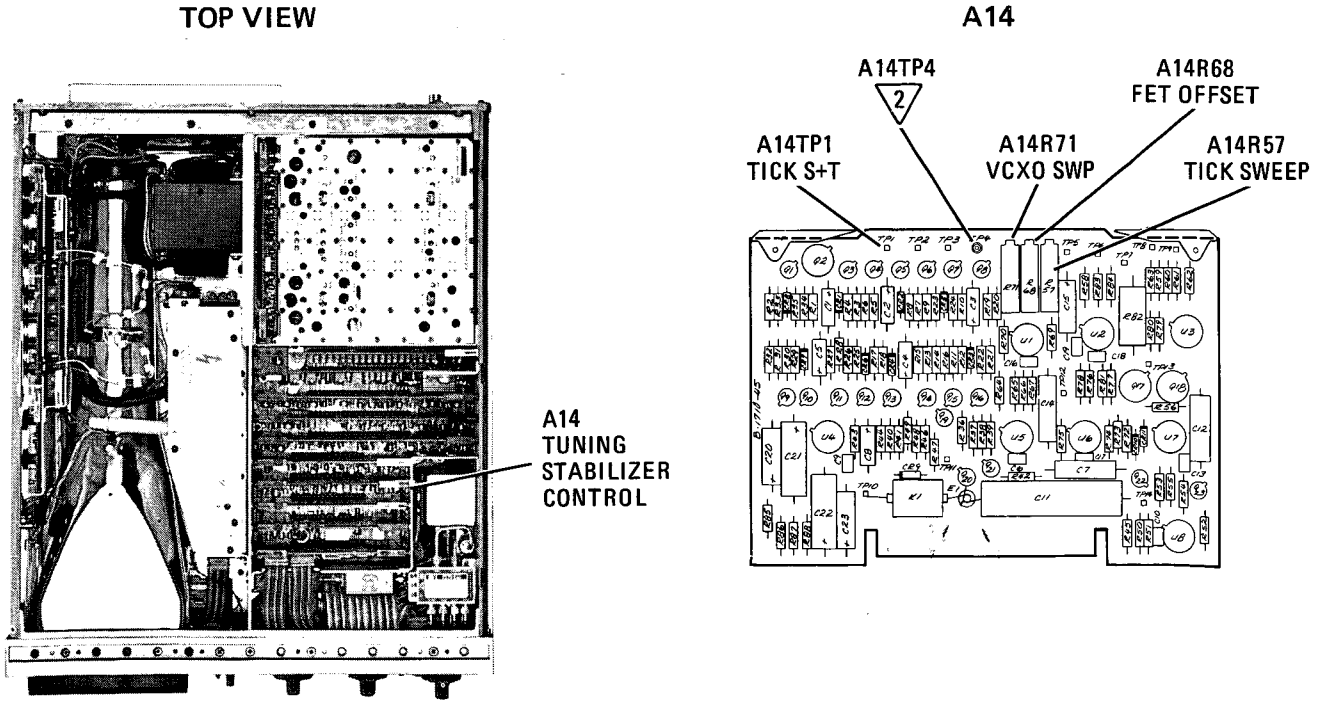


Figure 5-43. Tuning Stabilizer Control Adjustment Locations

ADJUSTMENTS

5-28. TUNING STABILIZER CONTROL ADJUSTMENTS (Cont'd)

PROCEDURE:

a. Set LINE switch OFF, disconnect power cord, and remove 8565A top and bottom covers.

b. Reconnect power cord, set LINE switch ON, and connect equipment as shown in Figure 5-42.

Tuning Stabilizer Control Adjustments

c. Set controls as follows:

8565A:
Set all Normal Settings (controls marked with green)

FREQUENCY BAND GHz	.01 – 1.8
RESOLUTION BW (Coupled)	10 kHz
FREQ SPAN/DIV	100 kHz
INPUT ATTEN	10 dB
REF LEVEL	0 dBm
REF LEVEL FINE	0
FREQUENCY SPAN MODE	ZERO SPAN
AUTO STABILIZER	OFF

Signal Generator:

Output Level	−20 dBm
Frequency	50 MHz
Modulation Frequency	100 kHz
Modulation	FM
Peak Deviation	300 kHz
FM	OFF

d. Connect digital voltmeter across A14TP1 TICK S + T (high DVM input) and A14TP4 ▽2▽ (low DVM input). (See Figure 5-43.)

e. Adjust FINE TUNING control for a digital voltmeter reading of 0 volts ±0.01 volts.

f. Connect digital voltmeter high input to A14TP3 VCXO SWP and adjust A14R68 FET OFF for 0.00 volts ±0.01 volts.

g. Set FREQUENCY SPAN MODE to PER DIV and connect signal generator output to spectrum analyzer INPUT 50Ω.

h. Center 50 MHz carrier frequency on spectrum analyzer CRT display, set 8640B FM switch to INT and adjust signal generator peak deviation for uniform amplitude of 100 kHz modulation peaks (Figure 5-44).

i. Adjust A14R57 TICK SWP for one division spacing between modulation peaks (use FINE TUNING control to align peaks on graticule line).

j. Set FINE TUNING control to midrange and activate tuning stabilizer (AUTO STABILIZER push-button out).

5-28. TUNING STABILIZER CONTROL ADJUSTMENTS (Cont'd)

k. Adjust A14R71 VCXO SWP for one division spacing between modulation peaks (use FINE TUNING control to align peaks on graticule line).

NOTE

In the following step, adjust signal generator carrier frequency (50 MHz) to set modulation peaks on graticule lines.

l. Set FREQ SPAN/DIV control to 20 kHz (RESOLUTION BW 3 kHz) and note 5 division spacing between modulation peaks.

m. Check 5 division spacing between modulation peaks with FINE TUNING control set at fully counterclockwise, midrange, and fully clockwise positions. Adjust A14R71 VCXO SWP for best compromise of 5 division spacing over the full range of FINE TUNING control.

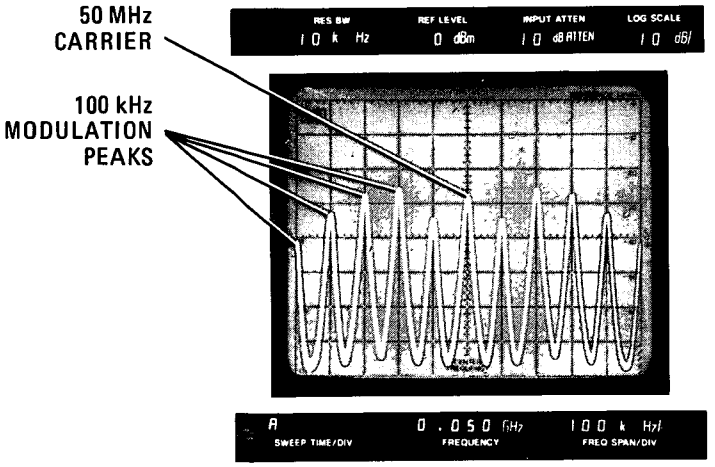


Figure 5-44. Spectrum Analyzer Display with 100 kHz FM

5-28. TUNING STABILIZER CONTROL ADJUSTMENTS (Cont'd)

Tuning Stabilizer VCXO Linearity Check and Adjustment

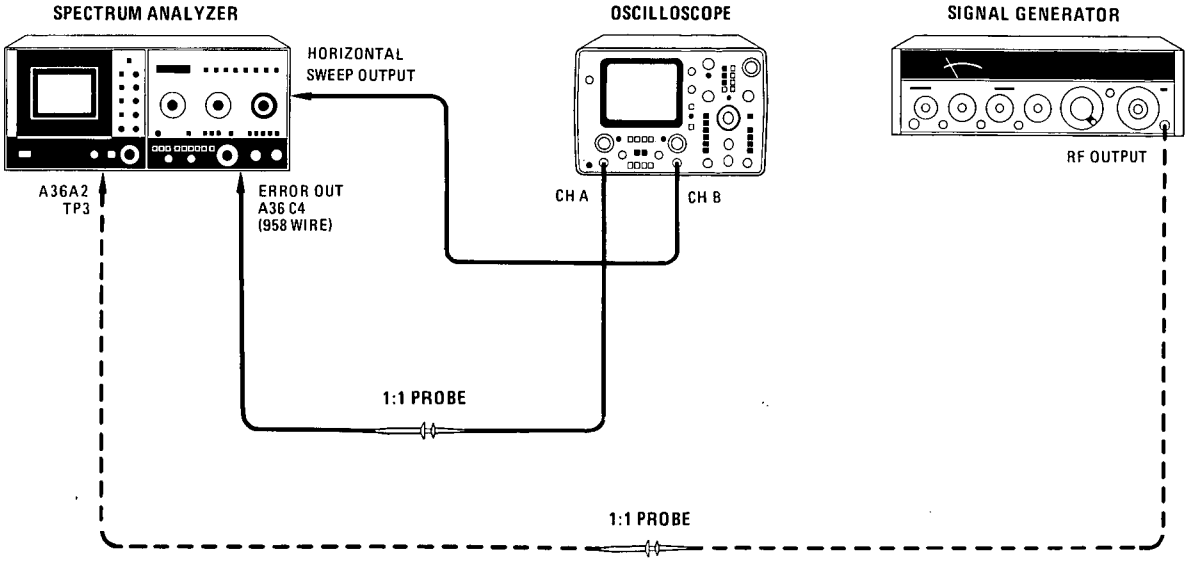


Figure 5-45. Tuning Stabilizer VCXO Check and Adjustment Test Setup

BOTTOM VIEW

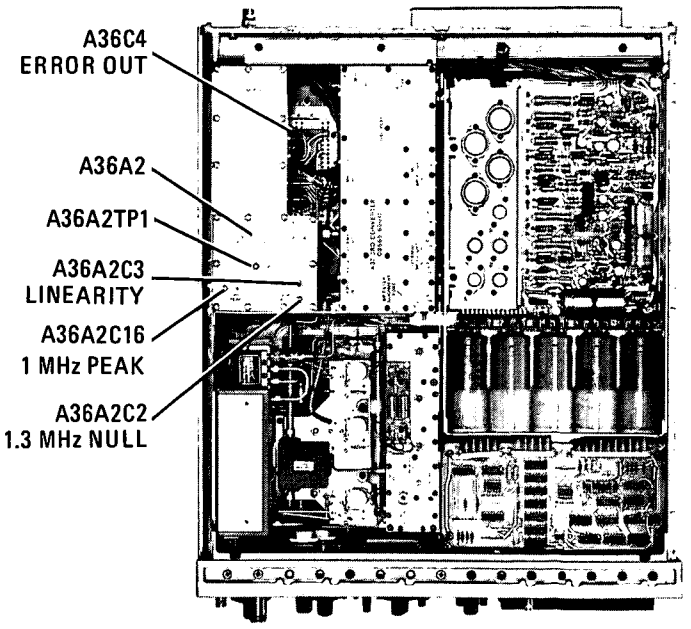


Figure 5-46. Tuning Stabilizer VCXO Adjustment Locations

5-28. TUNING STABILIZER CONTROL ADJUSTMENTS (Cont'd)

n. Connect equipment as shown in Figure 5-45 and set oscilloscope for an externally swept (A / B) dc coupled display. Set CHAN A to 10 mV/DIV and CHAN B to 1V/DIV. Set 8565A controls as follows:

Set all Normal Settings (controls marked with green)

FREQUENCY BAND GHz	.01 – 1.8
FREQUENCY	0 MHz
RESOLUTION BW (coupled)	10 kHz
FREQ SPAN/DIV	100 kHz
FREQUENCY SPAN MODE	PER DIV
FINE TUNING control	midrange
AUTO STABILIZER	on (out)

o. Momentarily switch AUTO STABILIZER to OFF to remove dc component on ERROR OUT signal. Center oscilloscope trace with oscilloscope position controls.

p. Check slope of oscilloscope trace. The trace should not change more than one-half vertical division (5 mV) for every horizontal division swept.

q. Adjust FINE TUNING control over its three turn range while observing the oscilloscope trace. The trace should not change more than one-half vertical division (5 mV) for every horizontal divison swept.

NOTE

If slope of oscilloscope trace is within tolerance, no further adjustment is necessary. If adjustment is necessary, do not adjust A36A2R27 1 MHz GAIN. (This is for factory adjustment only).

r. If slope of oscilloscope trace is out of tolerance, set up oscilloscope for internal sweep and set 8565A FREQUENCY SPAN MODE to ZERO SPAN and AUTO STABILIZER pushbutton to OFF.

s. Remove A36A2 cover plate (Figure 5-46) for access to test points and center A36A2C3 LINEARITY.

t. Connect 1.3 MHz 3 volt peak-to-peak signal from signal generator through a 1:1 probe to A36A2TP3 (connect ground clip to chassis ground).

u. Connect oscilloscope through 10:1 probe to A36A2TP1 and adjust A36A2C2 1.3 MHz NULL for minimum 1.3 MHz signal. Disconnect signal generator from A36A2TP3.

v. Connect oscilloscope through 10:1 probe to A36A2TP2 and adjust A36A2C16 1 MHz PEAK for maximum 1 MHz signal.

w. Reinstall A36A2 cover plate and repeat steps n through q. If slope of oscilloscope trace is out of tolerance (steps p and q)make adjustments as follows:

5-28. TUNING STABILIZER CONTROL ADJUSTMENTS (Cont'd)

NOTE

Do each of the following adjustments in small steps and switch AUTO STABILIZER OFF then ON after each adjustment.

1. Adjust A36A2C3 LINEARITY and A36A2C16 1 MHz PEAK for minimum slope of oscilloscope trace.
2. Check slope of oscilloscope trace while adjusting FINE TUNING control over its three turn range. Oscilloscope trace should not change more than one-half vertical divison (5 mV) per horizontal division swept.
3. Repeat steps w-1 and w-2 until no further adjustment is necessary.

x. Check Tuning Stabilizer Control Adjustments (steps c through m). If VCXO SWP adjustment is performed, repeat steps n through q to check VCXO linearity.

y. Adjustment complete. Set LINE switch OFF disconnect power cord, and install 8565A top and bottom covers.

5-29. PRELIMINARY BIAS ADJUSTMENT

REFERENCE:

Service Sheet 19

DESCRIPTION:

NOTE

This is a preliminary adjustment and requires that the Frequency Response Adjustment (5-31) also be performed.

A synchronizer and sweep oscillator are connected to make a tracking generator for the 8565A. The sweep oscillator is phase locked on each FREQUENCY BAND checked, and mixer bias adjustments are performed for minimum amplitude variation consistent with near minimum conversion loss across the FREQUENCY BAND.

5-29. PRELIMINARY BIAS ADJUSTMENT (Cont'd)

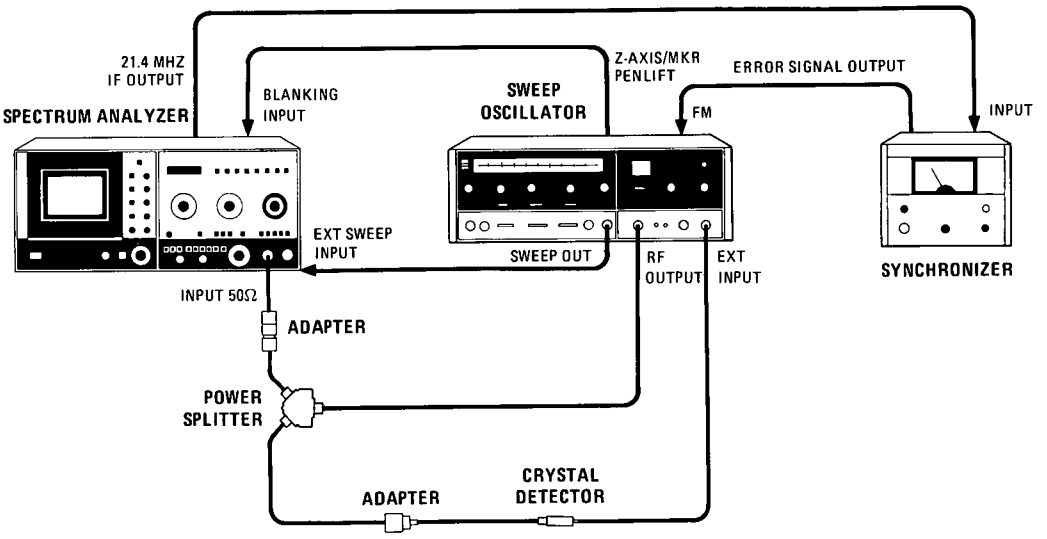


Figure 5-47. Preliminary Bias Adjustment Test Setup

EQUIPMENT:

Sweep oscillator	HP 8620C/86290A-H08
Synchronizer	HP 8709A-H10
Power Splitter	HP 11667A Option 002
Crystal Detector	HP 33330C
Adapter, APC-7 to Type N Male	HP 11525A
Adapter, APC-7 to SMA Female	HP 11534A

5-29. PRELIMINARY BIAS ADJUSTMENT (Cont'd)

PROCEDURE:

a. Set LINE switch OFF disconnect power cord, and remove 8565A top cover.

b. Reconnect power cord, set LINE switch ON, connect equipment as shown in Figure 5-47, and set controls as follows:

8565A:
Set all Normal Settings (controls marked with green)

FREQUENCY BAND GHz	5.8 – 12.9
INPUT ATTEN	10 dB
REF LEVEL	0 dBm
REF LEVEL FINE	–4
FREQUENCY SPAN MODE	FULL BAND
AMPLITUDE SCALE	5 dB (LOG/DIV)
SWEEP SOURCE	EXT
PRESELECTOR PEAK	Centered in green

8620C/86290A-H08:

BAND	Band 4
MARKER SWEEP pushbutton	Depress
START MARKER pointer	5.8 GHz
STOP MARKER pointer	12.9 GHz
SWEEP TIME-SECONDS	.1 — .01
SWEEP TIME-SECONDS vernier	Fully counterclockwise
RF OFF-ON	ON
ALC switch	EXT
POWER LEVEL	Midrange
RF BLANKING/OFF	RF BLANKING
DISPLAY BLANKING/OFF	DISPLAY BLANKING
FM-NORM-PL	PL

c. Set A28S1 NORM-OFF-TEST switch to OFF. Set synchronizer ERROR SIGNAL switch to +.

d. Phase lock sweep oscillator as follows:

1. Set sweep oscillator to manual sweep mode with manual sweep control fully counterclockwise.

2. Set sweep oscillator start marker to low frequency of selected spectrum analyzer FREQUENCY BAND and adjust start marker for synchronizer phase lock (minimum phase error).

3. Set sweep oscillator manual sweep control fully clockwise and stop marker to high frequency of selected spectrum analyzer FREQUENCY BAND. Adjust stop marker for synchronizer phase lock (minimum phase error).

4. Set sweep oscillator to automatic sweep mode and check for phase locked spectrum analyzer CRT display (Figure 5-48). If the system is breaking phase lock, repeat steps d-1 through d-3.

5-29. PRELIMINARY BIAS ADJUSTMENT (Cont'd)

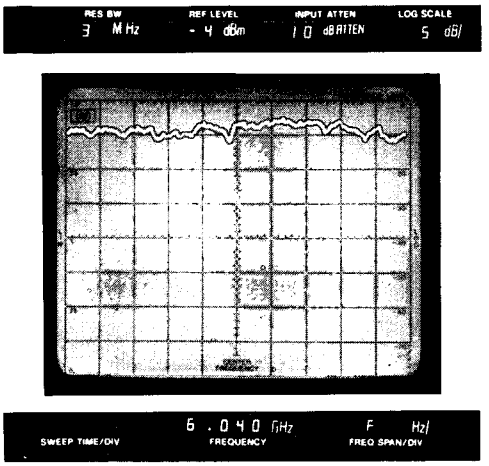


Figure 5-48. Phase Locked Spectrum Analyzer CRT Display

e. Adjust A20R3 V4 (Figure 5-49) over full range and note position for minimum ripple on CRT trace. Set A20R3 V4 for minimum ripple.

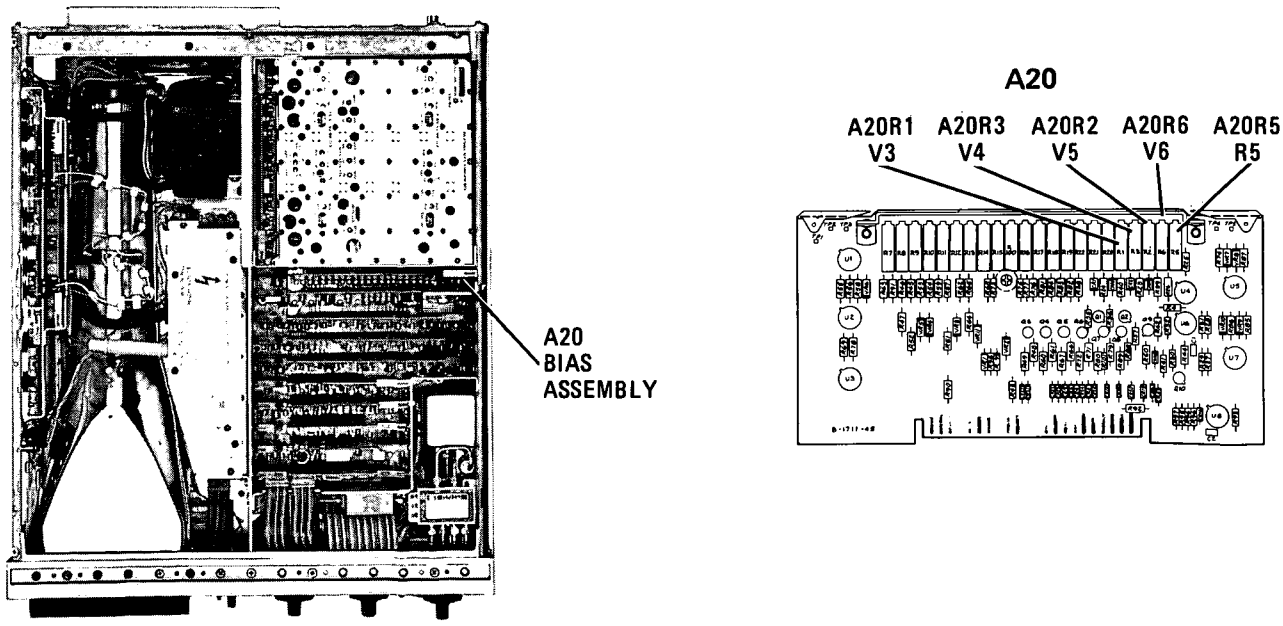


Figure 5-49. Preliminary Bias Adjustment Locations

5-29. PRELIMINARY BIAS ADJUSTMENT (Cont'd)

f. Set 8565A FREQUENCY BAND to 3.8 — 8.5 GHz. Set 8620C sweep oscillator for a MARKER SWEEP of 3.8 GHz to 8.5 GHz. Phase lock sweep oscillator according to step d.

g. Adjust A20R1 V3 over full range and note position for minimum ripple on CRT trace. Set A20R1 V3 for minimum ripple.

h. Set 8565A FREQUENCY BAND to 8.5 — 18 GHz. Set synchronizer ERROR SIGNAL switch to −. Set 8620C sweep oscillator for a MARKER SWEEP of 8.5 GHz to 18 GHz. Phase lock sweep oscillator according to step d.

i. Adjust A20R2 V5 over full range and note position for minimum ripple on CRT trace. Set A20R2 V5 for minimum ripple.

NOTE

If extended range sweep oscillator (8620C/86290A-H08) is not available, proceed to step l to perform preliminary bias adjustment for the 10.5 to 22 GHz FREQUENCY BAND.

j. Set 8565A FREQUENCY BAND to 10.5 — 22 GHz. Set 8620C/86290A-H08 sweep oscillator for a MARKER SWEEP of 10.5 GHz to 22 GHz. Phase lock sweep oscillator according to step d.

k. Adjust A20 R6 V6 over full range and note position for minimum ripple on CRT trace. Set A20R6 V6 for minimum ripple.

NOTE

Steps l and m are the procedure for performing the preliminary bias adjustment for the 10.5 to 22 GHz FREQUENCY BAND with a standard 8620C/86290A sweep oscillator. If steps j and k have been successfully completed, do not perform steps l and m.

l. Set 8565A FREQUENCY BAND to 10.5 — 22 GHz. Set 8620C sweep oscillator CW MARKER pointer to 16.4 GHz and ΔF pointer to 11.9 GHz (119 MHz X10). Press 8620C ΔF pushbutton, and phase lock sweep oscillator as follows:

1. Set sweep oscillator to manual sweep mode with manual sweep control set to midrange.

2. Adjust CW MARKER control for synchronizer phase lock (minimum phase error).

3. Set sweep oscillator manual sweep control fully counterclockwise. Adjust sweep oscillator ΔF control for synchronizer phase lock (minimum phase error).

4. Repeat steps n-1 through n-3 until no further adjustment is necessary.

5. Set sweep oscillator to automatic sweep mode and check for phase locked spectrum analyzer CRT display (Figure 5-50). If system is breaking phase lock repeat steps l-1 through l-4.

5-29. PRELIMINARY BIAS ADJUSTMENT (Cont'd)

m. Adjust A20R6 V6 over full range and note position for minimum ripple on CRT trace. Set A20R6 V6 for minimum ripple.

n. Set A28S1 NORM-OFF-TEST switch to NORM. Perform Paragraph 5-31 Frequency Response Adjustment.

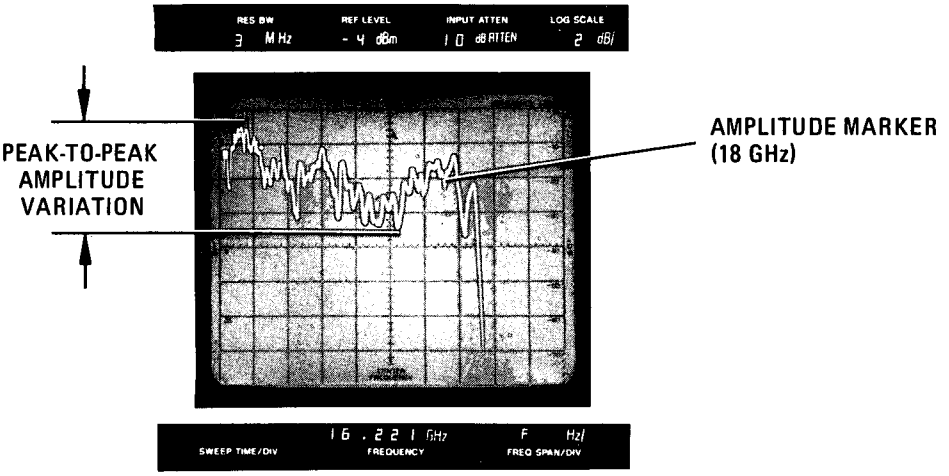


Figure 5-50. Phase Locked Spectrum Analyzer CRT Display (10.5–18 GHz)

5-30. YTF TRACKING ADJUSTMENT

REFERENCE:

Service Sheets 12 and 14

DESCRIPTION:

With a signal applied to INPUT 50Ω connector, the spectrum analyzer is set to ZERO SPAN (1st L.O. is CW frequency) and the YIG Tuned Filter (YTF) is swept around the center frequency. This results in the YTF passband being displayed on the CRT screen. YTF tracking adjustments are performed to keep the YTF passband approximately centered around the center frequency vertical graticule line over the full frequency range of the spectrum analyzer.

5-30. YTF TRACKING ADJUSTMENT (Cont'd)

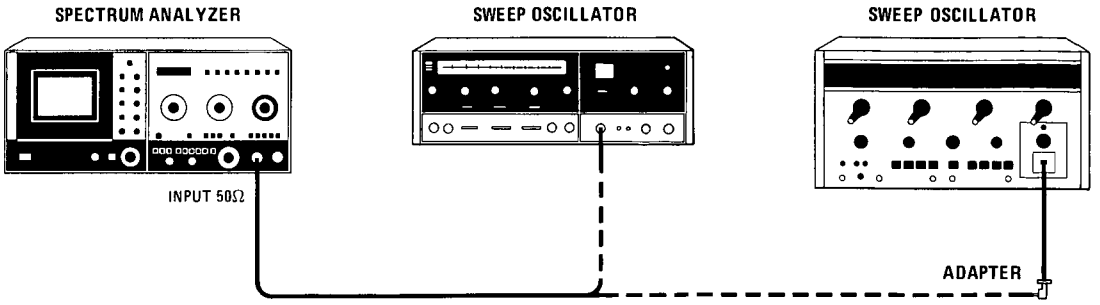


Figure 5-51. YTF Tracking Adjustment Test Setup

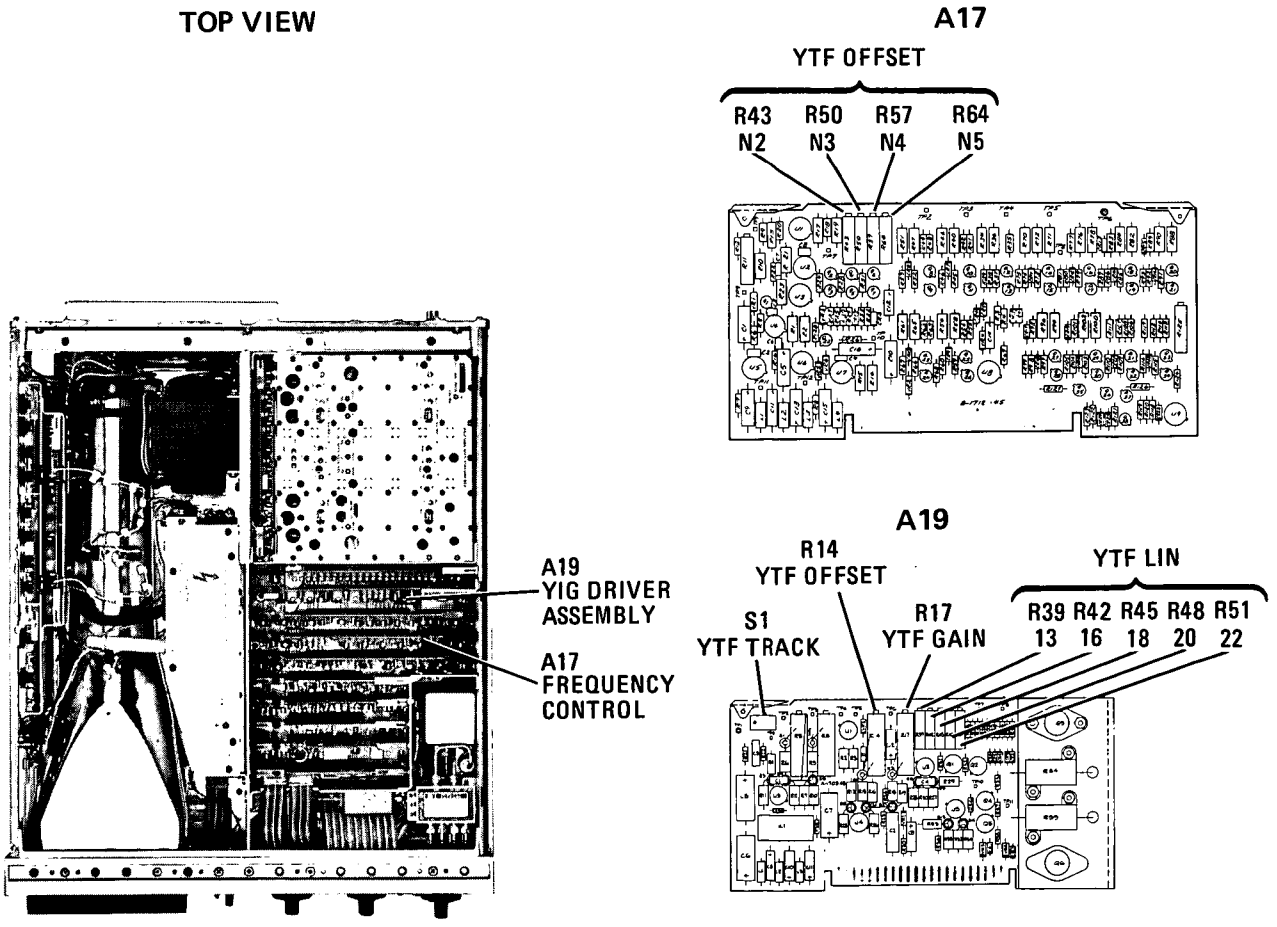


Figure 5-52. YTF Tracking Adjustment Locations

5-30. YTF TRACKING ADJUSTMENT (Cont'd)

EQUIPMENT:

NOTE

If an extended range sweep oscillator (8620C/86290A-H08) is available, the 8690B/8696A sweep oscillator is not required.

Sweep Oscillator (2 — 18 GHz)	HP 8620C/86290A
Sweep Oscillator (18 — 22 GHz)	HP 8690B/8696A
Adapter, Waveguide to SMA Jack	Narda 4608

PROCEDURE:

NOTE

Allow at least one hour instrument warm up before performing YTF Tracking Adjustment.

a. Set LINE switch OFF disconnect power cord, and remove 8565A top cover.

b. Reconnect power cord, set LINE switch ON, connect equipment as shown in Figure 5-51, and set 8565A controls as follows:

Set all Normal Settings (controls marked with green)

FREQUENCY BAND GHz	1.7 – 4.1
INPUT ATTEN	10 dB
REF LEVEL	0 dBm
REF LEVEL FINE	0
RESOLUTION BW	3 MHz
FREQUENCY SPAN MODE	ZERO SPAN
SWEEP TIME/DIV	20 mSEC
AUTO STABILIZER	OFF
PRESELECTOR PEAK	Centered in green
TUNING	2.000 GHz

c. Set A19S1 YTF TRACK (Figure 5-52) switch to TEST position.

d. Simultaneously depress EXT and INT SWEEP SOURCE pushbuttons to obtain a dot on spectrum analyzer CRT display. Adjust front panel HORIZ POSN to position dot on center vertical graticule line. Set SWEEP SOURCE to INT. Select 1.7 — 22 GHz SPAN FREQUENCY SPAN MODE and allow spectrum analyzer to sweep several times before reselecting PER DIV FREQUENCY SPAN MODE.

5-30. YTF TRACKING ADJUSTMENT (Cont'd)

NOTE

Ensure that PRESELECTOR PEAK remains in center of green region throughout adjustment procedure.

NOTE

When repeating adjustments in group A, readjust YTF GAIN only at 10.5 GHz. If there is insufficient range on YTF LIN adjustments in groups B and C, the YTF GAIN can be compromised at 10.5 GHz to aid the YTF LIN adjustments. The YTF OFFSET affects offsets on all bands. YTF GAIN has an increasing affect with increasing frequency (for example: YTF GAIN has no affect at 2 GHz. But at 4 GHz, a 2 MHz shift in passband will result in a 6 MHz shift at 8 GHz, an 8 MHz shift at 10 GHz, and a 16 MHz shift at 18 GHz.

e. Tracking adjustments in Table 5-10 are listed in three groups (A, B, and C). Perform adjustments according to groups, and repeat adjustments in each group to give best compromise of centered passbands for that group before proceeding to the next group of adjustments. Perform each tracking adjustment listed in Table 5-10 as follows:

1. Select spectrum analyzer FREQUENCY BAND and adjust TUNING control for given FREQUENCY.

2. Remove error due to hysteresis by switching FREQUENCY SPAN MODE to FULL BAND, then back to ZERO SPAN.

3. Set sweep oscillator for a CW frequency equal to spectrum analyzer FREQUENCY. Adjust sweep oscillator CW frequency for maximum signal amplitude on spectrum analyzer CRT display.

4. Perform corresponding YTF tracking adjustment to center passband (10 dB points) on spectrum analyzer CRT display (Figure 5-53). Ensure that at least 25%of passband is on each side of center vertical graticule line.

f. Verify PRESELECTOR PEAK is centered in green region, and without making adjustments, recheck tracking by repeating step e.

g. Set A19S1 YTF TRACK switch to NORM. Set LINE switch OFF, disconnect power cord, and install 8565A top cover.

5-30. YTF TRACKING ADJUSTMENT (Cont'd)

Table 5-10. YTF Tracking Adjustment

Adjustment Group	Frequency Band	Frequency	Tracking Adjustment	Adjustment Effect
A	1.7 – 4.1 GHz	2.0 GHz	A19R14 YTF OFFSET	Overall Offset
	1.7 – 4.1 GHz	4.0 GHz	A19R17 YTF GAIN	Overall Gain
	3.8 – 8.5 GHz	4.0 GHz	A17R43 YTF OFFSET N2	Offset 3.8 – 8.5 BAND
	3.8 – 8.5 GHz	8.5 GHz	A19R17 YTF GAIN	Overall Gain
	5.8 – 12.9 GHz	8.5 GHz	A17R50 YTF OFFSET N3	Offset 5.8 – 12.9 BAND
	5.8 – 12.9 GHz	10.5 GHz	A19R17 YTF GAIN	Overall Gain
B	8.5 – 18 GHz	10.5 GHz	A17R57 YTF OFFSET N4	Offset 8.5 – 18 BAND
	8.5 – 18 GHz	13.0 GHz	A19R39 YTF LIN 13	Δ Gain above 10 GHz
	8.5 – 18 GHz	16.0 GHz	A19R42 YTF LIN 16	Δ Gain above 14 GHz
	8.5 – 18 GHz	18.0 GHz	A19R45 YTF LIN 18	Δ Gain above 16 GHz
C	10.5 – 22 GHz	10.5 GHz	A17R64 YTF OFFSET N5	Offset 10.5 – 22 GHz BAND
	10.5 – 22 GHz	20.0 GHz	A19R48 YTF LIN 20	Δ Gain above 18 GHz
	10.5 – 22 GHz	22.0 GHz	A19R51 YTF LIN 22	Δ Gain above 20 GHz

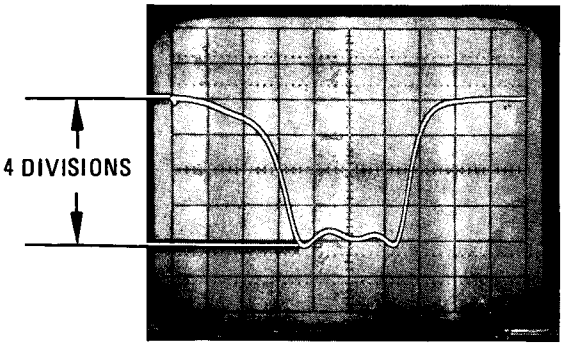


Figure 5-53. YTF Passband Display

ADJUSTMENTS

5-31. FREQUENCY RESPONSE ADJUSTMENT

REFERENCE:

Service Sheets 19 and 20

DESCRIPTION:

A synchronizer and sweep oscillator are connected to make a tracking generator for the 8565A. The YTF is modulated with a 1 kHz sine wave to eliminate amplitude variations due to small errors in YTF Tracking. The sweep oscillator is phase locked across each FREQUENCY BAND, and frequency response adjustments are performed.

CONFIGURATION A

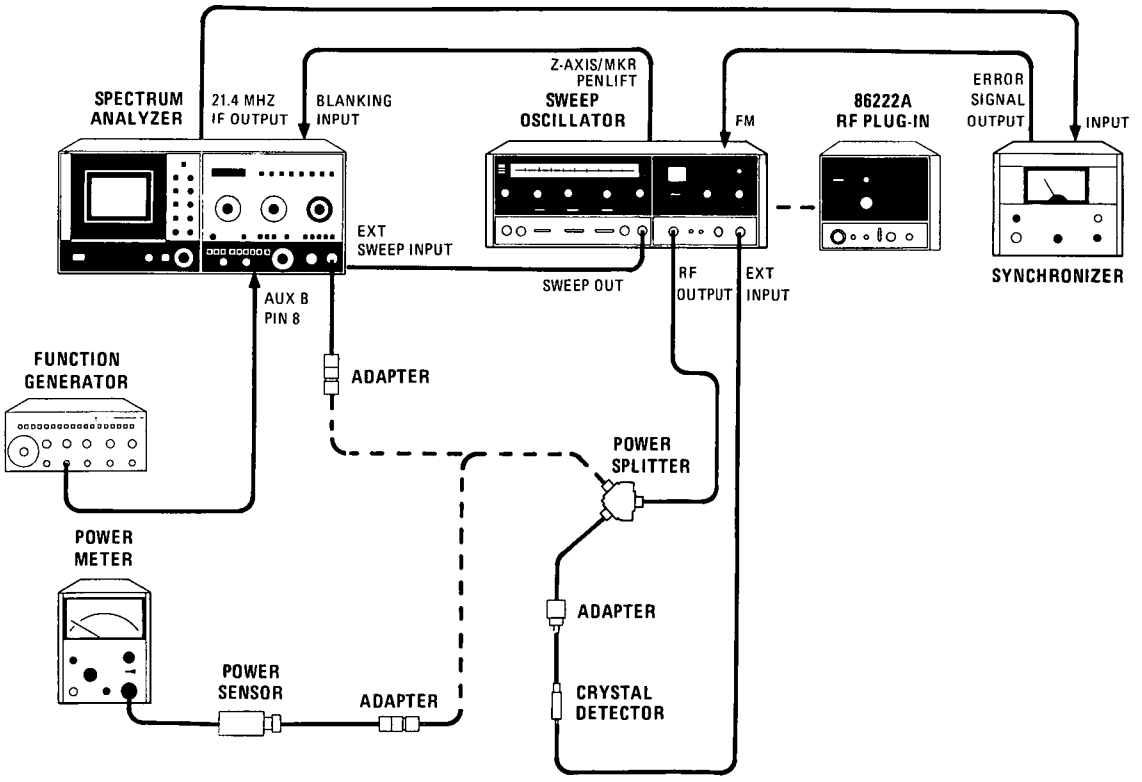


Figure 5-54. Frequency Response Adjustment Test Setup (Configuration A)

5-31. FREQUENCY RESPONSE ADJUSTMENT (Cont'd)

CONFIGURATION B

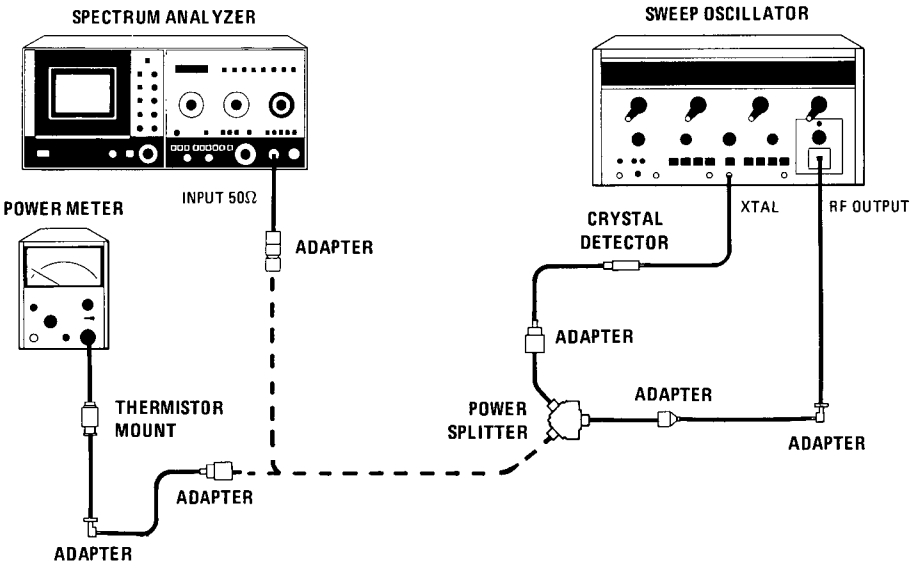


Figure 5-55. Frequency Response Adjustment Test Setup (Configuration B)

NOTE

If an extended range sweep oscillator (8620C/86290A-H08) is available, only the test equipment listed for CONFIGURATION A (Figure 5-54 is required. A standard 8620C/86290A sweep oscillator may be substituted, but then equipment listed for both CONFIGURATION A and B (Figure 5-55 is required.

CONFIGURATION A (Figure 5-54):

Sweep Oscillator	HP 8620C/86290A-H08
RF Plug-in	HP 86222A
Synchronizer	HP 8709-H10
Function Generator	HP 3312A
Power Meter	HP 435A
Power Splitter	HP 11667A Option 002
Power Sensor	HP 8481A
Crystal Detector	HP 33330C
Adapter, APC-7 to Type N Male	HP 11525A
Adapter, APC-7 to SMA Female	HP 11534A
Adapter, APC-7 to Type N Female	HP 11524A

5-31. FREQUENCY RESPONSE ADJUSTMENT (Cont'd)

CONFIGURATION B (Figure 5-55):

Sweep Oscillator	HP 8690B/8696A
Power Meter	HP 432A
Power Splitter (Same as CONFIGURATION A)	HP 11667A Option 002
Thermistor Mount	HP K486A
Crystal Detector (Same as CONFIGURATION A)	HP 33330C
Adapter	HP 11525A
Adapter	HP 11534A
Adapter	Narda 4608

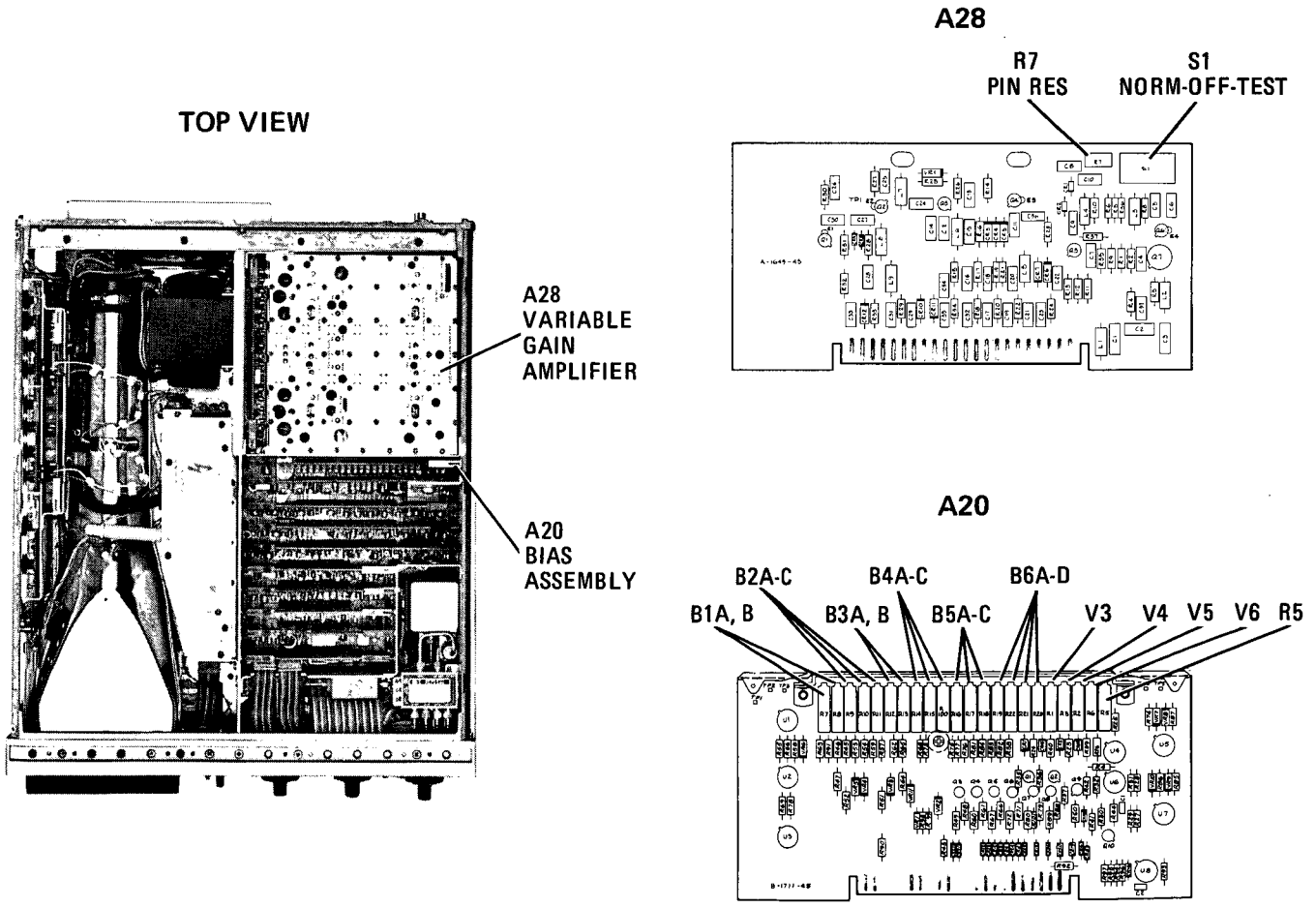


Figure 5-56. Frequency Response Adjustment Locations

PROCEDURE:

a. Set LINE switch OFF, disconnect power cord, and remove 8565A top cover.

5-31. FREQUENCY RESPONSE ADJUSTMENT (Cont'd)

b. Reconnect power cord, set LINE switch ON, connect equipment as shown in Figure 5-54. CONFIGURATION A, and set controls as follows:

8565A:
Set all Normal Settings (controls marked with green)

FREQUENCY BAND GHz	3.8 – 8.5
INPUT ATTEN	10 dB
REF LEVEL	0 dBm
REF LEVEL FINE	0
SWEEP SOURCE	EXT
FREQUENCY SPAN MODE	FULL BAND
AMPLITUDE SCALE	5 dB (LOG/DIV)
PRESELECTOR PEAK	Centered in green

Sweep Oscillator (8620C/86290A-H08):

BAND	Band 4
MARKER SWEEP pushbutton	Depress
START MARKER pointer	3.8 GHz
STOP MARKER pointer	8.5 GHz
SWEEP TIME-SECONDS	1 - .1
SWEEP TIME-SECONDS vernier	Fully clockwise
RF OFF-ON	ON
ALC switch	EXT
POWER LEVEL	Midrange
RF BLANKING/OFF (Rear Panel)	RF BLANKING
DISPLAY BLANKING/OFF (Rear Panel)	DISPLAY BLANKING
FM-NORM-PL (Rear Panel)	PL

c. Set A28S1 NORM-OFF-TEST switch (Figure 5-56) to OFF. Set synchronizer ERROR SIGNAL switch to +. Set function generator for a 1 kHz 1 to 2-volt peak-to-peak sine wave output.

d. Phase lock sweep oscillator as follows:

1. Set sweep oscillator to manual sweep mode with manual sweep control fully counterclockwise.

2. Set sweep oscillator start marker to low frequency of selected spectrum analyzer FREQUENCY BAND and adjust start marker for synchronizer phase lock (minimum phase error).

3. Set sweep oscillator manual sweep control fully clockwise and stop marker to high frequency of selected spectrum analyzer FREQUENCY BAND. Adjust stop marker for synchronizer phase lock (minimum phase error).

4. Set sweep oscillator to automatic sweep mode and check for phase locked spectrum analyzer CRT display. If the system is breaking phase lock, repeat steps d-1 through d-3.

e. Note signal level on screen.

5-31. FREQUENCY RESPONSE ADJUSTMENT (Cont'd)

f. Set A28S1 NORM-OFF-TEST switch to TEST and front panel INPUT ATTEN to 0 dB. Adjust A28R7 PIN RES for same signal level on CRT screen as that noted in step e.

g. Set PERSIST control fully counterclockwise and adjust INTENSITY control for normal intensity trace. Set AMPLITUDE SCALE to 2 dB.

NOTE

The "best line," as used in the following procedures, approximates the median line between the peaks and troughs of the upper edge of the 1 kHz modulation envelope. The best line is illustrated in Figure 5-57.

h. Note the best line as illustrated in Figure 5-57. Adjust REF LEVEL FINE control to set lowest point of that line on center horizontal graticule line. This point is used as a reference in checking for approximately same power level in FREQUENCY BANDS 5.8 — 12.9 GHz, 8.5 — 18 GHz and 10.5 — 22 GHz (steps i through u).

i. Set 8565A FREQUENCY BAND to 5.8 — 12.9 GHz. Set sweep oscillator for a MARKER SWEEP of 5.8 GHz to 12.9 GHz. Phase lock sweep oscillator according to step d.

j. Check that lowest point of best line (as defined above) is within ±2 dB of center horizontal graticule line. If not, change value of factory selected resistor A28R19* B4 GAIN. (Lower value increases signal level).

k. Set 8565A FREQUENCY BAND to 8.5 — 18 GHz and synchronizer ERROR SIGNAL switch to −. Set sweep oscillator for a MARKER SWEEP of 8.5 GHz to 18 GHz. Phase lock sweep oscillator according to step d.

l. Check that lowest point of best line is within ±2 dB of center horizontal graticule line. If not, change value of factory selected resistor A28R21* B5 GAIN (lower value increases signal level).

NOTE

If extended range sweep oscillator (8620C/86290A-H08) is not available, proceed to step o to check power level of the 10.5 — 22 GHz FREQUENCY BAND.

m. Set 8565A FREQUENCY BAND to 10.5 22 GHz. Set sweep oscillator for a MARKER SWEEP of 10.5 GHz to 22 GHz. Phase lock sweep oscillator according to step d.

n. Check that lowest point of best line is within ±2 dB of center horizontal graticule line. If not, change value of factory selected resistor A28R23* B6 GAIN (lower value increases signal level).

NOTE

Steps o through u are the procedure for checking power level of the 10.5 — 22 GHz FREQUENCY BAND with a standard 8620C/86290A sweep oscillator. If steps m and n have been successfully completed, do not perform steps o through u.

5-31. FREQUENCY RESPONSE ADJUSTMENT (Cont'd)

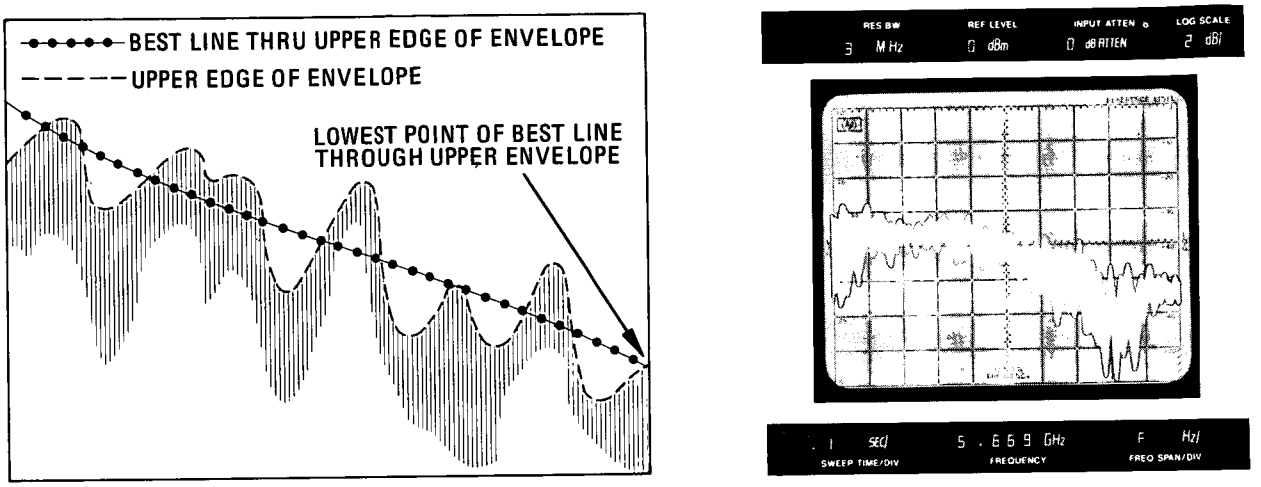


Figure 5-57. Best Line Relative to 1 kHz Modulation Envelope

o. Set 8565A FREQUENCY BAND to 10.5 — 22 GHz. Set 8620C sweep oscillator CW MARKER pointer to 16.4 GHz and ΔF POINTER to 11.9 GHz. Phase lock sweep oscillator as follows:

1. Set sweep oscillator to manual sweep mode with manual sweep control set to midrange.
2. Adjust CW MARKER control for synchronizer phase lock (minimum phase error).
3. Set sweep oscillator manual sweep control fully counterclockwise. Adjust ΔF control for synchronizer phase lock (minimum phase error).
4. Repeat steps o-1 through o-3 until no further adjustment is necessary.
5. Set sweep oscillator to automatic sweep mode and check for phase locked spectrum analyzer CRT display. If the system is breaking phase lock repeat steps o-1 through o-4.

p. Check that lowest point of best line is within ±2 dB of center horizontal graticule line. If not, change value of factory selected resistor A28R23* B6 GAIN (lower value increases signal level).

q. Set sweep oscillator amplitude marker to 18 GHz and note level of spectrum analyzer trace coincident with marker. Disconnect 8620C sweep oscillator output from 8565A INPUT 50Ω.

r. Connect 8690B/8696A as shown in Figure 5-55 CONFIGURATION B and set sweep oscillator for a CW frequency of 18 GHz.

s. Set 8565A SWEEP SOURCE to INT and adjust 8690B/8696A sweep oscillator power level for same 18 GHz signal level noted in step q.

5-31. FREQUENCY RESPONSE ADJUSTMENT (Cont'd)

t. Characterize sweep oscillator output as follows:

1. Disconnect power splitter from spectrum analyzer INPUT 50Ω and connect power meter to power splitter output.

2. Note power level at 18 GHz, then slowly tune sweep oscillator from 18 GHz to 22 GHz and note all peak deviations and frequencies at which they occur, from power level at 18 GHz. Record frequencies and deviations in Table 5-11 (see example).

3. Reconnect power splitter output to 8565A INPUT 50Ω and set 8690B/8696A sweep oscillator for a manually triggered start/stop sweep of 18 GHz to 22 GHz with a sweep time of 100 seconds.

4. Set 8565A PERIST control fully clockwise and press ERASE pushbutton.

5. Trigger sweep oscillator start/stop sweep and adjust sweep time vernier for display similar to that of Figure 5-58. STORE display on spectrum analyzer CRT.

6. Record deviations from signal level at 18 GHz in Table 5-11.

7. Algebraically subtract Peak Deviation from CRT Actual Deviation for each frequency in Table 5-11. Record corrected deviation in Table 5-11.

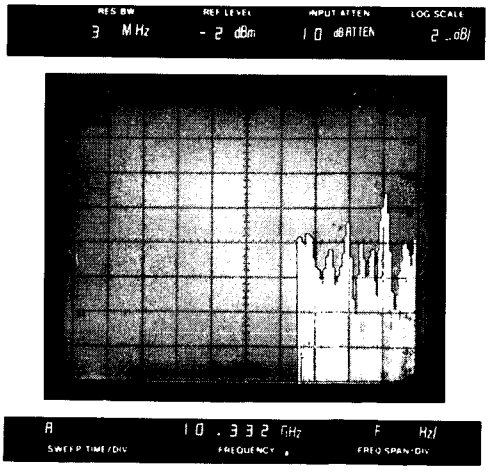


Figure 5-58. Typical Frequency Response (8690B/8696A)

5-31. FREQUENCY RESPONSE ADJUSTMENT (Cont'd)

Table 5-11. Error Characterization of Signal/Source

Frequency (GHz)	Peak Deviation (dB)	CRT Horizontal Displacement (div)	Actual Deviation (dB)	Corrected Deviation (dB)

Example:

Frequency (GHz)	Peak Deviation (dB)	CRT Horizontal Displacement (div)	Actual Deviation (dB)	Corrected Deviation (dB)
18.6	−1.0	7	−1.0	0
19.6	−0.5	7.8	−1.0	−0.5
20.1	+1.0	8.3	0	−1.0
20.6	−1.5	8.7	−2.0	−0.5
21.2	+0.5	9.2	+1.5	+1.0
21.8	−1.0	9.7	−0.4	+0.6

u. Algebraically add the maximum negative corrected deviation and power level recorded at 18 GHz (step t-2). This corrected power level should be within ±2 dB of reference set in step h. If not, change value of factory selected resistor A28R23* B6 GAIN (lower value increases signal level).

5-31. FREQUENCY RESPONSE ADJUSTMENT (Cont'd)

v. Connect equipment as shown in Figure 5-54 CONFIGURATION A. Set A28S1 NORM-OFF-TEST switch to NORM. Set 8565A FREQUENCY BAND to 3.8 — 8.5 GHz, INPUT ATTEN to 10 dB, REF LEVEL to 0 dBm and REF LEVEL FINE to 0. Set synchronizer ERROR SIGNAL switch to +. Set sweep oscillator for a MARKER SWEEP of 3.8 GHz to 8.5 GHz.

w. Phase lock sweep oscillator and set output power level as follows:

1. Set sweep oscillator to manual sweep mode with manual sweep control fully counterclockwise.

2. Set sweep oscillator start marker to low frequency of selected spectrum analyzer FREQUENCY BAND and adjust start marker for synchronizer phase lock (minimum phase error).

3. Set sweep oscillator manual sweep control fully clockwise and stop marker to high frequency of selected spectrum analyzer FREQUENCY BAND. Adjust stop marker for synchronizer phase lock (minimum phase error).

4. Disconnect power splitter from 8565A INPUT 50Ω and connect power meter to power splitter output.

5. Slowly adjust sweep oscillator manual sweep control over its entire range, and adjust power level for an average power meter reading of −8 dBm.

6. Disconnect power meter and reconnect power splitter output to 8565A INPUT 50Ω.

7. Set sweep oscillator to automatic sweep mode and check for phase locked spectrum analyzer CRT display. If the system is breaking phase lock, repeat steps w-1 through w-3.

x. Obtain on-screen display using REF LEVEL CAL. Adjust A20R13 B3B for minimum slope of trace. Adjust A20R12 B3A CCW so that the right side of trace drops 2 dB. Readjust A20R13 B3B for minimum slope (see Figure 5-59). Using REF LEVEL CAL and REFERENCE LEVEL FINE, set the best line. Do not readjust REF LEVEL CAL or REFERENCE LEVEL FINE in steps z through as.

y. Adjust A20R1 V3 for minimum amplitude variations of upper edge of envelope on CRT trace. Repeat step x.

z. Set 8565A FREQUENCY BAND to 5.8 — 12.9 GHz. Set sweep oscillator for a MARKER SWEEP of 5.8 GHz to 12.9 GHz. Phase lock sweep oscillator and set output power level according to step w.

aa. Adjust A20R14 B4A, A20R15 B4B, and A20R100 B4C to set best line at the center horizontal graticule line, with minimum slope.

5-31. FREQUENCY RESPONSE ADJUSTMENT (Cont'd)

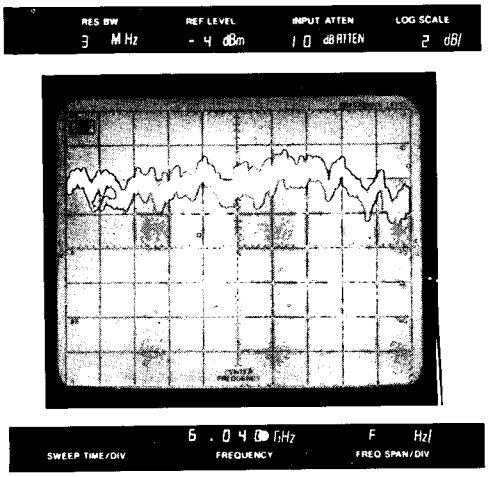


Figure 5-59. Frequency Response Adjustment CRT Display

ab. Adjust A20R3 V4 for minimum amplitude variations of the upper edge of the envelope on CRT trace. If amplitude variations on high frequency portion of the band are excessive ($> \pm 2.5$ dB) change value of factory selected resistor A20R29* and readjust A20R3 V4. Repeat step aa.

ac. Set 8565A FREQUENCY BAND to 8.5 — 18 GHz. Set synchronizer ERROR SIGNAL switch to −. Set sweep oscillator for a MARKER SWEEP of 8.5 GHz to 18 GHz. Phase lock sweep oscillator and set output power level according to step w.

ad. Adjust A20R16 B5A, A20R17 B5B, and A20R18 B5C to set best line at center horizontal graticule line.

ae. Set A20R5 fully counterclockwise and adjust A20R2 V5 for minimum amplitude variations of upper edge of envelope on CRT trace. Set A20R5 to several positions over its range and readjust A20R2 V5 for minimum amplitude variations at each setting. Set A20R5 to position giving minimum amplitude variations and adjust A20R2 V5 for minimum variations. Repeat step ad.

af. Set 8565A FREQUENCY BAND to 10.5 — 22 GHz. Set sweep oscillator for a MARKER SWEEP of 10.5 GHz to 22 GHz. Phaselock sweep oscillator and set output power level according to step w.

ag. Adjust A20R19 B6A, A20R22 B6B, A20R21 B6C, and A20R20 B6D to set best line at the center horizontal graticule line, with minimum slope.

ah. Adjust A20R6 V6 for minimum amplitude variations on CRT trace. Repeat step ag.

5-31. FREQUENCY RESPONSE ADJUSTMENT (Cont'd)

NOTE

Steps ai through am are the flatness adjustment procedures for the 10.5 — 22 GHz FREQUENCY BAND using standard sweep oscillators (8620C/86290A and 8690B/8696A). If steps af through ah have been successfully completed, do not perform steps ai through am.

ai. Set 8565A FREQUENCY BAND to 10.5 — 22 GHz. Set 8620C sweep oscillator CW MARKER pointer to 16.4 GHz and ΔF pointer to 11.9 GHz. Phase lock sweep oscillator and set output power level as follows:

1. Set sweep oscillator to manual sweep mode with manual sweep control set to midrange.
2. Adjust CW MARKER control for synchronizer phase lock (minimum phase error).
3. Set sweep oscillator manual sweep control fully counterclockwise. Adjust ΔF control for synchronizer phase lock (minimum phase error).
4. Repeat steps ai-1 through ai-3 until no further adjustment is necessary.
5. Disconnect power splitter from 8565A INPUT 50Ω connector and connect power meter to power splitter output.
6. Set 8565A AMPLITUDE SCALE to 10 dB and note that CRT trace can be manually swept with sweep oscillator manual sweep control. Manually sweep spectrum analyzer CRT trace from left graticule edge (10.5 GHz) to six and one-half divisions (18 GHz) and adjust sweep oscillator power level for an average power meter reading of −8 dBm over this range.
7. Disconnect power meter and reconnect power splitter output to 8565A INPUT 50Ω. Set 8565A AMPLITUDE SCALE to 2 dB.
8. Set sweep oscillator to automatic sweep mode and check for phase locked spectrum analyzer CRT display. If system is breaking phase lock, repeat steps ai-1 through ai-4.

aj. Adjust A20R19 B6A, A20R22 B6B, and A20R21 B6C to set best line at the center horizontal graticule line, with minimum slope. Do this for the first 6.5 divisions of sweep.

ak. Adjust A20R6 V6 for minimum amplitude variations of upper edge of envelope for first 6.5 divisions of CRT trace. Repeat step aj.

al. Perform steps q through t.

am. Use corrected deviation data (step t-7) to determine approximate slope of corrected CRT trace. Adjust A20R20 B6D to set the best line at the center horizontal graticule line with minimum slope.

5-31. FREQUENCY RESPONSE ADJUSTMENT (Cont'd)

an. Connect equipment as shown in Figure 5-54 CONFIGURATION A. Select 8565A FREQUENCY BAND of 1.7 — 4.1 GHz and set SWEEP SOURCE to EXT. Set synchronizer ERROR SIGNAL switch to +. Set 8620C sweep oscillator CW MARKER pointer to 2.9 GHz and ΔF pointer to 2.4 GHz. Depress 8620C ΔF pushbutton. Phase lock sweep oscillator and set output power level as follows:

1. Set sweep oscillator to manual sweep mode with manual sweep control fully clockwise.
2. Adjust sweep oscillator ΔF control for synchronizer phase lock (minimum phase error).
3. Set sweep oscillator manual sweep control to midrange. Adjust CW MARKER control for synchronizer phase lock (minimum phase error).
4. Repeat steps an-1 through an-3 until no further adjustment is necessary.
5. Disconnect power splitter from 8565A INPUT 50Ω and connect power meter to power splitter output.
6. Slowly adjust sweep oscillator manual sweep control over its entire range, and adjust power level for an average power meter reading of −8 dBm.
7. Disconnect power meter and reconnect power splitter output to 8565A INPUT 50Ω.
8. Set sweep oscillator to automatic sweep mode and check for phase locked spectrum analyzer CRT display. If system is breaking phase lock, repeat steps an-1 through an-4.

ao. Adjust A20R9 B2A, A20R10 B2B, and A20R11 B2C to set best line at the center horizontal graticule line, with minimum slope.

ap. Set sweep oscillator LINE switch OFF and replace 86290A RF Plug-in test setup (Figure 5-54 CONFIGURATION A) with 86222 RF Plug-in. Set sweep oscillator LINE switch ON, POWER LEVEL to midrange, ALC switch to EXT, and rear panel FM-NORM-PL switch to PL.

aq. Set 8565A FREQUENCY BAND to .01 — 1.8 GHz. Set sweep oscillator for a MARKER SWEEP of .01 GHz to 1.8 GHz. Phase lock sweep oscillator and set output power level according to step w.

ar. Adjust A20R7 B1A and A20R8 B1B to set best line at the center horizontal graticule line, with minimum slope.

as. Adjustment complete. Proceed to 5-32 Absolute Amplitude Calibration.

5-32. ABSOLUTE AMPLITUDE CALIBRATION

REFERENCE:

Service Sheet 20

DESCRIPTION:

The 100 MHz CAL OUTPUT signal is displayed on the spectrum analyzer CRT screen. Factory selected resistor A28R2 is selected so that REF LEVEL CAL functions over the range that optimizes noise and distortion performance.

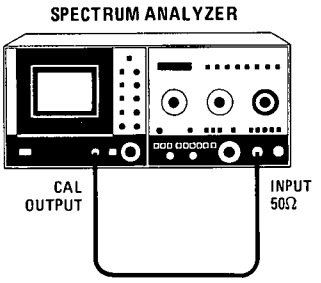


Figure 5-60. Absolute Amplitude Calibration Test Setup

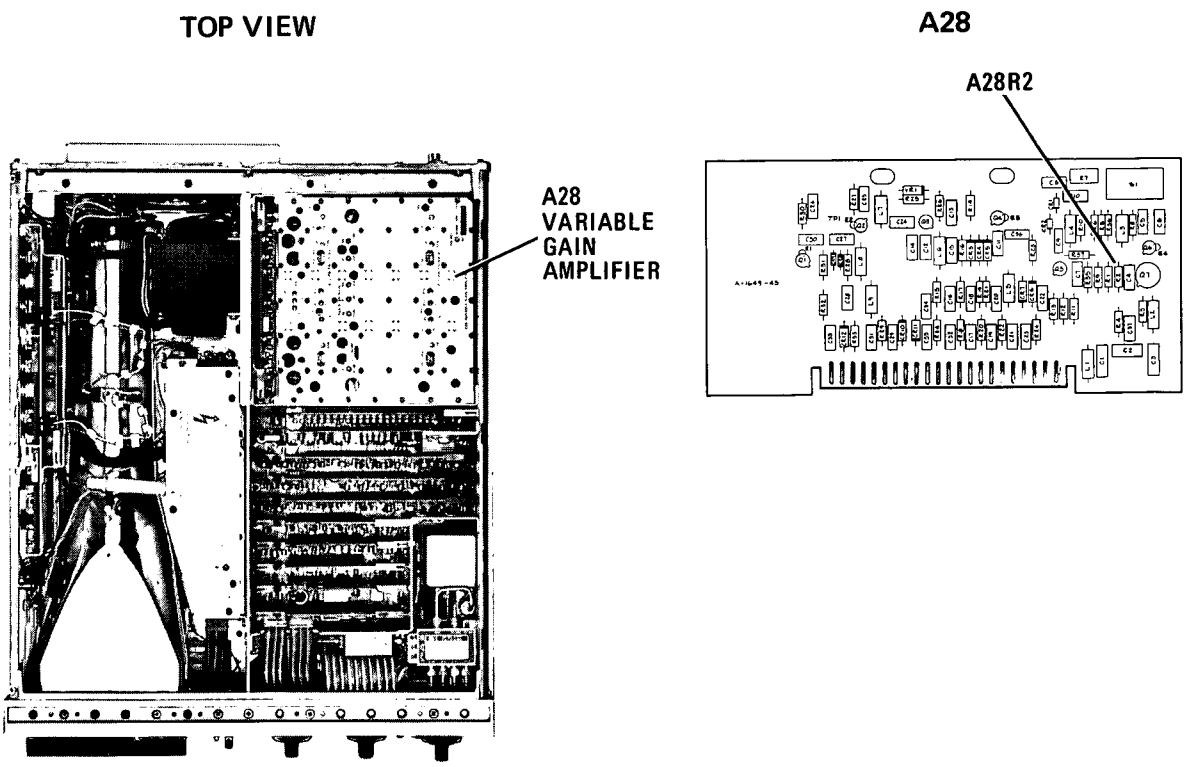


Figure 5-61. Absolute Amplitude Calibration Adjustment Locations

5-32. ABSOLUTE AMPLITUDE CALIBRATION (Cont'd)

PROCEDURE:

a. Set LINE switch OFF, disconnect power cord, and remove 8565A top cover.

b. Reconnect power cord, set LINE switch ON, connect equipment as shown in Figure 5-60, and set 8565A controls as follows:

Set all Normal Settings (controls marked with green)

FREQUENCY BAND GHz	.01 – 1.8
INPUT ATTEN	10 dB
REF LEVEL	0 dBm
REF LEVEL FINE	0
RESOLUTION BW	1 MHz
FREQUENCY SPAN/DIV	10 MHz
AMPLITUDE SCALE	2 dB
TUNING	0.100 GHz
REF LEVEL CAL	Fully counterclockwise

c. Adjust TUNING control to center 100 MHz signal on CRT display.

d. Adjust REF LEVEL CAL clockwise to increase 100 MHz signal amplitude by 3 dB (1 1/2 divisions).

e. Note how many dB signal peak is away from third graticule line from the bottom of display.

f. For every dB signal peak is away from this graticule line, change value of factory selected resistor A28R2 (Figure 5-61) by 10%. (An increase in resistance will increase signal level.) When signal is within 1 dB of graticule line, proceed to step g.

g. Adjust REF LEVEL CAL to position signal peak on third graticule line from bottom of display.

h. Adjustment complete. Set LINE switch OFF, disconnect power cord, and install 8565A top cover.

5-33. OPTION 100 BANDWIDTH FILTER ADJUSTMENTS

REFERENCE:

Service Sheets 37, 38, and 39

DESCRIPTION:

The first-stage center frequency of the 3 MHz Filter is aligned with the center frequency of the 3 kHz bandwidth. The bandpass of each stage of the 3 MHz Filter is adjusted for centering and symmetry while the spectrum analyzer is in the 1 kHz bandwidth. The LO NULL capacitor in the Up Down Converter is adjusted for minimum 18.4 MHz LO signal to the Step Gain Amplifier. (This signal is monitored in the Bandwidth Filter No. 2 Assembly.) DC GAIN in the Up Down Converter is adjusted to set the amplitude of the 1 kHz bandwidth relative to the amplitude of the 1 MHz bandwidth. The .3 kHz and .1 kHz bandwidth amplitudes are then adjusted to the 1 kHz bandwidth amplitude. The 1 kHz, .3 kHz, and .1 kHz bandwidths 3-dB points are measured to ensure that they are within tolerance.

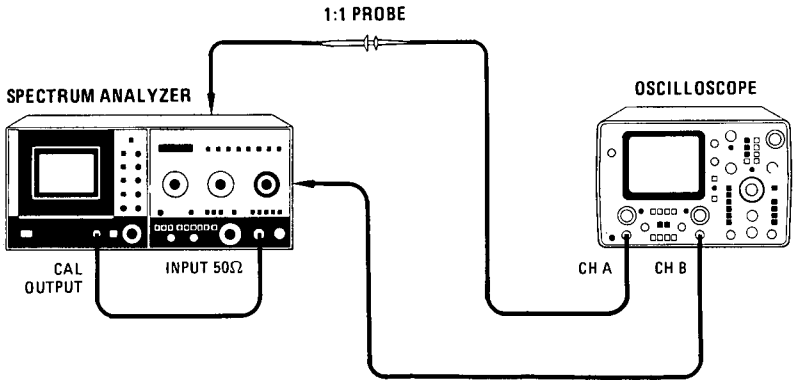


Figure 5-62. Option 100 Bandwidth Filter Adjustments Test Setup

EQUIPMENT:

Oscilloscope	HP 1740A
1:1 Divider Probe	HP 10007D

5-33. OPTION 100 BANDWIDTH FILTER ADJUSTMENTS (Cont'd)

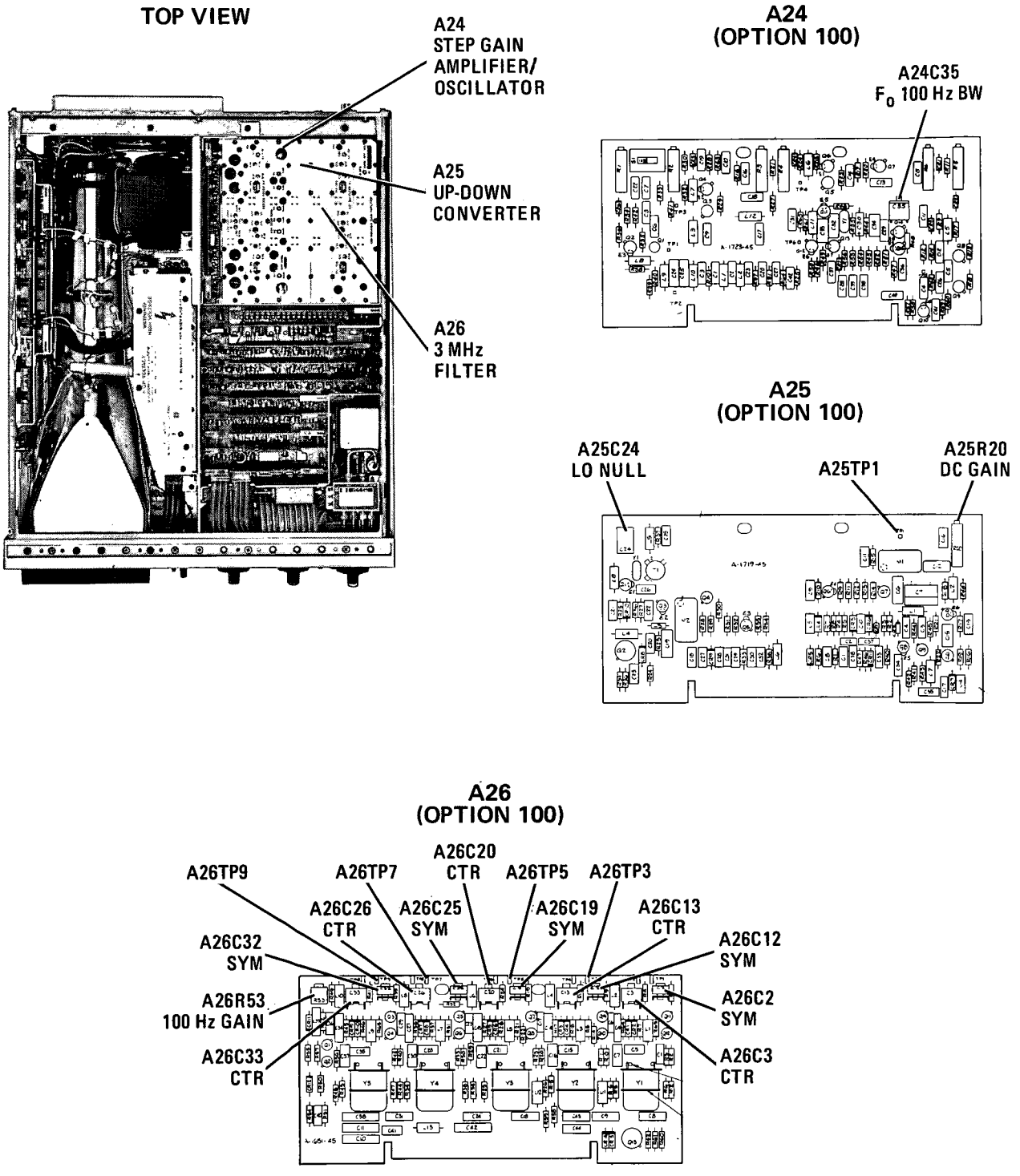


Figure 5-63. Option 100 Bandwidth Filter Adjustment Locations

5-33. OPTION 100 BANDWIDTH FILTER ADJUSTMENTS (Cont'd)

PROCEDURE:

a. Set LINE switch OFF, disconnect power cord, remove 8565A top cover, and install A25 Up-Down Converter on an extender board.

b. Reconnect power cord, set LINE switch ON, connect equipment as shown in Figure 5-62, and set 8565A controls as follows:

FREQUENCY BAND GHz	.01 — 1.8
INPUT ATTEN	0 dB
REF LEVEL	−10 dBm
REF LEVEL FINE	0
RESOLUTION BW	1 kHz
FREQUENCY SPAN/DIV	1 kHz
FREQUENCY SPAN MODE	LIN
TUNING	100 MHz

c. Connect oscilloscope probe to A25 pin 31 and check 18.4 MHz LO signal is approximately 22 millivolts peak-to-peak (−10 dBm). If LO signal is less than 22 millivolts peak-to-peak, decrease value of factory selected resistor A24R55* (minimum value 383 ohms).

d. Set RESOLUTION BW to 3 kHz and adjust front panel TUNING and FINE TUNING controls to center 100 MHz signal on spectrum analyzer CRT display.

e. Connect oscilloscope probe to A26TP3 (Figure 5-63) and set RESOLUTION BW switch to 1 kHz.

NOTE

A non-metallic tuning tool is required for all crystal filter and LO adjustments.

f. Adjust A26C3 CTR for minimum signal amplitude on oscilloscope display.

g. Adjust A24C35 F_O 100 Hz Bw to center signal on oscilloscope display.

h. Repeat steps d through g until no further adjustment is necessary.

i. Adjust A26C2 SYM and A26C3 CTR for a centered and symmetrical bandpass on oscilloscope display.

j. Connect oscilloscope probe to A26TP5 and adjust A26C12 SYM and A26C13 CTR for a centered and symmetrical bandpass on oscilloscope display.

k. Connect oscilloscope probe to A26TP7 and adjust A26C19 SYM and A26C20 CTR for a centered and symmetrical bandpass on oscilloscope display.

l. Connect oscilloscope probe to A26TP9 and adjust A26C25 SYM and A26C26 CTR for a centered and symmetrical bandpass on oscilloscope display.

5-33. OPTION 100 BANDWIDTH FILTER ADJUSTMENTS (Cont'd)

m. Disconnect oscilloscope probe and adjust A26C32 SYM and A26C33 CTR for a centered and symmetrical bandpass on spectrum analyzer CRT display.

n. Check that RESOLUTION BW is set to 1 kHz. Disconnect 100 MHz CAL OUTPUT signal from INPUT 50Ω connector. Set INPUT ATTEN to 0 dB, REF LEVEL to −50 dBm, REF LEVEL FINE to −12, and FREQUENCY SPAN MODE to ZERO SPAN.

o. Connect oscilloscope probe to A23TP1 in the Bandwidth Filter No. 2 Assembly and adjust A25C24 LO NULL for minimum signal amplitude.

p. Connect 100 MHz CAL OUTPUT signal to INPUT 50Ω connector. Set REF LEVEL to 0 dBm, RESOLUTION BW to 1 MHz, and FREQUENCY SPAN MODE to PER DIV.

q. Adjust REF LEVEL FINE control to set 100 MHz signal peak on REFERENCE LEVEL graticule line.

r. Set RESOLUTION BW to 1 kHz (center signal on CRT) and adjust A25R20 DC GAIN to set 100 MHz signal peak on REFERENCE LEVEL graticule line. If adjustment does not have enough range, change value of factory selected resistor A25R23*. An increase in resistance increases signal amplitude.

s. Set RESOLUTION BW to .1 kHz and adjust A26R53 100 Hz GAIN to set 100 MHz signal peak on REFERENCE LEVEL graticule line.

t. Set RESOLUTION BW to .3 kHz and check 100 MHz signal peak is within ±0.5 dB of REFERENCE LEVEL graticule line. If not, change value of factory selected resistor A26R54*. An increase in resistance increases signal amplitude.

u. Set RESOLUTION BW to 1 kHz, FREQUENCY SPAN/DIV to 1 kHz, and AMPLITUDE SCALE to LIN. Connect frequency counter to rear panel 21.4 MHz IF OUTPUT connector.

v. Adjust REF LEVEL FINE control to set 100 MHz signal peak 7.1 divisions above graticule line.

NOTE

When signal peak is set to 7.1 divisions, the 3 dB bandwidth points are located five divisions above the baseline graticule.

w. Measure 3 dB bandwidth for each RESOLUTION BW listed in Table 5-12 as follows:

1. Set SWEEP SOURCE to MAN.

2. Adjust MANUAL SWEEP control to position trace on lower frequency 3 dB point. Note frequency counter indiction.

Frequency_____ MHz

5-33. OPTION 100 BANDWIDTH FILTER ADJUSTMENTS (Cont'd)

3. Adjust MANUAL SWEEP control to position trace on upper frequency 3 dB point. Note frequency counter indication.

Frequency_____ MHz

4. Subtract frequency noted in step 2 from frequency noted in step 3. This frequency difference is the 3 dB bandwidth; check that it is within the 3 dB bandwidth limits listed in Table 5-12.

5. If the 1 kHz RESOLUTION BW is out of tolerance, change the values of factory-selected resistors listed in Table 5-12. These resistors must be changed in pairs (shown by parentheses), and the parallel resistance of any pair should not vary more than 10 percent from the parallel resistance of any other pair.

6. If the .3 kHz or .1 kHz RESOLUTION BW is out of tolerance, change the values of the factory-selected resistors listed in Table 5-12. Each resistor in a set must have a value within 10 percent of the other resistors.

x. Adjustment complete. Set LINE switch OFF, disconnect power cord, and install 8565A top cover.

Table 5-12. Factory-Selected Resistors

Resolution BW	Factory-Selected Resistors	3 dB BW Limits
1 kHz	(A26R9, A26R10), (A26R19, A26R20), (A26R29, A26R30), (A26R39, A26R40), (A26R49, A26R48)	0.8 to 1.2 kHz
.3 kHz	A26R7, A26R18, A26R28, A26R37, A26R46	255 to 345 Hz
.1 kHz	A26R17, A26R27, A26R36, A26R45, A26R64	85 to 115 Hz

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