

Errata

Title & Document Type: 8559A Spectrum Analyzer Operating and Service Manual

Manual Part Number: 08559-90012

Revision Date: January 1984

HP References in this Manual

This manual may contain references to HP or Hewlett-Packard. Please note that Hewlett-Packard's former test and measurement, semiconductor products and chemical analysis businesses are now part of Agilent Technologies. We have made no changes to this manual copy. The HP XXXX referred to in this document is now the Agilent XXXX. For example, model number HP8648A is now model number Agilent 8648A.

About this Manual

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**HEWLETT
PACKARD**

OPERATION AND SERVICE MANUAL

**8559A
SPECTRUM ANALYZER
0.1 – 21 GHz**

SERIAL NUMBERS

This manual applies directly to instruments with serial numbers prefixed 2347A.

With modifications described in Section VII, this manual also applies to instruments with serial number prefixes 1909A through 2320A.








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

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**MANUAL PART NUMBER 08559-90012
Microfiche Part Number 08559-90013**

Printed: January 1984

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* * * * MANUAL UPDATING COVERAGE * * * *	* * * * MANUAL IDENTIFICATION * * * * *
* * * * *	* * * * *
* This supplement adapts your manual * *	* Instrument Model Number: 8559A *
* to instruments with serial numbers * *	* Manual Part Number: 08559-90012 *
* prefixed through 2818A. * *	* Manual Print Date: January 1984 *
* * * * *	* Manual Update P/N: 08559-90030 *
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ABOUT THIS SUPPLEMENT

The information in this supplement is provided to correct manual errors and to adapt the manual to instruments containing changes made after the manual print date.

Change and correction information in this supplement is itemized on separate pages corresponding to the original manual pages. The pages in this supplement are organized in numerical order by manual page number. These pages are intended to be inserted into the manual to either supplement or replace the original manual pages.

Manual updating supplements are revised as often as necessary to keep manuals as accurate as possible. Hewlett-Packard recommends that you periodically request the latest edition of this supplement. Free copies are available from all HP offices. When requesting copies quote the model number, print date, and part number listed at the top of this page.

HOW TO USE THIS SUPPLEMENT

Insert this title page in front of the title page in your manual.

Insert the change pages in this supplement into your manual adjacent to the original manual pages.

Insert any complete replacement pages provided into your manual in the proper location. The original manual pages may be discarded or the original manual may be left intact to document all instrument configurations.

If your manual has been updated according to the last edition of this supplement, you need only record the latest changes. See NEW INFORMATION IN THIS SUPPLEMENT, below.

NEW INFORMATION IN THIS SUPPLEMENT

► indicates new information.

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SAFETY SYMBOLS

The following safety symbols are used throughout this manual and in the instrument. Familiarize yourself with each of the symbols and its meaning before operating this instrument.



Instruction manual symbol. The instrument will be marked with this symbol when it is necessary for the user to refer to the instruction manual in order to protect the instrument against damage. Location of pertinent information within the manual is indicated by use of this symbol in the table of contents.



Indicates dangerous voltages are present. Be extremely careful.

CAUTION

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

WARNING

The WARNING sign denotes a hazard. It calls attention to a procedure 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.

GENERAL SAFETY CONSIDERATIONS

WARNING

BEFORE THIS INSTRUMENT IS SWITCHED ON, make sure it has been properly grounded through the protective conductor of the ac power cable to a socket outlet provided with protective earth contact. Any interruption of the protective (grounding) conductor, inside or outside the instrument, or disconnection of the protective earth terminal can result in personal injury.

WARNING

There are voltages at many points in the instrument which can, if contacted, cause personal injury. Be extremely careful. Any adjustments or service procedures that require operation of the instrument with protective covers removed should be performed only by trained service personnel.

CAUTION

BEFORE THIS INSTRUMENT IS SWITCHED ON, make sure its primary power circuitry has been adapted to the voltage of the ac power source. Failure to set the ac power input to the correct voltage could cause damage to the instrument when the ac power cable is plugged in.

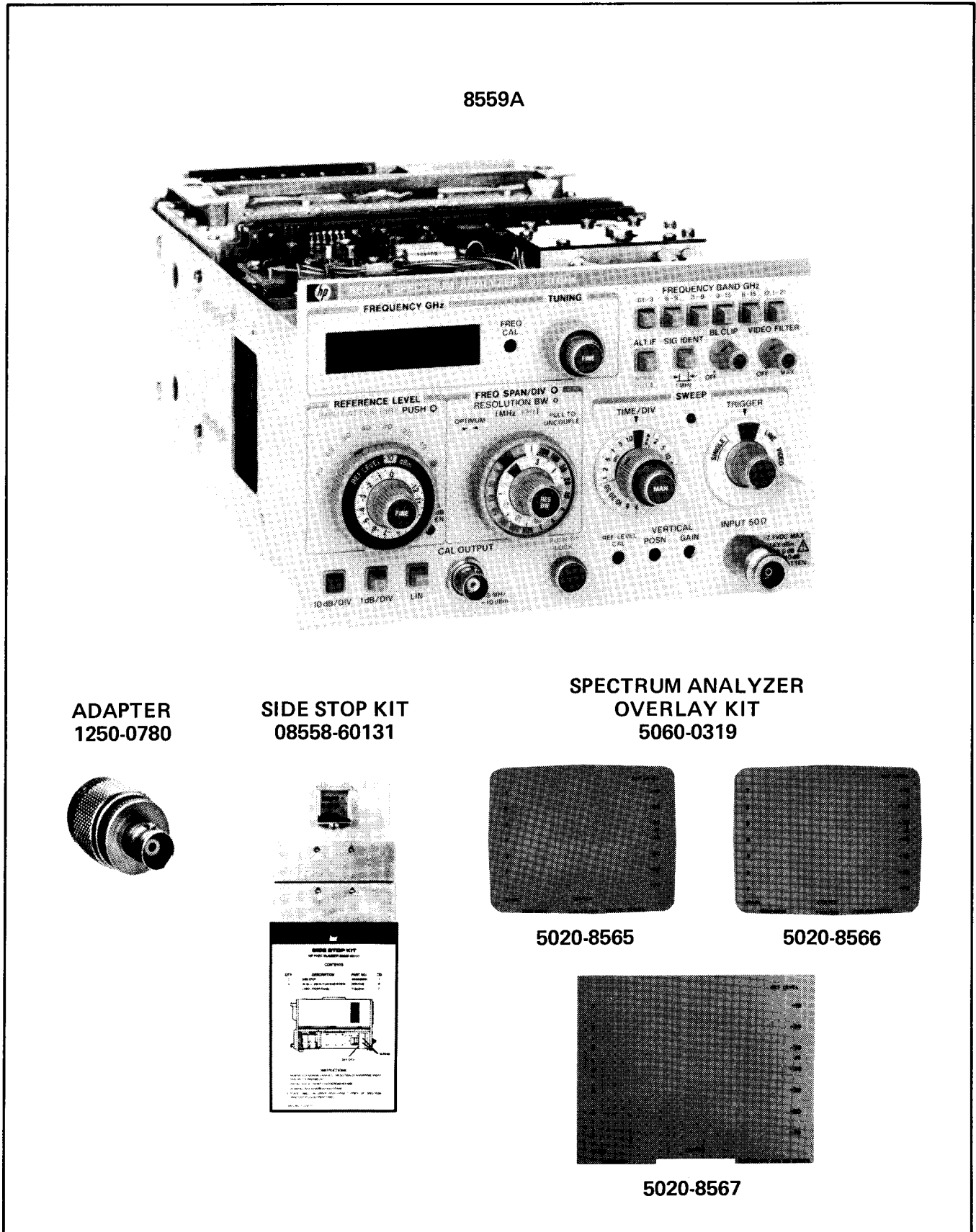


FIGURE 1-1. HP MODEL 8559A SPECTRUM ANALYZER AND ACCESSORIES SUPPLIED

SECTION I GENERAL INFORMATION

1-1. INTRODUCTION

1-2. This Operation and Service manual contains information required to install, operate, test, adjust, and service the Hewlett-Packard 8559A Spectrum Analyzer. Figure 1-1 shows the instrument and accessories supplied. This section covers instrument identification, description, options, accessories, specifications, and other basic information.

1-3. DESCRIPTION

1-4. The HP 8559A displays the amplitude and frequency of each component of an input signal on a CRT. This display gives quantitative information often not available from a conventional oscilloscope. The HP 8559A is capable of measuring signals from -112 dBm to $+30$ dBm over a frequency range of 10 MHz to 21 GHz.

1-5. The complete measuring system includes the HP 8559A Spectrum Analyzer plugged into a compatible Hewlett-Packard display mainframe.

1-6. MANUAL ORGANIZATION

1-7. This manual is divided into eight sections as follows:

SECTION I, GENERAL INFORMATION; contains the instrument description and specifications, explains accessories and options, and lists recommended test equipment.

SECTION II, INSTALLATION AND OPERATION VERIFICATION; contains information concerning initial mechanical inspection, preparation for use, operating environment, packaging and shipping, and operation verification.

SECTION III, OPERATION; contains detailed operating instructions for operation of the instrument.

SECTION IV, PERFORMANCE TESTS; contains the necessary tests to verify that the electrical operation of the instrument is in accordance with published specifications.

SECTION V, ADJUSTMENTS; contains the necessary adjustment procedures to properly adjust the instrument after repair.

SECTION VI, REPLACEABLE PARTS; contains the information necessary to order parts and/or assemblies for the instrument.

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

SECTION VIII, SERVICE; contains schematic diagrams, block diagrams, component location illustrations, circuit descriptions, and troubleshooting information to aid in repair of the instrument.

1-8. On the title page of this manual, below the manual part number, is a microfiche part number. This number may be used to order 4- by 6-inch microfilm transparencies of the manual. Each microfiche contains up to 60 photo-duplicates of the manual pages. The microfiche package also includes the latest Manual Updating supplement.

1-9. SPECIFICATIONS

1-10. 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 HP 8559A meets the specifications listed in Table 1-1, performance tests (Section IV) should be performed every six months.

1-11. SAFETY CONSIDERATIONS

1-12. Before operating this instrument, you should familiarize yourself with the safety markings on the instrument and safety instructions in this manual. This instrument has been manufactured and tested according to international safety standards. However, to ensure safe operation of the instrument and personal safety of the user and service personnel, the cautions and warnings in this manual must be followed. Refer to the summary of safety considerations at the beginning of this section. Refer also to individual sections of this manual for detailed safety notation concerning the use of the instrument as described in those individual sections.

1-13. INSTRUMENTS COVERED BY MANUAL

1-14. Serial Numbers

1-15. Attached to the rear of this instrument is a mylar serial number label. The serial number is in two parts. The first four digits and letter are the serial number prefix; the last five digits are the suffix. (Refer to Figure 1-2.) 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

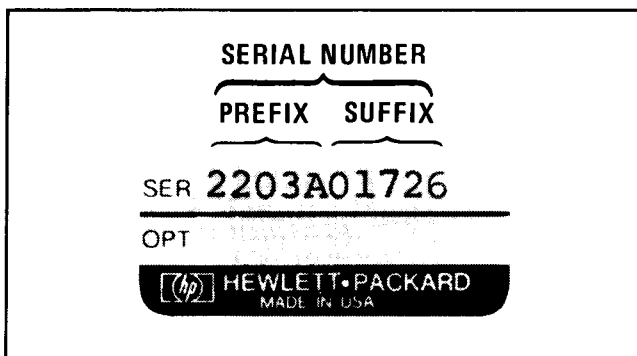


FIGURE 1-2. TYPICAL SERIAL NUMBER LABEL

instruments with the serial number prefix(es) listed under SERIAL NUMBERS on the title page.

1-16. Manual Updating Supplement

1-17. An instrument manufactured after the printing of this manual might 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 Updating 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 current and accurate as possible, Hewlett-Packard recommends that you periodically request the latest Manual Updating supplement. The supplement carries a manual identification block that includes the model number, print date of the manual, and manual part number. Complimentary copies of the supplement are available from Hewlett-Packard. Addresses of Hewlett-Packard offices are located at the back of this manual.

1-19. Manual Backdating Changes

1-20. Instruments manufactured before the printing of this manual have been assigned serial number prefixes other than those for which this manual was written directly. Manual backdating information is provided in Section VII to adapt this manual to earlier serial number prefixes.

1-21. This information should not be confused with information contained in the yellow Manual Updating supplement, which is intended to adapt this manual to instruments manufactured after the printing of this manual.

1-22. ACCESSORIES SUPPLIED

1-23. A type-N male to BNC female adapter, HP Part Number 1250-0780, is supplied with the standard instrument for the use of lightweight cables with BNC connectors.

1-24. Side stop kit, HP Part Number 08558-60131, is supplied to prevent the spectrum analyzer from sliding out of the mainframe. When the side stops are installed, the plug-in cannot be removed from the mainframe. Refer to Section II for installation or removal of the side stops.

1-25. Three graticule overlays provide the operator with reference-level labels for the CRT. HP Part Number 5020-8565 is the overlay for HP 180-series display mainframes. HP Part Number 5020-8566 is the overlay for HP 181-series display mainframes. HP Part Number 5020-8567 is the overlay for HP 182-series display mainframes. For proper installation of the graticule overlay, refer to Section II.

TABLE 1-1. HP MODEL 8559A SPECIFICATIONS (1 OF 4)

SPECIFICATIONS

FREQUENCY SPECIFICATIONS

FREQUENCY RANGE

10 MHz to 21 GHz, covered in six pushbutton-selectable ranges:

Frequency Band GHz	Mixing Mode (n)	Lowest Freq (GHz) [ALT IF]	Highest Freq (GHz)
.01 - 3	1 -	0.010 [0.025]	3.060
6 - 9	1 +	6.035 [6.020]	9.060
3 - 9	2 -	3.033 [3.048]	9.120
9 - 15	2 +	9.058 [9.043]	15.120
6 - 15	3 -	6.055 [6.070]	15.180
12.1 - 21	3 +	12.080 [12.065]	21.000

FREQUENCY SPANS

Full Span (F)

Entire frequency band displayed with frequency of tunable marker indicated by Frequency GHz readout.

Per Division (MHz/Div, kHz/Div)

14 frequency scale calibrations in 1-2-5 sequence from 10 kHz/div to 200 MHz/div. Center frequency is set with the TUNING control and indicated by the FREQUENCY GHz readout.

Zero Span (0)

Analyzer functions as a manually tuned receiver, at the frequency indicated by the FREQUENCY GHz readout, for time-domain display of signal modulation.

FREQUENCY ACCURACY

Tuning Accuracy

Frequency GHz readout (center or marker frequency), after zeroing on the LO feedthrough:

0.01 - 3.0 GHz: ± (1 MHz + 0.3% of center frequency)

3.0 - 21.0 GHz: ± (5 MHz + 0.2% of center frequency)

Frequency Readout Resolution

1 MHz

Frequency Span Accuracy

± 5% of displayed frequency separation

SPECTRAL RESOLUTION AND STABILITY

Resolution Bandwidths

Eight selectable resolution (3-dB) bandwidths in 1-3 sequence from 1 kHz to 3 MHz. Bandwidth may be selected independently or coupled with frequency span. Optimum ratio of frequency span to resolution bandwidth is indicated by alignment of markers (><) on the two controls.

Resolution Bandwidth Accuracy:

Individual resolution bandwidth 3-dB points: < ± 15% (< ± 30% for 3-MHz bandwidth)

Selectivity:

60-dB/3-dB resolution bandwidth ratio: < 15:1

Stability

For fundamental mixing (n = 1 - or 1 +):

Residual FM:

< 2 kHz p-p in 0.1 second¹

Noise Sidebands:

≥ 70 dB down, > 30 kHz from center of CW signal with 1 kHz resolution bandwidth and video filter at MAX (not in detent).

Video Filter

Post-detection low-pass filter averages displayed noise for a smooth trace. The MAX (detent) position selects a video filter bandwidth of approximately 1.5 Hz for noise level measurement.

AMPLITUDE SPECIFICATIONS

AMPLITUDE RANGE

- 111 dBm to + 30 dBm.

¹< 2 kHz p-p in 0.1 second in a 180-series display main-frame with 220/240 line voltage.

TABLE 1-1. HP MODEL 8559A SPECIFICATIONS (2 OF 4)

Maximum Input (without damage) Levels

Total Power:

+ 20 dBm (0.1W, 2.2 Vrms) with 0 dB input attenuation

+ 30 dBm (1W, 7.1 Vrms) with ≥10 dB input attenuation

DC: ±7.1V

AC (<100 Hz): 7.1 Vrms

Peak Pulse Power:

+ 50 dBm (100W, <10 μsec pulse width, 0.01% duty cycle) with input attenuation ≥30 dB

Gain Compression

<0.5 dB for a -10 dBm input level with 0 dB input attenuation.

Average Noise Level

The displayed average noise level determines sensitivity (minimum discernible signal). Signals at this input level peak approximately 3 dB above the displayed noise.

Maximum average noise level with 1 kHz resolution bandwidth, 0 dB input attenuation, and video filter at MAX (detent):

Frequency Band (GHz)	Harmonic Mode	Average Noise Level (dBm)
.01 — 3	1 -	-111
6 — 9	1 +	-108
3 — 9	2 -	-103
9 — 15	2 +	-98
6 — 15	3 -	-93
12.1 — 18	3 +	-92
18 — 21	3 +	-90

Calibrated Display Range

Log (from Reference Level):

70 dB with 10 dB/DIV Amplitude Scale

8 dB with 1 dB/DIV Amplitude Scale

Linear:

8 divisions with LIN Amplitude Scale

AMPLITUDE ACCURACY

With AUTO sweep time selected, amplitude accuracy is determined by one or more of the following factors, depending on the measurement technique.²

²When switching to or from the Alternate IF, the REF LEVEL CAL and the FREQ CAL should be readjusted. Without readjustment, an additional reference level error of ±1 dB and an additional frequency readout error of ±1 MHz may result.

Calibrator Output

-10 dBm ± 0.3 dB (into 50Ω)

35 MHz ± 400 kHz

Reference Level

10-dB steps and a 12-dB vernier for calibrated Reference Level adjustment from -112 dBm to +60 dBm.³

Step Accuracy (with 0 dB input attenuation):

-10 dBm to -80 dBm: ±0.5 dB

-10 dBm to -100 dBm: ±1.0 dB

Vernier Accuracy:

±0.5 dB

Frequency Response

Frequency response, measured with 0 or 10 dB input attenuation, includes input attenuator flatness, mixer flatness, and band-to-band amplitude variation:

Frequency Band GHz	Frequency Response (± dB MAX.)
.01 — 3	1.0
6 — 9	1.0
3 — 9	1.5
9 — 15	1.8
6 — 15	2.1
12.1 — 18	2.3
18 — 21	3.0

Input Attenuator

0 dB to 70 dB of input attenuation selectable in 10-dB steps

Step Accuracy:

0 dB to 60 dB, 0.01 to 18.0 GHz: <±1.0 dB per 10-dB step

Maximum Cumulative Step Error:

0 dB to 60 dB, 0.01 to 18.0 GHz: <±2.4 dB

Bandwidth Switching (Amplitude Variation)

Bandwidths 3 MHz to 300 kHz: <±0.5 dB

Bandwidths 3 MHz to 1 kHz: <±1.0 dB

³Input level not to exceed maximum levels.

TABLE 1-1. HP MODEL 8559A SPECIFICATIONS (3 OF 4)

Display Fidelity

CRT linearity and log or linear fidelity affect amplitude accuracy at levels other than Reference Level.

Log Incremental Accuracy:

± 0.1 dB per dB from Reference Level

Log Maximum Cumulative Error:

$\leq \pm 1.5$ dB over entire 70-dB range

Linear Accuracy:

$\pm 3\%$ of Reference Level

RESIDUAL RESPONSES

< -90 dBm (0.01 – 3.06 GHz)⁴ with 0 dB input attenuation and no signal present at input.

SWEEP SPECIFICATIONS**SWEEP TIME****Automatic (AUTO):**

Sweep time adjusted automatically to maintain absolute amplitude calibration for any combination of frequency span, resolution bandwidth, and video filter bandwidth.

Calibrated Sweep Times (sec/Div, mSec/Div, μ Sec/Div):

20 selectable sweep times in 1-2-5 sequence from 2 μ sec/div to 10 sec/div (excluding 2 sec/div), provided primarily for time-domain calibration in zero span (0).

Sweep time accuracy: $\pm 10\%$ ($\pm 20\%$ for 5 and 10 sec/div)

GENERAL SPECIFICATIONS**TEMPERATURE RANGE**

Operating: 0°C to +55°C

Storage: -40°C to +75°C

HUMIDITY RANGE

Type-tested from 50% to 95% relative humidity ($\leq +40^\circ\text{C}$) per requirements of MIL-STD-810C, Method 507.1, Procedure IV.

⁴0.025 – 3.06 GHz with ALT IF selected.

EMI

Conducted and radiated interference is in compliance with MIL-STD 461A, Methods CE03 and RE02, CISPR Publication 11 (1975) and Messemphaenger Postverfuegung 526/527/79 (Kennzeichnung Mit F-Nummer/Funkschutzzeichen).

POWER REQUIREMENTS**HP Model 853A Display with HP Model 8559A Spectrum Analyzer:**

100 or 120 Vac $\pm 5\%$ – 10%, 48 to 66 Hz, single-phase. Power consumption less than 200 Volt-amperes with plug-in installed.

HP Model 182T/180TR Display with HP Model 8559A Spectrum Analyzer:

115 or 230 Vac $\pm 10\%$, 48-440 Hz. Power consumption less than 200 Volt-amperes with plug-in installed, convection cooled.

HP Model 181T/181TR Display with HP Model 8559A Spectrum Analyzer:

115 or 230 Vac $\pm 10\%$, 48-440 Hz. Power consumption less than 225 Volt-amperes with plug-in installed, convection cooled.

WEIGHT**HP Model 8559A Spectrum Analyzer:**

Net: 5.5 kg (12.1 lbs)

Shipping: 9.1 kg (20 lbs)

HP Model 853A Display:

Net: 15.9 kg (35 lbs)

Shipping: 18.6 kg (41 lbs)

HP Model 853A Option 001 Display:

Net: 14.5 kg (32 lbs)

Shipping: 17.3 kg (38 lbs)

HP Model 182T Display:

Net: 12.5 kg (27 lbs)

Shipping: 16.5 kg (36 lbs)

HP Model 181T Display:

Net: 11.0 kg (24 lbs)

Shipping: 15.5 kg (34 lbs)

HP Model 181TR Display:

Net: 12.0 kg (26 lbs)

Shipping: 17.5 kg (38 lbs)

HP Model 180TR Display:

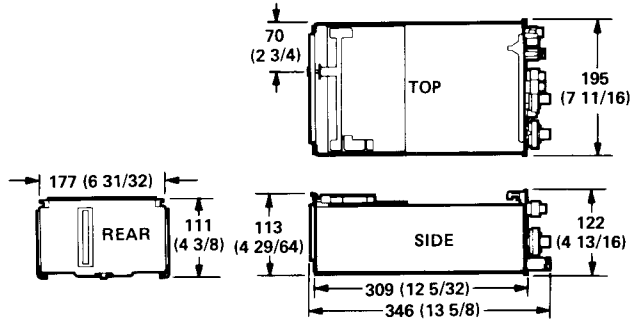
Net: 12.0 kg (26 lbs)

Shipping: 17.5 kg (38 lbs)

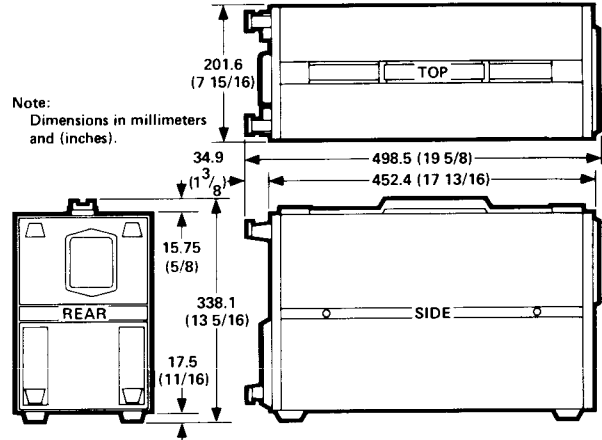
TABLE 1-1. HP MODEL 8559A SPECIFICATIONS (4 OF 4)

DIMENSIONS

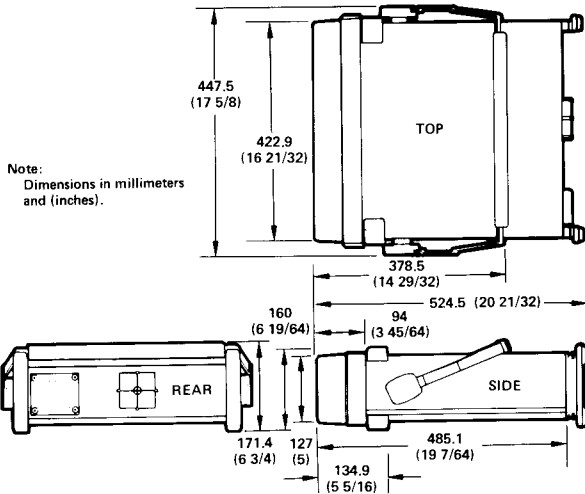
HP Model 8559A Spectrum Analyzer:



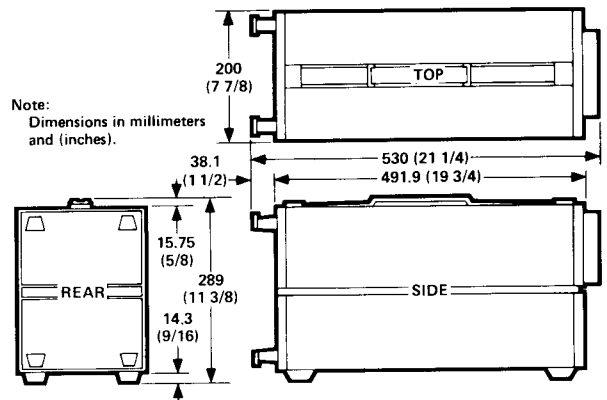
HP Model 182T Display:



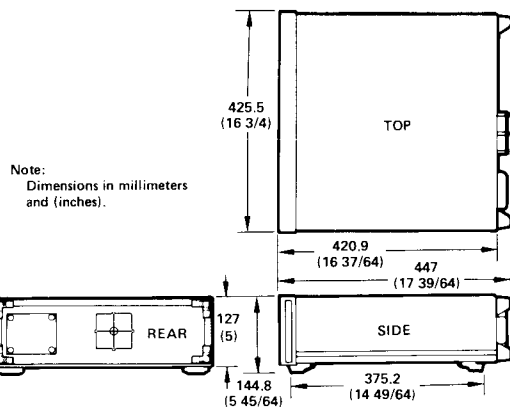
HP Model 853A Display:



HP Model 181T Display:



HP Model 853A Option 001 Display:



HP Model 180TR/181TR Display:

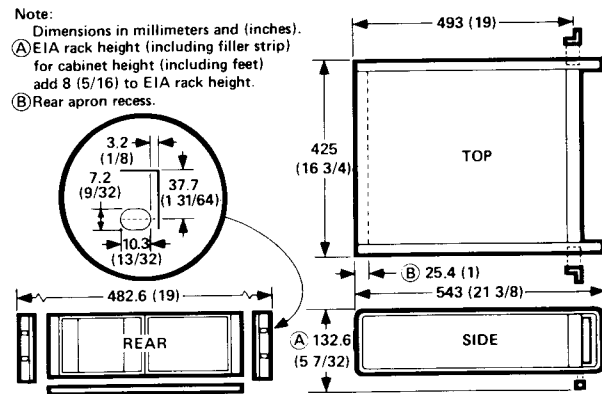


TABLE 1-2. MODEL 8559A/180-SERIES SUPPLEMENTAL CHARACTERISTICS (1 OF 3)

SUPPLEMENTAL CHARACTERISTICS

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

FREQUENCY CHARACTERISTICS

FREQUENCY ACCURACY

Frequency Cal

Adjusts digital FREQUENCY GHz readout. FREQUENCY CAL control may be used to calibrate the frequency readout on a known signal or on the 35 MHz CAL OUTPUT signal.

FREQUENCY RANGE

Alternate IF

Regular IF approximately 3.0075 GHz. Alternate IF available at approximately 2.9925 GHz for all frequency bands (minimum frequency 25 MHz).

SPECTRAL RESOLUTION AND STABILITY

Frequency Drift

(Fundamental mixing - n = 1 - or 1 +)

At fixed center frequency after 2-hour warmup:

< ± 25 kHz/10 minutes

With temperature changes:

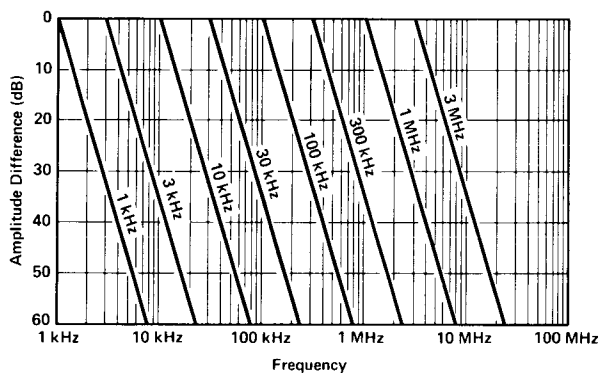
< 200 kHz/°C

Resolution Bandwidth Shape

Approximately gaussian (synchronously-tuned, 4-pole filter).

Spectral Resolution

The following graph shows typical spectrum analyzer resolution for different resolution bandwidths.



SIGNAL RESOLUTION VS. FREQUENCY SEPARATION

AMPLITUDE CHARACTERISTICS

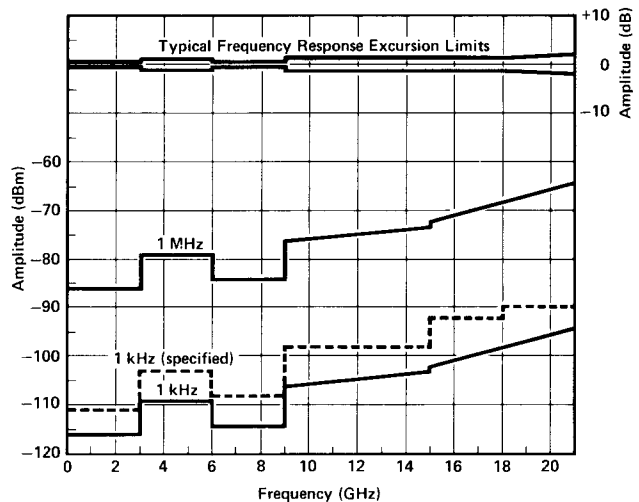
AMPLITUDE RANGE AND ACCURACY

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): >70 dB.

Frequency Response and Average Noise Level

The following graph shows typical frequency response and average noise level versus frequency.



AVERAGE NOISE LEVEL AND FREQUENCY RESPONSE

Amplitude Scale Switching

Reference Level variation is typically less than + / - 1 dB for any change in Amplitude Scale.

SPURIOUS RESPONSES

(with 0 dB input attenuation)

Second Harmonic Distortion

Input Power	Relative Distortion
-40 dBm	< -70 dB

TABLE 1-2. MODEL 8559A/180-SERIES SUPPLEMENTAL CHARACTERISTICS (2 OF 3)

SUPPLEMENTAL CHARACTERISTICS

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

Third Order Intermodulation Distortion

For Two Input Signals with		Relative Distortion
Input Power	Signal Sep.	
-30 dBm	50 kHz	<-70 dB

Signal Identifier

Signal identifier provided over entire frequency range and in all Frequency Span/Div settings. Correct signal response is a 1 MHz shift to the left and approximately a 6 dB lower amplitude.

SWEEP CHARACTERISTICS

MANUAL SWEEP

Spectrum analyzer may be swept manually, in either direction, with front panel control.

SWEEP TRIGGER

Free Run

End of each sweep triggers new sweep.

Line

Sweep triggered at ac line frequency.

Video

Sweep triggered on post-detection video waveform. One-half major division of vertical deflection required to trigger sweep.

Single

Single sweep started or reset by turning SWEEP TRIGGER clockwise momentarily.

FRONT PANEL INPUT AND OUTPUT CHARACTERISTICS

SIGNAL INPUT

Input Impedance

50 ohms nominal; Precision Type N female connector.

Input SWR

<2.0 SWR with 0 dB input attenuation
<1.3 SWR with ≥ 10 dB input attenuation

LO Emission (3.0 – 6.1 GHz)

≤ -8 dBm with 0 dB input attenuation

REAR PANEL OUTPUT CHARACTERISTICS¹

VERTICAL, PENLIFT/BLANKING, AND HORIZONTAL OUTPUTS (AUX A, B, D)

These outputs are compatible with and may be used to drive HP X-Y Recorders (using positive pencoils or TTL penlift input) and CRT monitors.

AUX A VERTICAL OUTPUT

BNC output provides detected video signal from a 50-ohm output impedance. Typical 0 – 800 mV range corresponds to full 8-division CRT vertical deflection.

AUX B PENLIFT/BLANKING OUTPUT

BNC output provides a +15V penlift/blinking signal from a 10K-ohm output impedance when CRT trace is blanked. Otherwise, output is low at 0V (low impedance, 150 mA max.) for an unblanked trace.

¹Rear panel outputs refer to 180T-series display mainframes and other 180-series mainframes with Option 807 installed. Horizontal, vertical, and blanking outputs, attenuated and shifted in dc level, are available on other 180-series mainframes at the MAIN SWEEP, MAIN GATE, and DELAYED GATE outputs, respectively. DO NOT connect an X-Y recorder to the DELAYED GATE OUTPUT, or damage will result.

TABLE 1-2. MODEL 8559A/180-SERIES SUPPLEMENTAL CHARACTERISTICS (3 OF 3)

SUPPLEMENTAL CHARACTERISTICS

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

AUX C 21.4 MHz IF OUTPUT

BNC output provides 21.4 MHz IF signal (linearly related to spectrum analyzer RF input) from a 50-ohm output impedance. Output bandwidth controlled by spectrum analyzer RESOLUTION BW setting; output amplitude controlled by INPUT ATTEN, REFERENCE LEVEL FINE, and first six REFERENCE LEVEL positions (i.e., -10 through -60 dBm

with 0 dB input attenuation). Output level is approximately -10 dBm into 50 ohms with a signal displayed at Reference Level.

AUX D HORIZONTAL OUTPUT

BNC output provides horizontal sweep voltage from a 5K-ohm output impedance. -5V to +5V range corresponds to full 10-division CRT horizontal deflection.

1-26. EQUIPMENT REQUIRED BUT NOT SUPPLIED

1-27. Display Mainframe

1-28. An HP 853A digital Spectrum Analyzer Display is recommended for use with the HP 8559A. The rear panel of the HP 853A mainframe provides the following output connections: HORIZ (SWEEP), VERTICAL (VIDEO), BLANK (PENLIFT), 21.4 MHz IF, and HP-IB interface connector.

1-29. An HP 180T-series display mainframe (180TR, 181T, 181TR, or 182T) is also designed for use with the HP 8559A. In the HP 180T-series mainframe, the rear-panel auxiliary output connectors (AUX A, AUX B, AUX C, and AUX D) provide, respectively, Vertical Output, Pen Lift Output, 21.4 MHz IF Output, and Horizontal Output. A standard HP 180-series display mainframe (HP 180A/AR, HP 180C/D, HP 181A/AR, HP 182A/C, or HP 184A/B) provides only horizontal, vertical, and blanking rear panel outputs. Furthermore, these outputs are attenuated and shifted in dc level. Unbuffered rear panel outputs (similar to the HP 180T-series) are provided only if Option 807 is installed.

1-30. Extender Cable Assembly

1-31. An Extender Cable Assembly (Figure 1-3), HP Part Number 5060-0303, allows operation of the HP 8559A outside the display mainframe. This provides access to the HP 8559A for necessary adjustments and some performance tests. This cable is also useful for troubleshooting.

1-32. EQUIPMENT AND ACCESSORIES AVAILABLE

1-33. Input Limiter

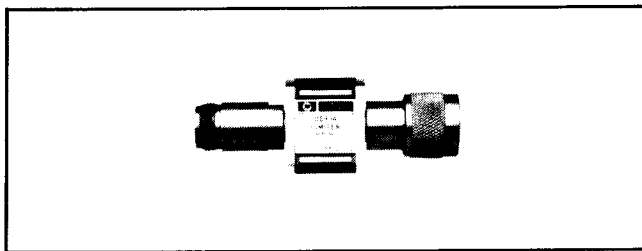


FIGURE 1-3. HP 11683A LIMITER

1-34. The HP 11693A Limiter can be used with the HP 8559A to prevent input mixer damage due to inadvertent application of strong signals. Frequency

response flatness is degraded by less than ± 0.5 dB from 100 MHz to 12.4 GHz; the limiter is usable from 10 MHz to 18 GHz. Input levels of 1 watt average or 75 watts peak can be tolerated.

1-35. Low Pass Filter

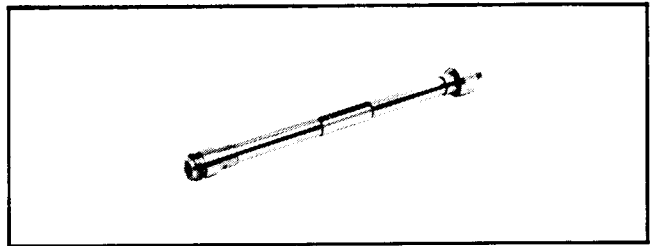


FIGURE 1-4. HP 11870A LOW PASS FILTER

1-36. The HP 11870A Low Pass Filter (dc-2.6 GHz) can be used with the HP 8559A to reject signals above 3 GHz by more than 60 dB for image-free measurements over the 10 MHz to 2.6 GHz range.

1-37. Modification Kit (Option 807 Connections)

1-38. A modification kit, HP Part Number 00180-69503, provides the materials and information necessary to install unbuffered rear panel connections (formerly included in Option 807) in the following display mainframes: HP 180A/AR, HP 180C/D, HP 181A/AR, HP 182A/C, and HP 184A/B. Refer to Table 1-3 for a description of parts included in the modification kit.

1-39. Oscilloscope Camera

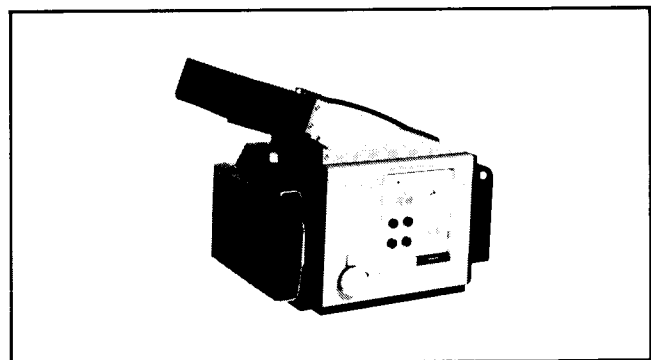


FIGURE 1-5. HP 197B Opt 002, 006 OSCILLOSCOPE CAMERA

1-40. The HP 197B, Option 002, General Purpose Camera can be used with HP 180- and HP 181-series display mainframes to make a permanent record of measurements. The HP 10367A adapter allows the camera to be used with HP 182-series mainframes.

TABLE 1-3. PARTS INCLUDED IN MODIFICATION KIT 00180-69503

Quantity	Description	HP Part Number
1	Output Amplifier Assembly (Auxiliary Output Board)	00180-66551
1	Label	7120-3116
2	3/4 inch pieces of shrink tubing	0890-0720
1	Service Note	180A/AR-10, 180C/D-2, 181A/AR8, 182A/C-1, or 184/B-1 (modification is similar for all instruments listed)

1-41. SERVICE ACCESSORIES

1-42. Service accessories are shown in Figure 1-6.

1-43. RECOMMENDED TEST EQUIPMENT

1-44. Table 1-4 lists all of the equipment required for testing, adjusting and troubleshooting the Hewlett-Packard Model 8559A Spectrum Analyzer. Other equipment may be substituted if it meets or exceeds the critical specifications listed in the table.

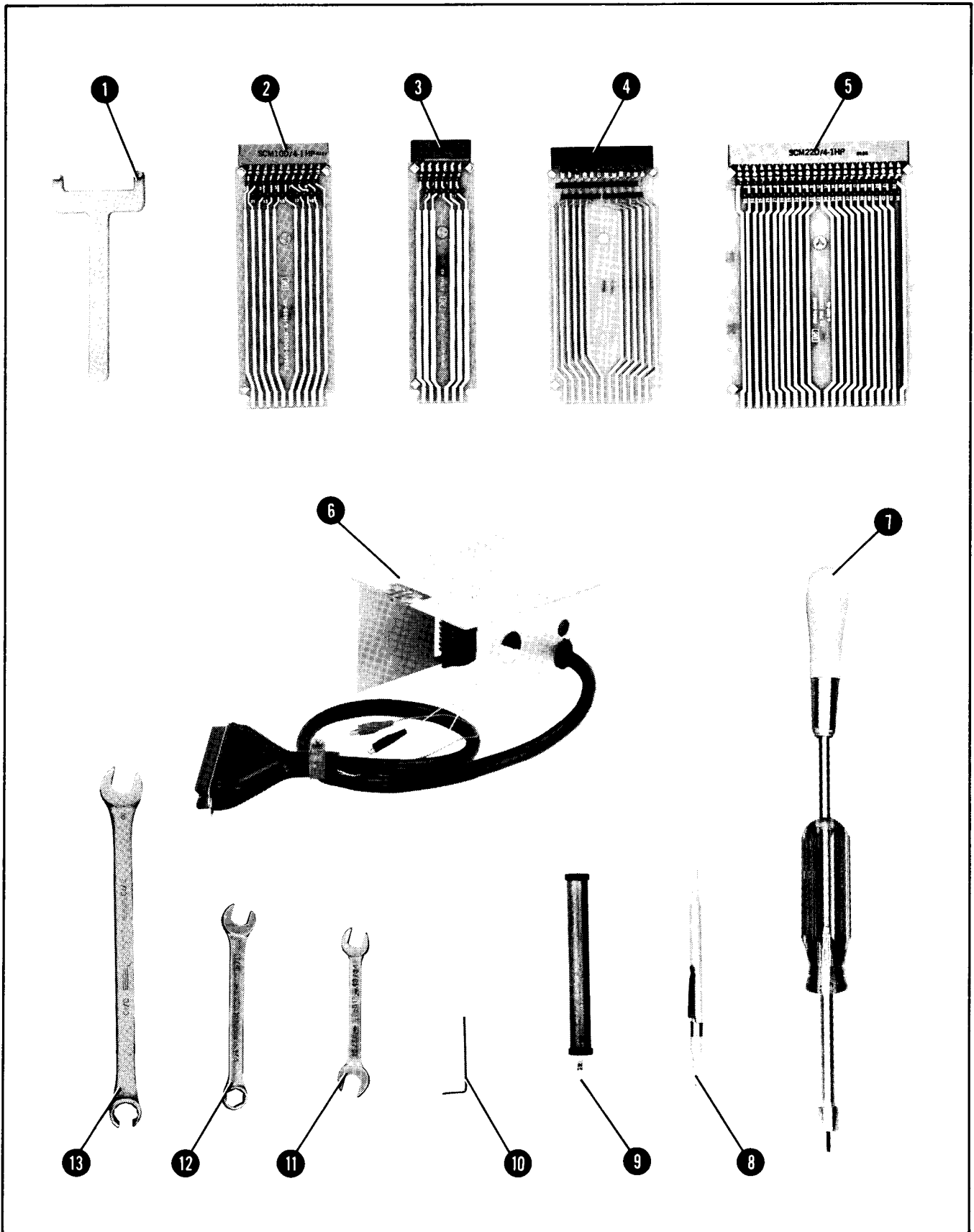


FIGURE 1-6. SERVICE ACCESSORIES (1 OF 2)

Item	Description	CD	HP Part Number
1	Board Puller, 2 prongs to lift PC boards	1	03950-4001
2	Extender Board, 6 pin, 12 contacts <i>60.00</i>	8	08505-60109
3	Extender Board, 10 pin, 20 contacts <i>76.00</i>	2	85680-60028
4	Extender Board, 12 pin, 24 contacts <i>82.50</i>	2	08559-60042
5	Extender Board, 22 pin, 44 contacts <i>115.00</i>	8	08565-60107
6	Extender Cable Assembly, for plug-in operation out of display mainframe	9	5060-0303 <i>300</i>
7	Tuning Tool, modified 5/16 inch nut driver with modified No. 10 Allen driver	6	08555-60107
8	Alignment tool, metal tip in plastic	7	8710-0630
9	Alignment tool, non-metallic <i>22.50</i>	4	8710-0033
10	Wrench, No. 2 Bristol	0	8710-0055
11	Wrench, 15/64 inch, combination	8	8710-0946
12	Wrench, 1/4 inch, open end	2	8720-0014
13	Wrench, 5/16 inch, slotted box end/open end	9	08555-20097

FIGURE 1-6. SERVICE ACCESSORIES (2 OF 2)

TABLE 1-4. RECOMMENDED TEST EQUIPMENT (1 OF 4)

Instrument	Critical Specifications	Recommended Model	Use*
Display Mainframe	HP 180 Series with Variable Persistence	HP 181 T/TR	P, A, T
Sweep Oscillator	Mainframe for RF Plug-Ins below. External Sweep Adjustable Sweep range (Marker Sweep)	HP 8620C	P, A
RF Plug-In	Compatible with mainframe above. Output Frequency: 0.01 to 2.4 GHz Output Amplitude: 0 to +10 dBm adjustable FM and Phase Lock Internal and External leveling (both crystal detector and power meter)	HP 86222A/B	P, A
RF Plug-In	Compatible with mainframe above. Output Frequency: 2 to 21 GHz Output Amplitude: Band 1, 0 to +10 dBm adjustable Band 2, 0 to +10 dBm adjustable Band 3, 0 to +3 dBm adjustable Band 4, 0 to +3 dBm adjustable FM and Phase Lock Internal and External leveling (both crystal detector and power meter)	HP 86290B-H08 ¹	P, A
Signal Generator	Output Frequency: 21.4 MHz and 321.4 MHz Output Amplitude: -40 to 0 dBm adjustable	HP 8640B	P, A, T
Function Generator	Output Frequency: 1 Hz to 1 MHz adjustable Output Amplitude: 0 to 15V p-p adjustable Triangle-Wave Output	HP 3310A	P, A
Comb Generator	1 MHz comb teeth to 3 GHz 100 MHz comb teeth to 21 GHz	HP 8406A	P, A
Spectrum Analyzer	Frequency Range: 20 MHz to 6 GHz Maximum Input Level: ≥ 0 dBm Amplitude Scale: Log 10 dB/DIV and 1 dB/DIV Minimum Resolution Bandwidth: ≤ 300 kHz Adjustable Reference Level	HP 8569B	A, T
Synchronizer	Input Frequency: 21.4 MHz Sensitivity: 6 MHz/Volt Error Voltage Output Polarity: + and - Selectable	HP 8709A-H10 ²	A

*P = Performance Test; A = Adjustments; T = Troubleshooting

¹Option H08 extends the frequency range of the standard HP 86290B from 18.6 GHz to 22 GHz. A standard (18.6 GHz) may be used if Option H08 (22 GHz) is not available.

²Option H10 changes input frequency to 21.4 MHz and adds error voltage output polarity selection capability.

TABLE 1-4. RECOMMENDED TEST EQUIPMENT (2 OF 4)

Instrument	Critical Specifications	Recommended Model	Use*
Oscilloscope	Frequency: 500 Hz Display Amplitude: -15 Vdc Single-Channel	HP 1740A	A, T
Frequency Counter	Frequency Range: 20 MHz to 23 GHz Sensitivity: -15 dBm Resolution: 0.1 MHz	HP 5342A-005	P, A, T
Universal Counter	Time Interval Measurement from 1 ms to 500 ms	HP 5300B/5302A	P, A
Digital Voltmeter	Range: -12 to +15 Vdc Accuracy: ± 1 mV	HP 3456A	P, A, T
Power Meter	Range: -20 to +10 dBm Resolution: 0.1 dB	HP 435A/B	P, A
Power Sensor	Frequency Range: 50 MHz to 26.5 GHz Maximum SWR: 1.15, 50 MHz to 100 MHz 1.10, 100 MHz to 2 GHz 1.15, 2 to 12.4 GHz 1.20, 12.4 to 18 GHz 1.25, 18 to 26.5 GHz	HP 8485A	P, A
Power Sensor	Frequency Range: 10 MHz to 18 GHz Maximum SWR: 1.40, 10 MHz to 30 MHz 1.18, 30 MHz to 50 MHz 1.10, 50 MHz to 2 GHz 1.18, 2 to 12.4 GHz 1.28, 12.4 to 18 GHz	HP 8481A	P, A
Power Splitter	Frequency Range: 10 MHz to 18 GHz Tracking between output arms: ≤ 0.25 dB Connectors: Type N (f) input, Type N (m) outputs	HP 11667A-C16 ³	P, A
Step Attenuator	Frequency Range: 20 MHz to 350 MHz Attenuation Range: 0 to 90 dB in 10 dB steps Step Accuracy: ± 0.1 dB Overall Accuracy (0 to 90 dB): ± 0.2 dB	HP 355D-H82 ⁴	P, A
Step Attenuator	Frequency Range: 20 MHz to 350 MHz Attenuation Range: 0 to 12 dB in 1 dB steps Step Accuracy: ± 0.05 dB Overall Accuracy (0 to 12 dB): ± 0.1 dB	HP 355C-H80 ⁵	P, A

*P = Performance Test; A = Adjustments; T = Troubleshooting

³ Option C16 provides Type N (m) output connectors to eliminate the use of adapters.

⁴ Option H82 is selected for best attenuation accuracy and provides calibration data at 30 MHz and 280 MHz.

⁵ Option H80 is selected for best attenuation accuracy and provides calibration data at 100 MHz.

TABLE 14. RECOMMENDED TEST EQUIPMENT (3 OF 4)

Instrument	Critical Specifications	Recommended Model	Use*
Fixed Attenuator (2 required)	Frequency Range: 10 MHz to 18 GHz Attenuation: 20 dB \pm 1.0 dB Connectors: Type N (m) (f)	HP 8491B Option 020 ⁶	P, A
Fixed Attenuator	Frequency Range: 10 MHz to 18 GHz Attenuation: 10 dB \pm 0.5 dB Connectors: Type N (m) (f)	HP 8491B Option 010 ⁶	P, A
Crystal Detector	Frequency Range: 10 MHz to 21 GHz Frequency Response: \pm 0.6 dB, .01 to 18 GHz Maximum SWR: \leq 1.5, .01 to 18 GHz Output Polarity: Negative Connectors: APC -3.5 (SMR) (m) input, SMC (m) output	HP 33330C	P, A
Termination	Frequency Range: 10 MHz to 18 GHz Impedance: 50 Ω Connector: Type N (m)	HP 909A Option 012 ⁷	P
Tuning Voltage Circuit	Refer to Figure 5-17	None	A
Crystal Bypass Networks	Refer to Figure 5-6	None	A
Special Extender Board	Refer to Figure 5-9	None	A
Extender Cable	Extends Spectrum Analyzer Plug-In for Servicing Refer to Figure 1-3.	HP 5060-0303	P, A, T
Cable	Frequency Range: 10 MHz to 21 GHz Maximum SWR: \leq 1.4 at 21 GHz Length: 61 cm (24 inches) Connectors: SMA (m) both ends	HP 8120-1578	P, A
Cable	BNC (m) to SMC (f), 36 inches long	HP 11592-60001	P, A
Cable	48 inch, 50 Ω coaxial cable with BNC (m) connectors on both ends (3 required)	HP 10503A	P, A, T
Cable	RG-214/U with Type N connectors (2 required)	HP 11500A	P, A
Cable	BNC (m) to Banana Plug	HP 10111A	P, A, T
Test Cable	Connectors: BNC (m) to SMB (f) Length: \geq 61 cm (24 inches)	HP 85680-60093	A, T

*P = Performance Test; A = Adjustments; T = Troubleshooting

⁶ Option number specifies attenuation value.

⁷ Option 012 provides type N male connector.

TABLE 1-4. RECOMMENDED TEST EQUIPMENT (4 OF 4)

Instrument	Critical Specifications	Recommended Model	Use*
Adapter	Type N (m) to BNC (f) (2 required)	HP 1250-0780	P, A, T
Adapter	Type N (m) to SMA (f) (2 required)	HP 1250-1250	P, A
Adapter	Type N (f) to SMA (f) (2 required)	HP 1250-1745	P, A
Adapter	Type N (f) to Type N (f) (2 required)	HP 1250-1472	P, A
Adapter	Type N (f) to BNC (m)	HP 1250-1477	P
Adapter	BNC (f) to SMC (m)	HP 1250-0832	A
Adapter	BNC (f) to BNC (f)	HP 1250-0080	P
Adapter	BNC (f) to alligator clips (2 required)	HP 8120-1292	A, T
Adapter	BNC (f) to SMB (f)	HP 1250-1236	P
Adapter	SMB (m) to SMB (m)	HP 1250-0669	A
Adapter	SMB (f) to SMB (f)	HP 1250-0672	A
Adapter	SMC (m) to SMC (m)	HP 1250-0827	A
Adapter	BNC Tee	HP 1250-0781	P, A
Tuning Tool	Allen Driver inserted through drilled-out 5/16" nut driver	HP 08555-60107	A
*P = Performance Test; A = Adjustments; T = Troubleshooting			

SECTION II INSTALLATION AND OPERATION VERIFICATION

2-1. INTRODUCTION

2-2. This section includes information on initial inspection, preparation for use, and storage and shipping requirements for the HP 8559A.

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. The electrical performance is checked by the Operation Verification procedure in this section. If the contents are incomplete, or if the instrument does not pass Operation Verification tests, 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. Installation

2-7. When properly installed, the spectrum analyzer obtains all necessary power from the display mainframe. The rear panel connector provides the interface.

CAUTION

BEFORE SWITCHING ON THIS INSTRUMENT, make sure it is adapted to the voltage of the ac power source to be used and the proper fuse is installed. Failure to set the ac power input of the instrument for the correct voltage level could cause damage to the instrument when plugged in. Refer to the display mainframe Operation and Service Manual for line voltage and fuse selection.

2-8. To install the spectrum analyzer in the mainframe:

- a. Set display mainframe LINE switch to OFF.
- b. Pull out lock knob and slide plug-in toward rear of compartment until it is seated firmly in place.
- c. Push in lock knob to secure spectrum analyzer in mainframe.

2-9. Side Stop Kits

2-10. Side stops unique to the installation of this instrument into the HP 853A Spectrum Analyzer Display are included with the HP 853A. Refer to the HP 853A Operation and Service Manual for further information.

2-11. Installation of a Side Stop Kit, HP Part Number 08558-60131, prevents the removal of the analyzer from the HP 180-series mainframe without the use of hand tools. This kit contains two side stops, mounting hardware, label, and installation instructions. (Refer to Table 2-1 for part numbers of individual items.)

TABLE 2-1. SIDE STOP KIT (08558-60131)

Quantity	Description	HP Part Number	C D
2	SIDE STOP	08558-00094	7
4	MACHINE SCREW, 4-40, .438 IN-LG 82 DEG FLATHEAD	2200-0168	9
1	LABEL, FRONT-PANEL	7120-8131	7
1	LABEL, INSTRUCTIONS	7120-8215	8

2-12. To install side stops:

WARNING

Before removing covers from display mainframe, disconnect line power by removing ac power cord.

1. Remove side covers from bottom section of mainframe. (Remove only right side cover if mainframe is a rack-mounted model.)
2. Use flathead machine screws to install side stops as shown in Figure 2-1.
3. Reinstall side covers on mainframe.

4. Place label on front panel of spectrum analyzer (upper right-hand corner) to indicate that the plug-in is secured with side stops.

2-13. To remove side stops:

WARNING

Before removing covers from display mainframe, disconnect line power by removing ac power cord.

1. Remove side covers from bottom section of mainframe. (Remove only right side cover if mainframe is a rack-mounted model.)
2. Remove side stops. See Figure 2-1.
3. Reinstall side covers on display mainframe.

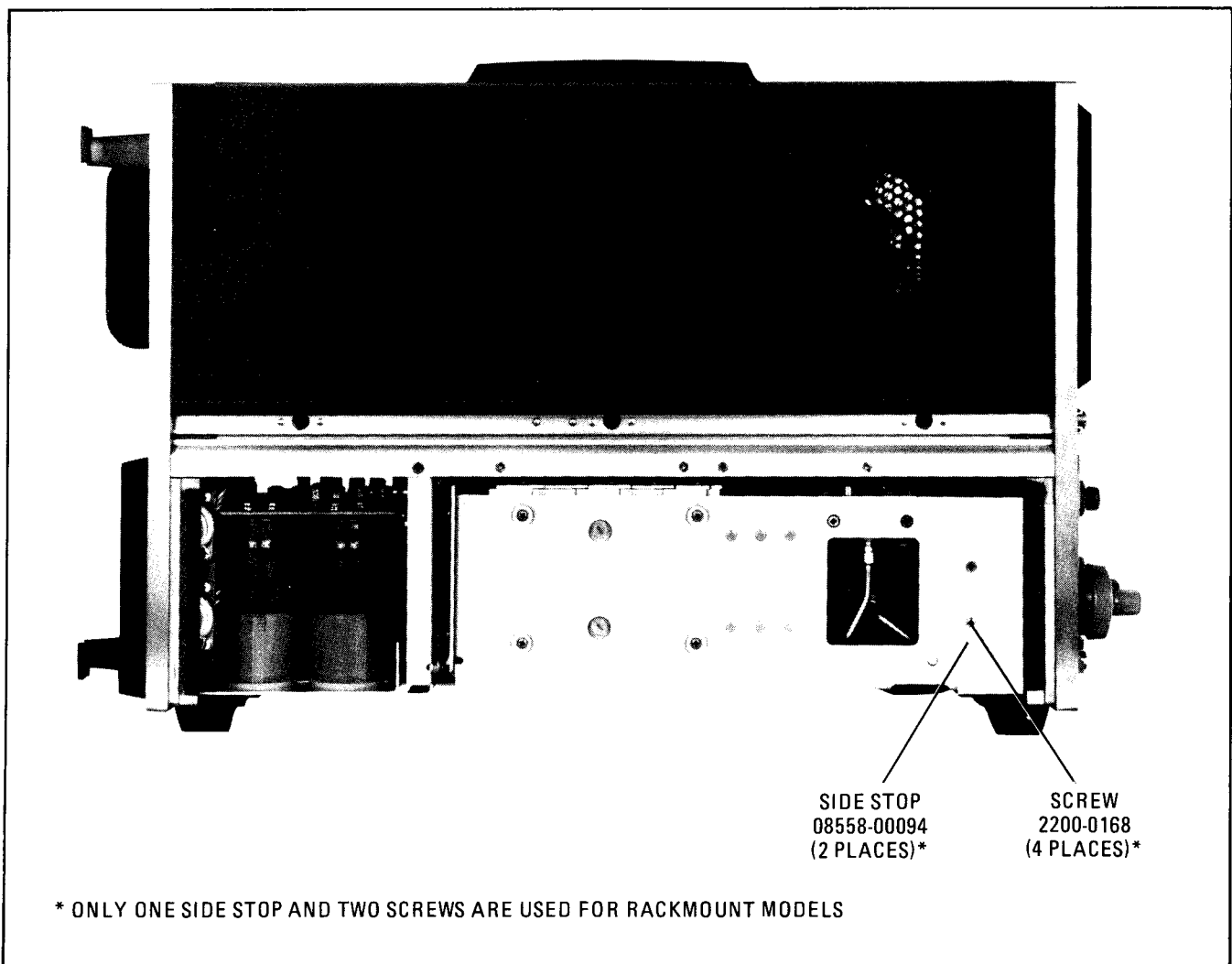


FIGURE 2-1. LOCATION OF SIDE STOPS

2-14. Graticule Overlays

2-15. To install a graticule overlay:

1. Select proper overlay. HP Part Number 5020-8565 is for HP 180TR display mainframes, HP Part Number 5020-8566 is for HP 181T/TR display mainframes, and HP Part Number 5020-8567 is for HP 182T display mainframes.
2. For HP 180TR and HP 181T/TR mainframes, remove CRT bezel and metallic-mesh contrast filter. Insert proper overlay and replace contrast filter and CRT bezel.
3. For HP 182T mainframes, grasp top portion of CRT bezel and pull straight up. Remove metallic-mesh contrast filter and insert proper overlay and contrast filter. (Either the metallic-mesh contrast filter or a light blue contrast filter may be used.)
4. Slide bezel back into place to retain overlay and filter.

2-16. When the HP 8559A is properly installed in the display mainframe, the interconnections are as listed in Table 2-2.

2-17. Operating Environment

2-18. Temperature. This instrument has been type tested for 95 percent relative humidity at 40°C for five days. The operating environment should be within the following limits:

Temperature 0 to 55°C
 Altitude <4572 meters (15,000 feet)

2-19. Modifications

2-20. A Modification Kit, HP Part Number 00180-69503, provides materials and information necessary to add Option 807 rear-panel connections to the standard HP 180-series display. Refer to Table 1-3 in Section I. Option 807 is factory-installed in HP 180TR, HP 181T, HP 181TR, and HP 182T mainframes. The modification kit is required for use with other mainframes if all four rear-panel outputs are needed.

TABLE 2-2. HP MODEL 8559A MAINFRAME INTERCONNECTIONS

Pin on P1	Signal or Voltage	Pin on P1	Signal or Voltage
1	CRT HORIZ (adjusted horizontal signal)	17	BLANKING
2	GROUND from mainframe (jumpered to pin 8)	18	NC
3	NC	19	GROUND from mainframe (jumpered to pin 24)
4	L NORM	20	AUTO SWP
5	Y NORM	21	BEAM FINDER
6	NC	22	NC
7	SING SWP	23	NC
8	GROUND from mainframe (jumpered to pin 2)	24	GROUND from mainframe (jumpered to pin 19)
9	MAN SWP	25	NC
10	NC	26	NC
11	AUX D Horizontal Output (to mainframe rear panel)	27	NC
12	AUX C 21.4 MHz IF Output (to mainframe rear panel)	28	-12.6 VDC from mainframe
13	AUX B Penlift/Blanking Output (to mainframe rear panel)	29	+15 VDC from mainframe
14	AUX A Vertical Output (to mainframe rear panel)	30	+100 VDC from mainframe
15	GROUND	31	30V p-p from mainframe (for LINE TRIGGER)
16	NC	32	NC
		W5	+VERT (top contact, yellow wire)
		(2 contacts)	- VERT (bottom contact, orange wire)

2-21. STORAGE AND SHIPMENT

2-22. Environment

2-23. The instrument may be stored or shipped in environments within the following limits:

Temperature: -40°C to $+75^{\circ}\text{C}$
 Altitude: <7620 meters (25,000 feet)

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

2-24. Packaging

2-25. 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. A supply of these tags is provided at the end of this section. Also mark the container **FRAGILE** to assure careful handling. In any correspondence, refer to the instrument by model number and full serial number.

2-26. Other Packaging. The following general instructions should be used for repackaging with commercially available materials:

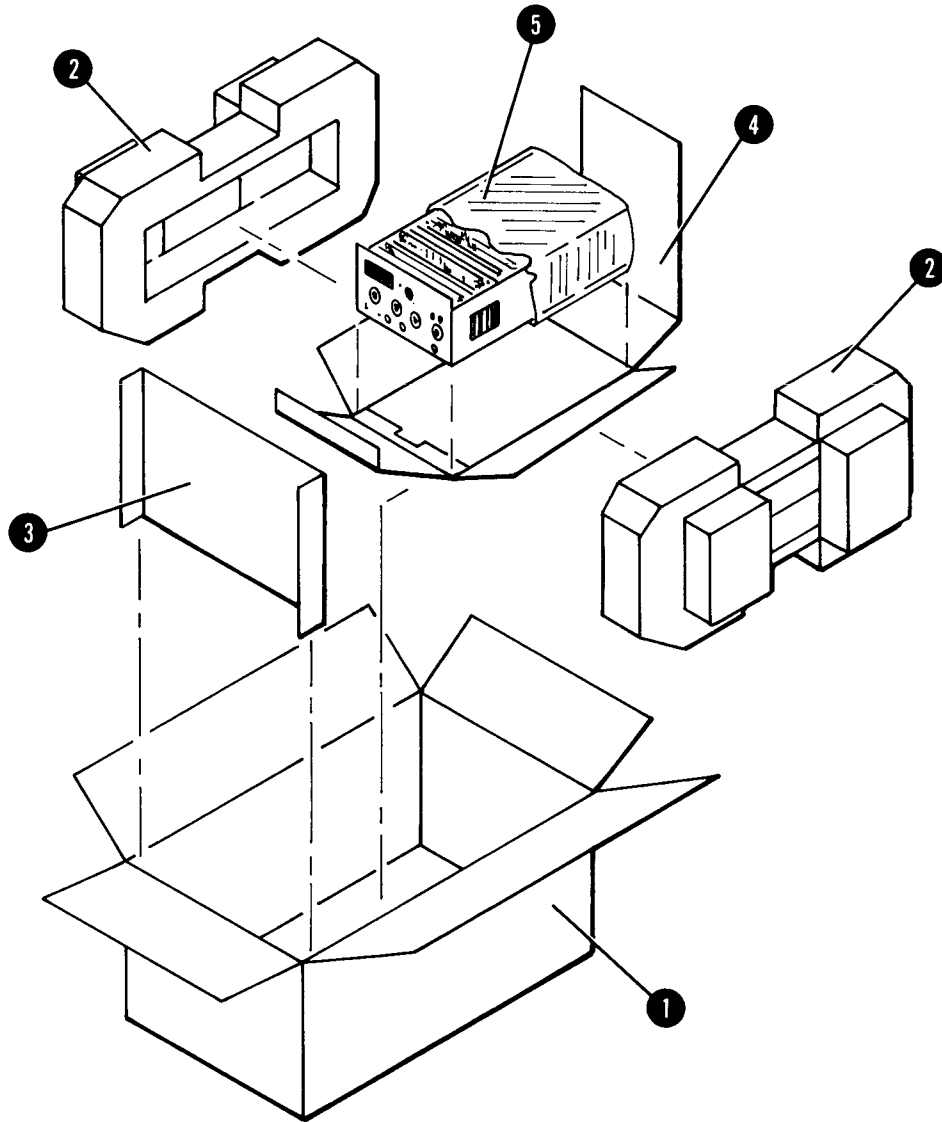
1. Wrap the instrument in heavy paper or plastic. If shipping to a Hewlett-Packard office or service center, attach a tag indicating the type of service required, return address, model number, and full serial number. A supply of these tags is provided at the end of this section.

2. Use a strong shipping container. A double-wall carton made of 350-pound test material is adequate.
3. Use enough shock-absorbing material (3-inch 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.
4. Seal the shipping container securely.
5. Mark the shipping container **FRAGILE** to assure careful handling.

2-27. OPERATION VERIFICATION

2-28. The Operation Verification tests only the most critical specifications and operating features of the instrument. It requires much less time and equipment than the complete performance tests provided in Section IV, and is recommended for verification of overall instrument operation, either as part of incoming inspection or after repair. Operation Verification consists of the following performance tests:

- Paragraph 4-11, Frequency Span Accuracy
- Paragraph 4-17, Average Noise Level
- Paragraph 4-21, Bandwidth Switching (Amplitude Variation)
- Paragraph 4-22, Input Attenuator Accuracy
- Paragraph 4-25, Calibrator Accuracy
- Paragraph 4-26, Display Fidelity



Item	Qty	C D	HP Part No.	Description
1	1	4	9211-3026	CARTON-OUTER
2	2	1	9220-3024	FOAM PADS-INNER
3	1	7	9220-3129	MANUAL PAD-FRONT
4	1	9	9220-3048	CARTON-INNER
5	1	7	9222-1054	BAG-ANTISTATIC

FIGURE 2-2. PACKAGING FOR SHIPMENT USING FACTORY PACKAGING MATERIALS

OPERATION

PAGE i:

► **Title Page**

All Serials Change "0.1 - 21 GHz" to read "0.01 - 21 GHz"

PAGE 3-3:

► **Table 1. Adjustment Settings**

All Serials Under Function, Reference Level delete Option 002.
Under Settings change "uncoupled" to "coupled" (2 places).

PAGE 3-4:

2347A & Above Replace all text on page 3-4 with the following:

3-31. Frequency and Amplitude Adjustments

1. Adjust VERTICAL POSN until the CRT trace aligns with the bottom CRT graticule line.
2. Connect the 35 MHz CAL OUTPUT to the spectrum analyzer input and center the 35 MHz signal with the TUNING control.
3. Narrow the FREQ SPAN/DIV to 200 kHz and adjust the REF LEVEL FINE control as necessary to position the 35 MHz signal peak near the top CRT graticule line.
4. Center the signal again, if necessary, and adjust FREQ CAL to calibrate the FREQUENCY GHz readout at 0.035 GHz.
5. Set the FREQ SPAN/DIV control to 1 MHz and adjust the REF LEVEL FINE control to place the 35 MHz signal peak at the top CRT graticule line.
6. Press the 10 dB/DIV Amplitude Scale pushbutton. Adjust VERTICAL GAIN to place the signal peak at the top CRT graticule line.
7. Press the LIN Amplitude Scale pushbutton. Adjust the REF LEVEL FINE control to place the signal peak at the top graticule line.
8. Repeat steps 6 and 7 until the signal peak remains at the top CRT graticule line when the Amplitude Scale is alternated between 10 dB/DIV and LIN.
9. Set the REF LEVEL FINE control to 0 and the REFERENCE LEVEL control to -10 dBm.

10. Press the LIN Amplitude Scale pushbutton and adjust REF LEVEL CAL to place the signal peak at the top CRT graticule line.

PAGE 4-8:

All Serials ► Paragraph 4.12. Tuning Accuracy (Cont'd)
In step 5, change Min. to 0.009
In step 6, change Min. to 1.494
In step 8, change Min to 2.990

SECTION III OPERATION

3-1. INTRODUCTION

3-2. This section provides operating information for the HP 8559A Spectrum Analyzer plug-in. It also provides a brief description of display mainframe controls. For a detailed description of the display mainframe, refer to its manual.

3-3. The HP 8559A Spectrum Analyzer plug-in can be used with either the 180-series display mainframes or the HP 853A Spectrum Analyzer Display mainframe.

3-4. DESCRIPTION

3-5. HP 8559A Spectrum Analyzer

3-6. The HP 8559A employs harmonic mixing to cover a measurement range of 10 MHz to 21 GHz in six frequency bands. It can display frequency spans as narrow as 100 kHz, and as wide as 9 GHz (the latter in full span mode). A five-digit LED readout indicates the spectrum analyzer center frequency with a resolution of 1 MHz. The HP 8559A can be used to measure signals over an amplitude range of -111 dBm to $+30$ dBm.

3-7. HP 853A Spectrum Analyzer Display

3-8. The HP 853A Spectrum Analyzer Display is a large-screen, digital storage display mainframe for use exclusively with the HP 8559A, 8558B, and 8557A Spectrum Analyzer plug-ins. Digital memory provides buffer storage for two independent traces, both of which can be displayed or blanked as desired. Digital processing also provides push-button features such as maximum signal hold, digital averaging, and trace normalization. A conventional analog display mode can also be selected.

3-9. HP-IB

3-10. The HP 853A has limited HP-IB capabilities. CRT trace and graticule data is dumped directly to a listen-only HP-IB plotter by pressing two front-panel push buttons. Control settings on the spectrum analyzer plug-in cannot be monitored via the HP-IB;

however, all digital display functions are programmable via a controller, and two lines of annotation can be displayed on the CRT for labelling purposes or operator prompting. In addition, controller commands allow transfer of trace data for analysis or storage.

3-11. CONTROLS, INDICATORS, AND CONNECTORS

3-12. Control Grouping

3-13. The Spectrum Analyzer plug-in and Display mainframe front-panel controls fall into three general groups: those that deal with the display, those that deal with frequency, and those that deal with amplitude. These controls are shown in Figure 3-1 and accompanied by detailed explanations of their use.

3-14. Display. The display group consists of:

SWEEP TIME/DIV	VIDEO FILTER
SWEEP TRIGGER	BASELINE CLIPPER
VERT POSN	HORIZONTAL POSITION
	INTENSITY
VERT GAIN	FOCUS
MANUAL SWEEP	TRACE ALIGN
HORIZ GAIN (rear panel of HP 8559A)	

3-15. The display group enables the operator to calibrate the display and to select a variety of scan and display conditions. However, when the SWEEP TIME/DIV Control is placed in the AUTO position, sweep time is controlled by the RESOLUTION BW, FREQ SPAN/DIV, and VIDEO FILTER controls.

3-16. Frequency. The frequency group consists of:

TUNING
FREQUENCY BAND GHz
ALT IF
SIG IDENT
RESOLUTION BW
FREQ SPAN/DIV

3-17. The frequency group enables the operator to control how the Spectrum Analyzer displays the frequency domain. The RESOLUTION BW and FREQ SPAN/DIV controls, when pushed in, are coupled together, and moving either control moves the other. When the SWEEP TIME/DIV control is in the AUTO position, varying the RESOLUTION BW or the FREQ SPAN/DIV (coupled or uncoupled) will change the sweep time to maintain calibration. With the two controls coupled together in the optimum position, RESOLUTION BW's of 3 MHz to 1 kHz will be automatically selected as the FREQ SPAN/DIV is narrowed from F (Full) to 0 (Zero). TUNING controls coarse and fine (coarse is larger knob) set the center frequency of the displayed spectrum. RESOLUTION BW control determines the resolution of the signals on the CRT.

3-18. Amplitude. The amplitude group consists of:

REFERENCE LEVEL dBm
 INPUT ATTEN
 REF LEVEL FINE
 REF LEVEL CAL
 10 dB/DIV – 1 dB/DIV – LIN (Amplitude Scale)

3-19. The amplitude group enables the operator to measure signal amplitude in units of either voltage or dBm.

3-20. OPERATING PRECAUTIONS

3-21. Signal Input

3-22. The HP 8559A Spectrum Analyzer plug-in is a sensitive measuring instrument. Overloading the input with too much power, peak voltage, or dc voltage will permanently damage the input circuits. Do not exceed the input levels specified below:

Maximum Input (Damage) Levels

HP 8559A

Total Power:

- + 20 dBm (0.1W, 2.2 Vrms) with 0 dB input attenuation
- + 30 dBm (1W, 7.1 Vrms) with ≥ 10 dB input attenuation

dc or ac (<100 Hz): $\pm 7.1V$

Peak Pulse Power: + 50 dBm (100W, $>10\mu\text{sec}$ pulse width, 0.01% duty cycle) with ≥ 30 dB input attenuation

NOTE

When you are measuring input signals of unknown power levels, a preliminary instrument setting of ≥ 30 dB INPUT ATTEN is recommended.

CAUTION

Although the spectrum analyzer's reference level can be set for power levels up to +60 dBm, the total input power must not exceed the absolute maximum limits listed above.

3-23. Line Power On

3-24. Before connecting the line power cord, make sure the proper line voltage and line fuse have been selected for the display mainframe. Failure to set the ac power input selector on the display mainframe to correspond with the level of the ac source voltage could cause damage to the instrument when the power cord is plugged in.

WARNING

The spectrum analyzer and any device connected to it must be connected to power line ground. Failure to ensure proper grounding could result in a shock hazard to personnel or damage to the instrument.

3-25. LINE power is switched at the display mainframe front panel. A safety indicator lights when the ac power is on. **NEVER** remove a spectrum analyzer plug-in from the display mainframe without first switching the ac LINE power switch to OFF.

3-26. For optimum performance, you should allow the spectrum analyzer to warm up for at least 30 minutes before using it to make measurements.

3-27. FRONT-PANEL ADJUSTMENT PROCEDURE

3-28. The front-panel adjustment procedure adapts the HP 8559A Spectrum Analyzer plug-in to a particular display mainframe, and should be performed daily after instrument warm-up. The step-by-step adjustment is also an excellent way for new users to become acquainted with the various spectrum analyzer controls. Once the procedure is completed, the

spectrum analyzer is calibrated for absolute amplitude and frequency measurements. Set the controls as shown in Table 1 before you start the adjustment procedure.

TABLE 1. ADJUSTMENT SETTINGS

Function	Setting
Spectrum Analyzer Plug-In	
INPUT ATTEN (dB)*	10 dB
REFERENCE LEVEL	0 dBm
Option 002	+50 dBmV
REF LEVEL FINE	0 dBm
Amplitude Scale	LIN
FREQ SPAN/DIV	10 MHz (uncoupled)
RESOLUTION BW	1 MHz (uncoupled)
SWEEP TIME/DIV	AUTO
SWEEP TRIGGER	FREE RUN
START-CENTER (8558B, 8557A)	CENTER
FREQUENCY BAND GHz (8559A)	.01-3
TUNING	>60 MHz
BASELINE CLIPPER	OFF
VIDEO FILTER	OFF
*On older plug-ins, set OPTIMUM INPUT to -30 dBm.	
HP 853A Spectrum Analyzer Display	
TRACE A	WRITE
TRACE B	STORE BLANK
DGTL AVG	OFF
INPUT-B→A	OFF
HP 180-Series Display Mainframe	
DISPLAY	INT
MAGNIFIER	X1
SCALE (180TR, 182T)	OFF
PERSISTENCE (181T/TR)	MIN
Display Mode (181T/TR)	WRITE

3-29. Display Adjustments – HP 853A Spectrum Analyzer Display

1. Switch LINE power OFF then ON while holding PLOT GRAT push button depressed to activate the digital test routines. The “#0” that appears on the left side of the CRT means digital test routine #0 is now activated.

2. Press and release the PLOT GRAT push button four times to step to digital test routine #4, as indicated by the “#4” displayed on the left side of the CRT.
3. With an adjustment tool, adjust the FOCUS control as necessary to make the characters on the CRT as clear as possible.
4. Adjust the X POSN and Y POSN controls the align the square trace pattern with the outermost CRT graticule lines.
5. Momentarily press the PLOT GRAT and PLOT TRACE push buttons simultaneously to exit the digital test routines.

3-30. Display Adjustments – HP 180-Series Display Mainframe

1. With an adjustment tool, adjust the VERTICAL POSN control to place the CRT trace on a horizontal graticule line near the CRT center.
2. Reduce the INTENSITY and set the SWEEP TIME/DIV control to MAN. Use the MAN SWEEP knob to center the CRT dot.

CAUTION

Leaving a dot on the CRT for prolonged periods at high intensity can burn the phosphor.

3. Adjust FOCUS and ASTIG controls for the smallest round dot possible.
4. Reset the SWEEP TIME/DIV control to AUTO and increase the INTENSITY for an optimum CRT trace. Adjust the HORIZONTAL POSITION control to center the CRT trace. If the horizontal deflection is not exactly 10 divisions, adjust the HORIZ GAIN control located on the rear panel of the spectrum analyzer plug-in.

NOTE

To adjust the HORIZ GAIN, you must switch the LINE power OFF, then remove the spectrum analyzer plug-in from the mainframe.

5. Adjust TRACE ALIGN so that the CRT trace is parallel to the horizontal graticule line.

3-31. Frequency and Amplitude Adjustments

1. Adjust VERTICAL POSN to align the CRT trace with the bottom graticule line.
2. Center the LO feedthrough (i.e., the “signal” at 0 MHz) on the CRT with the TUNING control.
3. Narrow the FREQ SPAN/DIV to 200 kHz. Adjust the REF LEVEL FINE control as necessary to position the signal peak near the top CRT graticule line.
4. Center the LO feedthrough again, if necessary, and adjust the FREQ ZERO to calibrate the FREQUENCY MHz readout at 00.0 MHz.
5. Set the FREQ SPAN/DIV control to 1 MHz and the REF LEVEL FINE control to 0. Adjust the TUNING control for a FREQUENCY MHz readout of approximately 250 MHz.
6. Press the 10 dB/DIV Amplitude Scale push button, and set the REFERENCE LEVEL control to -20 dBm ($+30$ dBmV for Option 002 instruments).
7. Connect the 250 MHz CAL OUTPUT to the spectrum analyzer input, and center the signal on the CRT with the TUNING control. The FREQUENCY MHz readout will indicate 250 MHz ± 3 MHz.
8. Press the LIN Amplitude Scale push button. Adjust the REF LEVEL FINE control to place the signal peak at the top CRT graticule line.
9. Press the 10 dB/DIV Amplitude Scale push button. Adjust VERTICAL GAIN to place the signal peak at the top CRT graticule line.
10. Repeat steps 8 and 9 until the signal peak remains at the top CRT graticule line when the Amplitude Scale is alternated between 10 dB/DIV and LIN.
11. Set the REF LEVEL FINE control to 0, and the REFERENCE LEVEL control to -30 dBm ($+20$ dBmV for Option 002 instruments).
12. Press the LIN Amplitude Scale push button, and adjust REF LEVEL CAL to place the signal peak at the top CRT graticule line.

HP 853A SPECTRUM ANALYZER DISPLAY

REAR PANEL FEATURES

- 1 **Line Power Receptacle:** Three-conductor male receptacle for connecting ac power cable. Power plug retaining bracket, included with standard instrument, can be installed to prevent power cable disconnection when instrument is in transit. Power cable coils on special rear feet when not in use.
- 2 **FUSE:** Spring-loaded holder for cartridge-type primary power fuse.
- 3 **SELECTOR (VOLTS):** Adapts primary power transformer configuration to voltage of ac primary power source.
- 4 **ADDRESS:** Switch settings determine address of instrument to be used for communications via HP-IB. Address is set as sum of the switches, where A5 = 16, A4 = 8, A3 = 4, A2 = 2, and A1 = 1.
- 5 **HORIZ (SWEEP) OUTPUT:** BNC jack is a sweep output or sweep input, depending on the position of SWEEP switch on Interface Assembly A9. SWEEP switch on assembly A9 is factory set for sweep output (INT).

As a BNC output, HORIZ (SWEEP) OUTPUT provides horizontal sweep voltage from a 5K-ohm output impedance. The -5V to +5V output range corresponds to a full 10-division CRT horizontal deflection.

As a BNC input with a 20K-ohm input impedance, HORIZ (SWEEP) OUTPUT allows the CRT display to be swept by a -5V to +5V external horizontal sweep signal (approximately 30V/sec maximum sweep rate for digital display mode).
- 6 **VERTICAL (VIDEO) OUTPUT:** BNC output provides detected video signal from a 50-ohm output impedance. Typical 0-800 mV output range corresponds to full 8-division CRT vertical deflection.

- 7 **BLANK (PENLIFT) OUTPUT:** BNC output provides a +15V penlift/blanking signal from a 10K-ohm output impedance when CRT trace is blanked. Otherwise, output is low at 0V (low impedance, 150 mA max.) for an unblanked trace.
- 8 **21.4 MHz IF OUTPUT:** BNC output provides 21.4 MHz IF signal (linearly related to spectrum RF input) from a 50-ohm output impedance. Spectrum analyzer RESOLUTION BW controls the output bandwidth. Spectrum analyzer INPUT ATTEN, REFERENCE LEVEL FINE, and the first six REFERENCE LEVEL positions control the output amplitude. Output level is approximately -10 dBm into 50 ohms with a signal displayed at Reference Level.
- 9 **HP-IB Connector:** Hewlett-Packard Interface Bus connection allows remote instrument operation and direct digital plotting of CRT display.

FRONT PANEL FEATURES

- 10 **TRACE A, B:** Selects CRT display mode for each of two independent digital trace memories.

CLEAR WRITE: Continuously updates trace memory with current input signal data and displays trace memory contents on CRT.

MAXHOLD: Updates trace memory with maximum input signal data and displays trace memory contents on CRT.

STORE VIEW: Current trace memory contents are preserved and displayed on CRT.

STORE BLANK: Current trace memory contents are preserved without being displayed on CRT.

ANALOG DISPLAY: CRT display switches to conventional analog display of current input signal when both STORE BLANK push buttons are depressed.
- 11 **DGTL AVG:** Activates digital filtering algorithm that averages trace data over successive sweeps. Digital averaging should be restarted after any change in spectrum analyzer control settings.

- 12 **INPUT-B→A:** Subtracts contents of trace B memory point-by-point from current input signal data and stores result (normalized input signal data) in trace A memory. Reference line is factory-preset at center horizontal CRT graticule line; normalized trace appears at reference line when input signal data is identical to stored trace B. Reference line indicates 0 dB for relative amplitude measurements.
- 13 **PLOT GRAT/HP-IB CLEAR:** Initiates sequence of plotter commands over HP-IB to plot CRT graticule lines (and remotely-programmed annotation). Press push button again to abort active plot. HP-IB plotter must be set to listen-only mode.

To recover from illegal HP-IB commands (SYNTAX ERR) and to reset display state, press push button for at least 3 seconds to perform HP-IB CLEAR. Instrument returns to LOCAL and discontinues any HP-IB operation in progress.

Activate digital test routines by pressing PLOT GRAT push button while switching LINE power ON. Push button then selects desired test routine. Press both PLOT GRAT and PLOT TRACE push buttons to revert to normal display state.
- 14 **PLOT TRACE:** Initiates sequence of plotter commands over HP-IB to plot displayed CRT trace(s). Press push button again to abort active plot. HP-IB plotter must be set to listen-only mode.
- 15 **LINE:** AC line switch. Switches instrument primary power ON and OFF.
- 16 **INTENSITY:** Adjusts brightness of CRT trace(s) and annotation characters.
- 17 **SCALE:** Adjusts CRT background illumination. SCALE control is disabled in ANALOG DISPLAY mode.
- 18 **Y POSN:** Adjusts vertical position CRT trace. Use Y POSN with reference pattern in digital test routine #4 to align digital trace memory coordinates with corresponding CRT graticule lines.
- 19 **X POSN:** Adjusts horizontal position of CRT trace. Use X POSN with reference pattern in digital test routine #4 to align digital trace memory coordinates with corresponding CRT graticule lines.
- 20 **TRACE ALIGN:** Rotates trace about center of CRT.
- 21 **FOCUS:** Adjusts sharpness of CRT trace.

- 22 **CRT Annotation:** Indicates display control settings. 33
- 34
- ### HP 8559A SPECTRUM ANALYZER PLUG-IN
- 23 **FREQUENCY GHz:** Displays spectrum analyzer center frequency.
 - 24 **FREQ CAL:** Adjusts FREQUENCY GHz (23) readout for calibration on 35 MHz CAL OUTPUT signal.
 - 25 **TUNING:** Adjusts spectrum analyzer start or center frequency. Coarse tuning is provided by large knob; smaller knob provides FINE tuning.
 - 26 **FREQUENCY BAND GHz (HP 8559A):** Selects calibrated frequency band. Shifts FREQUENCY GHz (23) readout and adjusts CRT frequency and amplitude calibration for proper display of in-band signals. 35
 - 27 **ALT IF:** Shifts first IF 15 MHz to eliminate baseline lift caused by input signals at approximately 3.0075 GHz.
 - 28 **SIG IDENT:** Identifies correct FREQUENCY BAND GHz (26) for unknown signal. Shifts IF and lowers displayed signals on alternate spectrum analyzer sweeps. Correct response is 1 MHz shift to left.
 - 29 **VERTICAL POSN:** Adjusts vertical position of CRT trace. 36
 - 30 **VERTICAL GAIN:** Adjusts deflection circuit gain for amplitude scale calibration of CRT display.
 - 31 **BASELINE CLIPPER:** Prevents CRT blooming in variable persistence, storage display mainframes (such as the HP 181T/TR) by blanking the lower portion of the CRT display. When it is operating in its digital display mode, the HP 853A Spectrum Analyzer Display does not respond to this control.
 - 32 **VIDEO FILTER:** Post-detection low-pass filter smooths CRT trace by averaging random noise. The MAX (detent) position selects 1.5 Hz bandwidth for maximum noise averaging and noise level measurements. The VIDEO FILTER bandwidth is scaled by resolution bandwidth (39) setting. The MAX VIDEO FILTER should **not** be used for CW signal analysis.

SWEEP Indicator: Remains lit during each sweep.

SWEEP TRIGGER: Selects sweep trigger mode.

VIDEO: Sweep triggered on internal post-detection video waveform. One-half major division of vertical deflection (noise, AM signal, etc.) is required to trigger sweep. VIDEO is normally used with 0 (zero) frequency span for time-domain analysis.

LINE: Sweep triggered at ac line frequency.

FREE RUN: End of each sweep triggers new sweep.

SINGLE: Single sweep triggered or reset by turning SWEEP TRIGGER clockwise momentarily.

INPUT 50Ω: Precision type N (female) or BNC (female) signal input connector with 50-ohm input impedance.

Options 001 and 002: INPUT 75Ω – 75-ohm BNC (female) signal input connector.

CAUTION

50-ohm BNC connectors might cause damage if used directly with Option 001 and 002 75-ohm BNC INPUT and CAL OUTPUT connectors.

SWEEP TIME/DIV: Selects time required to sweep one major horizontal division on CRT.

AUTO: Automatically selects fastest allowable sweep time as a function of **FREQ SPAN/DIV (38)**, **RESOLUTION BW (39)**, and **VIDEO FILTER (32)** settings to maintain display amplitude calibration. AUTO operation retained with **FREQ SPAN/DIV** and **RESOLUTION BW** controls uncoupled.

TIME/DIV: Selects calibrated sweep time. TIME/DIV is used primarily with 0 (Zero) frequency span for time-domain analysis of modulation waveforms. Display amplitude calibration not guaranteed for other frequency spans.

MAN: Enables manual frequency scan using MAN SWEEP knob.

37 REF LEVEL CAL: Adjusts spectrum analyzer RF gain to calibrate top CRT graticule line for absolute amplitude measurements.

38 FREQ SPAN/DIV: Selects CRT horizontal axis frequency calibration.

MHz/DIV

kHz/DIV: Selects desired frequency span. Alignment of OPTIMUM markings (> <) selects optimum resolution bandwidth (39).

0 (Zero Span): Spectrum analyzer operates as a manually-tuned receiver, at frequency indicated by **FREQUENCY GHz** or **FREQUENCY MHz** readout, for time-domain display of signal modulation.

F (Full Band): Spectrum analyzer sweeps entire selected frequency band. **FREQUENCY GHz (23)** readout corresponds to location of tuning marker displayed on CRT.

39 RESOLUTION BW: Selects spectrum analyzer 3-dB bandwidth. Alignment of OPTIMUM markings (> <) automatically selects optimum resolution bandwidth for any frequency span. When pushed in, RESOLUTION BW couples mechanically with **FREQ SPAN/DIV (38)**.

40 CAL OUTPUT: BNC (female) output provides calibration signal from 50-ohm output impedance. *Options 001 and 002: 75-ohm output impedance.*

CAUTION

50-ohm BNC connectors might cause damage if used directly with Option 001 and 002 75-ohm BNC INPUT and CAL OUTPUT connectors.

41 10 dB/DIV – 1 dB/DIV – LIN (Amplitude Scale): Selects CRT vertical axis amplitude calibration (logarithmic or linear scale). Reference Level remains constant at top CRT graticule line.

42 REFERENCE LEVEL: Adjusts power level (in dBm or dBmV) represented by top CRT graticule line. Large outer knob adjusts REFERENCE LEVEL in calibrated 10-dB steps; FINE vernier provides 12 dB of continuous adjustment.

43 INPUT ATTEN: Selects desired RF input attenuation, indicated by blue numbers (push and turn).

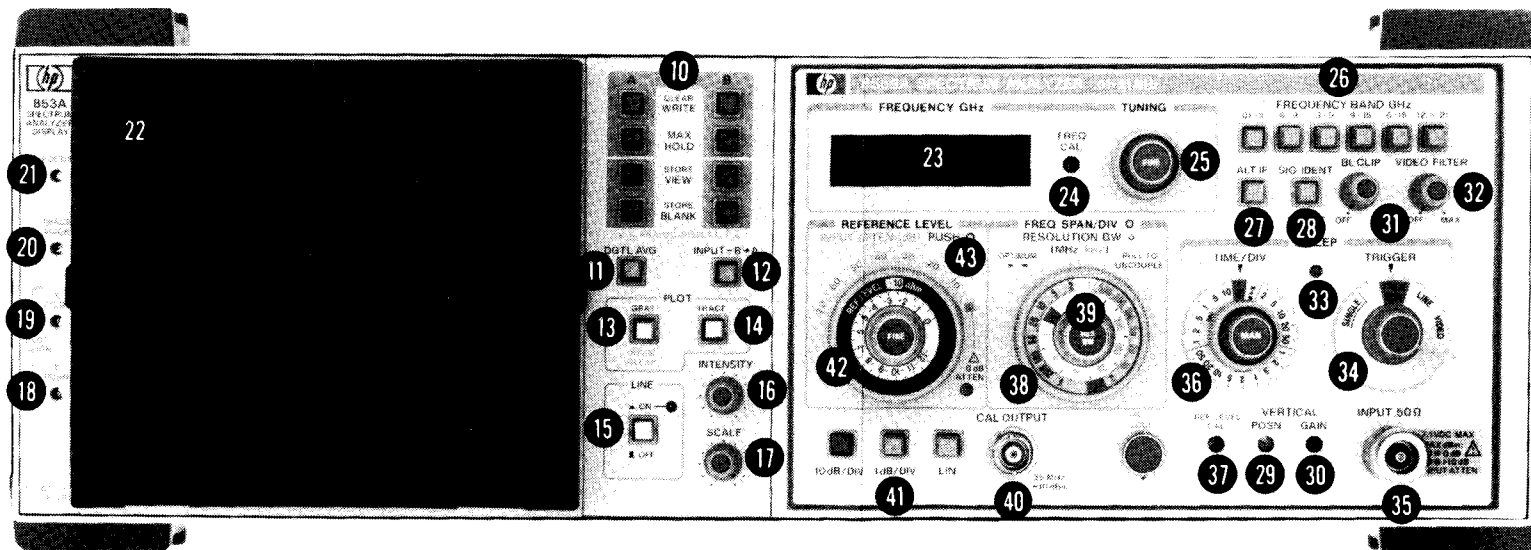
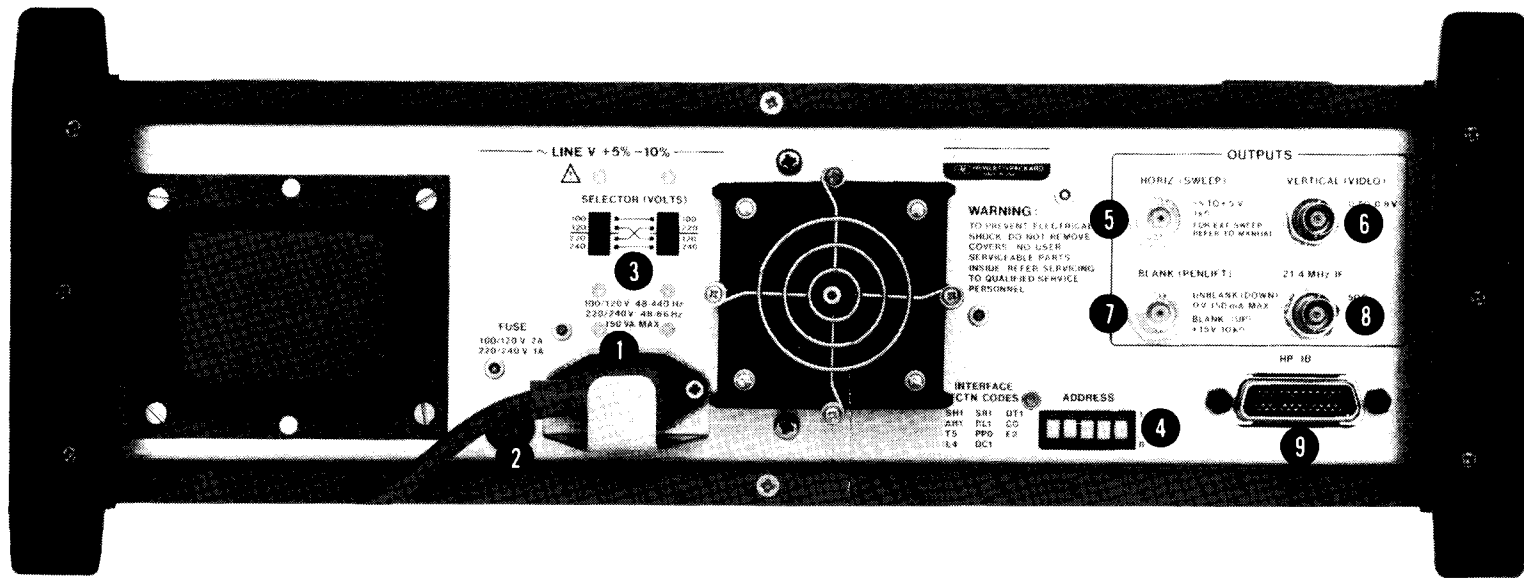


FIGURE 3-1. HP 8559A/853A CONTROLS, CONNECTORS, AND INDICATORS

PERFORMANCE TESTS

PAGES 4-14 THROUGH 4-19, PARAGRAPH 4-15:

- Procedure: Resolution Bandwidth Accuracy**
- All Serials Change the minimum bandwidth specification in steps 7 and 8 from 2.0 to 2.1 MHz.
- ▶ In step 17, change Min. to 25.5 kHz
 - ▶ In step 18, change Min. to 8.5 kHz.
 - ▶ In step 19, change Min. to 2.55 kHz.
 - ▶ In step 20, change Min. to 0.85 kHz.

PAGES 4-39 THROUGH 4-41, PARAGRAPH 4-20:

- Equipment list**
- All Serials In the equipment list, change the 20 dB attenuator to a 10 dB attenuator, HP 8491B, Option 010.

- Figure 4-16. Gain Compression Test Setup**
- All Serials Change the 20 dB attenuator to a 10 dB attenuator.

PAGES 4-54 THROUGH 4-65/4-66:

- ▶ **Paragraph 4-24. Sweep Time Accuracy (Cont'd)**
In the last sentence of step 6, change ± 0.04 sec to ± 0.40 sec.

- Table 4-18. Performance Test Record**
- All Serials For paragraph 4-17, add the following step:

12. Average Noise level with ALT IF on:

Freq Band Setting	Actual	Max.
.01--3 GHz	_____	-111 dBm
6--9 GHz	_____	-108 dBm
3--9 GHz	_____	-103 dBm
9--15 GHz	_____	-98 dBm
6--15 GHz	_____	-93 dBm
12.1--18 GHz	_____	-92 dBm
18--21 GHz	_____	-90 dBm

- All Serials For paragraph 4-18, step 7 (ALT IF), change the range to:
.025 GHz to 3 GHz.

SECTION IV PERFORMANCE TESTS

4-1. INTRODUCTION

4-2. The procedures in this section test the electrical performance of the instrument using the specifications in Section I as the performance standards. The performance tests included in this section are listed in Table 4-1. Most of the tests can be performed without access to the interior of the instrument. If a test measurement is marginal, perform the appropriate adjustment procedures in Section V.

TABLE 4-1. PERFORMANCE TESTS

Paragraph	Test
4-11	Frequency Span Accuracy
4-12	Tuning Accuracy
4-13	Residual FM
4-14	Noise Sidebands
4-15	Resolution Bandwidth Accuracy
4-16	Resolution Bandwidth Selectivity
4-17	Average Noise Level
4-18	Residual Responses
4-19	Frequency Response
4-20	Gain Compression
4-21	Bandwidth Switching (Amplitude Variation)
4-22	Input Attenuator Accuracy
4-23	Reference Level Accuracy
4-24	Sweep Time Accuracy
4-25	Calibrator Output Accuracy
4-26	Display Fidelity

4-3. INSTRUMENTS TESTED

4-4. Since a compatible display mainframe is required for operation of the HP Model 8559A Spectrum Analyzer plug-in, the specifications listed in Table 1-1 apply when both instruments are functioning together. Consequently, the performance tests in this section verify the proper operation of both the HP 8559A and the display mainframe.

4-5. EQUIPMENT REQUIRED

4-6. The equipment required for the performance tests is listed under Recommended Test Equipment in Section I. Any equipment that satisfies the critical specifications given in the table may be substituted for the recommended model.

4-7. TEST RECORD

4-8. Results of the performance tests may be tabulated in the Performance Test Record at the end of this section. The test record lists test specifications and acceptable limits.

4-9. CALIBRATION CYCLE

4-10. This instrument requires periodic calibration. Calibration should be verified every six months by means of the performance tests.

PERFORMANCE TESTS

NOTE

Perform the Front Panel Adjustment Procedure in Section III before proceeding with performance tests. Allow at least 30 minutes warmup time.

4-11. FREQUENCY SPAN ACCURACY

SPECIFICATION:

There are 14 calibrated spans ranging from 10 kHz per division to 200 MHz per division in a 1, 2, 5 sequence. Frequency error between any two points on the display is within ± 5 percent of the indicated frequency separation.

DESCRIPTION:

Wide span widths are checked using the 100-, 10-, and 1-MHz outputs of a comb generator. Narrow span widths are checked using the output of a comb generator 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 variation of distance among the spectral line intervals displayed across the CRT. The amount of span error is determined by comparing the distance of the first nine graticule divisions with the displayed distance of the corresponding spectral line intervals.

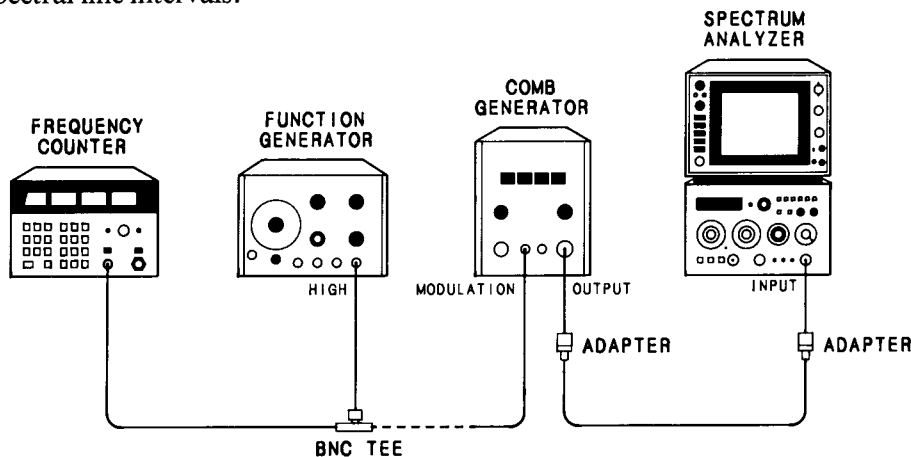


FIGURE 4-1. FREQUENCY SPAN ACCURACY TEST SETUP

EQUIPMENT:

Comb Generator	HP 8406A
Frequency Counter	HP 5342A, Opt. 005
Function Generator	HP 3310A
BNC Tee	HP 1250-0781
Adapter, Type N (m) to BNC (f) (2 required)	HP 1250-0780

PERFORMANCE TESTS

4-11. FREQUENCY SPAN ACCURACY (Cont'd)**PROCEDURE:**

1. Set equipment controls as follows:

Spectrum Analyzer:

FREQUENCY BAND GHz .....	.01 – 3
TUNING	1.5 GHz
FREQ SPAN/DIV	200 MHz
RESOLUTION BW	OPTIMUM, coupled (pushed in)
INPUT ATTEN	0 dB
REFERENCE LEVEL	– 10 dB
REF LEVEL FINE	0
Amplitude Scale	10 dB/DIV
SWEEP TIME/DIV	AUTO
SWEEP TRIGGER	FREE RUN
ALT IF	OFF
SIG IDENT	OFF
BL CLIP	OFF
VIDEO FILTER	OFF

Comb Generator:

COMB FREQUENCY – MHz	100 MC
INTERPOLATION AMPLITUDE – 1 MHz	OFF
OUTPUT AMPLITUDE	10 o'clock

Function Generator:

FUNCTION	SINE
RANGE	10K
Frequency	200 kHz
DC OFFSET LEVEL	0

2. Connect equipment as shown in Figure 4-1 but do not connect function generator to comb generator.
-

PERFORMANCE TESTS

4-11. FREQUENCY SPAN ACCURACY (Cont'd)

- Adjust spectrum analyzer TUNING control to position one spectral line (from comb generator) at first graticule line (left-hand edge of display). Measure the error between 17th spectral line and 9th graticule line as shown in Figure 4-2. Error should be no greater than ± 0.4 division.

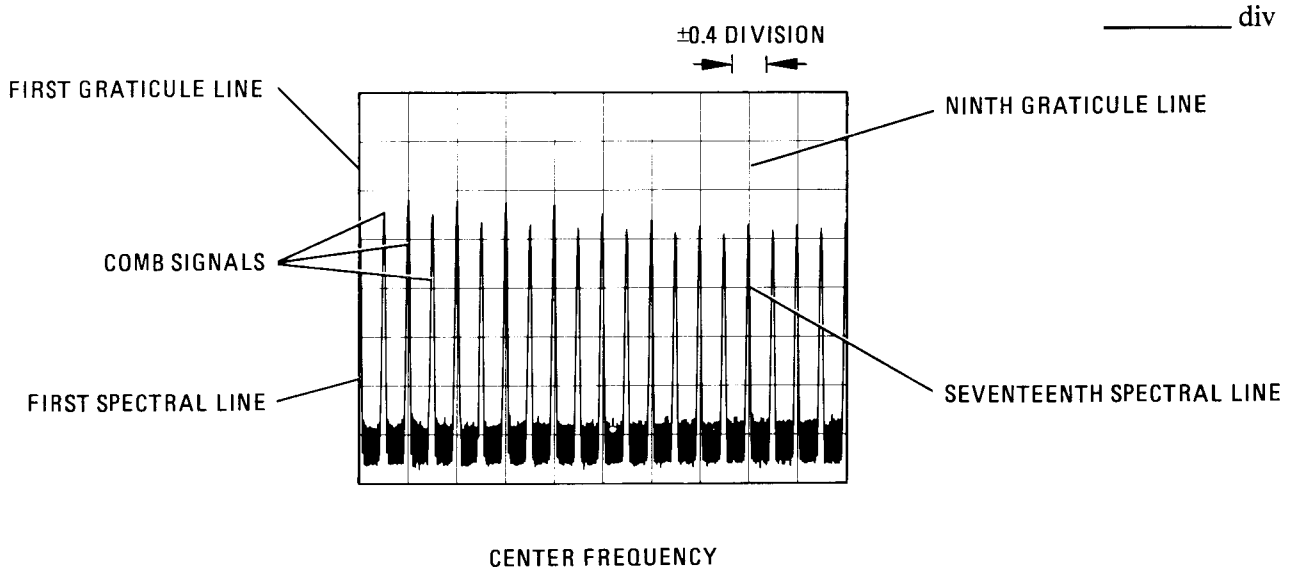


FIGURE 4-2. FREQUENCY SPAN ACCURACY MEASUREMENT FOR SEVENTEENTH SPECTRAL LINE

- Set **FREQ SPAN/DIV** to 100 MHz. Adjust **TUNING** control to position one spectral line on the first graticule line. Measure the error between ninth spectral line and ninth graticule line. Error should be no greater than ± 0.4 division.

_____ div

- Set **FREQ SPAN/DIV** to 50 MHz. Adjust **TUNING** control to position one spectral line on the first graticule line. Measure the error between fifth spectral line and ninth graticule line. Error should be no greater than ± 0.4 division.

_____ div

- Set comb generator **COMB FREQUENCY** – MHz for 10-MHz comb. Set spectrum analyzer **FREQ SPAN/DIV** to 20 MHz. Adjust **TUNING** control to position one spectral line on the first graticule line. Measure the error between 17th spectral line and ninth graticule line as shown in Figure 4-3. Error should be no greater than ± 0.4 division.

_____ div

- Set **FREQ SPAN/DIV** to 10 MHz. Adjust **TUNING** control to position one spectral line on the first graticule line. Measure the error between ninth spectral line and ninth graticule line. Error should be no greater than ± 0.4 division.

_____ div

PERFORMANCE TESTS

4-11. FREQUENCY SPAN ACCURACY (Cont'd)

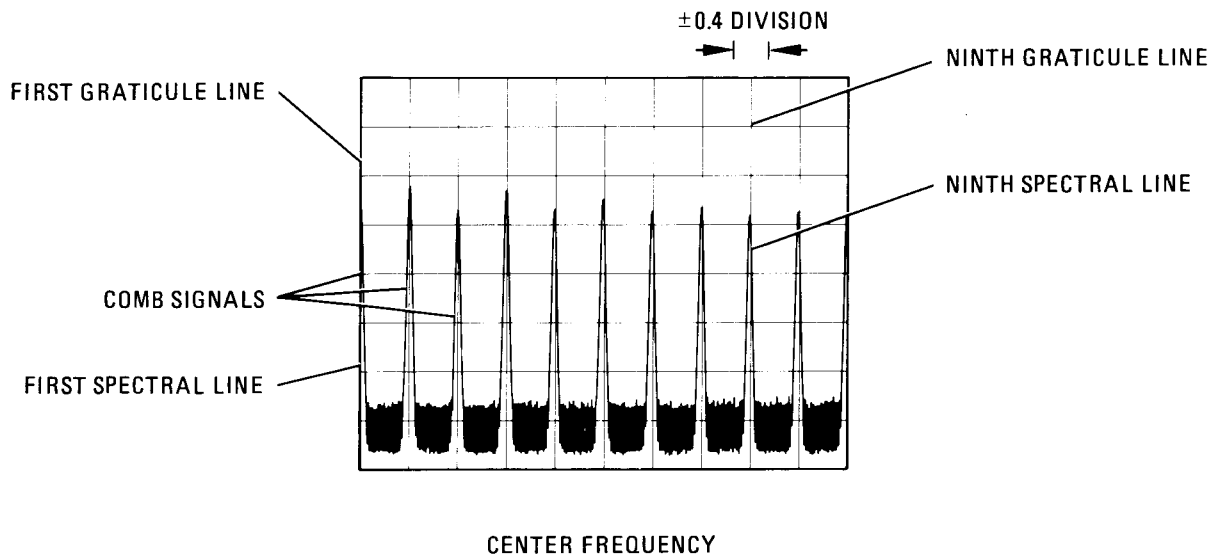


FIGURE 4-3. FREQUENCY SPAN ACCURACY MEASUREMENT FOR NINTH SPECTRAL LINE

8. Set **FREQ SPAN/DIV** to 5 MHz. Adjust **TUNING** control to position one spectral line on the first graticule line. Measure the error between fifth spectral line and ninth graticule line. Error should be no greater than ± 0.4 division.

_____ div

9. Set comb generator **COMB FREQUENCY** – MHz for 1-MHz comb and increase **OUTPUT AMPLITUDE** control to maximum setting. Set spectrum analyzer **FREQ SPAN/DIV** to 2 MHz. Adjust **TUNING** control to position one spectral line on the first graticule line. Measure the error between 17th spectral line and ninth graticule line. Error should be no greater than ± 0.4 division.

_____ div

10. Set **FREQ SPAN/DIV** to 1 MHz. Adjust **TUNING** control to position one spectral line at first graticule line. Measure the error between ninth spectral line and ninth graticule line. Error should be no greater than ± 0.4 division.

_____ div

11. Set **FREQ SPAN/DIV** to 500 kHz. Adjust **TUNING** control to position one spectral line on the first graticule line. Measure the error between fifth spectral line and ninth graticule line. Error should be no greater than ± 0.4 division.

_____ div

12. Set comb generator **COMB FREQUENCY** – MHz for 10-MHz comb. Adjust spectrum analyzer **TUNING** to position an in-band spectral line on the center graticule line (use **SIG IDENT** if necessary).

PERFORMANCE TESTS

4-11. FREQUENCY SPAN ACCURACY (Cont'd)

13. Set function generator frequency to 200 kHz ($\pm 0.5\%$) using frequency counter. Connect function generator output to comb generator MODULATION input. Set function generator OUTPUT LEVEL for a clean 200-kHz comb on the spectrum analyzer display.

NOTE

To obtain a clean comb on the spectrum analyzer display, use either the LOW or HIGH output of the function generator and readjust the OUTPUT LEVEL control as necessary.

14. Set spectrum analyzer FREQ SPAN/DIV to 200 kHz. Adjust TUNING control to position one spectral line on the first graticule line. Measure the error between ninth spectral line and ninth graticule line. Error should be no greater than ± 0.4 division.

_____ div

15. Using the procedure of NOTE in step 13, vary spectrum analyzer FREQ SPAN/DIV and function generator output frequency in accordance with Table 4-2. Adjust spectrum analyzer TUNING control to position one spectral line on the first graticule line. Measure the span error between ninth spectral line and ninth graticule line.

NOTE

Disconnect function generator from comb generator when setting frequency with frequency counter. Increase spectrum analyzer REFERENCE LEVEL control setting as necessary for the lowest frequencies.

TABLE 4-2. NARROW SPAN WIDTH ERROR MEASUREMENT

Spectrum Analyzer		Function Generator Output Frequency*	Span Width Error	
FREQ SPAN/DIV	RESOLUTION BW		Maximum	Actual
100 kHz	OPTIMUM	100 kHz	± 0.4 div.	_____ div.
50 kHz	OPTIMUM	50 kHz	± 0.4 div.	_____ div.
20 kHz	OPTIMUM	20 kHz	± 0.4 div.	_____ div.
10 kHz	OPTIMUM	10 kHz	± 0.4 div.	_____ div.

*Check function generator output frequency using a frequency counter. Frequency readout should be within $\pm 0.5\%$ of desired audio frequency.

PERFORMANCE TESTS

4-12. TUNING ACCURACY

SPECIFICATION:

- 0.1 – 3.0 GHz: $\pm(1 \text{ MHz} + 0.3\% \text{ of center frequency})$
- 3.0 – 21.0 GHz: $\pm(5 \text{ MHz} + 0.2\% \text{ of center frequency})$

DESCRIPTION:

An external RF source is used to provide a frequency-calibrated input signal to the spectrum analyzer for three points on each frequency band. The digital FREQUENCY GHz readout is compared with the known test frequency to find the amount of readout (or tuning) error. The 10 dB attenuator is necessary to reduce LO emission from the spectrum analyzer to the frequency counter when using the sweep oscillator.

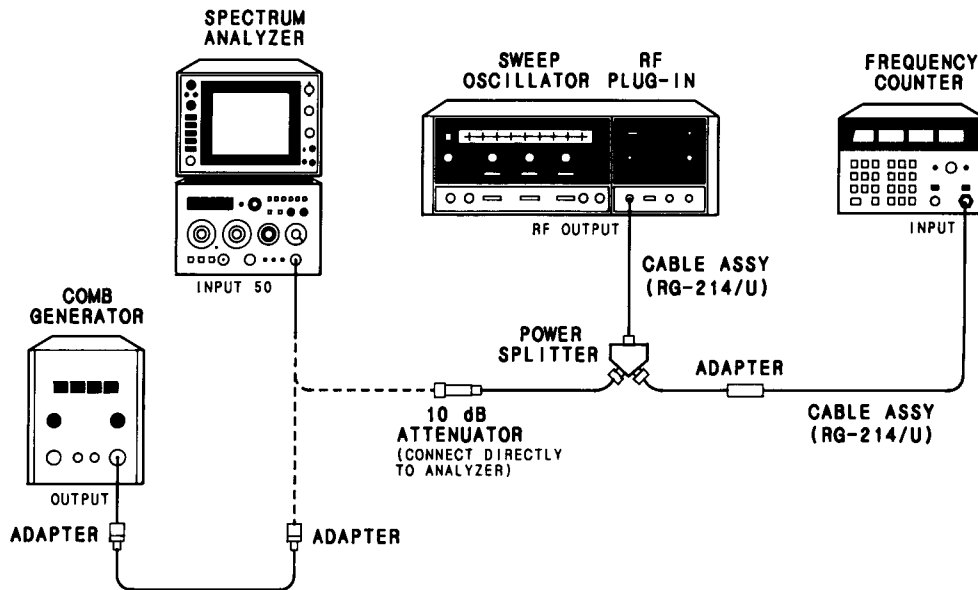


FIGURE 4-4. TUNING ACCURACY TEST SETUP

NOTE

The HP 8350A Sweep Oscillator may be substituted for the HP 8620C in this procedure.

EQUIPMENT:

Comb Generator	HP 8406A
Sweep Oscillator	HP 8620C
RF Plug-In	HP 86290B, Opt. HO8
Frequency Counter	HP 5342A, Opt. 005
Power Splitter	HP 11667A-C16
10-dB Attenuator	HP 8491B, Opt. 010
Cable Assembly, RG-214/U, with Type N Connectors (2 required)	HP 11500A
Adapter, Type N (f) to N (f)	HP 1250-1472
Adapter, Type N (m) to BNC (f) (2 required)	HP 1250-0780

PERFORMANCE TESTS

4-12. TUNING ACCURACY (Cont'd)

PROCEDURE:

1. Set spectrum analyzer controls as follows:

FREQUENCY BAND GHz01 – 3
 TUNING 0.035 GHz
 FREQ SPAN/DIV 200 kHz
 RESOLUTION BW OPTIMUM, coupled (pushed in)
 INPUT ATTEN 10 dB
 REFERENCE LEVEL – 10 dBm
 REF LEVEL FINE 0
 Amplitude Scale 10 dB/DIV
 SWEEP TIME/DIV AUTO
 SWEEP TRIGGER FREE RUN
 ALT IF OFF
 SIG IDENT OFF
 BL CLIP OFF
 VIDEO FILTER OFF

2. Connect CAL OUTPUT signal of spectrum analyzer to INPUT 50Ω. Adjust TUNING control to position signal at center graticule line of display. Adjust FREQ CAL potentiometer for a FREQUENCY GHz display of 0.035.
3. Connect comb generator to spectrum analyzer INPUT 50Ω as shown in Figure 4-4.
4. Set comb generator controls as follows:

COMB GENERATOR – MHz 10 MC
 INTERPOLATION AMPLITUDE – 1 MHz OFF
 OUTPUT AMPLITUDE Full clockwise

5. Adjust spectrum analyzer TUNING control to center 10-MHz comb tooth. FREQUENCY GHz readout should indicate:

Min.	Actual	Max.
0.00 0.009	_____	0.011

6. Set comb generator COMB FREQUENCY – MHz for 100 MHz comb. Set spectrum analyzer FREQ SPAN/DIV to 1 MHz, and adjust TUNING control to position 1.5-GHz comb tooth at center graticule line of display. FREQUENCY GHz readout should indicate:

Min.	Actual	Max.
1.50 1.494	_____	1.506

7. Connect sweep oscillator to spectrum analyzer INPUT 50Ω as shown in Figure 4-4.

PERFORMANCE TESTS

4-12. TUNING ACCURACY (Cont'd)

NOTE

The 10 dB attenuator should be connected directly to the INPUT 50Ω of the spectrum analyzer and the 11667A power splitter (no cable assembly should be used between attenuator and analyzer or power splitter).

- Adjust sweep oscillator for CW output at 3.000 GHz, as measured by frequency counter. Vary POWER LEVEL control as required for accurate measurement. Adjust spectrum analyzer TUNING control to center signal on display. FREQUENCY GHz readout should indicate:

Min.	Actual	Max.
2.90 2.990	_____	3.010

- Using procedure of step 8, check spectrum analyzer tuning accuracy at remaining frequencies listed in Table 4-3. Indication on FREQUENCY GHz readout must fall within corresponding test limits at each frequency.

NOTE

Use SIG IDENT to verify that spectrum analyzer is tuned to desired in-band signal response whenever tuning error appears excessive.

TABLE 4-3. TUNING ACCURACY MEASUREMENT

Spectrum Analyzer	RF Source	FREQUENCY GHz READOUT		
		Minimum (GHz)	Actual (GHz)	Maximum (GHz)
0.01-3	0.01	0.009	_____	0.011
	1.5	1.494	_____	1.506
	3.0	2.990	_____	3.010
6-9	6.1	6.083	_____	6.117
	7.5	7.480	_____	7.520
	9.0	8.977	_____	9.023
3-9	3.1	3.089	_____	3.110
	6.0	5.983	_____	6.017
	9.0	8.977	_____	9.023
9-15	9.1	9.077	_____	9.123
	12.0	11.971	_____	12.029
	15.0	14.965	_____	15.035
6-15	6.1	6.083	_____	6.117
	10.5	10.474	_____	10.526
	15.0	14.965	_____	15.035
12.1-21	12.1	12.071	_____	12.129
	17.0	16.961	_____	17.039
	21.0	20.953	_____	21.047

*nominal band limits

**frequency set to within ±0.05%

PERFORMANCE TESTS

4-13. RESIDUAL FM

SPECIFICATION:

Less than 2 kHz peak-to-peak for a time interval ≤ 0.1 second; less than 2 kHz peak-to-peak in a 180-series display mainframe with 220/240 line voltage.

DESCRIPTION:

This test measures the inherent short-term instability (residual FM) of the LO system in the spectrum analyzer. A stable signal (supplied by a comb generator) is applied to the spectrum analyzer input and slope-detected with the linear portion of the 10-kHz bandwidth filter in zero span (fixed-tuned receiver – see Figure 4-6). Variations of the spectrum analyzer's LO frequency (residual FM) can be measured as an amplitude shift on the CRT display (1 kHz \approx 0.7 major division with LIN Amplitude Scale).

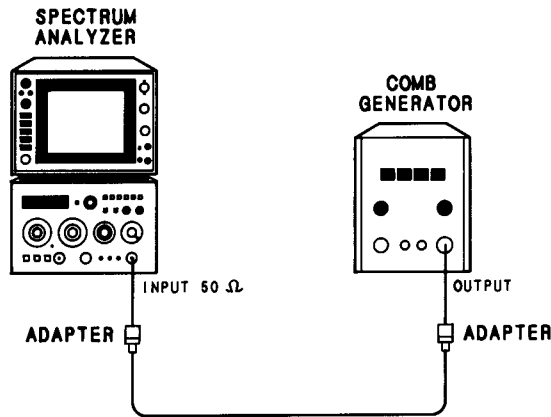


FIGURE 4-5. RESIDUAL FM TEST SETUP

EQUIPMENT:

Comb Generator	HP 8406A
Adapter, Type N (m) to BNC (f) (2 required)	HP 1250-0780

PROCEDURE:

1. Set equipment controls as follows:

Spectrum Analyzer:

FREQUENCY BAND GHz .....	.01 – 3
TUNING	3.000 GHz
FREQUENCY SPAN/DIV	100 kHz
RESOLUTION BW	10 kHz
INPUT ATTEN	30 dB
REFERENCE LEVEL	–20 dBm
REF LEVEL FINE	0
Amplitude Scale	LIN
SWEEP TIME/DIV	AUTO
SWEEP TRIGGER	FREE RUN
ALT IF	OFF
SIG IDENT	OFF
BL CLIP	OFF
VIDEO FILTER	OFF

PERFORMANCE TESTS

4-13. RESIDUAL FM (Cont'd)

Comb Generator:

COMB FREQUENCY – MHz 100 MC
 INTERPOLATION AMPLITUDE – 1 MHz OFF
 OUTPUT AMPLITUDE Full clockwise

- 2. Connect OUTPUT of comb generator to spectrum analyzer INPUT 50Ω as shown in Figure 4-5.

NOTE

The 8559A is sensitive to vibration. Be sure spectrum analyzer is in a vibration-free environment.

- 3. Adjust spectrum analyzer TUNING control to display 3.0 GHz signal produced by comb generator. Adjust REFERENCE LEVEL and REF LEVEL FINE controls to position peak of signal at top graticule line.
- 4. Keep 3.0 GHz signal centered on CRT with TUNING control while reducing FREQ SPAN/DIV to zero.
- 5. Set RESOLUTION BW to 10 kHz and SWEEP TIME/DIV to 0.1 sec.
- 6. Slightly readjust spectrum analyzer FINE TUNING control until trace appears between fourth and seventh graticule lines. Peak-to-peak variation of trace should not exceed 1.4 vertical division for each horizontal division (see Figure 4-7).

_____ div

NOTE

For 220/240 line voltages, peak-to-peak variation of trace should not exceed 1.4 vertical divisions (2 kHz) in a 180-series display mainframe.

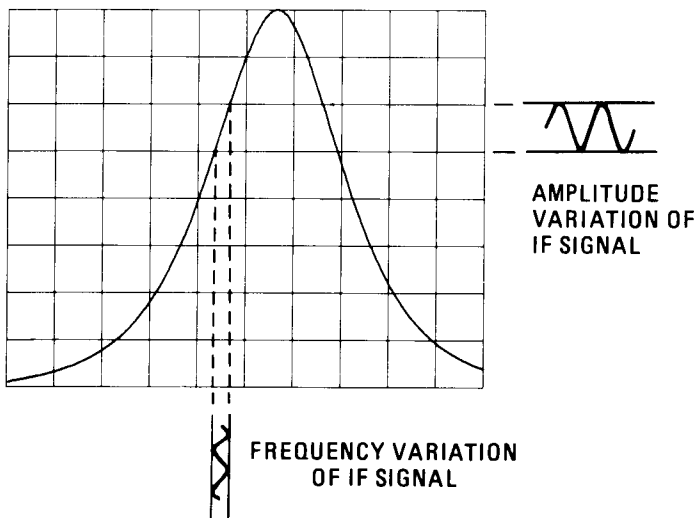


FIGURE 4-6. RESIDUAL FM TO AM CONVERSION DISPLAY

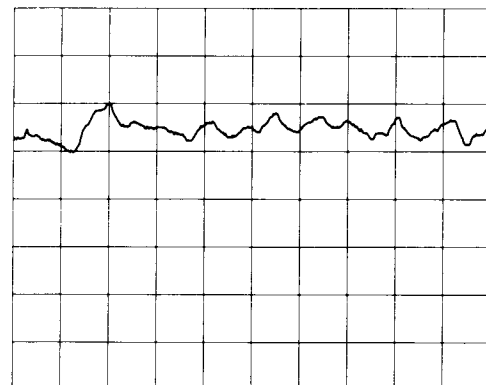


FIGURE 4-7. RESIDUAL FM DISPLAY

PERFORMANCE TESTS

4-14. NOISE SIDEBANDS

SPECIFICATION:

Noise sidebands are at least 70 dB below a CW signal, 30 kHz or more away from the signal with a 1 kHz resolution bandwidth and full video filtering.

DESCRIPTION:

A stable 1.8 GHz CW signal is applied at a -20 dBm level to the spectrum analyzer and displayed on the CRT. The amplitudes of noise-associated sidebands and unwanted responses near the signal are measured.

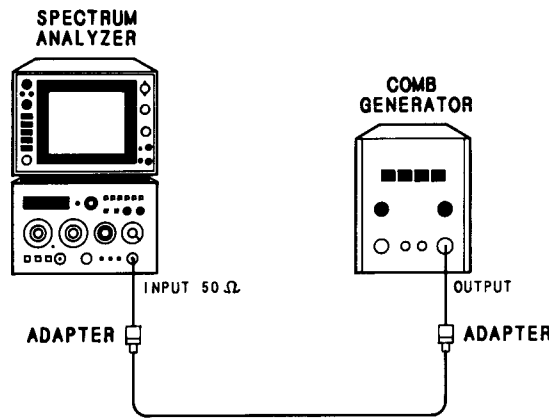


FIGURE 4-8. NOISE SIDEBANDS TEST SETUP

EQUIPMENT:

- Comb Generator HP 8406A
- Adapter, Type N (m) to BNC (f) (2 required) HP 1250-0780

PROCEDURE:

1. Set equipment controls as follows:

Spectrum Analyzer:

- FREQUENCY BAND GHz01 – 3
- TUNING 1.8 GHz
- FREQ SPAN/DIV 1 MHz
- RESOLUTION BW 30 kHz, uncoupled
- INPUT ATTEN 0 dB
- REFERENCE LEVEL -20 dBm
- REF LEVEL FINE 0
- Amplitude Scale 10 dB/DIV
- SWEEP TIME/DIV AUTO
- SWEEP TRIGGER FREE RUN
- ALT IF OFF
- SIG IDENT OFF
- BL CLIP OFF
- VIDEO FILTER OFF

PERFORMANCE TESTS

4-14. NOISE SIDEBANDS (Cont'd)

Comb Generator:

COMB FREQUENCY – MHz 100 MC
INTERPOLATION AMPLITUDE – 1 MHz OFF
OUTPUT AMPLITUDE Full clockwise

2. Connect equipment as shown in Figure 4-8.
3. Adjust TUNING control to locate 1.8-GHz comb tooth on CRT.
4. Adjust REFERENCE LEVEL and REF LEVEL FINE controls to position peak of 1.8-GHz signal at top graticule line.
5. Decrease FREQ SPAN/DIV to 20 kHz and RESOLUTION BW to 1 kHz. Adjust TUNING as necessary to keep signal centered.
6. Position signal at center of display. Set VIDEO FILTER control fully clockwise (not in MAX detent position). Measure noise sidebands existing more than 1.5 divisions (30 kHz) from 1.8-GHz signal. Noise sidebands should be more than 70 dB (7 divisions) down from top graticule line.

_____ div. down

PERFORMANCE TESTS

4-15. RESOLUTION BANDWIDTH ACCURACY

SPECIFICATION:

Individual resolution bandwidth 3-dB points are calibrated to $\pm 15\%$ ($\pm 30\%$ for 3 MHz bandwidth).

DESCRIPTION:

Resolution bandwidth accuracy is measured in the linear mode to eliminate log amplifier errors. Since signal level at the 3-dB points (half-power points) is related to peak signal level by a voltage ratio of 0.707:1.0, a peak level of 7.1 vertical divisions on the spectrum analyzer display gives a half-power level of 5 vertical divisions:

$$0.707 \text{ (voltage ratio)} = X \text{ div}/7.1 \text{ div}$$

$$X \text{ div} = (7.1)(0.707)$$

$$\approx 5 \text{ div}$$

In the 30-, 10-, 3-, and 1-kHz bandwidths, a 21.4 MHz signal (final IF) is injected directly into Bandwidth Filter No. 1 Assembly A11 to provide the stability required for measurement of narrow resolution bandwidths.

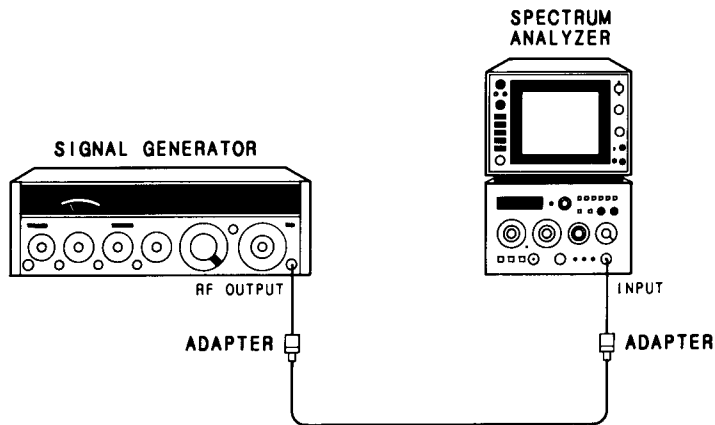


FIGURE 4-9. RESOLUTION BANDWIDTH ACCURACY TEST SETUP, 3 MHz TO 100 kHz

EQUIPMENT:

Signal Generator	HP 8640B
Extender Cable Assembly	HP 5060-0303
Adapter, Type N (m) to BNC (f) (2 required)	HP 1250-0780
Adapter, Type SMB (f) to BNC (f)	HP 1250-1236

PERFORMANCE TESTS

4-15. RESOLUTION BANDWIDTH ACCURACY (Cont'd)

PROCEDURE:



Part of this test must be performed with power supplied to the instrument and with protective covers removed. The test should be performed only by service-trained personnel who are aware of the hazards involved.

- 1. Set equipment controls as follows:

Spectrum Analyzer:

FREQUENCY BAND GHz	.01 – 3
TUNING	0.035 GHz
FREQ SPAN/DIV	0
RESOLUTION BW	3 MHz
INPUT ATTEN	10 dB
REFERENCE LEVEL	0 dBm
REF LEVEL FINE	0
Amplitude Scale	LIN
SWEEP TIME/DIV	AUTO
SWEEP TRIGGER	FREE RUN
ALT IF	OFF
SIG IDENT	OFF
BL CLIP	OFF
VIDEO FILTER	OFF

Signal Generator:

COUNTER MODE	INT, EXPAND X10
AM	OFF
FM	OFF
FREQUENCY TUNE	35 MHz
RF	ON
OUTPUT LEVEL	0 dBm

- 2. Connect equipment as shown in Figure 4-9.
- 3. Adjust spectrum analyzer TUNING control to locate peak of 35-MHz signal on CRT. Reduce signal generator output if necessary.

NOTE

If necessary, select 10 dB/DIV to locate signal, then switch to LIN.

- 4. Adjust signal generator OUTPUT LEVEL to position trace at 7.1 divisions above graticule baseline.

PERFORMANCE TESTS

4-15. RESOLUTION BANDWIDTH ACCURACY (Cont'd)

5. Tune signal generator frequency until trace drops to 5 divisions above graticule baseline. Record signal generator frequency.

_____ MHz

6. Tune signal generator frequency in direction opposite to that of step 5 until trace peaks (7.1 divisions above graticule baseline) and then drops to 5 divisions above graticule baseline. Record signal generator frequency.

_____ MHz

NOTE

The bandwidths recorded in this performance test are required for calculations in 4-16 Resolution Bandwidth Selectivity performance test.

7. Calculate and record resolution bandwidth at 3-dB points (difference between frequencies recorded in steps 5 and 6).

Min.	Actual	Max.
2.1 2.0	_____	3.90 MHz

8. Select ALT IF (switch pushed in), leaving FREQ SPAN/DIV set to 0. Set signal generator to 35 MHz and repeat steps 3 through 7.

Min.	Actual	Max.
2.1 2.0	_____	3.90 MHz

9. Return ALT IF switch to OFF position. Set RESOLUTION BW to 1 MHz, leaving FREQ SPAN/DIV set to 0. Set signal generator to 35 MHz and repeat steps 3 through 7.

Min.	Actual	Max.
850	_____	1150 kHz

10. Set RESOLUTION BW to 300 kHz, leaving FREQ SPAN/DIV set to 0. Set signal generator to 35 MHz and repeat steps 3 through 7.

Min.	Actual	Max.
255	_____	345 kHz

11. Set RESOLUTION BW to 100 kHz, leaving FREQ SPAN/DIV set to 0. Set signal generator to 35 MHz and repeat steps 3 through 7.

Min.	Actual	Max.
85	_____	115 kHz

PERFORMANCE TESTS

4-15. RESOLUTION BANDWIDTH ACCURACY (Cont'd)

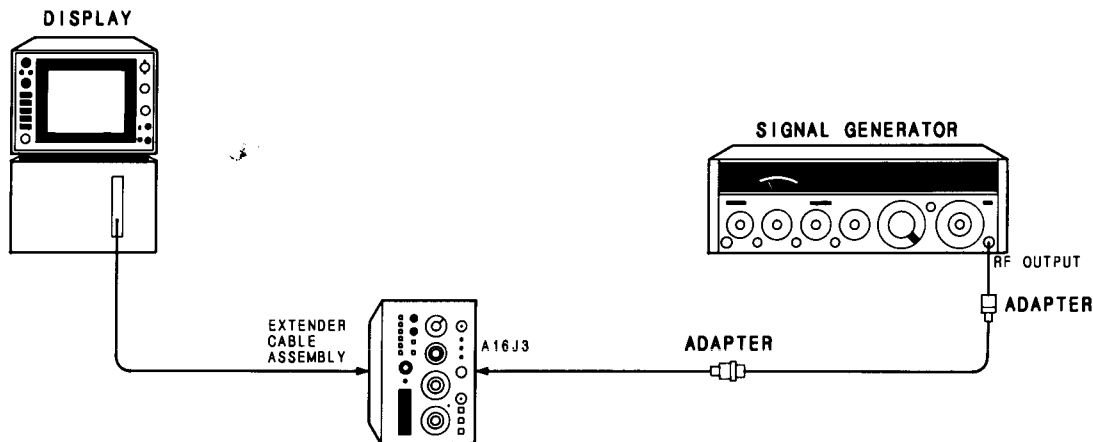


FIGURE 4-10. RESOLUTION BANDWIDTH ACCURACY TEST SETUP, 30 kHz TO 1 kHz

WARNING

In the following procedure, the plug-in must be removed from the display mainframe and connected through the extender cable assembly. Be very careful; the energy at some points in the instrument will, if contacted, cause personal injury. This test should be performed only by a skilled person who knows the hazard involved.

12. Set equipment controls as follows:

Spectrum Analyzer:

FREQUENCY BAND GHz	.....	.01 – 3
TUNING	.....	>0.010 GHz
FREQ SPAN/DIV	.....	0 kHz
RESOLUTION BW	.....	30 kHz
INPUT ATTEN	.....	10 dB
REFERENCE LEVEL	.....	0 dBm
REF LEVEL FINE	.....	0
Amplitude Scale	.....	LIN
SWEEP TIME/DIV	.....	AUTO
SWEEP TRIGGER	.....	FREE RUN
ALT IF	.....	OFF
SIG IDENT	.....	OFF
BL CLIP	.....	OFF
VIDEO FILTER	.....	OFF

PERFORMANCE TESTS

4-15. RESOLUTION BANDWIDTH ACCURACY (Cont'd)

Signal Generator:

COUNTER MODE INT, EXPAND X10
 AM OFF
 FM OFF
 FREQUENCY TUNE 21.4 MHz
 RF ON
 OUTPUT LEVEL ≈ -3 dBm

13. Connect equipment as shown in Figure 4-10.

NOTE

For early instruments that do not feature A16J3, a 21.4-MHz signal can be injected directly into the 300-MHz output (A10J1) of Third Converter Assembly A10. Set the signal generator OUTPUT LEVEL to 0 dBm and use the spectrum analyzer REFERENCE LEVEL and REF LEVEL FINE controls in step 14 (≈ -40 dBm) to position the trace at 7.1 divisions above the graticule baseline.

14. Adjust signal generator frequency until spectrum analyzer trace is at peak. Set signal generator OUTPUT LEVEL to position trace at 7.1 divisions above graticule baseline. Set COUNTER MODE to EXPAND X100 (most significant digit will overflow).
15. Tune signal generator frequency until trace drops to 5 divisions above graticule baseline. Record signal generator frequency.

_____ MHz

16. Tune signal generator frequency in direction opposite to that of step 15 until trace peaks (7.1 divisions above graticule baseline) and then drops to 5 divisions above graticule baseline. Record signal generator frequency.

_____ MHz

17. Calculate and record resolution bandwidth at 3-dB points (difference between frequencies recorded in steps 15 and 16).

Min.	Actual	Max.
25.5 25.0 kHz	_____	34.50 kHz

18. Set RESOLUTION BW to 10 kHz, leaving FREQ SPAN/DIV set to 0. Repeat steps 14 through 17.

Min.	Actual	Max.
8.5 8.0 kHz	_____	11.50 kHz

PERFORMANCE TESTS

4-15. RESOLUTION BANDWIDTH ACCURACY (Cont'd)

19. Set RESOLUTION BW to 3 kHz, leaving FREQ SPAN/DIV set to 0. Repeat steps 14 through 17.

Min.	Actual	Max.
2.5 2.55	_____	3.45 kHz
2.5 kHz		

20. Set RESOLUTION BW to 1 kHz, leaving FREQ SPAN/DIV set to 0. Repeat steps 14 through 17.

Min.	Actual	Max.
.8 .85	_____	1.15 kHz
.8 kHz		

21. Leave signal generator connected to A16J3 if continuing on with next performance test.

PERFORMANCE TESTS

4-16. RESOLUTION BANDWIDTH SELECTIVITY

SPECIFICATION:

60-dB/3-dB resolution bandwidth ratio: <15:1

DESCRIPTION:

The 60-dB bandwidth is measured for all resolution bandwidths. The 60- to 3-dB resolution bandwidth ratio (shape factor) is then computed for each bandwidth by dividing the 3-dB value (from the Resolution Bandwidth Accuracy test) into the 60-dB value.

In the 30-, 10-, 3-, and 1-kHz bandwidths, a 21.4-MHz signal (final IF) is injected into Bandwidth Filter No. 1 Assembly A11 to provide the stability required for the measurement of narrow resolution bandwidths.

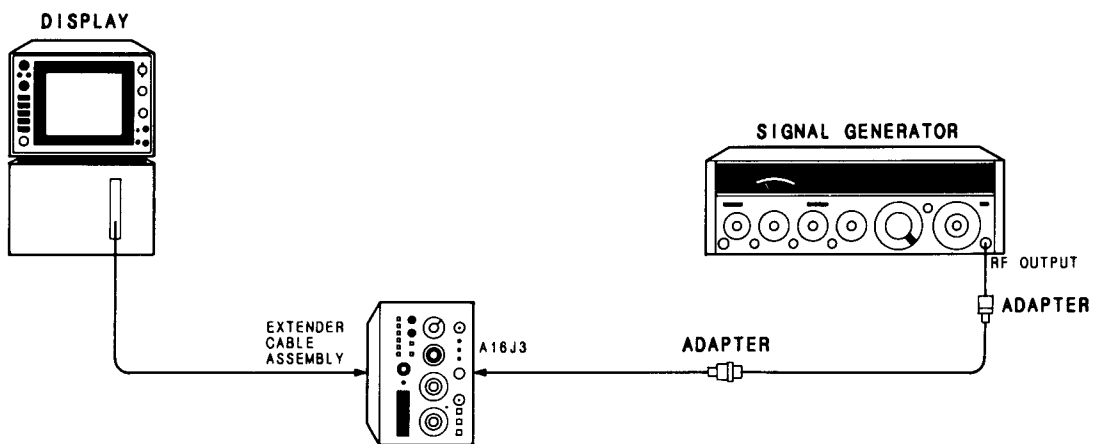


FIGURE 4-11. RESOLUTION BANDWIDTH SELECTIVITY TEST SETUP, 1 kHz TO 30 kHz

WARNING

In the following procedure, the plug-in must be removed from the display mainframe and connected through the extender cable assembly. Be very careful; the energy at some points in the instrument will, if contacted, cause personal injury. This test should be performed only by a skilled person who knows the hazard involved.

EQUIPMENT:

Signal Generator	HP 8640B
Extender Cable Assembly	HP 5060-0303
Adapter, SMB (f) to BNC (f)	HP 1250-1236
Adapter, Type N (m) to BNC (f) (2 required)	HP 1250-0780

PERFORMANCE TESTS

4-16. RESOLUTION BANDWIDTH SELECTIVITY (Cont'd)

PROCEDURE:

1. Set equipment controls as follows:

Spectrum Analyzer:

FREQUENCY BAND GHz01 – 3
 TUNING >0.010 GHz
 FREQ SPAN/DIV 0
 RESOLUTION BW 1 kHz
 INPUT ATTEN 10 dB
 REFERENCE LEVEL 0 dBm
 REF LEVEL FINE 0
 Amplitude Scale 10 dB/DIV
 SWEEP TIME/DIV AUTO
 SWEEP TRIGGER FREE RUN
 ALT IF OFF
 SIG IDENT OFF
 BL CLIP OFF
 VIDEO FILTER 12 o'clock

Signal Generator:

COUNTER MODE INT, EXPAND X10
 AM OFF
 FM OFF
 FREQUENCY TUNE 21.4 MHz
 RF ON
 OUTPUT LEVEL ≈ -3 dBm

2. Connect equipment as shown in Figure 4-11.

NOTE

For early instruments that do not feature A16J3, a 321.4 MHz, -25 dBm signal can be injected directly into the input of Third Converter Assembly A10 at blue cable A10W1. Set signal generator COUNTER MODE to EXPAND X100 (most significant digit will overflow).

3. Adjust signal generator frequency until spectrum analyzer trace is at peak. Put signal generator OUTPUT LEVEL to position trace at top graticule line.
4. Tune signal generator until trace drops to 2 divisions above graticule baseline. Record signal generator frequency.

_____ MHz

PERFORMANCE TESTS

4-16. RESOLUTION BANDWIDTH SELECTIVITY (Cont'd)

5. Tune signal generator in direction opposite to that of step 4 until trace peaks (top graticule line) and then drops to 2 divisions above graticule baseline. Record signal generator frequency.

_____ MHz

6. Calculate and record resolution bandwidth at 60-dB points (difference between frequencies recorded in steps 4 and 5).

_____ kHz

7. Set RESOLUTION BW to 3 kHz, leaving FREQ SPAN/DIV set to 0. Repeat steps 3 through 6.

_____ kHz

8. Set RESOLUTION BW to 10 kHz, leaving FREQ SPAN/DIV set to 0. Repeat steps 3 through 6.

_____ kHz

9. Set RESOLUTION BW to 30 kHz, leaving FREQ SPAN/DIV set to 0. Repeat steps 3 through 6.

_____ kHz

10. Disconnect signal generator from A16J3. Set the display's LINE power to OFF and remove extender cable assembly. Install plug-in in mainframe and set LINE power to ON.

11. Set equipment controls as follows:

Spectrum Analyzer:

FREQUENCY BAND GHz	.....	.01 – 3
TUNING	.....	0.035 GHz
FREQ SPAN/DIV	.....	0
RESOLUTION BW	.....	100 kHz
INPUT ATTEN	.....	10 dB
REFERENCE LEVEL	.....	0 dBm
REF LEVEL FINE	.....	0
Amplitude Scale	.....	10 dB/DIV
SWEEP TIME/DIV	.....	AUTO
SWEEP TRIGGER	.....	FREE RUN
ALT IF	.....	OFF
SIG IDENT	.....	OFF
BL CLIP	.....	OFF
VIDEO FILTER	.....	12 o'clock

PERFORMANCE TESTS

4-16. RESOLUTION BANDWIDTH SELECTIVITY (Cont'd)

Signal Generator:

COUNTER MODE INT, EXPAND X10
 AM OFF
 FM OFF
 FREQUENCY TUNE 35 MHz
 RF ON
 OUTPUT LEVEL 0 dBm

12. Connect equipment as shown in Figure 4-12.

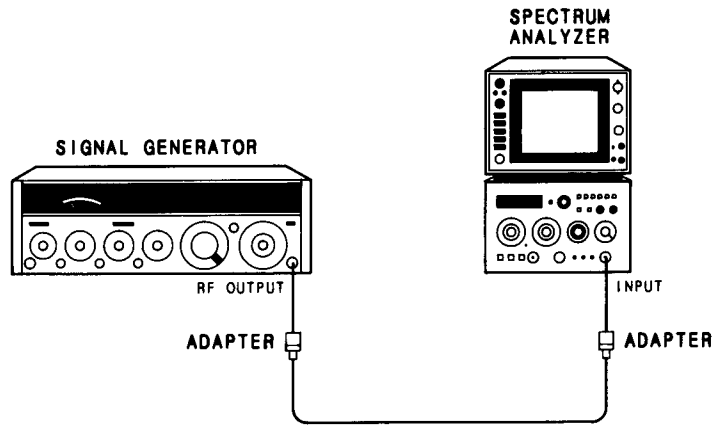


FIGURE 4-12. RESOLUTION BANDWIDTH SELECTIVITY TEST SETUP, 100 kHz TO 3 MHz

13. Adjust spectrum analyzer TUNING to locate peak of 35-MHz signal on CRT. Reduce signal generator output if necessary.

14. Adjust signal generator OUTPUT LEVEL to position trace at top graticule line.

15. Tune signal generator frequency until trace drops to 2 divisions above graticule baseline. Record signal generator frequency.

_____ MHz

16. Tune signal generator frequency in direction opposite to that of step 15 until trace peaks (top graticule line) and then drops to 2 divisions above graticule baseline. Record signal generator frequency.

_____ MHz

17. Calculate and record resolution bandwidth at 60-dB points (difference between frequencies recorded in steps 15 and 16).

_____ kHz

PERFORMANCE TESTS

4-16. RESOLUTION BANDWIDTH SELECTIVITY (Cont'd)

- 18. Set RESOLUTION BW to 300 kHz, leaving FREQ SPAN/DIV set to 0. Repeat steps 14 through 18.
_____ kHz
- 19. Set RESOLUTION BW to 1 MHz, leaving FREQ SPAN/DIV set to 0. Repeat steps 14 through 18.
_____ MHz
- 20. Select ALT IF (switch pushed in). Set RESOLUTION BW to 3 MHz, leaving FREQ SPAN/DIV set to 0. Repeat steps 14 through 18.
_____ MHz
- 21. Return ALT IF switch to OFF position. With RESOLUTION BW still in 3 MHz and FREQ SPAN/DIV set to 0, repeat steps 14 through 18.
_____ MHz
- 22. In Table 4-4, record 3-dB bandwidths computed in 4-15 Resolution Bandwidth Accuracy test.
- 23. In Table 4-4, record 60-dB bandwidths recorded in this procedure.
- 24. For each resolution bandwidth, divide 60-dB bandwidth by 3-dB bandwidth to obtain Resolution Bandwidth Ratio. Each ratio should be less than 15:1.

TABLE 4-4. RESOLUTION BANDWIDTH SELECTIVITY

RESOLUTION BW Setting	Actual 3 dB BW	Actual 60 dB BW	Resolution Bandwidth Ratio (60 dB/3 dB BW)
3 MHz	_____	_____	_____
3 MHz (ALT IF)	_____	_____	_____
1 MHz	_____	_____	_____
300 kHz	_____	_____	_____
100 kHz	_____	_____	_____
30 kHz	_____	_____	_____
10 kHz	_____	_____	_____
3 kHz	_____	_____	_____
1 kHz	_____	_____	_____

PERFORMANCE TESTS

4-17. AVERAGE NOISE LEVEL

SPECIFICATION:

The maximum average noise level for each frequency band, with 1 kHz resolution bandwidth and 0 dB attenuation, is given in Table 4-5.

DESCRIPTION:

The average noise level of the spectrum analyzer is checked by observing the average noise power level displayed on the CRT when no input signal is applied to the instrument.

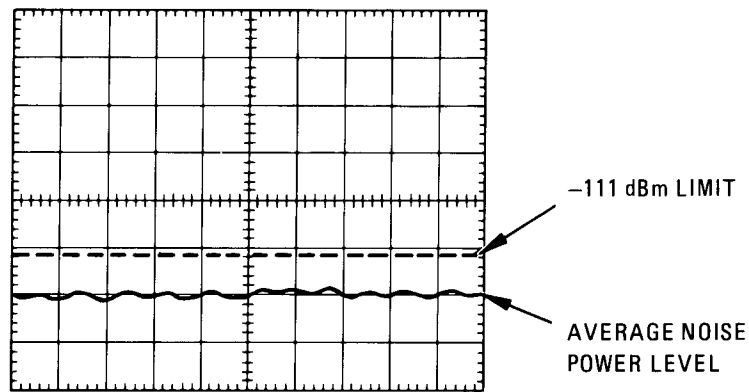


FIGURE 4-13. AVERAGE NOISE LEVEL MEASUREMENT, .01 – 3 GHz

EQUIPMENT:

- Variable Persistence/Storage Display HP 181T/TR
- 50Ω Termination HP 909A, Opt. 012

NOTE

The HP 853A Spectrum Analyzer Display may be substituted for the HP 181T/TR in this procedure.

NOTE

This test can be performed with no input termination if INPUT ATTEN is set to 20 dB. Note that the input attenuation must then be taken into consideration in establishing the equivalent REFERENCE LEVEL control setting for the measurement. A REFERENCE LEVEL setting of -40 dBm with 20 dB INPUT ATTEN is equivalent to a REFERENCE LEVEL setting of -60 dBm with 0 dB INPUT ATTEN.

PERFORMANCE TESTS

4-17. AVERAGE NOISE LEVEL (Cont'd)

PROCEDURE:

1. Set spectrum analyzer controls as follows:

FREQUENCY BAND GHz .....	.01 – 3
TUNING	0.010 GHz
FREQ SPAN/DIV	F
RESOLUTION BW	3 MHz, uncoupled
INPUT ATTEN	0 dB
REFERENCE LEVEL	– 60 dBm
REF LEVEL FINE	0
Amplitude Scale	10 dB/DIV
SWEEP TIME/DIV	AUTO
SWEEP TRIGGER	FREE RUN
ALT IF	OFF
SIG IDENT	OFF
BL CLIP	OFF
VIDEO FILTER	Full CW (not in detent)

2. With FREQ SPAN/DIV set to F, set VIDEO FILTER fully clockwise, but not in detent. Adjust TUNING to position marker at frequency where displayed average noise level is highest.

NOTE

Do not tune marker beyond specified band edge.

3. Set VIDEO FILTER to detent and FREQ SPAN/DIV to 0.
4. Set RESOLUTION BW to 1 kHz.
5. Measure average noise level displayed on CRT (see Figure 4-13) and record results in Table 4-5.
6. Set FREQUENCY BAND GHz to 6 – 9 and repeat steps 2 through 5.
7. Set FREQUENCY BAND GHz to 3 – 9 and repeat steps 2 through 5.
8. Set FREQUENCY BAND GHz to 9 – 15 and repeat steps 2 through 5.
9. Set FREQUENCY BAND GHz to 6 – 15 and repeat steps 2 through 5.
10. Set FREQUENCY BAND GHz to 12.1 – 21 and repeat steps 2 through 5 for the frequency range of 12.1 – 18.0 GHz.

PERFORMANCE TESTS

4-17. AVERAGE NOISE LEVEL (Cont'd)

NOTE

Do not tune above 18.0 GHz for this step.

11. Repeat steps 2 through 5 for the frequency range of 18.0 – 21.0 GHz.
12. Repeat entire procedure with ALT IF on.

TABLE 4-5. AVERAGE NOISE LEVEL

FREQUENCY BAND GHz Setting	Specified Frequency Range (GHz)		Average Noise Level		
	Reg. IF	ALT IF	Maximum	Actual (Reg. IF)	Actual (ALT IF)
.01–3	0.010–3.060	0.025–3.060	–111 dBm	– _____ dBm	– _____ dBm
6–9	6.035–9.060	6.020–9.060	–108 dBm	– _____ dBm	– _____ dBm
3–9	3.033–9.120	3.048–9.120	–103 dBm	– _____ dBm	– _____ dBm
9–15	9.058–15.120	9.043–15.120	–98 dBm	– _____ dBm	– _____ dBm
6–15	6.055–15.180	6.070–15.180	–93 dBm	– _____ dBm	– _____ dBm
12.1–21	12.080–18.000	12.065–18.000	–92 dBm	– _____ dBm	– _____ dBm
12.1–21	18.000–21.000	18.000–21.000	–90 dBm	– _____ dBm	– _____ dBm

PERFORMANCE TESTS

4-18. RESIDUAL RESPONSES

SPECIFICATION:

Residual responses are less than -90 dBm (0.01 – 3.06 GHz) with 0 dB input attenuation and no signal present at input. They are less than -90 dBm (0.025 – 3.06 GHz) with ALT IF selected.

DESCRIPTION:

Signals present on the display without an input signal applied to the spectrum analyzer are residual responses. The .01 – 3 GHz frequency band is checked for residual responses greater than -90 dBm.

EQUIPMENT:

Variable Persistence/Storage Display HP 181T/TR
 50 Ω Termination, Type N (m) HP 909A, Opt. 012

NOTE

The HP 853A Spectrum Analyzer Display may be substituted for the HP 181T/TR in this procedure.

NOTE

This test can be performed with no input termination if INPUT ATTEN is set to 20 dB. Note that the input attenuation must then be taken into consideration in establishing the equivalent REFERENCE LEVEL control setting for the measurement. A REFERENCE LEVEL setting of -40 dBm with 20 dB INPUT ATTEN is equivalent to a REFERENCE LEVEL setting of -60 dBm with 0 dB INPUT ATTEN.

PROCEDURE:

1. Set spectrum analyzer controls as follows:

FREQUENCY BAND GHz01 – 3
 TUNING 0.050 GHz
 FREQ SPAN/DIV 10 MHz
 RESOLUTION BW 1 MHz, uncoupled
 INPUT ATTEN 0 dB
 REFERENCE LEVEL -60 dBm
 REF LEVEL FINE 0
 Amplitude Scale 10 dB/DIV
 SWEEP TIME/DIV AUTO
 SWEEP TRIGGER FREE RUN
 ALT IF OFF
 SIG IDENT OFF
 BL CLIP OFF
 VIDEO FILTER 12 o'clock

 PERFORMANCE TESTS

4-18. RESIDUAL RESPONSES (Cont'd)

2. Terminate INPUT 50 Ω connector with 50-ohm termination.
3. Adjust TUNING control to position LO feedthrough signal on leftmost vertical graticule line.
4. Set RESOLUTION BW control to 10 kHz, leaving FREQ SPAN/DIV set to 10 MHz. Adjust BL CLIP control clockwise until just the peaks of the noise are displayed. Set the SWEEP TRIGGER control to SINGLE and display PERSISTENCE control to MAX.
5. Set display to WRITE and momentarily press ERASE. Turn SWEEP TRIGGER control clockwise to trigger a single sweep, adjusting BL CLIP and display INTENSITY controls until just the peaks of the noise are displayed. Press ERASE and trigger another sweep.
6. Set display to VIEW and check for residual responses greater than -90 dBm. Record frequency and amplitude of residual response with the greatest amplitude.

_____ GHz

_____ dBm

NOTE

Residual responses are often visible within 10 MHz of the HP 8559A LO feedthrough signal (25 MHz with ALT IF selected). These residual responses are not within the instrument's specified frequency range and should be excluded from consideration in this performance test.

7. Increase TUNING control setting in 100-MHz increments and use procedure of steps 5–7 to check for residual responses from 10 MHz to 3.060 GHz (25 MHz – 3.060 GHz with ALT IF selected).

0.025 GHz - 3 GHz

PERFORMANCE TESTS

4-19. FREQUENCY RESPONSE

SPECIFICATION:

Frequency response measured with 0 or 10 dB of input attenuation includes input attenuator flatness, mixer flatness, and band-to-band amplitude variation. Table 4-6 shows the frequency response specifications.

TABLE 4-6. FREQUENCY RESPONSE SPECIFICATIONS

FREQUENCY BAND (GHz)	Frequency Response (\pm dB Maximum)
.01-3	1.0
6-9	1.0
3-9	1.5
9-15	1.8
6-15	2.1
12.1-18.0	2.3
18.0-21.0	3.0

DESCRIPTION:

Frequency response is checked in each frequency band. With the spectrum analyzer set to full sweep, an RF input signal is very slowly swept across the entire frequency band. The resulting display is a series of narrow signals that vary in height across the CRT. Since the RF source is leveled and held flat across each frequency band, variations in amplitude on the display represent variations in the frequency response of the spectrum analyzer. Leveling within reasonable limits becomes difficult from 18 GHz to 21 GHz, so the RF output at the power splitter is characterized and compensated for when making the measurement of this frequency range.

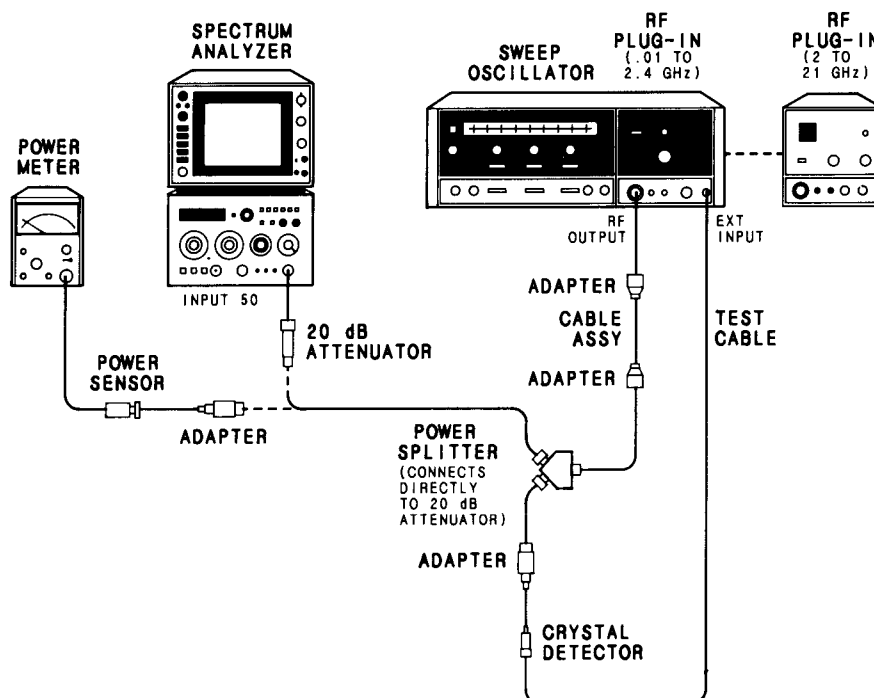


FIGURE 4-14. FREQUENCY RESPONSE TEST SETUP

PERFORMANCE TESTS

4-19. FREQUENCY RESPONSE (Cont'd)

NOTE

The HP 853A Spectrum Analyzer Display is not recommended for use in this procedure.

The HP 8350A Sweep Oscillator may be substituted for the HP 8620C in this procedure, if necessary.

EQUIPMENT:

Variable Persistence/Storage Display	HP 181T/TR
Sweep Oscillator	HP 8620C
RF Plug-in	HP 86222A
RF Plug-in	HP 86290B-H08
Power Meter	HP 435A/B
Power Sensor	HP 8485A
Power Splitter	HP 11667A, Opt. C16
Attenuator, 20-dB	HP 8491B, Opt. 020
Crystal Detector	HP 33330C
Adapter, Type N (m) to SMA (f) (2 required)	HP 1250-1250
Adapter, Type N (f) to SMA (f)	HP 1250-1745
Adapter, Type N (m) to N (m)	HP 1250-0778
Test Cable, SMC (m) to BNC (m)	HP 11592-60001
Cable Assembly, SMA (m) to SMA (m)	HP 8120-1578

PROCEDURE:

1. Set equipment controls as follows:

Spectrum Analyzer:

FREQUENCY BAND GHz .....	.01 – 3
TUNING	0.000 GHz
FREQ SPAN/DIV	10 MHz
RESOLUTION BW	300 kHz, coupled
INPUT ATTEN	0 dB
REFERENCE LEVEL	-20 dBm
REF LEVEL FINE	-4
Amplitude Scale	10 dB/DIV
SWEEP TIME/DIV	AUTO
SWEEP TRIGGER	FREE RUN
ALT IF	OFF
SIG IDENT	OFF
BL CLIP	OFF
VIDEO FILTER	Full CW (not in detent)

PERFORMANCE TESTS

4-19. FREQUENCY RESPONSE (Cont'd)

Sweep Oscillator:

CW Frequency 0.100 GHz
 MARKERS OFF
 SWEEP MODE AUTO (or TIME)
 SWEEP TRIGGER EXT
 SWEEP-TIME-SEC 100
 RF OFF-ON OFF
 ALC Switch EXT
 POWER LEVEL Midrange
 RF BLANKING (Rear Panel) ON
 FM-NORM-PL (Rear Panel) NORM
 1 kHz SQ WAVE (Rear Panel) OFF

- Center LO feedthrough signal on CRT with spectrum analyzer TUNING control. Adjust FREQ CAL for a FREQUENCY GHz readout of 0.000.

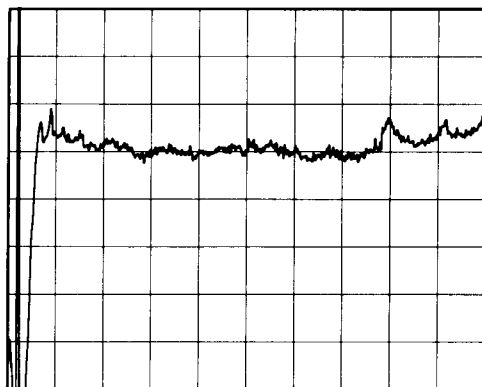


FIGURE 4-15. TYPICAL FREQUENCY RESPONSE FOR .01 TO 2.4 GHz

- Using 0.01 – 2.4 GHz sweep oscillator plug-in, connect equipment as shown in Figure 4-14. Connect output of power splitter, through 20-dB attenuator, to spectrum analyzer input. Turn sweep oscillator RF power ON and adjust ALC GAIN control for levelled output indication.

NOTE

Use maximum possible ALC GAIN to avoid leveling errors during swept measurements.

PERFORMANCE TESTS

4-19. FREQUENCY RESPONSE (Cont'd)

4. Adjust spectrum analyzer TUNING control for a FREQUENCY GHz readout of 0.100. Set sweep oscillator to CW with frequency of 100 MHz and use CW control to center signal on spectrum analyzer display.
5. Calibrate and zero power sensor and meter. Disconnect power splitter from 20-dB attenuator and connect to power sensor. Adjust sweep oscillator POWER LEVEL control for a power meter indication of -8 dBm.
6. Connect output of power splitter through 20-dB attenuator directly (do not use cable) to spectrum analyzer input. Select Amplitude Scale setting of 1 dB/DIV, and adjust REF LEVEL FINE control as necessary to place peak of 100 MHz signal at center horizontal graticule line of spectrum analyzer display.
7. Adjust spectrum analyzer TUNING control for a FREQUENCY GHz readout of 0.060. Adjust sweep oscillator CW control for 60 MHz signal, centered on spectrum analyzer display.
8. Set sweep oscillator ΔF control for 100 MHz sweep. Adjust spectrum analyzer display PERSISTENCE control fully clockwise. Adjust sweep oscillator SWEEP TIME vernier for slow sweep (30 seconds or longer) and trigger a sweep. Record greatest positive and greatest negative deviation of signal peaks from center horizontal graticule line (10 MHz to 110 MHz).

Maximum _____ divisions

Minimum _____ divisions

9. Adjust spectrum analyzer TUNING control for a FREQUENCY GHz readout of 0.100. Set sweep oscillator to CW with frequency of 100 MHz and use CW control to center signal on spectrum analyzer display.
10. Set spectrum analyzer FREQ SPAN/DIV control to F (full band) and RESOLUTION BW control to 3 MHz. Adjust TUNING control fully clockwise to position tuning marker at high end of selected frequency band. Adjust REF LEVEL FINE control as necessary to place peak of 100 MHz signal (near LO feed-through signal) at center horizontal graticule line of spectrum analyzer display.
11. Set sweep oscillator for FULL BAND (10 MHz to 2.4 GHz) and trigger a sweep. Record greatest positive and greatest negative deviation of signal peaks from center horizontal graticule line (10 MHz to 2.4 GHz). Record deviation of signal peak located at 8th vertical graticule line (approximately 2.1 GHz).

Maximum _____ divisions

Minimum _____ divisions

8th graticule line _____ divisions

12. Remove 0.01 – 2.4 GHz RF Plug-in from sweep oscillator mainframe and replace with 2 – 22 GHz RF Plug-in. Select band 4 (2.0 – 22 GHz) on HP 8620C sweep oscillator.
 13. Set sweep oscillator to CW with frequency of 2.1 GHz and use CW control to position signal on 8th vertical graticule line of spectrum analyzer display. Adjust ALC GAIN control for leveled sweep oscillator output and adjust POWER LEVEL control to place signal peak at same amplitude measured in step 11.
-

PERFORMANCE TESTS

4-19. FREQUENCY RESPONSE (Cont'd)

NOTE

Use maximum possible ALC GAIN to avoid leveling errors during swept measurements.

Do not adjust spectrum analyzer REF LEVEL FINE control or sweep oscillator POWER LEVEL control during the remaining steps of this performance test.

14. Adjust spectrum analyzer TUNING control fully counterclockwise to position tuning marker at low end of selected frequency band. Set sweep oscillator CW control to 2.5 GHz and ΔF control for 1 GHz sweep. Trigger a sweep, and record greatest positive and greatest negative deviation of signal peaks from center horizontal graticule line (2 GHz to 3 GHz).

Maximum _____ divisions

Minimum _____ divisions

NOTE

It is normal for the HP 8559A to exhibit baseline lift with an input signal at approximately 3.0075 GHz (2.9925 with ALT IF selected). Adjust sweep oscillator sweep range as necessary to avoid baseline lift during frequency response measurements.

If frequency response appears out of specification near a band edge, use a frequency counter with sweep oscillator in CW to ensure the frequency in question is within the specified band.

15. Compare values recorded in steps 8, 11, and 14, and record overall greatest positive and greatest negative deviation from center horizontal graticule line for entire .01 – 3 GHz frequency band. Frequency response (deviation from center horizontal graticule line) should not exceed ± 1.0 dB (± 1.0 division).

Maximum _____ divisions (.01 – 3 GHz)

Minimum _____ divisions (.01 – 3 GHz)

16. Calculate mean deviation for .01 – 3 GHz frequency band using maximum and minimum values recorded in step 15. (For example, a maximum of +0.5 and a minimum of –0.7 results in a mean deviation of –0.1)

$$\text{Mean deviation} = \frac{\text{Maximum} + \text{Minimum}}{2} = \text{_____ divisions}$$

PERFORMANCE TESTS

4-19. FREQUENCY RESPONSE (Cont'd)**Frequency Response, 3 – 18 GHz****NOTE**

For the higher frequency bands, multiple responses may appear on spectrum analyzer display during frequency response measurement. Adjust INTENSITY control as necessary for optimum display of in-band signal peaks.

17. Select 6 – 9 GHz frequency band on spectrum analyzer. Set sweep oscillator to CW and frequency to 7.5 GHz. Use CW control to center signal on spectrum analyzer display. Set ΔF control for 3 GHz and trigger a sweep. Adjust spectrum analyzer TUNING control clockwise several turns to reposition tuning marker. Trigger another sweep. Record greatest positive and greatest negative deviation of signal peaks from center horizontal graticule line (neglect deviations caused by tuning marker).

Maximum _____ divisions

Minimum _____ divisions

18. To calculate frequency response for 6 – 9 GHz frequency band, subtract mean deviation of step 16 from maximum and minimum values recorded in step 17. Frequency response should not exceed ± 1.0 dB (± 1.0 division).

Maximum _____ divisions (6 – 9 GHz)

Minimum _____ divisions (6 – 9 GHz)

19. Select 3 – 9 GHz frequency band on spectrum analyzer. Set sweep oscillator to CW and frequency to 6.0 GHz. Use CW control to center signal on spectrum analyzer display. Set ΔF control for 6 GHz and trigger a sweep. Adjust spectrum analyzer TUNING control to reposition tuning marker. Trigger another sweep. Record greatest positive and greatest negative deviation of signal peaks from center horizontal graticule line (neglect deviations caused by tuning marker).

Maximum _____ divisions

Minimum _____ divisions

20. Subtract mean deviation of step 16 from maximum and minimum values recorded in step 19. Frequency response for 3 – 9 GHz frequency band should not exceed ± 1.5 dB (± 1.5 divisions).

Maximum _____ divisions (3 – 9 GHz)

Minimum _____ divisions (3 – 9 GHz)

PERFORMANCE TESTS

4-19. FREQUENCY RESPONSE (Cont'd)

21. Select 9 – 15 GHz frequency band on spectrum analyzer. Set sweep oscillator to CW and frequency to 12.0 GHz. Use CW control to center signal on spectrum analyzer display. Trigger a 6 GHz sweep. Adjust spectrum analyzer TUNING control to reposition tuning marker. Trigger another sweep. Record greatest positive and greatest negative deviation of signal peaks from center horizontal graticule line (neglect deviations caused by tuning marker).

Maximum _____ divisions

Minimum _____ divisions

22. Subtract mean deviation of step 16 from maximum and minimum values recorded in step 21. Frequency response for 9 – 15 GHz frequency band should not exceed ± 1.8 dB (± 1.8 divisions).

Maximum _____ divisions (9 – 15 GHz)

Minimum _____ divisions (9 – 15 GHz)

23. Select 6 – 15 GHz frequency band on spectrum analyzer. Set sweep oscillator to CW and frequency to 10.5 GHz. Use CW control to center signal on spectrum analyzer display. Set ΔF control for 9 GHz and trigger a sweep. Adjust spectrum analyzer TUNING control several turns to reposition tuning marker. Trigger another sweep. Record greatest positive and greatest negative deviation of signal peaks from center horizontal graticule line (neglect deviations caused by tuning marker).

Maximum _____ divisions

Minimum _____ divisions

24. Subtract mean deviation of step 16 from maximum and minimum values recorded in step 23. Frequency response for 6 – 15 GHz frequency band should not exceed ± 2.1 dB (± 2.1 divisions).

Maximum _____ divisions (6 – 15 GHz)

Minimum _____ divisions (6 – 15 GHz)

25. Select 12.1 – 21 GHz frequency band on spectrum analyzer and adjust TUNING control fully clockwise. Set sweep oscillator to CW and frequency to 15 GHz. Set ΔF control for 6 GHz and trigger a sweep. Record greatest positive and greatest negative deviation of signal peaks from center horizontal graticule line (12.1 GHz to 18 GHz).

Maximum _____ divisions

Minimum _____ divisions

PERFORMANCE TESTS

4-19. FREQUENCY RESPONSE (Cont'd)

26. Subtract mean deviation of step 16 from maximum and minimum values recorded in step 25. Frequency response for 12.1 – 18 GHz portion of 12.1 – 21 GHz frequency band should not exceed ± 2.3 dB (± 2.3 divisions).

Maximum _____ divisions (12.1 – 18 GHz)

Minimum _____ divisions (12.1 – 18 GHz)

Frequency Response, 18 – 21 GHz

27. Disconnect power splitter from 20-dB attenuator and connect it to the power sensor. Set sweep oscillator to CW with frequency of 18.0 GHz and measure output at power splitter with power meter.
- _____ dBm
28. Use CW control to slowly tune sweep oscillator from 18 GHz to 21 GHz. Note all peak deviations from reference power level (recorded in step 27) and the frequencies at which they occur. Record frequencies and power levels in Table 4-7.
29. Connect output of power splitter through 20-dB attenuator to spectrum analyzer input. Adjust spectrum analyzer TUNING control counterclockwise several turns. Use CW control to tune sweep oscillator to frequencies recorded in step 28 and record deviation of signal peak from center horizontal graticule line.
30. Set sweep oscillator to CW with frequency of 19.5 GHz. Set ΔF control for 3 GHz and trigger a sweep. Note greatest positive and greatest negative deviation of signal peaks (18 GHz to 21 GHz). Use sweep oscillator CW control to tune to points of greatest deviation. Record frequencies and deviations from center horizontal graticule line in Table 4-7.
31. Disconnect power splitter from 20-dB attenuator and connect it to the power sensor. Use CW control to tune sweep oscillator to frequencies recorded in step 30 and record power levels in Table 4-7.
32. Algebraically subtract reference power level recorded in step 27 from each power meter indicated recorded in Table 4-7. Record results in Power Deviation column (see example). Add corresponding deviation from center horizontal graticule line to each power deviation and record results in Sum of Deviations column. Subtract mean deviation of step 16 from each value in Sum of Deviations column and record results in Deviation from Mean column. Frequency response for 18 – 21 GHz portion of 12.1 – 21 GHz frequency band should not exceed ± 3.0 dB (± 3 divisions).

PERFORMANCE TESTS

4-19. FREQUENCY RESPONSE (Cont'd)

TABLE 4-7. CORRECTING FOR FREQUENCY RESPONSE OF SIGNAL SOURCE

Frequency (GHz)	Power Meter Indication (dBm)	Power Deviation* (dB)	Deviation from Center Graticule Line (divisions or dB)	Sum of Deviations (dB)	Deviation from Mean (dB)
18.0	_____	0 (Ref.)	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____

*deviation relative to power meter indication at 18.0 GHz, recorded in step 27.

EXAMPLE (MEAN DEVIATION OF -0.1 dB)

Frequency (GHz)	Power Meter Indication (dBm)	Power Deviation* (dB)	Deviation from Center Graticule Line (divisions or dB)	Sum of Deviations (dB)	Deviation from Mean (dB)
18.0	-8.0	0 (Ref.)	-0.4	-0.4	-0.3
18.6	-9.0	-1.0	-1.0	-2.0	-1.9
19.6	-8.5	-0.5	-1.0	-1.5	-1.4
20.1	-7.0	+1.0	0.0	+1.0	+1.1
21.8	-9.0	-1.0	-0.4	-1.4	-1.3
20.6	-8.5	-0.5	-2.0	-2.5	-2.4
21.2	-7.5	+0.5	+1.5	+2.0	+2.1

PERFORMANCE TESTS

4-20. GAIN COMPRESSION

SPECIFICATION:

Gain compression is less than 0.5 dB for a -10 dBm input level with 0 dB attenuation.

DESCRIPTION:

Gain compression is measured by changing the power level at the spectrum analyzer input from -20 dBm to -10 dBm. The displayed signal level will change by less than 10 dB, indicating gain compression in the input mixer. Since a 10-dB change in IF gain is used to keep the signal trace near the same point on the display when the input power is increased, the error due to this IF gain change is first measured, then subtracted from the displayed deviation to give the deviation due only to gain compression.

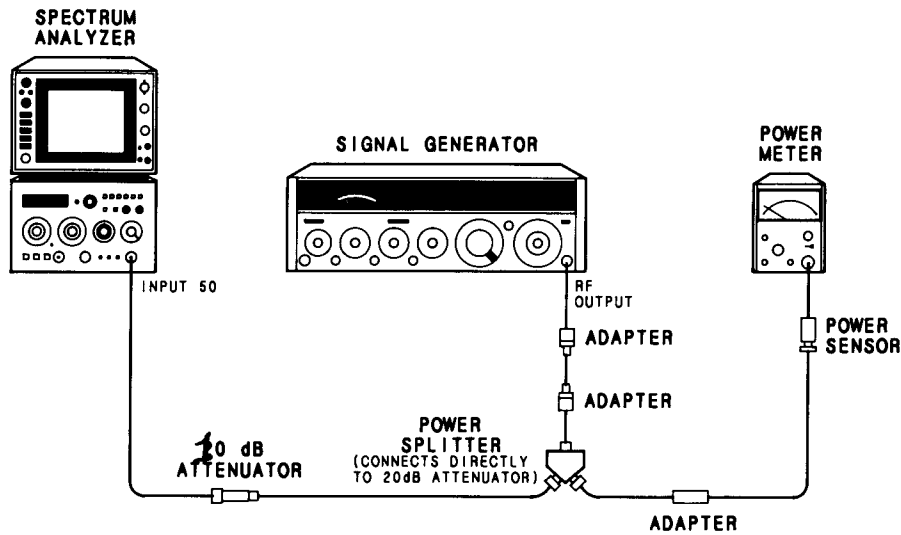


FIGURE 4-16. GAIN COMPRESSION TEST SETUP

EQUIPMENT:

Signal Generator	HP 8640B
Power Meter	HP 435A/B
Power Sensor	HP 8481A
Power Splitter	HP 11667A, Opt. C16
10-dB Attenuator	HP 8491B, Opt. 010
Adapter, Type N (m) to BNC (f) (2 required)	HP 1250-0780
Adapter, Type N (f) to N (f)	HP 1250-1472

PERFORMANCE TESTS

4-20. GAIN COMPRESSION (Cont'd)

PROCEDURE:

1. Set equipment controls as follows:

Spectrum Analyzer:

FREQUENCY BAND GHz .....	.01 – 3
TUNING	0.050 GHz
FREQ SPAN/DIV	100 kHz
RESOLUTION BW	300 kHz, uncoupled
INPUT ATTEN	10 dB
REFERENCE LEVEL	– 10 dBm
REF LEVEL FINE	– 10
Amplitude Scale	10 dB/DIV
SWEEP TIME/DIV	AUTO
SWEEP TRIGGER	FREE RUN
ALT IF	OFF
SIG IDENT	OFF
BL CLIP	OFF
VIDEO FILTER	OFF

Signal Generator:

COUNTER MODE	INT
AM	OFF
FM	OFF
FREQUENCY TUNE	50 MHz
RF	ON
OUTPUT LEVEL	– 4 dBm

2. Connect equipment as shown in Figure 4-16. Note that the 10-dB attenuator is placed between the power splitter and spectrum analyzer INPUT 50Ω connector.
3. Adjust signal generator OUTPUT LEVEL control for a power meter reading of – 10 dBm (– 20 dBm at spectrum analyzer INPUT 50Ω connector).
4. Adjust spectrum analyzer TUNING control to center 50 MHz signal on CRT. Set Amplitude Scale control to 1 dB/DIV and adjust REF LEVEL FINE control to place peak of signal at a convenient horizontal graticule line other than top graticule line.
5. Adjust signal generator OUTPUT LEVEL control for a power meter reading of 0 dBm (– 10 dBm at spectrum analyzer INPUT 50Ω connector).
6. Set spectrum analyzer REFERENCE LEVEL control to 0 dBm, leaving REF LEVEL FINE control at setting established in step 4. Record deviation of signal peak from reference graticule line of step 4 (step-gain error). Values above reference line are positive (+); those below are negative (–).

_____ dB

PERFORMANCE TESTS

4-20. GAIN COMPRESSION (Cont'd)

7. Adjust signal generator OUTPUT LEVEL control for a power meter reading of -10 dBm (-20 dBm at spectrum analyzer 50Ω connector).
8. Set spectrum analyzer INPUT ATTEN control to 0 dBm, REFERENCE LEVEL control to -20 dBm, and REF LEVEL FINE control to 0 . Adjust REF LEVEL CAL control to place peak of signal at reference graticule line of step 4.
9. Adjust signal generator OUTPUT LEVEL control for a power meter reading of 0 dBm (-10 dBm at spectrum analyzer 50Ω connector).
10. Set spectrum analyzer REFERENCE LEVEL control to -10 dBm. Record deviation of signal peak from reference graticule line of step 4.

_____ dB
11. Calculate gain compression by algebraically subtracting step-gain error (step 4) from deviation of signal peak (step 7). Gain compression should be less than 0.5 dB.

_____ dB
12. Set spectrum analyzer INPUT ATTEN control to 10 dB and REFERENCE LEVEL control to -10 dBm. Connect CAL OUTPUT to INPUT 50Ω connector and recalibrate REF LEVEL CAL control setting.

PERFORMANCE TESTS

4-21. BANDWIDTH SWITCHING (AMPLITUDE VARIATION)**SPECIFICATION:**Bandwidths 3 MHz to 300 kHz: $< \pm 0.5$ dBBandwidths 3 MHz to 1 kHz: $< \pm 1.0$ dB**DESCRIPTION:**

The CAL OUTPUT signal is applied to INPUT 50 Ω connector and displayed on CRT. The peak of displayed 35-MHz signal is centered on CRT and adjusted for a vertical deflection of several divisions. The amplitude variation of the signal is measured for each RESOLUTION BW control setting. The overall variation between RESOLUTION BW settings of 3 MHz through 300 kHz should be less than 1.0 dB (± 0.5 dB). The overall variation between RESOLUTION BW settings of 3 MHz through 1 kHz should be less than 2.0 dB (± 1.0 dB).

PROCEDURE:

1. Set spectrum analyzer controls as follows:

FREQUENCY BAND GHz	.01 – 3
TUNING	0.035 GHz
FREQ SPAN/DIV	1 MHz
RESOLUTION BW	3 MHz, uncoupled
INPUT ATTEN	10 dB
REFERENCE LEVEL	0 dBm
REF LEVEL FINE	– 10
Amplitude Scale	1 dB/DIV
SWEEP TIME/DIV	AUTO
SWEEP TRIGGER	FREE RUN
ALT IF	OFF
SIG IDENT	OFF
BL CLIP	OFF
VIDEO FILTER	OFF

2. Connect CAL OUTPUT signal to INPUT 50 Ω connector.
 3. Adjust TUNING control to center 35-MHz signal on CRT.
 4. Adjust REF LEVEL FINE control to position peak of signal seven divisions above graticule baseline.
 5. Set RESOLUTION BW and FREQ SPAN/DIV controls to settings indicated in Table 4-8. Record deviation of signal peak from reference graticule line for each RESOLUTION BW control setting. Values above reference line set in step 4 are positive (+); values below reference line are negative (–).
 6. To find overall variation in Table 4-8, algebraically subtract greatest negative amplitude deviation from greatest positive amplitude deviation. If all changes in amplitude are of the same sign, overall variation is largest positive or largest negative change in amplitude. Overall variation between 3 MHz and 300 kHz RESOLUTION BW setting should be < 1.0 dB (± 0.5 dB). Overall variation between 3 MHz and 1 kHz RESOLUTION BW settings should be < 2.0 dB (± 1.0 dB).
-

PERFORMANCE TESTS

4-21. BANDWIDTH SWITCHING (AMPLITUDE VARIATION) (Cont'd)

TABLE 4-8. BANDWIDTH SWITCHING (AMPLITUDE VARIATION)

RESOLUTION BW Setting	FREQ SPAN/DIV Setting	Amplitude Deviation (dB)	Overall Variation Between 3 MHz and 300 kHz RESOLUTION BW Settings (dB)	Overall Variation Between 3 MHz and 1 kHz RESOLUTION BW Settings (dB)
3 MHz 1 MHz 300 kHz	1 MHz 500 kHz 100 kHz	0 (Ref) _____ _____	_____	_____
100 kHz 30 kHz 10 kHz 3 kHz 1 kHz	50 kHz 10 kHz 10 kHz 10 kHz 10 kHz	_____ _____ _____ _____ _____		_____

PERFORMANCE TESTS

4-22. INPUT ATTENUATOR ACCURACY

SPECIFICATION:

Step Accuracy (0 dB to 60 dB): $< \pm 1.0$ dB per 10-dB step, 0.01 to 18.0 GHz
 Maximum Cumulative Step Error (0 dB to 60 dB): $< \pm 2.4$ dB, 0.01 to 18.0 GHz

DESCRIPTION:

The input attenuator accuracy is tested over the range of 0 to 60 dB using an RF substitution method. A step attenuator that has been calibrated at 30 MHz by a Standards Laboratory is used for substitution. The known error of the calibrated attenuator is taken into account when computing the input attenuator accuracy.

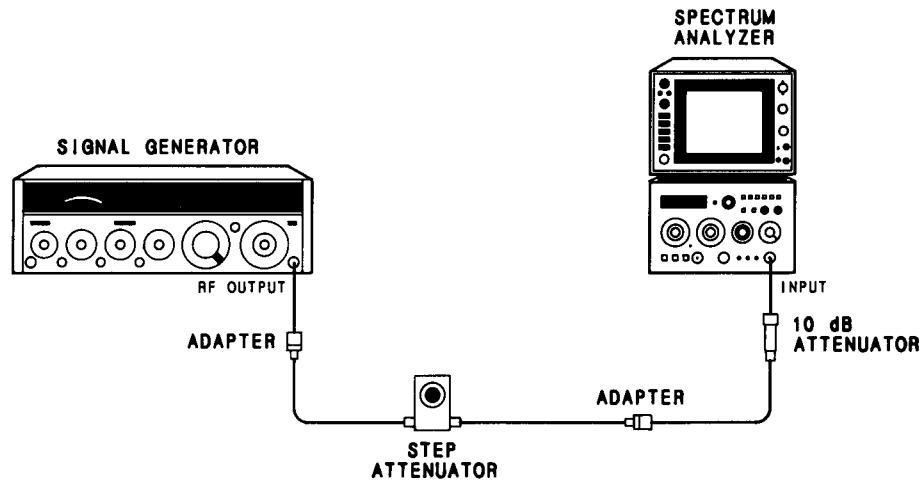


FIGURE 4-17. INPUT ATTENUATOR ACCURACY TEST SETUP

EQUIPMENT:

Signal Generator	HP 8640B
Step Attenuator (10 dB/step)	HP 355D, Opt. H82
10-dB Attenuator	HP 8491B, Opt. 010
Adapter, Type N (m) to BNC (f) (2 required)	HP 1250-0780

PERFORMANCE TESTS

4-22. INPUT ATTENUATOR ACCURACY (Cont'd)

PROCEDURE:

1. Connect equipment as shown in Figure 4-17 and set controls as follows:

Spectrum Analyzer:

FREQUENCY BAND GHz .....	.01 – 3
TUNING	30 MHz
FREQ SPAN/DIV	2 MHz
RESOLUTION BW	1 MHz
INPUT ATTEN	60 dB
REFERENCE LEVEL	0 dBm
REF LEVEL FINE	0
Amplitude Scale	10 dB/DIV
SWEEP TIME/DIV	AUTO
SWEEP TRIGGER	FREE RUN
ALT IF	OFF
SIG IDENT	OFF
BL CLIP	OFF
VIDEO FILTER	2 o'clock

Signal Generator:

COUNTER MODE	INT EXPAND X10
AM	OFF
FM	OFF
FREQUENCY TUNE	30.0 MHz
RF	ON
OUTPUT LEVEL	0 dBm

2. Set step attenuator to 0 dB and use spectrum analyzer TUNING control to center 30 MHz signal from signal generator on CRT display. Set FREQ SPAN/DIV to 20 kHz, RESOLUTION BW to 10 kHz, and Amplitude Scale to 1 dB/DIV.
3. Adjust signal generator OUTPUT LEVEL control to position peak of signal seven divisions above graticule baseline.
4. Set step attenuator and INPUT ATTEN control to settings indicated in Table 4-9. For each setting, record deviation of signal peak from reference graticule line set in step 3.

NOTE

The REFERENCE LEVEL control setting changes by 10 dB for every 10-dB change in INPUT ATTEN. Do not change the REFERENCE LEVEL setting after changing the INPUT ATTEN setting.

PERFORMANCE TESTS

4-22. INPUT ATTENUATOR ACCURACY (Cont'd)

TABLE 4-9. INPUT ATTENUATOR ACCURACY

INPUT ATTEN Setting (dB)	Step Attenuator Setting (dB)	Amplitude Deviation (dB)	Step Attenuator Error (Calibration)*	Corrected Deviation (dB)
60	0	0 (Ref)	(Ref)	0 (Ref)
50	10	_____	_____	_____
40	20	_____	_____	_____
30	30	_____	_____	_____
20	40	_____	_____	_____
10	50	_____	_____	_____
0	60	_____	_____	_____

*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.

5. To compute corrected deviation for each setting, add step attenuator error to amplitude deviation. Corrected deviation should not exceed ± 1.0 dB between any two adjacent INPUT ATTEN setting.

_____ dB Maximum Error per 10-dB Step

6. Record maximum positive and maximum negative corrected deviation values. Difference between these two values (maximum cumulative step error) should not exceed 2.4 dB.

_____ dB Maximum Positive Corrected Deviation

_____ dB Maximum Negative Corrected Deviation

_____ dB Maximum Cumulative Step Error

PERFORMANCE TESTS

4-23. REFERENCE LEVEL ACCURACY

SPECIFICATION:

Step Accuracy (steps referenced with 0 dB input attenuation):

- 10 dBm to - 80 dBm: ±0.5 dB
- 10 dBm to - 100 dBm: ±1.0 dB

Vernier Accuracy: ±0.5 dB

DESCRIPTION:

The reference level accuracy is tested over the range of - 10 dBm to - 100 dBm by checking the IF gain steps in 1 dB/DIV (Log) and in LIN. The resulting maximum deviation in each case must be less than ±0.5 dB from - 10 dBm to - 80 dBm and less than ± 1.0 dB from - 10 dBm to - 100 dBm.

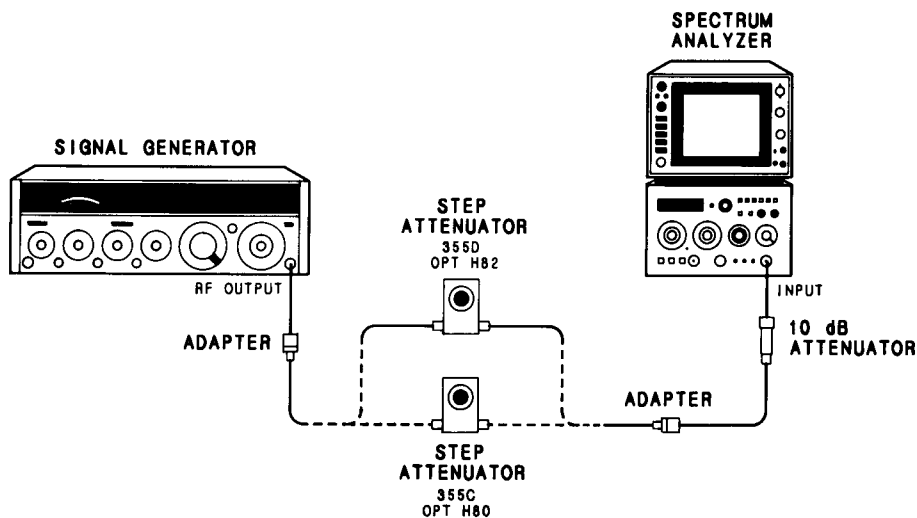


FIGURE 4-18. REFERENCE LEVEL ACCURACY TEST SETUP

EQUIPMENT:

Signal Generator	HP 8640B
10-dB Attenuator	HP 8491B, Opt. 010
Step Attenuator (1 dB/step)	HP 355C, Opt. H80
Step Attenuator (10 dB/step)	HP 355D, Opt. H82
Adapter, Type N (m) to BNC (f) (2 required)	HP 1250-0780

PERFORMANCE TESTS

4-23. REFERENCE LEVEL ACCURACY (Cont'd)

PROCEDURE:

Step Accuracy in Log Mode

1. Set equipment controls as follows:

Spectrum Analyzer:

FREQUENCY BAND GHz .....	.01 – 3
TUNING	30 MHz
FREQ SPAN/DIV	100 kHz
RESOLUTION BW	30 kHz, uncoupled
INPUT ATTEN	0 dB
REFERENCE LEVEL	– 10 dBm
REF LEVEL FINE	0
Amplitude Scale	1 dB/DIV
SWEEP TIME/DIV	AUTO
SWEEP TRIGGER	FREE RUN
ALT IF	OFF
SIG IDENT	OFF
BL CLIP	OFF
VIDEO FILTER	2 o'clock

Signal Generator:

COUNTER MODE	INT, EXPAND X10
AM	OFF
FM	OFF
FREQUENCY TUNE	30 MHz
RF	ON
OUTPUT LEVEL	– 2 dBm

2. Connect equipment as shown in Figure 4-18 using 10-dB step attenuator. Set step attenuator to 0 dB and adjust spectrum analyzer TUNING control to center 30 MHz signal on CRT. Set FREQ SPAN/DIV control to 10 kHz and RESOLUTION BW control to 3 kHz, adjusting TUNING control as necessary to keep signal centered on CRT.
3. Adjust signal generator OUTPUT LEVEL control to position peak of signal 6 divisions above graticule baseline. Set step attenuator and spectrum analyzer REFERENCE LEVEL control to settings indicated in Table 4-10. Record deviation of signal peak from 6th division for each setting.
4. To calculate Corrected Deviation, add Step Attenuator Error (calibration data at 30 MHz) to Deviation from 6th Division for each setting. Corrected Deviation should not exceed ± 0.5 dB from – 10 dBm to – 80 dBm, and should not exceed ± 1.0 dB from – 10 dBm to – 100 dBm. Record maximum values.

_____ dB (– 10 dBm to – 80 dBm)
 _____ dB (– 10 dBm to – 100 dBm)

PERFORMANCE TESTS

4-23. REFERENCE LEVEL ACCURACY (Cont'd)

TABLE 4-10. IF GAIN ACCURACY IN LOG MODE

REFERENCE LEVEL Setting (dBm)	Step Attenuator Setting (dB)	Deviation from 6th Division (dB)	Step Attenuator Error (Calibration)* (dB)	Corrected Deviation (dB)
-10	0	0 (Ref)	(Ref)	0 (Ref)
-20	10	_____	_____	_____
-30	20	_____	_____	_____
-40	30	_____	_____	_____
-50	40	_____	_____	_____
-60	50	_____	_____	_____
-70	60	_____	_____	_____
-80	70	_____	_____	_____
-90	80	_____	_____	_____
-100	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.

Step Accuracy in Linear Mode

- Set spectrum analyzer Amplitude Scale switch to LIN and REFERENCE LEVEL control to -10 dBm. Set step attenuator to 0 dB. Readjust signal generator OUTPUT LEVEL control to position peak of signal 6 divisions above graticule baseline.
- Set step attenuator and spectrum analyzer REFERENCE LEVEL control to settings indicated in Table 4-11. Record deviation of signal peak from 6th division for each setting.
- Using Table 4-12, convert Deviation from 6th Division in Linear Mode to Deviation in dB for each setting. Record dB values in Table 4-11.
- To calculate Corrected Deviation, add Step Attenuator Error to Deviation from 6th Division in dB for each setting. Corrected Deviation should not exceed ±0.5 dB from -10 dBm to -80 dBm and ±1.0 dB from -10 dBm to -100 dBm. Record maximum values.

_____ dB (-10 dBm to -80 dBm)

_____ dB (-10 dBm to -100 dBm)

PERFORMANCE TESTS

4-23. REFERENCE LEVEL ACCURACY (Cont'd)

TABLE 4-11. IF GAIN ACCURACY IN LINEAR MODE

REFERENCE LEVEL Setting (dBm)	Step Attenuator Setting (dB)	Deviation from 6th Division Linear Mode (div.)	Deviation from 6th Division in dB*	Step Attenuator Error (Calibration)**(dB)	Corrected Deviation (dB)
-10	0	0 (Ref.)	0 (Ref.)	Ref.	0 (Ref.)
-20	10	_____	_____	_____	_____
-30	20	_____	_____	_____	_____
-40	30	_____	_____	_____	_____
-50	40	_____	_____	_____	_____
-60	50	_____	_____	_____	_____
-70	60	_____	_____	_____	_____
-80	70	_____	_____	_____	_____
-90	80	_____	_____	_____	_____
-100	90	_____	_____	_____	_____

*Use Table 4-12 to convert deviation in linear mode to deviation in dB.

**Attenuations > dial settings are positive (+). Attenuations < dial settings are negative (-).

TABLE 4-12. CONVERSION TABLE, DEVIATION IN LINEAR MODE

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
+10	+1.34	-10	-1.58
+11	+1.46	-11	-1.76
+12	+1.58	-12	-1.94
+13	+1.70		
+14	+1.82		
+15	+1.94		

PERFORMANCE TESTS

4-23. REFERENCE LEVEL ACCURACY (Cont'd)

Vernier Accuracy

9. Replace 10-dB step attenuator with 1-dB step attenuator. Set spectrum analyzer controls as follows:

- FREQUENCY BAND GHz01 – 3
- TUNING 0.030 GHz
- FREQ SPAN/DIV 50 kHz
- RESOLUTION BW 300 kHz, uncoupled
- INPUT ATTEN 0 dB
- REFERENCE LEVEL – 10 dBm
- REF LEVEL FINE 0
- Amplitude Scale 1 dB/DIV
- SWEEP TIME/DIV AUTO
- SWEEP TRIGGER FREE RUN
- ALT IF OFF
- SIG IDENT OFF
- BL CLIP OFF
- VIDEO FILTER 2 o'clock

10. Set step attenuator to 0 dB. Center signal on CRT and adjust signal generator OUTPUT LEVEL control to position peak of signal 6 divisions above graticule baseline. Set step attenuator and spectrum analyzer REFERENCE LEVEL FINE control to settings indicated in Table 4-13. Record deviation of signal peak from 6th division for each setting.

11. To compute Corrected Deviation, add Step Attenuator Error to Deviation from 6th Division for each setting. Corrected Deviation should not exceed ± 0.5 dB for each setting. Record maximum value.

TABLE 4-13. VERNIER ACCURACY

_____ dB

Step Attenuator Setting (dB)	REFERENCE 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 (-).

PERFORMANCE TESTS

4-24. SWEEP TIME ACCURACY

SPECIFICATION:

There are 20 selectable and calibrated sweep times in a 1-2-5 sequence from 2 μ sec/DIV to 10 sec/DIV (excluding 2 sec/DIV).

Sweep time accuracy: $\pm 10\%$ ($\pm 20\%$ for 5 and 10 sec/DIV)

DESCRIPTION:

For SWEEP TIME/DIV control settings of 10 msec and less, the triangle-wave output of a function generator is used to modulate a 100-MHz signal applied to the spectrum analyzer input. This signal is demodulated in zero span, displaying a triangular waveform on the CRT. The function generator is tuned to align the waveform with the vertical CRT graticule lines. The period of the function generator output is then measured with a counter to determine the sweep time.

For SWEEP TIME/DIV control settings of 20 msec and greater, the display (AUX B) PENLIFT/BLANKING output is connected directly to the counter. The blanking signal is "low" during a spectrum analyzer sweep; the time interval between the falling and rising edges is measured to determine the sweep speed.

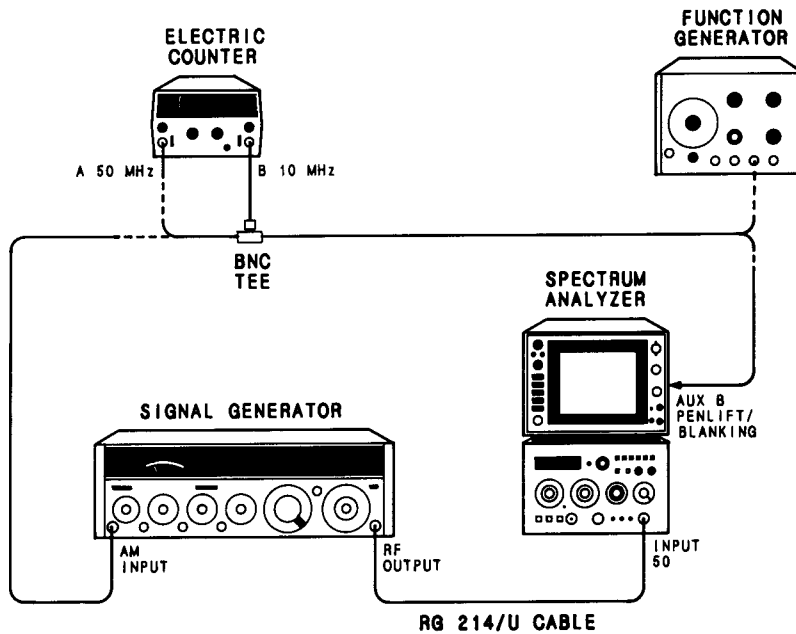


FIGURE 4-19. SWEEP TIME ACCURACY TEST SETUP

EQUIPMENT:

Signal Generator	HP 8640B
Function Generator	HP 3310A
50 MHz Universal Counter	HP 5300B/5302A
BNC Tee	HP 1250-0781
Cable Assembly RG-214/U with Type N Connectors	HP 11500A

PERFORMANCE TESTS

4-24. SWEEP TIME ACCURACY (Cont'd)

PROCEDURE:

1. Set equipment controls as follows:

Spectrum Analyzer:

FREQUENCY BAND GHz	.01 – 3
TUNING	0.100 GHz
FREQ SPAN/DIV	10 MHz
RESOLUTION BW	3 MHz, uncoupled
INPUT ATTEN	10 dB
REFERENCE LEVEL	– 10 dBm
REF LEVEL FINE	0
Amplitude Scale	LIN
SWEEP TIME/DIV	AUTO
SWEEP TRIGGER	FREE RUN
ALT IF	OFF
SIG IDENT	OFF
BL CLIP	OFF
VIDEO FILTER	OFF



Signal Generator:

COUNTER MODE	INT, EXPAND X10
AM	OFF
FM	OFF
FREQUENCY TUNE	100 MHz
RF	ON
OUTPUT LEVEL	– 10 dBm

Function Generator:

FUNCTION	TRI
RANGE	10K
Frequency	250 kHz
DC OFFSET LEVEL	0

50 MHz Universal Counter:

FUNCTION	PER AVG B
SAMPLE RATE	Full counterclockwise
TIME BASE	1 ms
SENSITIVITY (A)	9 o'clock
A 50 MHz Input	 (falling edge)
SENSITIVITY (B)	Full clockwise
B 10 MHz Input	 (rising edge)

PERFORMANCE TESTS

4-24. SWEEP TIME ACCURACY (Cont'd)

2. Connect equipment as shown in Figure 4-19. Connect counter's B 10 MHz input to the function generator low output and the signal generator's AM input.
3. Adjust spectrum analyzer TUNING control to center 100-MHz signal on CRT. Set FREQ SPAN/DIV control to 0, leaving RESOLUTION BW control at 3 MHz setting. Set SWEEP TIME/DIV control to 2 μ sec.
4. Set AM switch of HP 8640B to AC position. Adjust function generator AMPLITUDE control and signal generator AM MODULATION control for 50 percent modulation as indicated on the signal generator meter.
5. Set spectrum analyzer SWEEP TRIGGER control to VIDEO. Adjust REFERENCE LEVEL and REF LEVEL FINE controls to center waveform on CRT.
6. Adjust function generator Frequency vernier to display exactly five cycles of triangle wave modulation on CRT, as shown in Figure 4-20a. Counter should indicate an average period of $4.00 \pm 0.04 \mu$ s.

* \uparrow
_____ μ sec

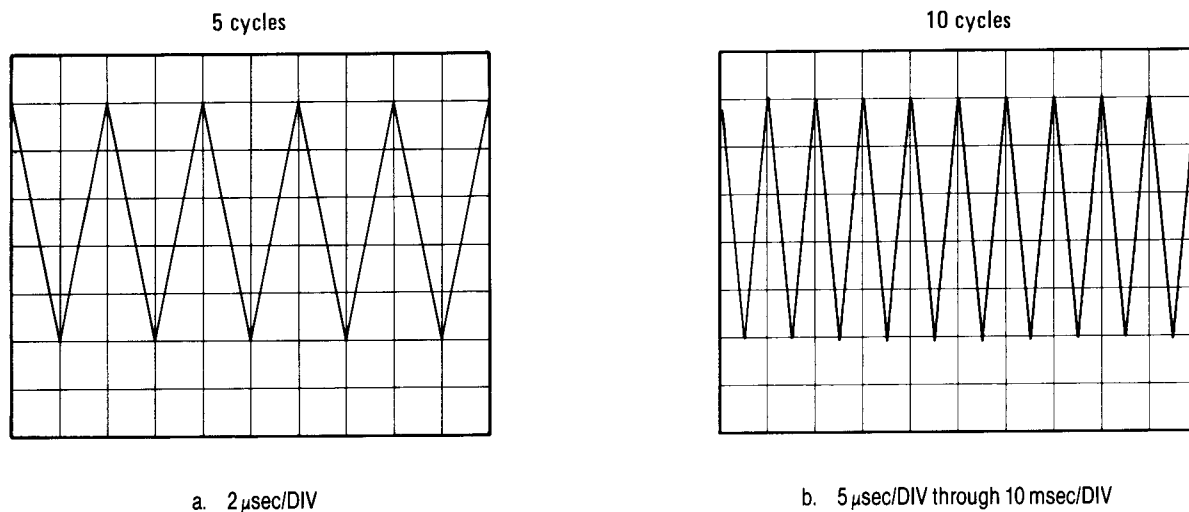


FIGURE 4-20. SWEEP TIME ACCURACY

7. Calculate actual sweep time per division by dividing average period from step 6 by 2. Record value in Table 4-14.
8. For spectrum analyzer SWEEP TIME/DIV control settings of 5 μ sec through 10 msec, adjust function generator RANGE and frequency controls to display exactly 10 cycles of triangle wave modulation on CRT, as shown in Figure 4-20b. Average period readings displayed on counter correspond to actual sweep time per division. Record values in Table 4-14.

PERFORMANCE TESTS



4-24. SWEEP TIME ACCURACY (Cont'd)

TABLE 4-14. SWEEP TIME ACCURACY, 2 μSEC THROUGH 10 MSEC

SWEEP TIME/DIV Setting	Function Generator Frequency (Approx.)	Sweep Time per Division		
		Minimum	Actual	Maximum
2 μsec	250 kHz	1.80 μsec	_____ μsec	2.20 μsec
5 μsec	200 kHz	4.40 μsec	_____ μsec	5.50 μsec
10 μsec	100 kHz	9.00 μsec	_____ μsec	11.00 μsec
20 μsec	50 kHz	18.00 μsec	_____ μsec	22.00 μsec
50 μsec	20 kHz	45.00 μsec	_____ μsec	55.00 μsec
.1 msec	10 kHz	90.0 μsec	_____ μsec	110.0 μsec
.2 msec	5 kHz	180.0 μsec	_____ μsec	220.0 μsec
.5 msec	2 kHz	450.0 μsec	_____ μsec	550.0 μsec
1 msec	1 kHz	900 μsec	_____ μsec	1100 μsec
2 msec	500 Hz	1800 μsec	_____ μsec	2200 μsec
5 msec	200 Hz	4500 μsec	_____ μsec	5500 μsec
10 msec	100 Hz	9.00 msec	_____ msec	11.00 msec

9. Connect display rear-panel AUX B PENLIFT/BLANKING output to BNC tee at counter's B 10 MHz input. Connect other side of tee to counter's A 50 MHz input.

10. Set counter controls as follows:

FUNCTION T.I. A to B
 SAMPLE RATE Full counterclockwise
 TIME BASE 0.1 ms
 SENSITIVITY (A) 9 o'clock
 A 50 MHz Input  (falling edge)
 SENSITIVITY (B) 9 o'clock
 B 10 MHz Input  (rising edge)

11. Set spectrum analyzer SWEEP TIME/DIV to 20 msec. Adjust counter's SENSITIVITY controls for a time interval reading of 0.2000 ± 0.0200 sec. Record sweep time value in Table 4-15.

12. Verify remaining spectrum analyzer SWEEP TIME/DIV control settings of 50 msec through 10 sec, recording sweep time values in Table 4-15.

PERFORMANCE TESTS

4-24. SWEEP TIME ACCURACY (Cont'd)

TABLE 4-15. SWEEP TIME ACCURACY, 20 MSEC THROUGH 10 SEC

SWEEP TIME/DIV Setting	Sweep Time		
	Minimum	Actual	Maximum
20 msec	0.180 sec	_____ sec	0.220 sec
50 msec	0.450 sec	_____ sec	0.550 sec
.1 sec	0.90 sec	_____ sec	1.10 sec
.2 sec	1.80 sec	_____ sec	2.20 sec
.5 sec	4.50 sec	_____ sec	5.50 sec
1 sec	9.0 sec	_____ sec	11.0 sec
5 sec	40.0 sec	_____ sec	60.0 sec
10 sec	80.0 sec	_____ sec	120.0 sec

PERFORMANCE TESTS

4-25. CALIBRATOR OUTPUT ACCURACY

SPECIFICATION:

Amplitude: $-10 \text{ dBm} \pm 0.3 \text{ dB}$

Frequency: $35 \text{ MHz} \pm 400 \text{ kHz}$

DESCRIPTION:

The frequency of the calibrator output signal is measured with a microwave counter. The calibrator output level is measured using a power meter.

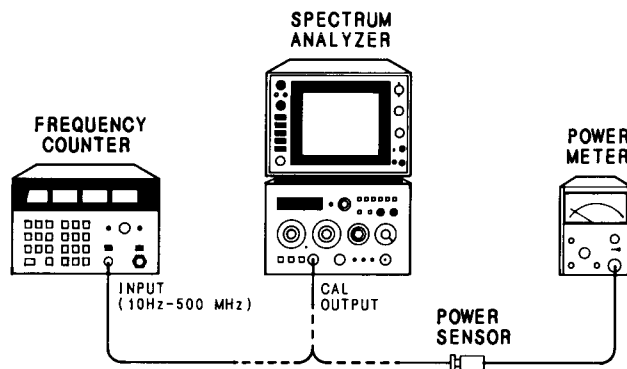


FIGURE 4-21. CALIBRATOR ACCURACY TEST SETUP

EQUIPMENT:

Frequency Counter	HP 5342A, Opt. 005
Power Meter	HP 435A/B
Power Sensor	HP 8481A

PROCEDURE:

1. Connect spectrum analyzer CAL OUTPUT to frequency counter's 10 Hz – 500 MHz (50Ω) input as shown in Figure 4-20. Measured output frequency should be $35 \text{ MHz} \pm 400 \text{ kHz}$.
2. Zero and calibrate power meter. Connect power sensor, through adapter, to spectrum analyzer's CAL OUTPUT and measure power level. Calibrator output level should be $-10 \text{ dBm} \pm 0.3 \text{ dB}$.

_____ dBm

PERFORMANCE TESTS

4-26. DISPLAY FIDELITY

SPECIFICATION:

Log Incremental Accuracy: ± 0.1 dB per dB from Reference Level
 Log Maximum Cumulative Error: $< \pm 1.5$ dB over entire 70-dB range
 Linear Accuracy: $\pm 3\%$ of Reference Level

DESCRIPTION:

The amplitude of the log display amplifier is tested by connecting a DVM to the display (AUX A) VERTICAL OUTPUT connector. A wide resolution bandwidth setting is selected so the signal appears as a straight horizontal line on the CRT. The DVM is used to provide good resolution when checking for ± 1 dB per 10 dB step (0.1 dB/dB).

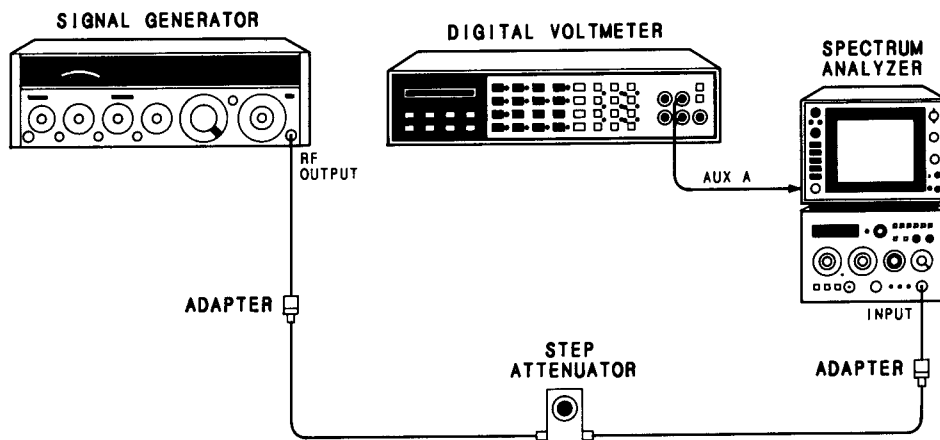


FIGURE 4-22. DISPLAY FIDELITY TEST SETUP

EQUIPMENT:

Signal Generator	HP 8640B
Digital Voltmeter	HP 3556A
Step Attenuator (10 dB/step)	HP 355D, Opt. H82
Adapter, Type N (m) to BNC (f) (2 required)	HP 1250-0780
Cable, BNC to Banana Plug	HP 11001A

PROCEDURE:

Log Display Accuracy

1. Set equipment controls as follows:

Spectrum Analyzer:

FREQUENCY BAND GHz .....	.01 – 3
TUNING	0.030 GHz

PERFORMANCE TESTS

4-26. DISPLAY FIDELITY (Cont'd)

FREQ SPAN/DIV 500 kHz
 RESOLUTION BW 300 kHz, uncoupled
 INPUT ATTEN 10 dB
 REFERENCE LEVEL 0 dBm
 REF LEVEL FINE 0
 Amplitude Scale LIN
 SWEEP TIME/DIV AUTO
 SWEEP TRIGGER FREE RUN
 ALT IF OFF
 SIG IDENT OFF
 BL CLIP OFF
 VIDEO FILTER OFF

Digital Voltmeter:

RANGE 100
 FUNCTION V (DC)
 AUTO CAL AUTO
 TRIGGER INTERNAL
 MATH OFF

Signal Generator:

COUNTER MODE INT
 AM OFF
 FM OFF
 FREQUENCY TUNE 30 MHz
 RF ON
 OUTPUT LEVEL 0 dBm

2. With no signal at spectrum analyzer's INPUT 50Ω, measure and record offset voltage at (AUX A) VERTICAL OUTPUT connector. _____ mV
3. Connect equipment as shown in Figure 4-22. Set step attenuator to 0 dB.
4. Set spectrum analyzer's Amplitude Scale to 10 dB/DIV and adjust TUNING control to center signal on CRT display.
5. Set spectrum analyzer's FREQ SPAN/DIV control to zero (0), VIDEO FILTER full CW (not in detent), and RESOLUTION BW control to 1 MHz. Adjust TUNING control for maximum reading on DVM.
6. Set signal generator OUTPUT LEVEL control for DVM reading of (+800 mV + offset (step 2) ±0.5 mV). Trace should be approximately at top CRT graticule line.
7. Record DVM readings for step attenuator settings, from 0 dB through 70 dB, in Table 4-16.

PERFORMANCE TESTS

4-26. DISPLAY FIDELITY (Cont'd)

TABLE 4-16. AMPLITUDE LOG DISPLAY ACCURACY

Attenuator Setting (dB)	DVM Reading (mV)	Corrected DVM Reading* (mV)	Theoretical Reading (mV)	Theoretical Reading Subtracted From Corrected 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 2.

EXAMPLE TABLE OF 4-16

Attenuator Setting (dB)	DVM Reading (mV)	Corrected DVM Reading* (mV)	Theoretical Reading (mV)	Theoretical Reading Subtracted From Corrected DVM Reading (mV)	Difference Between Adjacent Readings (mV)
0	+805	+800	+800	0	
10	+708	+703	+700	+3	-3
20	+599	+594	+600	-6	+9
30	+497	+492	+500	-8	+2
40	+406	+401	+400	+1	-9

*DVM Reading minus offset recorded in step 2.

- After recording DVM readings for step attenuator settings from 0 dB through 70 dB, calculate each Corrected DVM Reading by algebraically subtracting offset recorded in step 2. Record results in Table 4-16 (see sample computations).
- Algebraically subtract corresponding Theoretical Reading from each Corrected DVM Reading, recording results in Table 4-16. Maximum value should not exceed ± 15 mV, corresponding to ± 1.5 dB. Divide maximum value by 10 to calculate Log Maximum Cumulative Error (in dB).

_____ dB Log Maximum Cumulative Error

PERFORMANCE TESTS

4-26. DISPLAY FIDELITY (Cont'd)

10. Algebraically subtract each converted reading (Theoretical Reading Subtracted from Corrected DVM Reading) from previous converted reading. Record results in Table 4-16 (see sample computations). Maximum difference between adjacent readings should not exceed ± 10 mV, corresponding to ± 1 dB/10 dB or ± 0.1 dB/dB. Divide maximum value by 100 to calculate Log Incremental Error (in dB/dB).

_____ dB/dB Log Incremental Error

- 11. Replace 10-dB step attenuator with 1-dB step attenuator. Set step attenuator to 0 dB.
- 12. Set spectrum analyzer Amplitude Scale to LIN and adjust TUNING control for maximum reading on DVM.
- 13. Adjust signal generator OUTPUT LEVEL for DVM reading of 800 mV + offset (step 2) ± 0.5 mV. Trace should be approximately at top CRT graticule line.
- 14. Record DVM reading for step attenuator settings of 6 dB and 12 dB in Table 4-17.
- 15. Calculate each Corrected DVM Reading by algebraically subtracting offset recorded in step 2. Record results in Table 4-17.
- 16. Algebraically subtract corresponding Theoretical Reading from each Corrected DVM Reading, recording results in Table 4-17. Maximum value should not exceed ± 24 mV, corresponding to $\pm 3\%$ of 800 mV Reference Level. Divide maximum value by 8 to calculate Percent Linear Error.

_____ % of Reference Level Linear Error

TABLE 4-17. AMPLITUDE LINEAR DISPLAY ACCURACY

Attenuator Setting (dB)	DVM Reading (mV)	Corrected DVM Reading* (mV)	Theoretical Reading (mV)	Theoretical Reading Subtracted From Corrected DVM Reading (mV)
0	_____	+800 (Ref.)	+800	0
6	_____	_____	+401	_____
12	_____	_____	+201	_____

*DVM Reading minus offset recorded in step 2.

TABLE 4-18. PERFORMANCE TEST RECORD (1 OF 4)

Hewlett-Packard Company Model 8559A Spectrum Analyzer .01–21 GHz		Tested by _____		
Serial No. _____		Date _____		
Para. No.	Test Description	Results		
		Min	Actual	Max
4-11.	Frequency Span Accuracy			
	3. 200 MHz FREQ SPAN/DIV	–0.4 div	_____	+0.4 div
	4. 100 MHz FREQ SPAN/DIV	–0.4 div	_____	+0.4 div
	5. 50 MHz FREQ SPAN/DIV	–0.4 div	_____	+0.4 div
	6. 20 MHz FREQ SPAN/DIV	–0.4 div	_____	+0.4 div
	7. 10 MHz FREQ SPAN/DIV	–0.4 div	_____	+0.4 div
	8. 5 MHz FREQ SPAN/DIV	–0.4 div	_____	+0.4 div
	9. 2 MHz FREQ SPAN/DIV	–0.4 div	_____	+0.4 div
	10. 1 MHz FREQ SPAN/DIV	–0.4 div	_____	+0.4 div
	11. 500 kHz FREQ SPAN/DIV	–0.4 div	_____	+0.4 div
	14. 200 kHz FREQ SPAN/DIV	–0.4 div	_____	+0.4 div
	15. 100 kHz FREQ SPAN/DIV	–0.4 div	_____	+0.4 div
	50 kHz FREQ SPAN/DIV	–0.4 div	_____	+0.4 div
	20 kHz FREQ SPAN/DIV	–0.4 div	_____	+0.4 div
	10 kHz FREQ SPAN/DIV	–0.4 div	_____	+0.4 div
4-12.	Tuning Accuracy			
	5. .01 GHz	0.009 GHz	_____	0.011 GHz
	6. 1.5 GHz	1.494 GHz	_____	1.506 GHz
	8. 3.0 GHz	2.990 GHz	_____	3.010 GHz
	9. 6.1 GHz	6.083 GHz	_____	6.117 GHz
	7.5 GHz	7.480 GHz	_____	7.520 GHz
	9.0 GHz	8.977 GHz	_____	9.023 GHz
	3.1 GHz	3.089 GHz	_____	3.110 GHz
	6.0 GHz	5.983 GHz	_____	6.017 GHz
	9.0 GHz	8.977 GHz	_____	9.023 GHz
	9.1 GHz	9.077 GHz	_____	9.123 GHz
	12.0 GHz	11.971 GHz	_____	12.029 GHz
	15.0 GHz	14.965 GHz	_____	15.035 GHz
	6.1 GHz	6.083 GHz	_____	6.117 GHz
	10.5 GHz	10.474 GHz	_____	10.526 GHz
	15.0 GHz	14.965 GHz	_____	15.035 GHz
	12.1 GHz	12.071 GHz	_____	12.129 GHz
17.0 GHz	16.961 GHz	_____	17.039 GHz	
21.0 GHz	20.953 GHz	_____	21.047 GHz	

TABLE 4-18. PERFORMANCE TEST RECORD (2 OF 4)

Para. No.	Test Description	Results		
		Min	Actual	Max
4-13.	Residual FM			
	6. Peak-to-Peak Variation of Trace		_____	1.4 div (2 kHz/0.1 sec)
4-14.	Noise Sidebands			
	6. Noise Sidebands		_____	7.0 div down (-70 dB)
4-15.	Resolution Bandwidth Accuracy			
	7. 3 MHz Resolution BW	2.10 MHz	_____	3.90 MHz
	8. 3 MHz Resolution BW (ALT IF)	2.10 MHz	_____	3.90 MHz
	9. 1 MHz Resolution BW	850 kHz	_____	1150 kHz
	10. 300 kHz Resolution BW	255 kHz	_____	345 kHz
	11. 100 kHz Resolution BW	85 kHz	_____	115 kHz
	17. 30 kHz Resolution BW	25.5 kHz	_____	34.5 kHz
	18. 10 kHz Resolution BW	8.5 kHz	_____	11.5 kHz
	19. 3 kHz Resolution BW	2.55 kHz	_____	3.45 kHz
	20. 1 kHz Resolution BW	0.85 kHz	_____	1.15 kHz
4-16.	Resolution Bandwidth Selectivity			
	24. 3 MHz Resolution BW Selectivity		_____	15:1
	3 MHz Resolution BW Selectivity (ALT IF)		_____	15:1
	1 MHz Resolution BW Selectivity		_____	15:1
	300 kHz Resolution BW Selectivity		_____	15:1
	100 kHz Resolution BW Selectivity		_____	15:1
	30 kHz Resolution BW Selectivity		_____	15:1
	10 kHz Resolution BW Selectivity		_____	15:1
	3 kHz Resolution BW Selectivity		_____	15:1
	1 kHz Resolution BW Selectivity		_____	15:1
4-17.	Average Noise Level			
	5. Average Noise Level, .01-3 GHz		_____	-111 dBm
	6. Average Noise Level, 6-9 GHz		_____	-108 dBm
	7. Average Noise Level, 3-9 GHz		_____	-103 dBm
	8. Average Noise Level, 9-15 GHz		_____	-98 dBm
	9. Average Noise Level, 6-15 GHz		_____	-93 dBm
	10. Average Noise Level, 12.1-18 GHz		_____	-92 dBm
	11. Average Noise Level, 18-21 GHz		_____	-90 dBm

TABLE 4-18. PERFORMANCE TEST RECORD (3 OF 4)

Para. No.	Test Description	Results		
		Min.	Actual	Max.
4-18.	Residual Responses			
	6. Residual Responses, .01 GHz to 3 GHz		_____	-90 dBm
	7. Residual Responses, .01 GHz to 3 GHz (ALT IF)		_____	-90 dBm
4-19.	Frequency Response			
	15. Frequency Response, .01 to 3.0 GHz		_____	±1.0 dB
	18. Frequency Response, 6.0 to 9.0 GHz		_____	±1.0 dB
	20. Frequency Response, 3.0 to 9.0 GHz		_____	±1.5 dB
	22. Frequency Response, 9.0 to 15.0 GHz		_____	±1.8 dB
	24. Frequency Response, 6.0 to 15.0 GHz		_____	±2.1 dB
	26. Frequency Response, 12.1 to 18.0 GHz		_____	±2.3 dB
	32. Frequency Response, 18.0 to 21.0 GHz		_____	±3.0 dB
4-20.	Gain Compression			
11. Gain Compression		_____	0.5 dB	
4-21.	Bandwidth Switching (Amplitude Variation)			
	6. 3 MHz to 300 kHz (overall variation)	-0.5 dB	_____	+0.5 dB
	3 MHz to 1 kHz (overall variation)	-1.0 dB	_____	+1.0 dB
4-22.	Input Attenuator Accuracy			
	5. Maximum Error per 10-dB step (0 dB-60 dB)	-1.0 dB	_____	+1.0 dB
	6. Maximum Cumulative Step Error (0 dB-60 dB)		_____	+2.4 dB
4-23.	Reference Level Variation			
	4. Reference Level Error in Log (-10 dBm to -80 dBm)	-0.5 dB	_____	+0.5 dB
	Reference Level Error in Log (-10 dBm to -100 dBm)	-1.0 dB	_____	+1.0 dB
	8. Reference Level Error in LIN (-10 dBm to -80 dBm)	-0.5 dB	_____	+0.5 dB
	Reference Level Error in LIN (-10 dBm to -100 dBm)	-1.0 dB	_____	+1.0 dB
	11. Vernier Error	-0.5 dB	_____	+0.5 dB

TABLE 4-18. PERFORMANCE TEST RECORD (4 OF 4)

Para. No.	Test Description	Results		
		Min.	Actual	Max.
4-24.	Sweep Time Accuracy			
	7. Sweep Time, 2 μ sec/div	1.80 μ sec	_____	2.20 μ sec
	8. Sweep Time, 5 μ sec/div	4.50 μ sec	_____	5.50 μ sec
	Sweep Time, 10 μ sec/div	9.00 μ sec	_____	11.00 μ sec
	Sweep Time, 20 μ sec/div	18.00 μ sec	_____	22.00 μ sec
	Sweep Time, 50 μ sec/div	45.00 μ sec	_____	55.00 μ sec
	Sweep Time, .1 msec/div	90.00 μ sec	_____	110 μ sec
	Sweep Time, .2 msec/div	180 μ sec	_____	220 μ sec
	Sweep Time, .5 msec/div	450 μ sec	_____	550 μ sec
	Sweep Time, 1 msec/div	900 μ sec	_____	1100 μ sec
	Sweep Time, 2 msec/div	1800 μ sec	_____	2200 μ sec
	Sweep Time, 5 msec/div	4500 μ sec	_____	5500 μ sec
	Sweep Time, 10 msec/div	9.00 msec	_____	11.00 msec
	12. Sweep Time, 20 msec/div	0.180 sec	_____	0.220 sec
	Sweep Time, 50 msec/div	0.450 sec	_____	0.550 sec
	Sweep Time, .1 sec/div	0.90 sec	_____	1.10 sec
	Sweep Time, .2 sec/div	1.80 sec	_____	2.20 sec
Sweep Time, .5 sec/div	4.50 sec	_____	5.50 sec	
Sweep Time, 1 sec/div	9.0 sec	_____	11 sec	
Sweep Time, 5 sec/div	40.0 sec	_____	60 sec	
Sweep Time, 10 sec/div	80.0 sec	_____	120 sec	
4-25.	Calibrator Output Accuracy			
	1. Calibrator Output Frequency	34.600 MHz	_____	35.400 MHz
	2. Calibrator Output Power (50 Ω)	-10.3 dBm	_____	-9.7 dBm
4-26.	Display Fidelity			
	9. Log Maximum Cumulative Error	-1.5 dB	_____	+1.5 dB
	10. Log Incremental Error	-0.1 dB/dB	_____	+0.1 dB/dB
	16. Percent Linear Error (Percent of Reference Level)		_____	3%

ADJUSTMENTS

► PAGES 5-3 THROUGH 5-13:

Table 5.1. Adjustable Components (1 of 3)

Under Adjustment Name column, delete reference to +10V.

Table 5.3 Factory Selected Components in Alphabetical Order

In the column titled reference designator, add A9R33 after A9R42.

► PAGE 5-11:

Paragraph 5-17. Power Supply Checks and Adjustments

Under Description:

In the fourth line, insert "is checked" after A9 and change "are then" to "is" after A8.

In the fifth line, place a period after "dependent.", and insert " The VO voltage. . ." in place of "and" to start the new sentence.

Add a final sentence, "The +10V power supply should be checked after the instrument has warmed-up (≥ 10 minutes)."

► PAGE 5-13:

Paragraph 5-17. PowerSupply Checks and Adjustments (Cont'd)

Under NOTE: Change the first line to read, "The VO (Varactor Offset) Voltage Adjustment"

In the fourth line, delete "and A9" and change "assemblies" to "assembly".

In the fifth line, replace "them" with "it" and "two assemblies" with "assembly".

In the sixth line, delete "A9R2 and".

Add a final sentence, "The +10V power supply should be checked after the instrument has warmed-up (≥ 10 minutes)."

In step 7, replace ". . . adjust +10V potentiometer A9R2" with "check".

PAGES 5-44 THROUGH 5-48, PARAGRAPH 5-25:

Procedure: First Converter Adjustments

All Serials In Figure 5-11, above the spectrum analyzer, change TUNE from "A7TP4" to "A7TP6".

► Procedure: First LO Adjustments

Change the sentence in step 6 to read, ". . . DVM indication of -100mVDC. Cancel YIG hysteresis by rotating FREQ SPAN/DIV to FULL and then back to 0 several times."

Change the first sentence in step 7 to read, ". . . indication of 3.03 GHz ± 1 MHz."

Change step 11 to read ". . . control for -100mVDC. . . indication of 3.03 GHz ± 1 MHz. Cancel hysteresis as in step 6, and recheck frequency.

Add a second sentence to step 14, "Cancel YIG hysteresis by rotating the FREQ SPAN/DIV to FULL and then back to 0 several times.

Change the specification in step 43 from 0.2 to 1.5 major divisions.

PAGES 5-49 THROUGH 5-52, PARAGRAPH 5-26:

Procedure: Second Converter Adjustments

- All Serials ▶ In step 21, change the TIME/DIV from "AUTO" to "20 msec."
▶ Change the sentence in step 24 to read, ". . . for a 0V to +15V
triangular signal with a frequency of 500 Hz."

Change the third sentence of step 30 to read:

Do not adjust Z2 and Z3 unless it is necessary to meet requirements.

PAGES 5-57 THROUGH 5-65, PARAGRAPH 5-28:

Procedure: Frequency Response Adjustments

- All Serials Change the title before step 53 to read: "6 to 15 GHz Adjustment".

SECTION V ADJUSTMENTS

5-1. INTRODUCTION

5-2. This section describes the adjustments used to restore the HP 8559A to its peak operating condition after a repair or to compensate for changes resulting from component aging. Illustrations showing the appropriate test setups are included in the adjustment procedures. Table 5-1 lists all the adjustments by adjustment name, adjustment reference designator, and by the paragraph number of the adjustment procedure. Included in the table is a brief description of the purpose of the adjustment.

5-3. Data taken during an adjustment should be recorded in the spaces provided in the procedure. Comparison of initial data with data taken during later adjustments is useful for preventative maintenance and troubleshooting.

WARNING

The adjustments in this section require the HP 8559A to be removed from the display mainframe and connected through an extender cable assembly. Be very careful; the energy at some points in the instrument will, if contacted, cause personal injury. 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, unless otherwise noted.

5-4. EQUIPMENT REQUIRED

5-5. Test equipment and accessories required for the adjustment procedures are listed in Table 1-3. If the listed equipment is not available, substitute

equipment may be used provided it meets the minimum specifications given in the table.

5-6. Adjustment Tools

5-7. Required service accessories, with part numbers, are illustrated in Section I.

5-8. For adjustments that require a non-metallic tuning tool, use fiber tuning tool, HP Part Number 8710-0033 (check digit 4). When a non-metallic tuning tool is not required, you may use an ordinary small, flat-bladed screwdriver or other suitable tool. Regardless of the tool used, do not try to force any adjustment control. Slug-tuning inductors and variable capacitors, especially, are easily damaged by excessive force.

5-9. Extender Cable Installation

WARNING

Disconnect display mainframe line power cord before installation of extender cable assembly.

5-10. Pull out the lock knob and slide the spectrum analyzer out of the display mainframe. If side stops are installed, refer to Section II for removal.

5-11. Carefully slide the extender cable assembly, HP Part Number 5060-0303, into the display mainframe, aligning the metal guide plate with the slotted side rails of the mainframe. Firmly seat the extender cable assembly to ensure good contact.

5-12. Connect the opposite end of the cable to the spectrum analyzer. The plug is keyed so it will go on correctly and will not make contact upside down. Remove the orange and the yellow leads from pins 3 and 4 on the A15 board at the rear of the spectrum analyzer. Connect the corresponding leads from the extender cable assembly to these pins by means of the insulated alligator clips.

5-13. RELATED ADJUSTMENTS

5-14. These adjustments should be performed when the troubleshooting information in Section VIII indicates that an adjustable circuit is not operating correctly. Perform the adjustments after repair or replacement of the circuit. The troubleshooting procedures and Table 5-2 specify the required adjustments.

5-15. FACTORY SELECTED COMPONENTS

5-16. Table 5-3 is a list of factory selected components used in the HP 8559A. The components are listed by reference designator, related adjustment paragraph, and by basis of selection. Factory selected components are identified by an asterisk (*) in the schematic diagrams in Section VIII and in the Replaceable Parts list in Section VIII. Part numbers for standard values of selected components are listed in Table 5-4.

TABLE 5-1. ADJUSTABLE COMPONENTS (1 OF 3)

Adjustment Name	Reference Designator	Adjustment Paragraph	Description
GAIN	A1A2R28	5-30	Adjusts DPM high indication.
OFFSET	A1A2R29	5-30	Adjusts DPM low indication.
2nd MIXER MATCH	A5L2	5-26	Adjusts Second Converter output match.
Z1	A5Z1	5-26	Adjusts First IF Bandpass Filter Response.
Z2	A5Z2	5-26	Adjusts First IF Bandpass Filter Response.
Z3	A5Z3	5-26	Adjusts First IF Bandpass Filter Response.
2nd LO FREQUENCY	A5Z4	5-26	Adjusts Second LO Frequency.
3 GHz	A7R8	5-25	Adjusts YTO low-end frequency.
-10V	A7R29	5-17	Adjusts -10V Power Supply output.
+14.5V	A7R41	5-17	Adjusts +14.5V Power Supply output.
6 GHz C	A7R47	5-25	Coarse adjusts YTO high-end frequency.
6 GHz F	A7R75	5-25	Fine adjusts YTO high-end frequency.
MO	A7R81	5-25	Adjusted to optimize centering between wide and narrow frequency spans.
DC	A7R83	5-25	Adjusts delay compensation.
FM	A7R92	5-25	Adjusts YTO linearity.
REG	A8R34	5-26	Adjusts varactor bias voltage for proper Second LO Shift between Regular and Alternate IF.
OFF	A8R39	5-26	Adjusts varactor bias voltage (offset) for Second LO frequency with Regular IF.
SIG ID	A8R40	5-26	Adjusts Second LO shift for signal identifier 1 MHz below signal.
DPM ZERO	A8R61	5-30	Adjusts DPM Driver output for 0V with 0V input (offset adjustment).
VO	A8R62	5-17	Adjusts varactor bias voltage (offset) with Alternate IF
+10V	A9R2	5-17	Adjusts +10V Power Supply output.
1 ms	A9R10	5-18	Adjusts sweep ramp to calibrate 1 ms/DIV sweep time.
5 ms	A9R13	5-18	Adjusts sweep ramp to calibrate 5 ms/DIV sweep time.
XTL	A9R72	5-21, 5-22	Adjusts 3 kHz IF bandwidth.
LC	A9R85	5-21, 5-22	Adjusts 1 MHz IF bandwidth.
C9	A10C9	5-27	Adjusts Second IF Bandpass Filter Response.
C10	A10C10	5-27	Adjusts Second IF Bandpass Filter Response.
C11	A10C11	5-27	Adjusts Second IF Bandpass Filter Response.
C12	A10C12	5-27	Adjusts Second IF Bandpass Filter Response.
CAL FREQ	A10C46	5-29	Adjusts CAL OUTPUT frequency.
LO ADJ	A10L12	5-27	Adjusts Third LO frequency.
CAL AMPL	A10R13	5-29	Adjusts CAL OUTPUT amplitude.
SYM	A11C15	5-21	Adjusts symmetry of first crystal bandwidth filter stage.
LC CTR	A11C23	5-21	Adjusts centering of first LC bandwidth filter stage.
CTR	A11C25	5-21	Adjusts centering of first crystal bandwidth filter stage.

TABLE 5-1. ADJUSTABLE COMPONENTS (2 OF 3)

Adjustment Name	Reference Designator	Adjustment Paragraph	Description
SYM	A11C38	5-21	Adjusts symmetry of second crystal bandwidth filter stage.
LC CTR	A11C45	5-21	Adjusts centering of second LC bandwidth filter stage.
CTR	A11C54	5-21	Adjusts centering of second crystal bandwidth filter stage.
C73 (LC DIP)	A11C73	5-21	Dip adjusts first LC bandwidth filter stage.
C74 (LC DIP)	A11C74	5-21	Dip adjusts second LC bandwidth filter stage.
LC	A11R26	5-21	Adjusts LC feedback of bandwidth filter.
XTL	A11R31	5-21	Adjusts crystal feedback of bandwidth filter.
RF GAIN	A12R5	5-23	Adjusts overall gain of step gain amplifiers.
10D (10 dB)	A12R6	5-24	Adjusts 10 dB step gain amplifier.
20D (20 dB)	A12R21	5-24	Adjusts first 20 dB step gain amplifier.
40D (40 dB)	A12R29	5-24	Adjusts second 20 dB step gain amplifier.
LC CTR	A13C23	5-21	Adjusts centering of first LC bandwidth filter stage.
CTR	A13C25	5-21	Adjusts centering of first crystal bandwidth filter stage.
SYM	A13C38	5-21	Adjusts symmetry of second crystal bandwidth filter stage.
LC CTR	A13C45	5-21	Adjusts centering of second LC bandwidth filter stage.
CTR	A13C54	5-21	Adjusts centering of second crystal bandwidth filter stage.
C73 (LC DIP)	A13C73	5-21	Dip adjusts first LC bandwidth filter stage.
C74 (LC DIP)	A13C74	5-21	Dip adjusts second LC bandwidth filter stage.
LC	A13R26	5-21	Adjusts LC feedback of bandwidth filter.
XTL	A13R31	5-21	Adjusts crystal feedback of bandwidth filter.
OFFSET	A14R10	5-19	Adjusts $-8V$ temperature compensated supply.
TC	A14R21		Adjusts gain of $+1V$ supply to provide temperature compensation for log mode temperature controlled variable gain amplifier. (Factory adjustable only.)
SLOPE	A14R23	5-19	Adjusts gain of log mode temperature controlled gain amplifier.
G6	A14R27	5-19	Adjusts combined gain of 2nd and 3rd stages in linear mode.
G5	A14R30	5-19	Adjusts gain of 4th stage in linear mode.
G4	A14R33	5-19	Adjusts gain of 5th stage in linear mode.
LIN	A14R34	5-19	Adjusts combined gain of 6th and 7th stages in linear mode.
-10 dB	A14R39	5-19	Adjusts shape of log fidelity curve at -10 dB.
-30 dB	A14R69	5-19	Adjusts shape of log fidelity curve at -30 dB.
1 VT	A14R88		Adjusts voltage at A14TP1 for approximately $+1V$. (Factory adjustable only.)

TABLE 5-1. ADJUSTABLE COMPONENTS (3 OF 3)

Adjustment Name	Reference Designator	Adjustment Paragraph	Description
LOG GAIN	A14R121	5-19	Adjusts dc offset circuitry at output of Log Amplifier Assembly A14 for 10 dB steps in log mode.
1 dB (offset)	A15R1	5-20	Adjusts LOG 10 dB/DIV translation.
OD (0 dB)	A12R35	5-24	Adjusts variable gain amplifier for 0 dB with REF LEVEL FINE control set to 0 dB.
-12D (-12 dB)	A12R39	5-24	Adjusts variable gain amplifier for -12 dB with REF LEVEL FINE control set to -12 dB.
1B	A12R47	5-28	Adjusts slope of Band 1 response.
2B	A12R48	5-28	Adjusts slope of Band 2 response.
3B	A12R49	5-28	Adjusts slope of Band 3 response.
4B	A12R51	5-28	Adjusts slope of Band 4 response.
5B	A12R53	5-28	Adjusts slope of Band 5 response.
5C	A12R54	5-28	Adjusts high-end breakpoint in slope of Band 5 response.
6B	A12R55	5-28	Adjusts slope of Band 6 response.
6C	A12R56	5-28	Adjusts high-end breakpoint in slope of Band 6 response.
1A	A12R57	5-28	Adjusts gain of Band 1.
2A	A12R58	5-28	Adjusts gain of Band 2.
3A	A12R59	5-28	Adjusts gain of Band 3.
4A	A12R60	5-28	Adjusts gain of Band 4.
5A	A12R61	5-28	Adjusts gain of Band 5.
6A	A12R62	5-28	Adjusts gain of Band 6.
V3+	A12R70	5-28	Adjusts diode bias for Band 6.
V3-	A12R71	5-28	Adjusts diode bias for Band 5.
V1	A12R72	5-28	Adjusts diode bias for Bands 1 and 2.
V2-	A12R83	5-28	Adjusts diode bias for Band 3.
V2+	A12R87	5-28	Adjusts diode bias for Band 4.
SYM	A13C15	5-21	Adjusts symmetry of first crystal bandwidth filter stage.

TABLE 5-2. RELATED ADJUSTMENTS

Assembly Replaced or Repaired		Perform the Following Related Adjustments	Paragraph Number
A1A1	DPM Display	Frequency Display Adjustments	5-30
A1A2	DPM Driver	Frequency Display Adjustments	5-30
A2	Front Panel Switch Assembly	First Converter Adjustments	5-25
		CAL OUTPUT and REF LEVEL CAL Adjustments	5-29
A3	Input Attenuator	Frequency Response Adjustments	5-28
A4	First Mixer	First Converter Adjustments	5-25
		Frequency Response Adjustments	5-28
		CAL OUTPUT and REF LEVEL CAL Adjustments	5-29
A5	Second Converter	Second Converter Adjustments	5-26
		CAL OUTPUT and REF LEVEL CAL Adjustments	5-29
A6	YIG-Tuned Oscillator	First Converter Adjustments	5-25
		Frequency Response Adjustments	5-28
		CAL OUTPUT and REF LEVEL CAL Adjustments	5-29
A7	Frequency Control	Power Supply Checks and Adjustments	5-17
		First Converter Adjustments	5-25
A8	Marker	First Converter Adjustments	5-25
A9	Sweep Generator/ Bandwidth Control	Power Supply Checks and Adjustments	5-17
		Calibrated Sweep Time Adjustments	5-18
		3-dB Bandwidth Adjustments	5-22
A10	Third Converter	Third Converter Adjustments	5-27
		CAL OUTPUT and REF LEVEL CAL Adjustments	5-29
A11, A13*	Bandwidth Filters	Bandwidth Filter Adjustments	5-21
		3-dB Bandwidth Adjustments	5-22
A12	Step Gain	RF Gain Adjustments	5-23
		Step Gain Adjustments	5-24
		CAL OUTPUT and REF LEVEL CAL Adjustments	5-29
A14	Log Amplifier	Log Amplifier Log and Linear Adjustments	5-19
		1-dB Offset Adjustment	5-20
		CAL OUTPUT and REF LEVEL CAL Adjustments	5-29
A15	Vertical Driver/ Blanking	1-dB Offset Adjustment	5-20
A16	Motherboard	No related adjustments	

* A11 and A13 bandwidth filter assemblies contain a matched set of crystals. These two assemblies must be treated as a matched pair when replacement is necessary.

TABLE 5-3. FACTORY SELECTED COMPONENTS IN ALPHA-NUMERICAL ORDER

Reference Designator	Basis of Selection	Reference Designator	Basis of Selection
A1A2R1	Adjusts bias on DPM Clock Oscillator.	A11R56	Selected to equalize feedback between LC stages (not field selectable).
A7C12	Selected to provide delay compensation for main coil sweeps.	A12C26	Selected to optimize 3 MHz to 1 MHz bandwidth amplitude and frequency correlation.
A7R59	Adjusts YTO sweep linearity.	A12R50	Adjusts Band 3 breakpoint for frequency response.
A7R60	Adjusts YTO sweep linearity.	A12R73	Shifts adjustment range of A12R72 V1.
A7R96	Selected to provide delay compensation for FM coil swept spans.	A12R74	Shifts adjustment range of A12R71 V3--.
A7R106	Selected to optimize Main Coil Span Accuracy.	A12R75	Shifts adjustment range of A12R70 V3+.
A7R107	Selected to optimize Main Coil Span Accuracy.	A12R80	Adjusts reference voltage to A12U2 for diode bias.
A8R94	Shifts adjustment range of A8R34 REG.	A12R84	Shifts adjustment range of A12R83 V2--.
A9R42	Selected to set low end of sweep ramp.	A12R88	Shifts adjustment range of A12R87 V2+.
A9R47	Selected to set high end of sweep ramp.	A13C16	Selected to shift adjustment range of A13C23. Should be same value as A13C20.
A9R109	Selected to optimize 1 kHz Bandwidth.	A13C20	Selected to shift adjustment range of A13C23. Should be same value as A13C16.
A9R110	Selected to optimize 3 kHz Bandwidth.	A13C43	Selected to shift adjustment range of A13C45. Should be same value as A13C64.
A9R111	Selected to optimize 10 kHz Bandwidth.	A13C64	Selected to shift adjustment range of A13C45. Should be same value as A13C43.
A9R116	Selected to optimize 300 kHz Bandwidth.	A13R7	Adjusts XTAL bandwidth amplitudes relative to LC amplitudes.
A9R118	Selected to optimize 1 MHz Bandwidth.	A13R19	Selected to give correct IF bandwidth for RESOLUTION BW of 100 kHz.
A9R120	Selected to optimize 3 MHz Bandwidth.	A13R23	Selected to give correct IF bandwidth for RESOLUTION BW of 30 kHz.
A10R25	Adjusts gain of Flatness Compensation Amplifier to compensate for gain of A12 flatness circuitry.	A13R32	Selected to shift adjustment range of A13R26.
A11C16	Selected to shift adjustment range of A11C23. Should be same value as A11C20.	A13R43	Selected to give correct IF bandwidth for RESOLUTION BW of 100 kHz.
A11C20	Selected to shift adjustment range of A11C23. Should be same value as A11C16.	A13R48	Selected to give correct IF bandwidth for RESOLUTION BW of 30 kHz.
A11C43	Selected to shift adjustment range of A11C45. Should be same value as A11C64.	A13R56	Selected to equalize feedback between LC stages (not field selectable).
A11C64	Selected to shift adjustment range of A11C45. Should be same value as A11C43.	A14R93	Selected to shift adjustment range of A11R34.
A11R7	Adjusts XTAL bandwidth amplitudes relative to LC amplitudes.	A14R101	Selected to shift adjustment range of A11R34.
A11R19	Selected to give correct IF bandwidth for RESOLUTION BW of 100 kHz.	A14R107	Selected to shift adjustment range of A11R23.
A11R23	Selected to give correct IF bandwidth for RESOLUTION BW of 30 kHz.	A15R26	Selected to provide increased range adjustment for 1 dB offset circuit.
A11R32	Selected to shift adjustment range of A11R26.		
A11R43	Selected to give correct IF bandwidth for RESOLUTION BW of 100 kHz.		
A11R48	Selected to give correct IF bandwidth for RESOLUTION BW of 30 kHz.		

TABLE 5-4. HP PART NUMBERS OF STANDARD VALUE REPLACEMENT COMPONENTS (1 OF 3)

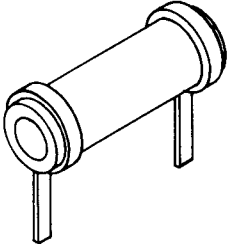
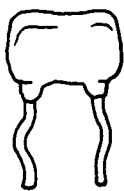
CAPACITORS					
<p>RANGE: 1 to 24 pF TYPE: Tubular TOLERANCE: 1 to 9.1 pF = ±.25 pF 10 to 24 pF = ±5%</p> 			<p>RANGE: 27 to 680 pF TYPE: Dipped Mica TOLERANCE: ±5%</p> 		
Value (pF)	HP Part Number	C D	Value (pF)	HP Part Number	C D
1.0	0160-2236	8	27	0160-2306	3
1.2	0160-2237	9	30	0160-2199	2
1.5	0150-0091	8	33	0160-2150	5
1.8	0160-2239	1	36	0160-2308	5
2.0	0160-2240	4	39	0140-0190	7
2.2	0160-2241	5	43	0160-2200	6
2.4	0160-2242	6	47	0160-2307	4
2.7	0160-2243	7	51	0160-2201	7
3.0	0160-2244	8	56	0140-0191	8
3.3	0150-0059	8	62	0140-0205	5
3.6	0160-2246	0	68	0140-0192	9
3.9	0160-2247	1	75	0160-2202	8
4.3	0160-2248	2	82	0140-0193	0
4.7	0160-2249	3	91	0160-2203	9
5.1	0160-2250	6	100	0160-2204	0
5.6	0160-2251	7	110	0140-0194	1
6.2	0160-2252	8	120	0160-2205	1
6.8	0160-2253	9	130	0140-0195	2
7.5	0160-2254	0	150	0140-0196	3
8.2	0160-2255	1	160	0160-2206	2
9.1	0160-2256	2	180	0140-0197	4
10.0	0160-2257	3	200	0140-0198	5
11.0	0160-2258	4	220	0160-0134	1
12.0	0160-2259	5	240	0140-0199	6
13.0	0160-2260	8	270	0140-0210	2
15.0	0160-2261	9	300	0160-2207	3
16.0	0160-2262	0	330	0160-2208	4
18.0	0160-2263	1	360	0160-2209	5
20.0	0160-2264	2	390	0140-0200	0
22.0	0160-2265	3	430	0160-0939	4
24.0	0160-2266	4	470	0160-3533	0
			510	0160-3534	1
			560	0160-3535	2
			620	0160-3536	3
			680	0160-3537	4

TABLE 5-4. HP PART NUMBERS OF STANDARD VALUE REPLACEMENT COMPONENTS (2 OF 3)


RESISTORS								
RANGE: 10 to 464K Ohms TYPE: Fixed-Film WATTAGE: .125 at 125°C TOLERANCE: ±1.0%								
Value (Ω)	HP Part Number	C D	Value (Ω)	HP Part Number	C D	Value (Ω)	HP Part Number	C D
10.0	0757-0346	2	464	0698-0082	7	21.5K	0757-0199	3
11.0	0757-0378	0	511	0757-0416	7	23.7K	0698-3158	4
12.1	0757-0379	1	562	0757-0417	8	26.1K	0698-3159	5
13.3	0698-3427	0	619	0757-0418	9	28.7K	0698-3449	6
14.7	0698-3428	1	681	0757-0419	0	31.6K	0698-3160	8
16.2	0757-0382	6	750	0757-0420	3	34.8K	0757-0123	3
17.8	0757-0294	9	825	0757-0421	4	38.3K	0698-3161	9
19.6	0698-3429	2	909	0757-0422	5	42.2K	0698-3450	9
21.5	0698-3430	5	1.0K	0757-0280	3	46.4K	0698-3162	0
23.7	0698-3431	6	1.1K	0757-0424	7	51.1K	0757-0458	7
26.1	0698-3432	7	1.21K	0757-0274	5	56.2K	0757-0459	8
28.7	0698-3433	8	1.33K	0757-0317	7	61.9K	0757-0460	1
31.6	0757-0180	2	1.47K	0757-1094	9	68.1K	0757-0461	2
34.8	0698-3434	9	1.62K	0757-0428	1	75.0K	0757-0462	3
38.3	0698-3435	0	1.78K	0757-0278	9	82.5K	0757-0463	4
42.2	0757-0316	6	1.96K	0698-0083	8	90.9K	0757-0464	5
46.4	0698-4037	0	2.15K	0698-0084	9	100K	0757-0465	6
51.1	0757-0394	0	2.37K	0698-3150	6	110K	0757-0466	7
56.2	0757-0395	1	2.61K	0698-0085	0	121K	0757-0467	8
61.9	0757-0276	7	2.87K	0698-3151	7	133K	0698-3451	0
68.1	0757-0397	3	3.16K	0757-0279	0	147K	0698-3452	1
75.0	0757-0398	4	3.48K	0698-3152	8	162K	0757-0470	3
82.5	0757-0399	5	3.83K	0698-3153	9	178K	0698-3243	8
90.9	0757-0400	9	4.22K	0698-3154	0	196K	0698-3453	2
100	0757-0401	0	4.64K	0698-3155	1	215K	0698-3454	3
110	0757-0402	1	5.11K	0757-0438	3	237K	0698-3266	5
121	0757-0403	2	5.62K	0757-0200	7	261K	0698-3455	4
133	0698-3437	2	6.19K	0757-0290	5	287K	0698-3456	5
147	0698-3438	3	6.81K	0757-0439	4	316K	0698-3457	6
162	0757-0405	4	7.50K	0757-0440	7	348K	0698-3458	7
178	0698-3439	4	8.25K	0757-0441	8	383K	0698-3459	8
196	0698-3440	7	9.09K	0757-0288	1	422K	0698-3460	1
215	0698-3441	8	10.0K	0757-0442	9	464K	0698-3260	9
237	0698-3442	9	11.0K	0757-0443	0			
261	0698-3132	4	12.1K	0757-0444	1			
287	0698-3443	0	13.3K	0757-0289	2			
316	0698-3444	1	14.7K	0698-3156	2			
348	0698-3445	2	16.2K	0757-0447	4			
383	0698-3446	3	17.8K	0698-3136	8			
422	0698-3447	4	19.6K	0698-3157	3			

TABLE 5-4. HP PART NUMBERS OF STANDARD VALUE REPLACEMENT COMPONENTS (3 OF 3)

RESISTORS

RANGE: 10 to 1.47M Ohms
 TYPE: Fixed-Film
 WATTAGE: .5 at 125°C
 TOLERANCE: ±1%



Value (Ω)	HP Part Number	C D	Value (Ω)	HP Part Number	C D	Value (Ω)	HP Part Number	C D	Value (Ω)	HP Part Number	C D
10.0	0757-0984	4	215	0698-3401	0	4.64K	0698-3348	4	110K	0757-0859	2
11.0	0575-0985	5	237	0698-3102	8	5.11K	0757-0833	2	121K	0757-0860	5
12.1	0757-0986	6	261	0757-1090	5	5.62K	0757-0834	3	133K	0757-0310	0
13.3	0757-0001	6	287	0757-1092	7	6.19K	0757-0196	0	147K	0698-3175	5
14.7	0698-3388	2	316	0698-3402	1	6.81K	0757-0835	4	162K	0757-0130	2
16.2	0757-0989	9	348	0698-3403	2	7.50K	0757-0836	5	178K	0757-0129	9
17.8	0698-3389	3	383	0698-3404	3	8.25K	0757-0837	6	196K	0757-0063	0
19.6	0698-3390	6	422	0698-3405	4	9.09K	0757-0838	7	215K	0757-0127	7
21.5	0698-3391	7	464	0698-0090	7	10.0K	0757-0839	8	237K	0698-3424	7
23.7	0698-3392	8	511	0757-0814	9	12.1K	0757-0841	2	261K	0757-0064	1
26.1	0757-0003	8	562	0757-0815	0	13.3K	0698-3413	4	287K	0757-0154	0
28.7	0698-3393	9	619	0757-0158	4	14.7K	0698-3414	5	316K	0698-3425	8
31.6	0698-3394	0	681	0757-0816	1	16.2K	0757-0844	5	348K	0757-0195	9
34.8	0698-3395	1	750	0757-0817	2	17.8K	0698-0025	8	383K	0757-0133	5
38.3	0698-3396	2	825	0757-0818	3	19.6K	0698-3415	6	422K	0757-0134	6
42.2	0698-3397	3	909	0757-0819	4	21.5K	0698-3416	7	464K	0698-3426	9
46.4	0698-3398	4	1.00K	0757-0159	5	23.7K	0698-3417	8	511K	0757-0135	7
51.1	0757-1000	7	1.10K	0757-0820	7	26.1K	0698-3418	9	562K	0757-0868	3
56.2	0757-1001	8	1.21K	0757-0821	8	28.7K	0698-3103	9	619K	0757-0136	8
61.9	0757-1002	9	1.33K	0698-3406	5	31.6K	0698-3419	0	681K	0757-0869	4
68.1	0757-0794	4	1.47K	0757-1078	9	34.8K	0698-3420	3	750K	0757-0137	9
75.0	0757-0795	5	1.62K	0757-0873	0	38.3K	0698-3421	4	825K	0757-0870	7
82.5	0757-0796	6	1.78K	0698-0089	4	42.2K	0698-3422	5	909K	0757-0138	0
90.0	0757-0797	7	1.96K	0698-3407	6	46.4K	0698-3423	6	1M	0757-0059	4
100	0757-0198	2	2.15K	0698-3408	7	51.1K	0757-0853	6	1.1M	0757-0139	1
110	0757-0798	8	2.37K	0698-3409	8	56.2K	0757-0854	7	1.21M	0757-0871	8
121	0757-0799	9	2.61K	0698-0024	7	61.9K	0757-0309	7	1.33M	0757-0194	8
133	0698-3399	5	2.87K	0698-3101	7	68.1K	0757-0855	8	1.47M	0698-3464	5
147	0698-3400	9	3.16K	0698-3410	1	75.0K	0757-0856	9			
162	0757-0802	5	3.48K	0698-3411	2	82.5K	0757-0857	0			
178	0698-3334	8	3.83K	0698-3412	3	90.9K	0757-0858	1			
196	0757-1060	9	4.22K	0698-3346	2	100K	0757-0367	7			

ADJUSTMENTS

5-17. POWER SUPPLY CHECKS AND ADJUSTMENTS

REFERENCE:

A7, A8, A9 Schematics

DESCRIPTION:

The +14.5V and -10V regulated power supplies on Frequency Control Assembly A7 are adjusted. The (dependent) -12V power supply is then checked for proper dc output (with less than ± 50 mV variation) while the spectrum analyzer is tuned from 10 MHz to 3 GHz. The +10V power supply on Sweep Generator/Bandwidth Control Assembly A9 and the VO (Varactor Offset) voltage on Marker Assembly A8 are then adjusted. Both the +10V power supply voltage and the VO voltage are temperature-dependent and must be adjusted during the first five minutes after the spectrum analyzer is turned on (cold instrument).

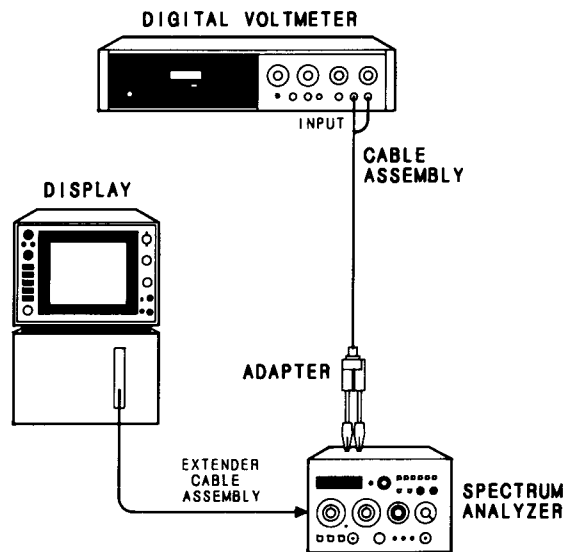


FIGURE 5-1. POWER SUPPLY CHECKS AND ADJUSTMENTS TEST SETUP

EQUIPMENT:

Digital Voltmeter	HP 3456A
Extender Cable	HP 5060-0303
Cable Assembly, BNC (m) to Banana Plug	HP 11001A
Adapter, BNC (f) to Alligator Clips	HP 8120-1292

 ADJUSTMENTS

5-17. POWER SUPPLY CHECKS AND ADJUSTMENTS (Cont'd)

PROCEDURE:

1. Set spectrum analyzer controls as follows:

FREQUENCY BAND GHz	.01 – 3
TUNING	0.010 GHz
FREQ SPAN/DIV	F (full)
RESOLUTION BW	Optimum, coupled
INPUT ATTEN	10 dB
REFERENCE LEVEL	0 dBm
REF LEVEL FINE	0
Amplitude Scale	10 dB/DIV
SWEEP TIME/DIV	MAN
SWEEP TRIGGER	FREE RUN
ALT IF	OFF
SIG IDENT	OFF
BL CLIP	OFF
VIDEO FILTER	OFF

NOTE

In all following adjustments, connect negative terminal of digital voltmeter to spectrum analyzer chassis unless otherwise instructed.

2. Connect equipment as shown in Figure 5-1. Install Frequency Control Assembly A7 on extender board and connect digital voltmeter to +14.5V test points A7TP3.
3. Adjust +14.5V potentiometer A7R41 for a voltmeter indication of $+14.500 \pm 0.002$ Vdc.
4. Connect digital voltmeter to –10V test point A7TP2 and adjust –10V potentiometer A7R29 for a voltmeter indication of -10.000 ± 0.005 Vdc.
5. Use digital voltmeter to check for -12.0 ± 0.1 Vdc at collector (case) of transistor A7Q7, located near center of Frequency Control Assembly A7. Vary MAN SWEEP control over entire range and verify that voltage indication varies no more than ± 0.05 Vdc.
6. Remove extender board and reinstall Frequency Control Assembly A7.

ADJUSTMENTS

5-17. POWER SUPPLY CHECKS AND ADJUSTMENTS (Cont'd)**NOTE**

The two following voltage adjustments, +10V and VO (Varactor Offset), must be performed while the spectrum analyzer is still cold (during first five minutes after turn-on). If the instrument has been operating longer than five minutes, turn off the display mainframe, remove A8 and A9 assemblies, and let them cool on bench for 15 minutes. Replace the two assemblies and proceed with adjustment of A9R2 and A8R62 during the first five minutes after turn-on.

7. Connect digital voltmeter to +10V test point A9TP7 and adjust +10V potentiometer A9R2 for a voltmeter indication of $+10.000 \pm 0.100$ Vdc.
8. Connect digital voltmeter to VO test point A8TP2. Set spectrum analyzer SWEEP TIME/DIV control to 10 ms and SWEEP TRIGGER control to SINGLE. Turn ALT IF and SIG IDENT on (pushbuttons depressed).
9. Voltage at A8TP2 will alternate between two values each time a sweep is triggered. Trigger sweep a few times until voltmeter indicates least negative VO voltage. Adjust VO potentiometer A8R62 for a voltmeter indication of -2.00 ± 0.10 Vdc.

ADJUSTMENTS

5-18. CALIBRATED SWEEP TIME ADJUSTMENT

REFERENCE:

A9 Schematic

DESCRIPTION:

A counter is used to adjust the time interval of the 1 millisecond per division and 5 milliseconds per division sweep times. Calibrated sweep times from 0.1 milliseconds through 50 milliseconds are then checked using the counter time-interval (T.I.) function.

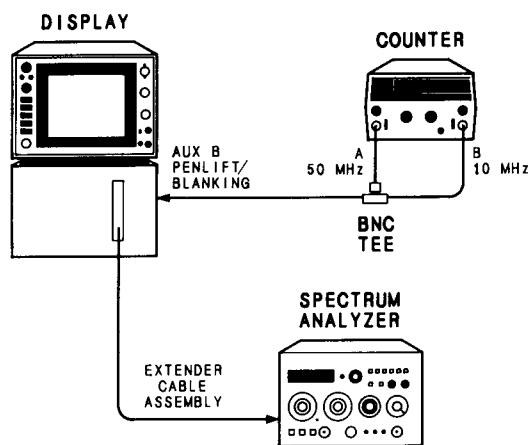


FIGURE 5-2. CALIBRATED SWEEP TIME ADJUSTMENT TEST SETUP

EQUIPMENT:

50 MHz Universal Counter	HP 5300B/5302A
Extender Cable Assembly	HP 5060-0303
BNC Tee	HP 1250-0781

PROCEDURE:

NOTE

Since the calibrated sweep time adjustments are dependent on the +14.5V and -10V power supplies, the Power Supply Checks and Adjustments (paragraph 5-17) should be performed before starting this procedure.

ADJUSTMENTS

5-18. CALIBRATED SWEEP TIME ADJUSTMENT (Cont'd)

1. Set equipment controls as follows:



NOTE

If an HP 853A Spectrum Analyzer Display mainframe is used, and a sweep time faster than 10 msec is selected, an error message will appear on the analyzer's CRT and the analyzer will go into mixed mode.

Spectrum Analyzer:

FREQUENCY BAND	GHz	.....	.01 – 3
TUNING		.....	>0.010 GHz
FREQ SPAN/DIV		.....	F (full)
RESOLUTION BW		.....	Optimum, coupled
INPUT ATTEN		.....	10 dB
REFERENCE LEVEL		.....	0 dBm
REF LEVEL FINE		.....	0
Amplitude Scale		.....	10 dB/DIV
SWEEP TIME/DIV		.....	1 msec
SWEEP TRIGGER		.....	FREE RUN
ALT IF		.....	OFF
SIG IDENT		.....	OFF
BL CLIP		.....	OFF
VIDEO FILTER		.....	OFF

50 MHz Universal Counter:

FUNCTION	.....	T.I. A to B
SAMPLE RATE	.....	Full counterclockwise
TIME BASE	.....	10 μ s
SENSITIVITY (A)	.....	9 o'clock
A 50 MHz INPUT	.....	(falling edge)
SENSITIVITY (B)	.....	9 o'clock
B 10 MHz INPUT	.....	(rising edge)

2. Connect equipment as shown in Figure 5-2.
3. Adjust counter SENSITIVITY controls (both channels) as necessary until counter triggers and indicates a time interval of approximately 10.00 ms.
4. Adjust 1 ms potentiometer A9R10 for a time interval indication of 10.00 \pm 0.80 ms.

ADJUSTMENTS

5-18. CALIBRATED SWEEP TIME ADJUSTMENT (Cont'd)

NOTE

In early instruments, A9R13 is labeled "2 ms." The adjustment of A9R13, however, should be performed with SWEEP TIME/DIV set at 5 ms.

5. Set spectrum analyzer SWEEP TIME/DIV control to 5 msec. Readjust counter SENSITIVITY controls as necessary and adjust 5 ms potentiometer A9R13 for a time interval indication of 50.00 ± 4.00 ms.
6. Check time interval for each SWEEP TIME/DIV control setting listed in Table 5-5. Readjust 1 ms potentiometer A9R10 and 5 ms potentiometer A9R13 as necessary if test limits are exceeded.

TABLE 5-5. CALIBRATED SWEEP TIME TEST LIMITS

SWEEP TIME/DIV Setting	Sweep Time (ms)
.1 ms	1.00 ± 0.10
.2 ms	2.00 ± 0.20
.5 ms	5.00 ± 0.40
1 ms	10.00 ± 0.80
2 ms	20.00 ± 1.50
5 ms	50.00 ± 4.00
10 ms	100.00 ± 8.00
20 ms	200.00 ± 16.00
50 ms	500.00 ± 40.00

ADJUSTMENTS

5-19. LOG AMPLIFIER LOG AND LINEAR ADJUSTMENTS

REFERENCE:

A14 and A15 Schematics

DESCRIPTION:

Step attenuators are used to change the level of the input signal to the spectrum analyzer in calibrated steps. The output of Vertical Driver and Blanking Assembly A15 is monitored, and adjustments are performed to calibrate Log Amplifier Assembly A14.

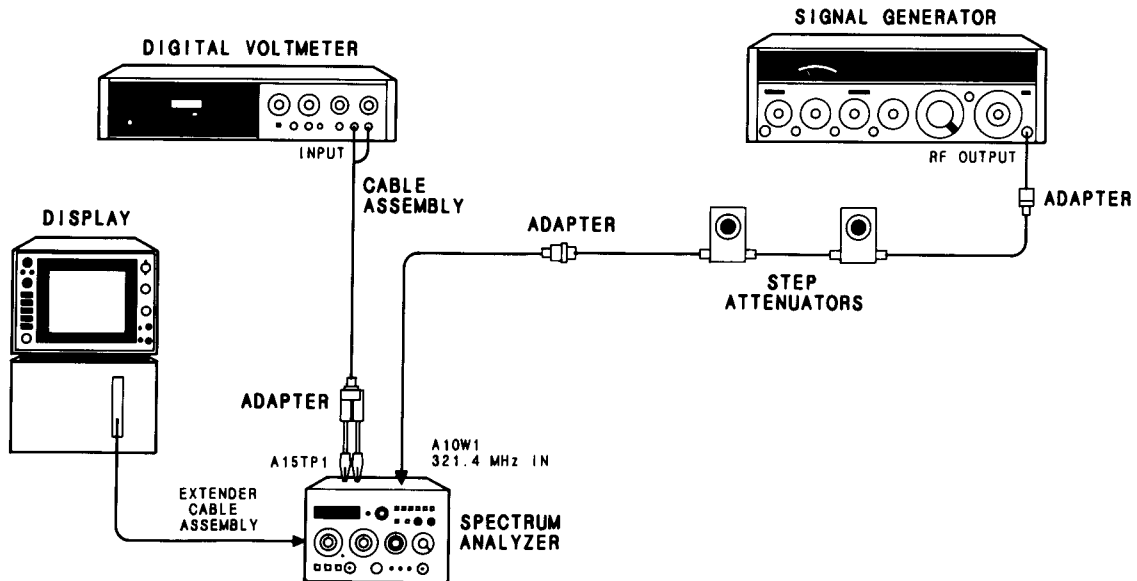


FIGURE 5-3. LOG AMPLIFIER LOG AND LINEAR ADJUSTMENTS TEST SETUP

EQUIPMENT:

Signal Generator	HP 8640B
Digital Voltmeter	HP 3456A
Step Attenuator (10-dB/step)	HP 355D, Opt. H82
Step Attenuator (1-dB/step)	HP 355C, Opt. H80
Cable Assembly, Banana Plug to BNC (m)	HP 14001A
Adapter, Type N (m) to BNC (f)	HP 1250-0780
Adapter, SMC (m) to BNC (f)	HP 1250-0832
Extender Cable Assembly	HP 5060-0303

 ADJUSTMENTS

5-19. LOG AMPLIFIER LOG AND LINEAR ADJUSTMENTS (Cont'd)

PROCEDURE:

1. Set equipment controls as follows:

Spectrum Analyzer:

FREQUENCY BAND GHz	.01 – 3
TUNING	>0.010 GHz
FREQ SPAN/DIV	0
RESOLUTION BW	300 kHz, uncoupled
INPUT ATTEN	10 dB
REFERENCE LEVEL	– 50 dBm
REF LEVEL FINE	0
Amplitude Scale	LIN
SWEEP TIME/DIV	AUTO
SWEEP TRIGGER	FREE RUN
ALT IF	OFF
SIG IDENT	OFF
BL CLIP	OFF
VIDEO FILTER	OFF

Signal Generator:

COUNTER MODE	INT
AM	OFF
FM	OFF
FREQUENCY TUNE	321.4 MHz
RF	ON
OUTPUT LEVEL	approx. – 28 dBm

2. Set 1-dB step attenuator to 10 dB and 10-dB step attenuator to 0 dB. Remove A10W1 (blue cable) from A5J2 and connect equipment as shown in Figure 5-3, using adapter to connect step attenuator to A10W1.

NOTE

The HP 355C 10 dB attenuation is included to compensate for 10 dB of gain on Step Gain Assembly A12 with the TEST-NORM switch in TEST.

3. Set TEST-NORM switch on Step Gain Assembly A12 to TEST position. Adjust signal generator FREQUENCY TUNE control for maximum signal amplitude on display with 10-dB step attenuator set to 0 dB (reduce signal generator OUTPUT LEVEL control setting as necessary to bring signal on-screen).

ADJUSTMENTS

5-19. LOG AMPLIFIER LOG AND LINEAR ADJUSTMENTS (Cont'd)

4. Disconnect signal generator output from step attenuator. Adjust spectrum analyzer VERTICAL POSN control to position signal trace at bottom CRT graticule line. Measure dc offset voltage at A15TP1 and record.

10.75
mV
5. Connect signal generator to step attenuator and adjust signal generator FINE TUNE control to peak signal on CRT display.
6. Adjust signal generator OUTPUT LEVEL for digital voltmeter (DVM) reading (± 1 mV) of 800 mV plus offset recorded in step 4, as measured at A15TP1. Adjust spectrum analyzer VERTICAL GAIN control to position signal trace at top graticule line.
7. Set spectrum analyzer Amplitude Scale control to 10 dB/DIV.
8. Set 10-dB step attenuator to 0 dB and adjust SLOPE potentiometer A14R23 for DVM reading (± 1 mV) of 800 mV plus offset recorded in step 4, as measured at A15TP1.
9. Set 10-dB step attenuator to 60 dB and adjust OFFSET potentiometer A14R10 for DVM reading (± 1 mV) of 200 mV plus offset recorded in step 4, as measured at A15TP1.
10. Repeat steps 8 and 9 until no further adjustment is necessary.
11. Set 10-dB step attenuator to 30 dB and adjust SLOPE potentiometer A14R23 for DVM reading (± 1 mV) of 500 mV plus offset recorded in step 4, as measured at A15TP1.
12. Set 10-dB step attenuator to 60 dB and adjust OFFSET potentiometer A14R10 for DVM reading (± 1 mV) of 200 mV plus offset recorded in step 4.
13. Repeat steps 11 and 12 until no further adjustment is necessary.
14. Set 10-dB step attenuator to 10 dB and adjust -30 dB potentiometer A14R69 for DVM reading (± 1 mV) of 700 mV plus offset recorded in step 4.
15. Set 10-dB step attenuator to 0 dB and adjust -10 dB potentiometer A14R39 for DVM reading (± 1 mV) of 800 mV plus offset recorded in step 4.
16. Set 10-dB step attenuator to 60 dB and adjust OFFSET potentiometer A14R10 for DVM reading (± 1 mV) of 200 mV plus offset recorded in step 4.
17. Set 10-dB step attenuator to 0 dB and adjust SLOPE potentiometer A14R23 for DVM reading (± 1 mV) of 800 mV plus offset recorded in step 4.
18. Repeat steps 16 and 17 until no further adjustment is necessary.
19. Check log fidelity per Table 5-6. If test limits are not met, repeat steps 8 through 18.

ADJUSTMENTS

5-19. LOG AMPLIFIER LOG AND LINEAR ADJUSTMENTS (Cont'd)

TABLE 5-6. LOG FIDELITY CHECK

Step Attenuator Setting (dB)	DVM Reading (mV)	Corrected DVM Reading* (mV)	Test Limits (mV)	Theoretical Reading (mV)	Theoretical Reading Subtracted from Corrected DVM Reading (mV)	Difference Between Adjacent Readings** (mV)
0	_____	_____	800 ± 1	800	_____	
10	_____	_____	700 ± 3	700	_____	_____
20	_____	_____	600 ± 4	600	_____	_____
30	_____	_____	500 ± 4	500	_____	_____
40	_____	_____	400 ± 5	400	_____	_____
50	_____	_____	300 ± 6	300	_____	_____
60	_____	_____	200 ± 7	200	_____	_____
70	_____	_____	100 ± 8	100	_____	_____

* DVM reading minus offset recorded in step 4.
** All values in the Difference Between Adjacent Readings column must be less than or equal to ± 10 mV.

Example (+ 5 mV offset):

TABLE 5-7. SAMPLE COMPUTATIONS OF AMPLITUDE LOG DISPLAY ACCURACY

Step Attenuator Setting (dB)	DVM Reading (mV)	Corrected DVM Reading* (mV)	Theoretical Reading (mV)	Theoretical Reading Subtracted from Corrected DVM Reading (mV)	Difference Between Adjacent Readings** (mV)
0	+805	+800	+800	0	
10	+708	+703	+700	+3	-3
20	+599	+594	+600	-6	+9
30	+497	+492	+500	-8	+2
40	+406	+401	+400	+1	-9

* DVM Reading minus offset recorded in step 4.
** All values in the Difference Between Adjacent Readings column must be less than or equal to ± 10 mV.

ADJUSTMENTS

5-19. LOG AMPLIFIER LOG AND LINEAR ADJUSTMENTS (Cont'd)

Linear Output and Linear Step Gain

20. Disconnect A10W1 from step attenuator and reconnect to A5J2.

CAUTION

When reconnecting A10W1 to A5J2, do not tighten to over 6 inch pounds of torque; A5J2 can be damaged if the connector is overtightened.

Set spectrum analyzer controls as follows:

INPUT ATTEN 10 dB
 REFERENCE LEVEL - 50 dBm
 FREQ SPAN/DIV 0
 TUNING 30 MHz

Set signal generator controls as follows:

OUTPUT LEVEL approx. - 5 dBm
 FREQUENCY 30 MHz

Set 10-dB step attenuator to 0 dB.

- 21. Remove adapter from step attenuator and connect step attenuator to spectrum analyzer input. Adjust the signal generator OUTPUT LEVEL for a DVM reading (± 1 mV) of 800 mV plus offset recorded in step 4 (measured at A15TP1).
- 22. Set spectrum analyzer amplitude scale for Linear display (LIN) and adjust LIN control A14R34 for DVM reading (± 1 mV) of 800 mV plus offset recorded in step 4.
- 23. Make adjustments indicated in Table 5-8, then recheck that all steps meet the DVM test limits. Between adjustments, recheck tuning of spectrum analyzer to be certain signal remains peaked.

TABLE 5-8. LINEAR GAIN ADJUSTMENTS

Adjustment	Step Attenuator	Reference Level (dBm)	DVM Reading*
A14R34 (LIN)	0	-50	Ref: 800 \pm 1 mV
A14R33 (G4)	10	-60	800 \pm 5 mV
A14R30 (G5)	20	-70	800 \pm 5 mV
A14R27 (G6)	30	-80	800 \pm 5 mV
No adjustment	40	-90	800 \pm 20 mV

*After subtracting offset.

ADJUSTMENTS

5-19. LOG AMPLIFIER LOG AND LINEAR ADJUSTMENTS (Cont'd)

Log Gain

24. Set spectrum analyzer controls as follows:

REFERENCE LEVEL - 50 dBm
 Amplitude Scale 1 db/DIV

25. Set 10-dB step attenuator to 0 dB. Retune spectrum analyzer to peak signal. Adjust signal generator OUTPUT LEVEL for DVM reading (± 1 mV) of 800 mV plus offset recorded in step 4, as measured at A15TP1.
26. Set 10-dB step attenuator to 40 dB. Set REFERENCE LEVEL to -90 dBm and adjust LOG GAIN control A14R121 for DVM reading of 800 mV plus offset recorded in step 4, as measured at A15TP1.
27. Check log gain steps according to Table 5-9. If limits are not met, repeat steps 25 through 27. If limits still are not met, return to step 1.

TABLE 5-9. LOG GAIN ADJUSTMENT LIMITS

Step Attenuator	Reference Level (dBm)	DVM Reading*
0	-50	Ref: 800 \pm 1 mV
10	-60	800 \pm 30 mV
20	-70	800 \pm 30 mV
30	-80	800 \pm 30 mV
40	-90	800 \pm 30 mV

*After subtracting offset.

28. Set spectrum analyzer controls as follows:

REFERENCE LEVEL - 50 dBm
 Amplitude Scale 1 dB/DIV

29. Set both step attenuators to 0 dB. Reduce signal generator OUTPUT LEVEL until signal appears at top of display. Adjust spectrum analyzer FINE TUNE to peak trace on display and adjust signal generator OUTPUT LEVEL for DVM reading (± 1 mV) of 800 mV plus offset recorded in step 4, as measured at A15TP1. Increase attenuation in 1-dB steps as shown in Table 5-10 and take DVM readings to check log amplifier output.
30. Return TEST-NORM switch A12S1 to NORM.

ADJUSTMENTS

5-19. LOG AMPLIFIER LOG AND LINEAR ADJUSTMENTS (Cont'd)

TABLE 5-10. LOG AMPLIFIER OUTPUT LIMITS

Step Attenuator Setting (dB)	DVM Reading (mV)	Corrected DVM Reading* (mV)	Test Limits (mV)	Theoretical Reading (mV)	Theoretical Reading Subtracted from Corrected DVM Reading (mV)	Difference Between Adjacent Readings** (mV)
0	_____	_____	800 ± 1	+800	0	_____
1	_____	_____	700 ± 10	+700	_____	_____
2	_____	_____	600 ± 20	+600	_____	_____
3	_____	_____	500 ± 30	+500	_____	_____
4	_____	_____	400 ± 30	+400	_____	_____
5	_____	_____	300 ± 30	+300	_____	_____
6	_____	_____	200 ± 30	+200	_____	_____
7	_____	_____	100 ± 30	+100	_____	_____

* DVM Reading minus offset.

** All values in the Difference Between Adjacent Readings column must be less than or equal to ± 10 mV.

ADJUSTMENTS

5-20. 1-dB OFFSET ADJUSTMENT

REFERENCE:

A15 Schematic

DESCRIPTION:

Reference is set in 10 dB/DIV amplitude scale and 1 dB offset is adjusted in 1 dB/DIV for the same full display reference.

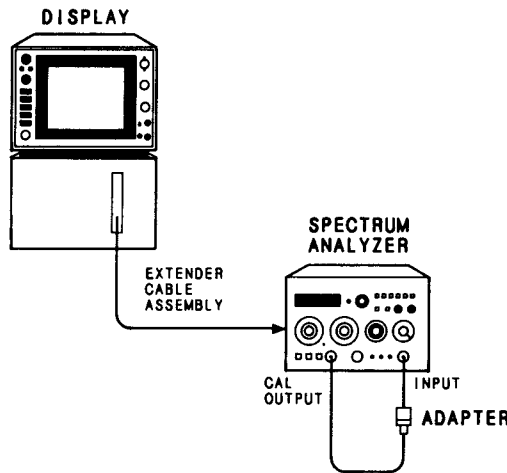


FIGURE 5-4. 1-dB OFFSET ADJUSTMENT TEST SETUP

EQUIPMENT:

Adapter, Type N (m) to BNC (f)	HP 1250-0780
Extender Cable Assembly	HP 5060-0303
BNC Cable, 9-Inch	HP 10502A

PROCEDURE:

1. Set spectrum analyzer controls as follows:

FREQUENCY BAND GHz .....	.01 – 3
TUNING	>60 MHz
FREQ SPAN/DIV	1 MHz
RESOLUTION BW	1 MHz, uncoupled
INPUT ATTEN	10 dB
REFERENCE LEVEL	0 dBm
REF LEVEL FINE	0
Amplitude Scale	LIN
SWEEP TIME/DIV	AUTO
SWEEP TRIGGER	FREE RUN
ALT IF	OFF
SIG IDENT	OFF
BL CLIP	OFF
VIDEO FILTER	OFF

ADJUSTMENTS

5-20. 1-dB OFFSET ADJUSTMENT (Cont'd)

2. Connect equipment as shown in Figure 5-4.
3. Adjust vertical position to align trace on bottom graticule.
4. Set tuning to 35 MHz. Set TUNING control to center the trace on the display. Set REF LEVEL FINE for a full-screen trace (signal at top graticule line).
5. Set Amplitude Scale to 10 dB/DIV. Adjust VERT GAIN if necessary for full screen trace.
6. Repeat steps 3 and 4 until the trace is full screen in both LIN and 10 dB/DIV.

NOTE

1 dB/DIV will read approximately 0.5 dB (0.5 division) low when using extender cable assembly. Adjusting A15R1 1 dB OFFSET for a trace 0.5 division down from top graticule line should place signal at top graticule line when HP 8559A is properly installed in display mainframe.

7. Set Amplitude Scale to 1 dB/DIV. Adjust A15R1 1 dB OFFSET for a trace 0.5 division down from top graticule line.

ADJUSTMENTS

5-21. BANDWIDTH FILTER ADJUSTMENTS

REFERENCE:

A9, A11, and A13 Schematics

DESCRIPTION:

The crystal and LC bandwidth filter circuits are adjusted for symmetry, center, and peak. The 3-dB bandwidths are adjusted with Sweep Generator/Bandwidth Control Assembly A9 (paragraph 5-22).

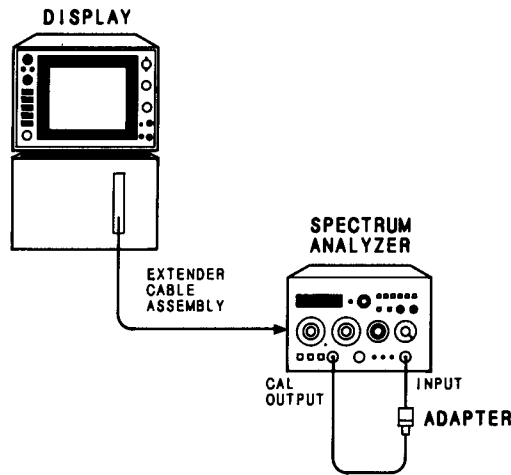


FIGURE 5-5. CRYSTAL AND LC BANDWIDTH FILTER ADJUSTMENTS TEST SETUP

EQUIPMENT:

Adapter, Type N (m) to BNC (f)	HP 1250-0780
Crystal Short (3 required)	See Figure 5-6
Extender Cable Assembly	HP 5060-0303

NOTE

A crystal short consists of a .01 μ F capacitor (HP Part Number 0160-0161) and a 90.9 ohm resistor (HP Part Number 0757-0400) connected in series. Two square terminal connectors (HP Part Number 0362-0265) are used to connect the crystal short across the test points.

ADJUSTMENTS

5-21. BANDWIDTH FILTER ADJUSTMENTS (Cont'd)

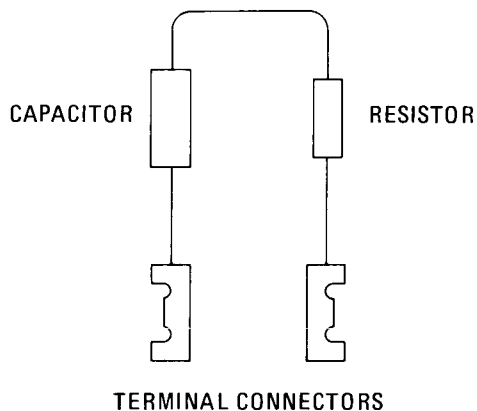


FIGURE 5-6. CRYSTAL SHORT CONFIGURATION

PROCEDURE:

NOTE

Allow 30 minutes warmup time before performing adjustments.

1. Set spectrum analyzer controls as follows:

FREQUENCY BAND .....	.01 – 3 GHz
TUNING	35 MHz
FREQ SPAN/DIV	200 kHz
RESOLUTION BW	1 MHz
INPUT ATTEN	10 dB
REFERENCE LEVEL	0 dBm
Amplitude Scale	LIN
SWEEP TIME/DIV	10 msec
SWEEP TRIGGER	FREE RUN

Crystal Alignment

2. Connect equipment as shown in Figure 5-5.

NOTE

If Sweep Generator A9 has been replaced or adjusted, perform steps 3 through 8. If not, proceed to step 9.

ADJUSTMENTS

5-21. BANDWIDTH FILTER ADJUSTMENTS (Cont'd)

3. Center the signal with TUNING control. Using REF LEVEL FINE control, place signal peak at 7.1 divisions (0.9 division from top graticule line).
4. Adjust A9R85 LC until signal is five divisions wide at the fifth graticule line (1 MHz wide at 3-dB points).
5. Set FREQ SPAN/DIV to 10 kHz and RESOLUTION BW to 10 kHz.
6. Center the signal with FINE TUNING control.
7. Using REF LEVEL FINE control, place signal peak at 7.1 divisions.
8. Adjust A9R72 XTL until signal is one division wide at the fifth graticule line (10 kHz wide at 3-dB points).
9. Set FREQ SPAN/DIV to 20 kHz and RESOLUTION BW to 30 kHz.
10. Center signal with TUNING control.
11. Adjust REF LEVEL FINE control to place signal at sixth graticule line.
12. Remove top guide rail. Connect crystal shorts (through cover access holes) across the following pairs of test points: A13TP1/TP2, A11TP1/TP2, and A11TP4/TP5.

NOTE

Keep crystal spike centered during adjustments. The SYM and CTR adjustments for each crystal interact (the signal also drifts in this narrow span).

13. Adjust front-panel TUNING control to center bandpass spike (Figure 5-7) on the CRT display.

NOTE

A non-metallic tuning tool is required for adjustments on the A11 and A13 bandwidth filter assemblies.

14. Adjust A13C54 CTR for minimum signal amplitude. Then adjust A13C38 SYM and A13C54 CTR for a centered and symmetrical bandpass as shown in Figure 5-7.

ADJUSTMENTS

5-21. BANDWIDTH FILTER ADJUSTMENTS (Cont'd)

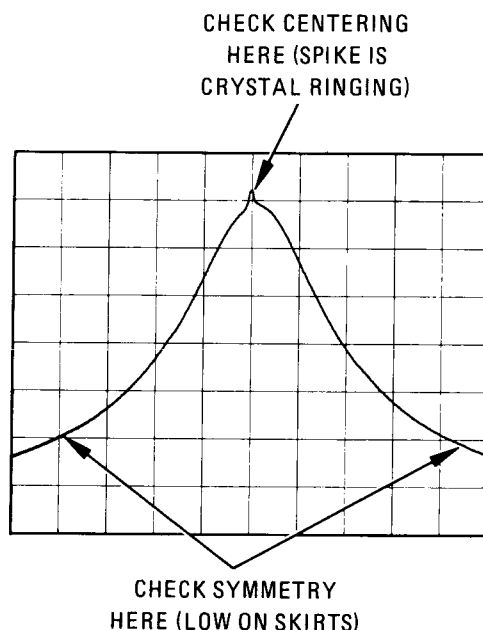


FIGURE 5-7. ADJUSTING CRYSTAL SYMMETRY AND CRYSTAL CENTERING

15. Remove crystal short from A13TP1/TP2 and connect it across A13TP4/TP5.
16. Adjust A13C25 CTR for minimum signal amplitude. Then adjust A13C15 SYM and A13C25 CTR for a centered and symmetrical bandpass.
17. Remove crystal short from A11TP4/TP5 and connect it across A13TP1/TP2.
18. Adjust A11C54 CTR for minimum signal amplitude. Then adjust A11C38 SYM and A11C54 CTR for a centered and symmetrical bandpass.
19. Remove crystal short from A11TP1/TP2 and connect it across A11TP4/TP5.
20. Adjust A11C25 CTR for minimum signal amplitude. Then adjust A11C15 SYM and A11C25 CTR for a centered and symmetrical bandpass.
21. Remove the crystal shorts.
22. Set **FREQ SPAN/DIV** to 10 kHz and **RESOLUTION BW** to 30 kHz. Center signal on CRT with **TUNING** control.
23. Switch **RESOLUTION BW** from 30 kHz to 10 kHz and back several times. Verify that signal shift does not exceed 3 kHz (0.3 divisions). If signal shift is out of tolerance, return to step 11.

ADJUSTMENTS

5-21. BANDWIDTH FILTER ADJUSTMENTS (Cont'd)**LC Alignment****CAUTION**

Accidentally shorting the case of A9Q1 (directly below A9TP6) to ANY test point will cause catastrophic failure to Sweep Generator Assembly A9.

24. Set RESOLUTION BW control to 100 kHz. Jumper A9TP6 to A9TP8. This forces the BW7 line to +15V. Set FREQ SPAN/DIV to 100 kHz.

NOTE

When Bandwidth Filter Assemblies A11 and A13 are installed with covers in place, midget copper alligator clips (HP Part Number 1400-0483) can be used to short test points to the cover.

25. Perform preliminary LC filter adjustments as follows:

NOTE

It might be necessary to adjust the REF LEVEL FINE control to obtain an on-screen display during the following adjustments.

- a. Remove A13 cover and install A13 on extender board.
- b. Short to ground the following test points: A13TP6, A11TP3, and A11TP6. (This widens all but one LC pole).
- c. Center signal on CRT with TUNING control. Adjust A13C73 for minimum signal amplitude.
- d. Disconnect short from A13TP6 and short to ground A13TP3.
- e. Adjust A13C74 for minimum signal amplitude. Remove shorts from A13TP3, A11TP3, and A11TP6.
- f. Reinstall A13 and cover. Short A13TP3 and A13TP6 to ground. Remove A11 cover and install A11 on extender board.
- g. Short A11TP6 to ground.
- h. Adjust A11C73 for minimum signal amplitude.
- i. Disconnect short from A11TP6 and short to ground A11TP3.
- j. Adjust A11C74 for minimum signal amplitude.
- k. Disconnect shorts from test points and reinstall A11 and cover. Leave jumper from A9TP6 to A9TP8 in place.

ADJUSTMENTS

5-21. BANDWIDTH FILTER ADJUSTMENTS (Cont'd)

26. Short to ground A11TP3, A11TP6, and A13TP3. Set RESOLUTION BW to 100 kHz and set FREQ SPAN/DIV to 20 kHz.
27. Center signal on CRT with TUNING control. Adjust A13C45 LC CTR for symmetrical bandpass display on CRT. Use FINE TUNING control to keep crystal spike centered.

NOTE

The crystal spike represents the center frequency of the crystal poles. In this procedure we are aligning the LC poles with the crystal poles. On some instruments, the crystal spike may not be very pronounced, in which case the center frequency of the 100 kHz RBW will have to be compared to the center frequency of the 30 kHz RBW.

28. Move short from A13TP3 to A13TP6. Leave other shorts in place. Center signal on CRT with TUNING control. Adjust A13C23 LC CTR for symmetrical bandpass display on CRT, keeping crystal spike centered.
29. Move short from A11TP6 to A13TP3. Leave other shorts in place. Center signal on CRT with TUNING control. Adjust A11C45 LC CTR for symmetrical bandpass display on CRT, keeping crystal spike centered.
30. Move short from A11TP3 to A11TP6. Leave other shorts in place. Center signal on CRT with TUNING control. Adjust A11C23 LC CTR for symmetrical bandpass display on CRT, keeping crystal spike centered.
31. Disconnect shorts from A11TP6, A13TP3, A13TP6, and from ground. Remove jumper from A9TP6 and A9TP8.
32. Set FREQ SPAN/DIV to 10 kHz and RESOLUTION BW to 30 kHz. Center signal on CRT with TUNING control. Set RESOLUTION BW to 100 kHz and note where signal crosses center vertical graticule line.
33. Adjust A11C23, A11C45, A13C23, and A13C45 in succession so that amplitude of signal is peaked where it crosses center vertical CRT graticule line, repeating step 32 between adjustments as necessary.
34. Repeat steps 32 and 33 until 30 kHz and 100 kHz bandwidths are centered with each other. If signal shift between 30 kHz and 100 kHz bandwidths is greater than 10 kHz (1 division), repeat steps 24 through 33.

Bandwidth Amplitude

35. Set Amplitude Scale switch to 1 dB/DIV and jumper A9TP6 to A9TP8.
36. Short A11TP3, A11TP6, A13TP3, and A13TP6 to ground.
37. Set RESOLUTION BW to 100 kHz and FREQ SPAN/DIV to 200 kHz.

ADJUSTMENTS

5-21. BANDWIDTH FILTER ADJUSTMENTS (Cont'd)

38. Adjust FINE TUNING and REF LEVEL FINE controls for a centered signal at 7 divisions from bottom graticule line.
39. Remove shorts from A13TP3 and A13TP6 and center signal with FINE TUNING control. Adjust A13R26 LC for a signal amplitude of 7 divisions. Replace shorts on A13TP3 and A13TP6.
40. Remove shorts from A11TP3 and A11TP6. Adjust A11R26 LC for a signal amplitude of 7 divisions.
41. Repeat steps 36 through 40 until no further adjustment is necessary. Remove shorts from A11TP3, A11TP6, A13TP3, and A13TP6.
42. Adjust A11R31 XTL and A13R31 XTL fully counterclockwise.
43. Set RESOLUTION BW to 1 kHz and FREQ SPAN/DIV to 10 kHz. Center signal with FINE TUNING control. Adjust A11R31 XTL and A13R31 XTL equally for a signal amplitude of 7 divisions. Each potentiometer should be adjusted to accomplish half the necessary increase in signal amplitude.
44. Remove jumper from A9TP6 and A9TP8.
45. Set FREQ SPAN/DIV to 500 kHz and RESOLUTION BW to 3 MHz.
46. Center signal with TUNING control. Adjust REF LEVEL FINE control for a signal amplitude of 7 divisions.
47. Step down RESOLUTION BW from 3 MHz to 300 kHz. Variation in signal amplitude should be less than ± 0.4 dB.
48. Set FREQ SPAN/DIV to 10 kHz, TIME/DIV to AUTO, and step down RESOLUTION BW from 100 kHz to 1 kHz. Variation of signal amplitude should be less than ± 0.7 dB from the 7th division reference.
49. Repeat steps 35 through 46 until variation in signal amplitude is within limits.

NOTE

If amplitude variation between crystal and LC poles exceeds specification, A11R7*/A13R7* can be replaced to bring the crystal poles to the amplitude of the LC poles.

ADJUSTMENTS

5-22. 3-dB BANDWIDTH ADJUSTMENTS

REFERENCE:

A9 Schematic

DESCRIPTION:

The 3-dB bandwidths for the 3 MHz through the 30 kHz RESOLUTION BW settings are adjusted using the CAL OUTPUT as the signal source. The 3-dB bandwidths for the 10 kHz, 3 kHz, and 1 kHz RESOLUTION BW settings are adjusted by injecting a stable 321.4 MHz signal into the Third Converter (A10) of the spectrum analyzer.

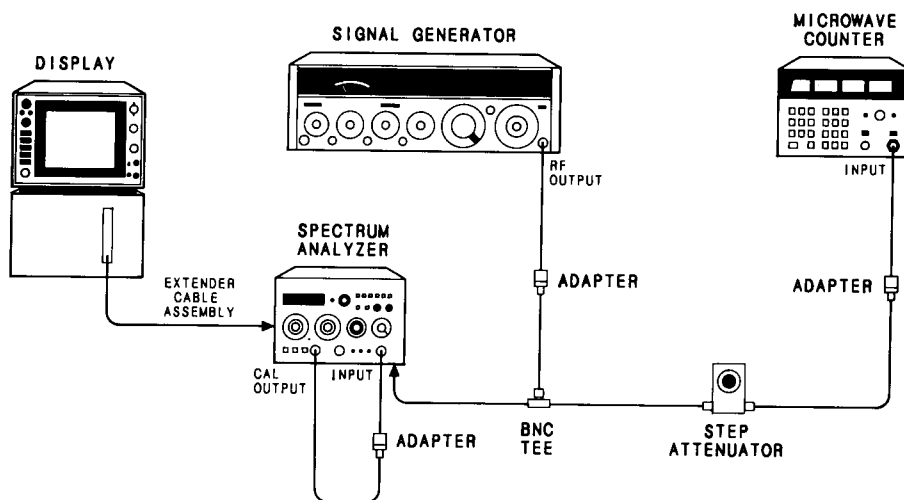


FIGURE 5-8. 3-dB BANDWIDTH ADJUSTMENT TEST SETUP

EQUIPMENT:

Signal Generator	HP 8640B
Frequency Counter	5342A
Step Attenuator	HP 355D
Adapter, Type N (m) to BNC (f) (2 required)	HP 1250-0780
Extender Cable Assembly	HP 5060-0303
Test Cable, BNC to SMB	HP 85680-60093
BNC Tee	HP 1250-0781

ADJUSTMENTS

5-22. 3-dB BANDWIDTH ADJUSTMENTS (Cont'd)

PROCEDURE:

1. Set spectrum analyzer controls as follows:

FREQUENCY BAND	0.01 – 3 GHz
TUNING	35 MHz
FREQ SPAN/DIV	200 kHz
RESOLUTION BW	1 MHz
INPUT ATTEN	10 dB
REFERENCE LEVEL	0 dBm
Amplitude Scale	LIN
SWEEP TIME/DIV	2 msec
SWEEP TRIGGER	FREE RUN
VIDEO FILTER	OFF
BASELINE CLIPPER	OFF
853A (if used)	TRACE A & TRACE B STORE BLANK (ANALOG DISPLAY)

2. Connect CAL OUTPUT to spectrum analyzer INPUT.
3. Set a 7.1 division signal level on display with REF LEVEL FINE control. Signal will be 0.9 division from top graticule line.
4. Adjust A9R85 LC control for a 5 division wide signal at fifth graticule line.
5. Set RESOLUTION BW to 3 MHz and FREQ SPAN/DIV to 500 kHz. If necessary, reset signal level to 7.1 divisions with REF LEVEL FINE control. The bandwidth at the fifth graticule line should be between 5.4 and 6.6 divisions.

NOTE

A9R85 LC may be further adjusted to bring the 3 MHz and 300 kHz bandwidths within limits; however, the final measurement of the 1 MHz bandwidth must be between 4.5 and 5.5 division at the fifth graticule line. (If the 3 MHz bandwidth cannot be brought within limits by adjustment of A9R85 LC, change the value of factory-selected resistor A9R120*. If the 300 kHz bandwidth cannot be brought within limits by adjustment of A9R85 LC, change the value of A9R116*.)

6. Set RESOLUTION BW to 300 kHz and FREQ SPAN/DIV to 50 kHz. If necessary, reset signal level to 7.1 divisions with REF LEVEL FINE control. The bandwidth should be between 5.4 and 6.6 divisions at the fifth graticule line.
7. Set RESOLUTION BW to 100 kHz and FREQ SPAN/DIV to 20 kHz. If necessary, reset signal level to 7.1 divisions with REF LEVEL FINE control. The bandwidth should be between 4.3 and 5.7 divisions at the fifth graticule line.

ADJUSTMENTS

5-22. 3-dB BANDWIDTH ADJUSTMENTS (Cont'd)**NOTE**

If the 100 kHz bandwidth is not within the specified limits, change the values of factory-selected resistors A11R19*, A11R43*, A13R19*, and A13R43*. If the bandwidth is too wide, increase the value of the resistors; if the bandwidth is too narrow, decrease the value of the resistors. The factory-selected resistors need not be of equal value, but each must be within one standard value of the others.

8. Set RESOLUTION BW to 30 kHz and FREQ SPAN/DIV to 10 kHz. If necessary, reset signal level with REF LEVEL FINE control. The bandwidth should be between 2.6 and 3.4 divisions at the fifth graticule line.

NOTE

If the 30 kHz bandwidth is not within the specified limits, change the values of factory-selected resistors A11R23*, A11R48*, A13R23*, and A13R48*. If the bandwidth is too wide, decrease the value of the factory-selected resistors; if the bandwidth is too narrow, increase the value of the resistors. The factory-selected resistors must be within three standard values of the nominal value.

9. Connect signal generator as shown in Figure 5-8. Tune signal generator to approximately 21.4 MHz. Set the signal generator to approximately 0 dBm and the step attenuator to 10 dB. Set COUNTER MODE to EXPAND X 100.
10. Place spectrum analyzer on right side and connect test cable to Third Converter 21.4 MHz output connector A16J3. If connector is not present (some early instruments were not so supplied), remove A10W1 from A5J2 and connect A10W1 through a 10 dB step attenuator set to 30 dB and the signal generator set for a -10 dBm output level. The 10 dB step attenuator between BNC tee and frequency counter can be eliminated.
11. Set HP 8559A RESOLUTION BW to 1 MHz. Tune signal generator to peak signal on CRT display (near 21.4 MHz) (321.4 MHz if injecting into A10W1). Adjust the output level of signal generator to place the signal at 7.1 divisions.
12. Set RESOLUTION BW to 3 kHz. Tune signal generator to peak signal on CRT display.
13. Adjust REF LEVEL FINE to place signal at 7.1 divisions.
14. Note the counter frequency and tune the signal generator 1500 Hz below the center frequency noted. Record the new counter frequency.

ADJUSTMENTS

5-22. 3-dB BANDWIDTH ADJUSTMENTS (Cont'd)

15. Adjust A9R72 XTL to bring signal level to the fifth graticule line (three divisions from the top graticule line).
16. Increase signal generator frequency until signal on CRT display peaks and then decreases to the fifth graticule line. Record counter frequency. _____
17. Compare new frequency with frequency recorded in step 14. The difference between the two frequencies should be 2800 to 3200 Hz. If the bandwidth is not within limits, repeat steps 12 through 17, slightly readjusting A9R72 XTL, until the specified limits are achieved.
18. Set RESOLUTION BW to 10 kHz. Tune signal generator to peak signal on CRT display.
19. Adjust REF LEVEL FINE to place signal at 7.1 divisions.
20. Decrease signal generator frequency until the signal on the CRT display is at the fifth graticule line. Record this frequency. _____
21. Increase the signal generator frequency until the signal on the CRT display peaks and then decreases to the fifth graticule line. Record this frequency. _____
22. Compare new frequency with frequency recorded in step 20. The difference between the two frequencies should be 9.000 kHz to 11.000 kHz.

NOTE

A9R72 XTL may be further adjusted to bring the 10 kHz and 1 kHz bandwidths within limits; however, the final measurement of the 3 kHz bandwidth must be between 2700 Hz and 3300 Hz. (If the 10 kHz bandwidth cannot be brought within limits by adjusting A9R72 XTL, change the value of factory-selected resistor A9R111*. If the 1 kHz bandwidth cannot be brought within limits by adjusting A9R72 XTL, change the value of A9R109*.)

23. Set RESOLUTION BW to 1 kHz. Tune signal generator to peak signal on CRT display.
24. Adjust REF LEVEL FINE to place signal at 7.1 divisions.
25. Record the counter frequency. _____

ADJUSTMENTS

5-22. 3-dB BANDWIDTH ADJUSTMENTS (Cont'd)

26. Increase signal generator frequency until signal on CRT display decreases to the fifth graticule line. Record the counter frequency.

27. Compare new frequency with frequency originally noted in step 25. The difference between the two frequencies should be 450 Hz to 550 Hz.

ADJUSTMENTS

5-23. RF GAIN ADJUSTMENT

REFERENCE:

A12 Schematic

DESCRIPTION:

The RF gain (sensitivity) of Step Gain Assembly A12 is adjusted by injecting a 21.4 MHz signal at XA10P1. Third Converter Assembly A10 is removed and replaced with a special extender board for applying the 21.4 MHz signal from the signal generator.

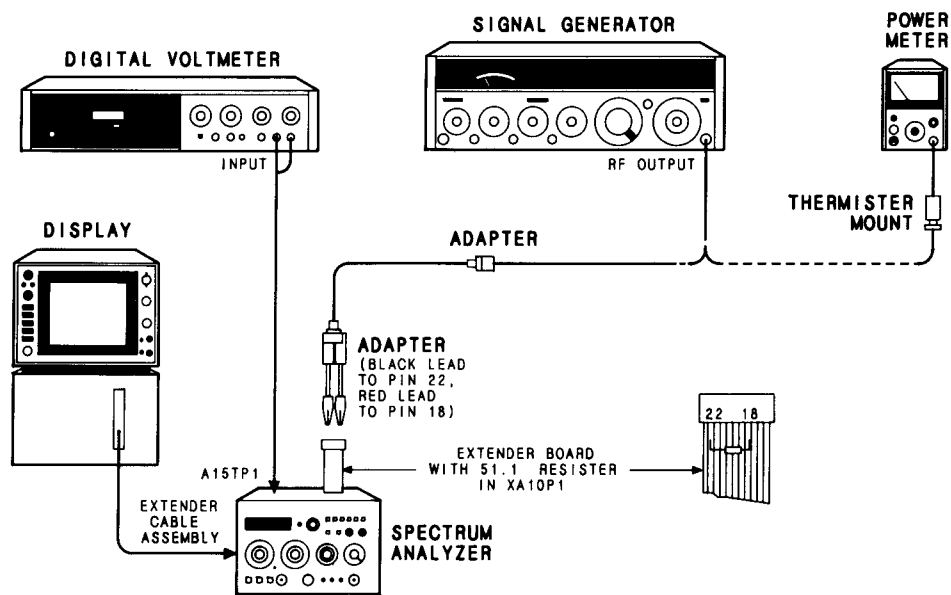


FIGURE 5-9. RF GAIN ADJUSTMENT TEST SETUP

EQUIPMENT:

Signal Generator	HP 8640B
Digital Voltmeter	HP 3456A
Power Meter	HP 435A/B
Power Sensor	HP 8481A
Special Extender Board with 51.1 ohm resistor	HP 5060-0258/0757-0394
Test Cable, BNC (m) to Banana Plug	HP 10111A
Extender Cable Assembly	HP 5060-0303
Adapter, BNC (f) to Alligator Clips (2 required)	HP 8120-1292

ADJUSTMENTS

5-23. RF GAIN ADJUSTMENT (Cont'd)

NOTE

To make special extender board, solder 51.1 ohm resistor from pin 18 to pin 22 of standard 24 pin extender board, HP Part No. 5060-0258. Leave resistor leads long for easy connection of clip leads.

PROCEDURE:

- 1. Set spectrum analyzer controls as follows:

FREQUENCY BAND GHz	.01 – 3
FREQ SPAN/DIV	1 MHz
RESOLUTION BW	1 MHz
INPUT ATTEN	0 dB
REF LEVEL dBm	- 10
REF LEVEL FINE	0
Amplitude Scale	LIN
SWEEP TIME/DIV	AUTO
SWEEP TRIGGER	FREE RUN
VIDEO FILTER	MIN

- 2. Connect equipment as shown in Figure 5-9. Resistor on extender board should be toward rear of HP 8559A.
- 3. Set signal generator frequency to 21.4 MHz. Set output level for approximately - 5 dBm.

NOTE

To remove Third Converter Assembly A10, it will be necessary to disconnect A10W1 from A5J2 and temporarily remove Marker Assembly A8 and Sweep Generator/Res BW Assembly A9.

- 4. Connect output of signal generator across 51.1 ohm resistor on special board using BNC to clip-lead adapter. The red lead (center conductor) should be connected to pin 18 of extender board.
- 5. Set signal generator frequency for peak amplitude on CRT display. Connect output of signal generator to power meter through a power sensor and set output level to - 3 dBm. Reconnect signal generator output to clip-lead adapter.
- 6. Adjust A12R5 GAIN adjustment for signal one division from top graticule line. DVM should indicate + 700 mV ± 30 mV. Remove special extender board and replace Third Converter Assembly A10.

NOTE

If step gain adjustments will be performed next, do not reconnect A10W1 to A5J2.

ADJUSTMENTS

5-23. RF GAIN ADJUSTMENT (Cont'd)**CAUTION**

When reconnecting A10W1 to A5J2, exercise caution; the connector should not be torqued more than 6 inch-pounds, otherwise damage to A5J2 will result.

NOTE

Front panel VERTICAL GAIN and POSN control settings can affect the voltage measured at A15TP1. Vertical calibration should be checked after adjusting A12R5 for 700 mV (Refer to Section III).

ADJUSTMENTS

5-24. STEP GAIN ADJUSTMENTS

REFERENCE:

A12 Schematic

DESCRIPTION:

REF LEVEL FINE, 0 dB, and -12 dB adjustments are properly set and step gains of 10 dB, 20 dB, and 40 dB are adjusted.

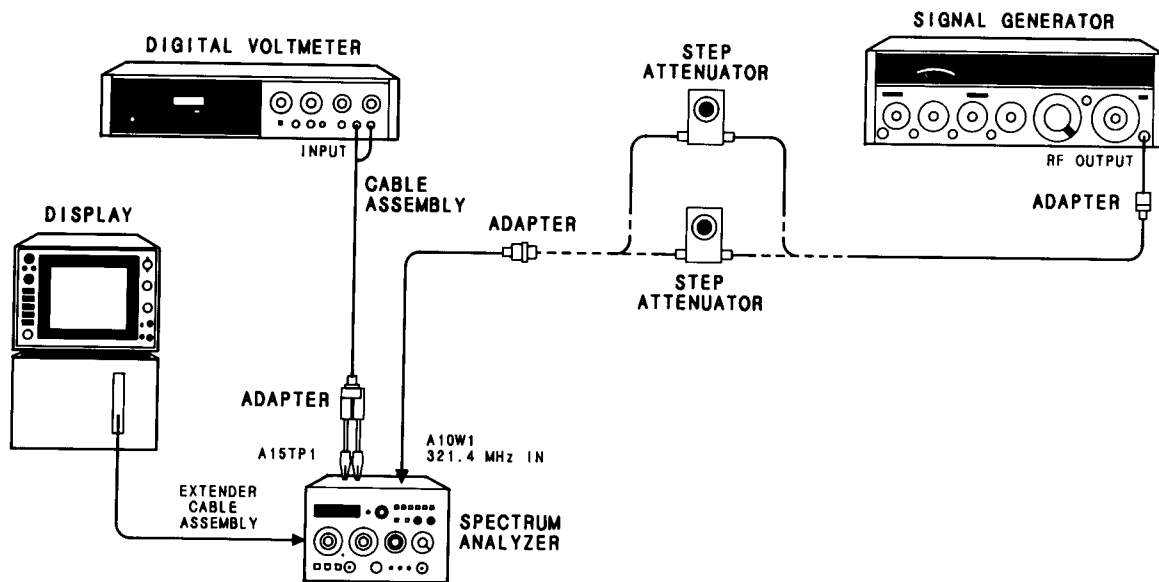


FIGURE 5-10. STEP GAIN ADJUSTMENTS TEST SETUP

EQUIPMENT:

Signal Generator	HP 8640B
Step Attenuator (1 dB/Step)	HP 355C, Option H80
Step Attenuator (10 dB/Step)	HP 355D, Option H82
Digital Voltmeter	HP 3456A
Adapter, Type N (m) to BNC (f)	HP 1250-0780
Adapter, BNC (m) to SMC (m)	HP 1250-0831
Cable, BNC (m) to Banana Plug	HP 10111A
Extender Cable Assembly	HP 5060-0303
Adapter, BNC (f) to Alligator Clips	HP 8120-1292

ADJUSTMENTS

5-24. STEP GAIN ADJUSTMENTS (Cont'd)

PROCEDURE:

1. Set spectrum analyzer controls as follows:

FREQ SPAN/DIV	1 MHz
RESOLUTION BW	1 MHz
INPUT ATTEN	10 dB
REF LEVEL dBm	0
Amplitude Scale	1 dB/DIV
SWEEP TIME/DIV	AUTO
SWEEP TRIGGER	FREE RUN
VIDEO FILTER	MIN

2. Connect equipment as shown in Figure 5-10. Connect signal generator tuned to 321.4 MHz with approximately -30 dBm output to one side of a 1 dB/step attenuator. Connect step attenuator output to A10W1 through adapter. Tune signal generator frequency for peak amplitude on display.
3. Set step attenuator to 12 dB and REF LEVEL FINE to -12 . Set signal generator level for a signal one division down from top graticule line.
4. Adjust A12R39 -12 D until signal stops rising on display, then adjust A12R39 counterclockwise until signal drops approximately one third to one half of a division.
5. Set signal generator level so signal is one division down from top graticule line on display.
6. Set step attenuator to 0 dB and REF LEVEL FINE to 0.
7. Adjust A12R35 0 D adjustment for a signal level one division from top graticule line.
8. Set step attenuator to 12 dB and REF LEVEL FINE to -12 . DVM indication should be 700 ± 30 mV (offset). If offset is greater than ± 30 mV, repeat steps 3 through 8 until DVM indication is within limits.
9. Replace 1 dB/step attenuator with 10 dB/step attenuator set to 0 dB. Set REF LEVEL FINE control to 0.
10. Tune signal generator frequency for peak amplitude on the display (near 321.4 MHz).
11. Set signal generator level for a signal one division down from top graticule line. Set step attenuator to 10 dB and REF LEVEL dBm to -10 .
12. Adjust A12R6 10 D adjustment for signal level one division from top graticule line.
13. Set step attenuator to 20 dB and REF LEVEL dBm to -20 .
14. Adjust A12R21 20 D adjustment for signal level one division from top graticule line.
15. Set attenuator to 40 dB and REF LEVEL dBm to -40 .

ADJUSTMENTS

5-24. STEP GAIN ADJUSTMENTS (Cont'd)

NOTE

Some video filtering might help reduce noise. Set VIDEO FILTER control so noise is reduced, but the signal amplitude remains unchanged.

16. Adjust A12R29 40 D adjustment for signal level one division from top graticule line.
17. Check REF LEVEL dBm control from 0 to -50 as shown in Table 5-11.

TABLE 5-11. REF LEVEL CONTROL CHECK

Reference Level (dBm)	Attenuator (dB)	Deviation From Reference (700 ± 20 mV)
0	0	Reference mV
-10	10	Reference ± 40 mV
-20	20	Reference ± 40 mV
-30	30	Reference ± 40 mV
-40	40	Reference ± 40 mV
-50	50	Reference ± 40 mV

18. Reconnect A10W1 to A5J2.

CAUTION

When reconnecting A10W1 to A5J2, exercise caution. The connector should not be torqued to more than 6 inch-pounds; otherwise, damage to A5J2 will result.

ADJUSTMENTS

5-25. FIRST CONVERTER ADJUSTMENTS

REFERENCE:

A3, A4, A5, A6, and A7 Schematics

DESCRIPTION:

The First LO (A6 YTO) is adjusted by monitoring the YTO output at the RF input connector (LO emission) and the tuning voltage (TUNE) output of the A7 Frequency Control board, and adjusting the YTO low-end frequency for 3 GHz at 0V tuning voltage and 6 GHz at $-10V$ tuning voltage.

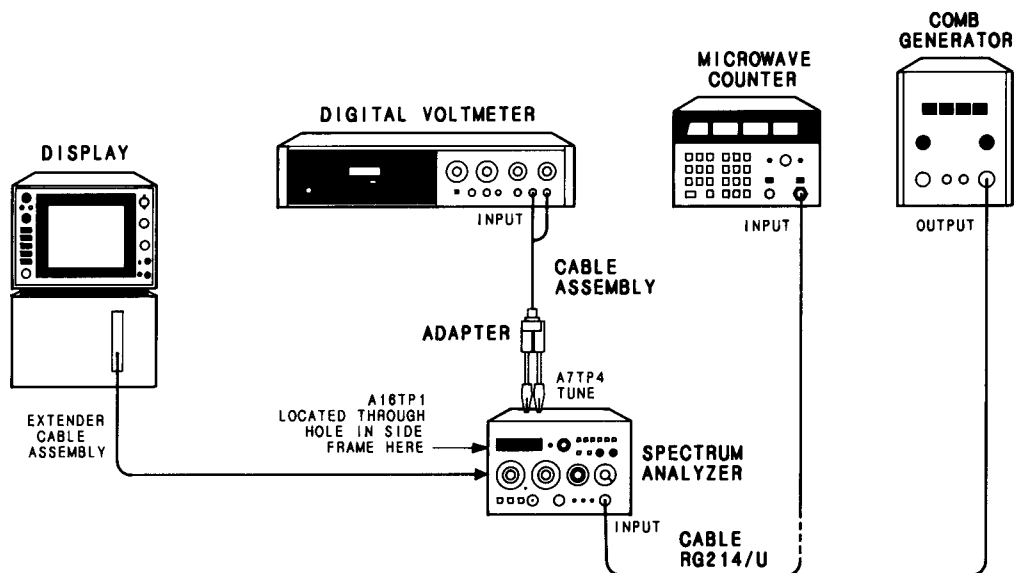


FIGURE 5-11. FIRST CONVERTER ADJUSTMENTS TEST SETUP

EQUIPMENT:

Frequency Counter	HP 5342A
Digital Voltmeter	HP 3456A
Comb Generator	HP 8406A
Cable, BNC (m) to Banana Plug	HP 10111A
Extender Cable Assembly	HP 5060-0303
Adapter, BNC (f) to Alligator Clips	HP 8120-1292
Cable Assembly, RG-214/U, Type N Connectors	HP 11500A

PROCEDURE:

1. Allow one-half hour warmup time of equipment with spectrum analyzer connected to mainframe with extender cable.

ADJUSTMENTS

5-25. FIRST CONVERTER ADJUSTMENTS (Cont'd)

First LO Adjustments

2. Connect DVM to A7TP6 TUNE.
3. Set spectrum analyzer controls as follows:

INPUT ATTEN	0 dB
FREQ SPAN/DIV	0
ALT IF	OFF

4. Connect frequency counter to spectrum analyzer RF Input.
5. Jumper A16TP1 DIODE BIAS to ground. A16TP1 is located on the motherboard through a hole in the analyzer left side gusset.
6. Adjust front-panel TUNING control for DVM indication of 0.000 Vdc (fully counterclockwise).
7. Adjust A7R8 (3 GHz) for frequency counter indication of 3.000 GHz \pm 1 MHz. (If this adjustment cannot be achieved, factory select resistor A7R3* can be added – if it is not installed – or decreased to provide the proper range. Select a value of 147K ohms for A7R3*, initially, and decrease this value to no less than 56.2K ohms.)
8. Adjust front-panel TUNING control for DVM indication of – 10.000 Vdc.
9. Set A7R75 6 GHz F (fine) to approximately mid-range (R75 is a 20-turn potentiometer).
10. Adjust A7R47 6 GHz C (coarse) for a frequency counter indication of 6.000 GHz \pm 2 MHz.
11. Retune front-panel TUNING control for 0.000 Vdc DVM indication and readjust A7R8 3 GHz if necessary for frequency counter indication of 3.000 GHz \pm 1 MHz.
12. Tune front-panel TUNING control for – 10.000 Vdc DVM indication.
13. Lightly tap the top edge of the A7 Frequency Control board with the handle of a small screwdriver to seat controls.
14. Adjust A7R75 6 GHz F (fine) for frequency counter indication of 6.000 GHz \pm 1 MHz.

ADJUSTMENTS

5-25. FIRST CONVERTER ADJUSTMENTS (Cont'd)

Alternate IF First LO Shift Check

- 15. Press front-panel ALT IF pushbutton IN to activate alternate IF.
- 16. Verify YTO frequency shift according to Table 5-12.

TABLE 5-12. FIRST LO SHIFT CHECK

FREQUENCY BAND GHz	ALT IF	FREQUENCY COUNTER INDICATION
1 (.01–3)	OFF	Reference (6.000 GHz)
1 (.01–3)	ON	Reference – 15 MHz ± 800 kHz
2 (6–9)	ON	Reference + 15 MHz ± 800 kHz
3 (3–9)	ON	Reference – 7.5 MHz ± 400 kHz
4 (9–15)	ON	Reference + 7.5 MHz ± 400 kHz
5 (6–15)	ON	Reference – 5 MHz ± 300 kHz
6 (12.1–21)	ON	Reference + 5 MHz ± 300 kHz

- 17. Remove jumper from A19TP1 DIODE BIAS to ground.

FM Driver Sensitivity and Delay Compensation Adjustment

- 18. Disconnect frequency counter from spectrum analyzer RF Input and connect comb generator to RF Input.
- 19. Set comb generator for 1 MHz comb teeth.
- 20. Set spectrum analyzer controls as follows:

```

FREQ SPAN/DIV ..... 1 MHz
RES BW ..... 30 kHz
TIME/DIV ..... AUTO
FREQUENCY BAND GHz ..... Band 1 (.01 – 3)
REF LEVEL dBm ..... – 20
INPUT ATTEN ..... 0 dB
ALT IF ..... OFF
SIG IDENT ..... OFF
Amplitude Scale ..... 10 dB/DIV
TRIGGER ..... FREE RUN
    
```

- 21. Tune front-panel TUNING control for approximately 1.5 GHz indication on front-panel FREQUENCY GHz display.
- 22. Adjust A7R83 DC (Delay Compensation) until the comb teeth on the left half of the mainframe CRT display have the same approximate spacing as those on the right half.

ADJUSTMENTS

5-25. FIRST CONVERTER ADJUSTMENTS (Cont'd)

23. Adjust front-panel TUNING FINE control to place a comb tooth on the first vertical graticule line of the CRT display.
24. Adjust A7R92 FM to place a comb tooth on the ninth vertical graticule line of the CRT display.
25. Switch to 10 kHz RES BW and adjust A7R83 DC for even spacing of the comb teeth on the first two graticule lines.
26. Readjust TUNING FINE control to place a comb tooth on the first vertical graticule line. Adjust A7R92 FM to place a comb tooth on each of the graticule lines while keeping the first comb tooth aligned using the TUNING FINE control.
27. Repeat steps 25 and 26 to achieve the best span linearity.

NOTE

Trim potentiometer A7R83 (DC) controls the amount of delay compensation; A7R96* controls the time constant of the compensation. If the adjustment of A7R83 does not result in even comb tooth spacing, R96* will have to be re-selected for even spacing.

28. Switch to 30 kHz RES BW. The comb tooth spacing should not change. If there is a shift of the comb teeth, repeat steps 22 through 27 for best compromise in span linearity.
 29. Tune to approximately 100 MHz and verify that a comb tooth placed on the first vertical graticule line, using the TUNING FINE control, will align the ninth comb tooth with the ninth vertical graticule line ± 1 minor division.
 30. Select the 10 kHz RES BW and verify that a comb tooth on the first vertical graticule line will align the ninth comb tooth with the ninth graticule line ± 1 minor division.
 31. Select the 30 kHz RES BW and repeat step 29 for a frequency of approximately 2.5 GHz.
 32. Repeat step 30 for a frequency of approximately 2.5 GHz.
 33. If necessary, A7R83 (DC) and A7R92 (FM) may be compromise adjusted for best span linearity at the three frequencies indicated.
 34. Set comb generator for 100-MHz comb teeth.
 35. Adjust front-panel TUNING control for 0.10 GHz indication on FREQUENCY display.
 36. Set FREQ SPAN/DIV to 2 MHz.
 37. Adjust TUNING to place 100-MHz comb tooth on center graticule line.
-

ADJUSTMENTS

5-25. FIRST CONVERTER ADJUSTMENTS (Cont'd)

38. Set **FREQ SPAN/DIV** to 1 MHz. Note position of comb tooth.
39. Adjust **A7R81 (MO)** to place comb tooth midway between position noted in step 38 and center graticule line.
40. Set **FREQ SPAN/DIV** to 2 MHz.
41. Adjust **TUNING** to place comb tooth in center graticule line.
42. Set **FREQ SPAN/DIV** to 1 MHz. Note displacement of comb tooth from center graticule line.
43. Repeat steps 36 through 42 until displacement of comb tooth is less than 0.2 major division when **FREQ SPAN/DIV** is switched from 2 MHz to 1 MHz.

ADJUSTMENTS

5-26. SECOND CONVERTER ADJUSTMENTS

REFERENCE:

A3, A4, A5, A6, and A8 Schematics

DESCRIPTION:

First, the Second LO is adjusted for proper frequency using a frequency counter. Next, the signal identifier (SIG ID) and alternate IF (ALT IF) signals are adjusted so that the displayed signal appears in the same location in both regular and alternate IF and the signal identifier is always 1 MHz away from this signal in either regular or alternate IF. Last, the first IF bandpass filter is aligned for a bandpass wide enough to allow for the first LO shift and amplitude characteristics such that there will be a minimal shift in displayed signal amplitude when the analyzer is switched from regular to alternate IF.

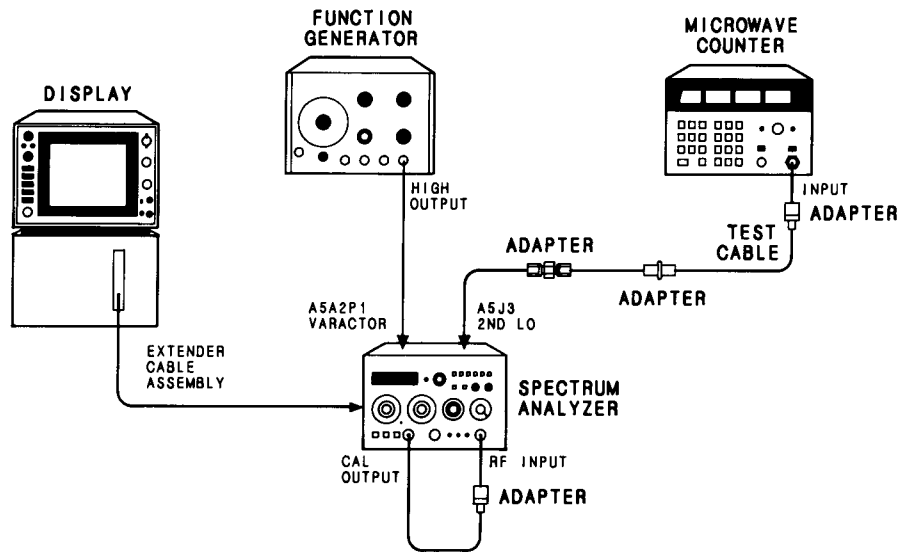


FIGURE 5-12. SECOND CONVERTER ADJUSTMENTS TEST SETUP

EQUIPMENT:

Frequency Counter	HP 5342A
Function Generator	HP 3310A
Test Cable, BNC (m) to SMB (f)	HP 85680-60093
Adapter, BNC (f) to Alligator Clips	HP 8120-1292
Adapter, SMB (m) to SMB (m)	HP 1250-0669
Adapter, SMB (f) to SMB (f)	HP 1250-0672
Adapter, Type N (m) to BNC (f) (2 required)	HP 1250-0780
Special Tuning Tool, Allen driver inserted through drilled-out 5/16 inch nut driver	HP 08555-60107
Oscilloscope	HP 1740A
Extender Cable Assembly	HP 5060-0303

 ADJUSTMENTS

5-26. SECOND CONVERTER ADJUSTMENTS (Cont'd)

PROCEDURE:

Second LO Preliminary Adjustment

1. Allow one-half hour warm-up time of equipment with analyzer connected to mainframe with extender cable.
 2. Connect frequency counter input to A5J3 2nd LO output using the test cable and two SMB adapters.
 3. Select Band 1 (.01 – 3) and Alternate IF on spectrum analyzer front-panel by depressing these pushbuttons.
 4. Using the special Allen driver/nut driver tuning tool, adjust A5Z4 2nd LO FREQUENCY for a frequency counter indication of 2671.1 MHz \pm 0.5 MHz.
 5. Connect spectrum analyzer CAL OUTPUT to RF INPUT and adjust front-panel TUNING controls to center the calibrator signal on the CRT display.
 6. Set spectrum analyzer controls as follows:

FREQ SPAN/DIV	1 MHz
RES BW	300 kHz
TIME/DIV	2 mSEC
FREQUENCY BAND GHz	BAND 1 (.01 – 3)
SIG IDENT	OFF
ALT IF	OFF
853A	TRACE A & B STORE BLANK (ANALOG DISPLAY)
 7. Depress front-panel SIG IDENT and ALT IF pushbuttons.
 8. Turn SIG IDENT off and on while monitoring the display. The signal traces which appear when SIG IDENT is switched on are the signal identifier signals. The others are the alternate IF signals.
 9. Adjust TUNING to place one of the signal identifier signals on a graticule line. This will be the reference graticule line.
 10. Turn ALT IF off. Adjust A8R34 REG to center the signal identifier signal on the reference graticule line.
 11. Turn ALT IF on. Verify that the signal identifier signal appears on reference graticule line. If not, repeat step 10.
 12. Adjust A8R40 SIG ID to place the alternate IF signal 1 MHz (1 division) higher than the signal identifier signal.
 13. Turn ALT IF off. Adjust A8R39 OFF to center the signal on the same graticule line as the alternate IF signal (1 MHz higher than reference graticule line).
-

ADJUSTMENTS

5-26. SECOND CONVERTER ADJUSTMENTS (Cont'd)

14. Turn ALT IF on and verify that the two signals do not appear to move.
 15. Change spectrum analyzer FREQ SPAN/DIV to 500 kHz.
 16. Repeat steps 7 through 14 if necessary to align both signal identifier signals and both alternate IF signals and spaced 1 MHz (2 divisions) apart on the CRT display.
 17. Depress front-panel ALT IF pushbutton. Turn SIG IDENT off.
 18. Note Second LO frequency on frequency counter.
 19. Adjust A5Z4 2nd LO FREQUENCY if necessary for a frequency counter indication of 2671.1 MHz \pm 0.5 MHz.
 20. If second LO frequency is readjusted, recheck second LO shift adjustments, steps 5 through 16.
 21. Set spectrum analyzer controls as follows:

FREQ SPAN/DIV	2 MHz
RES BW	3 MHz
REF LEVEL dBm	-10
INPUT ATTEN	10 dB
Amplitude Scale	1 dB/DIV
TIME/DIV	AUTO
FREQUENCY BAND GHz	Band 1 (.01 - 3)
ALT IF	ON
SIG IDENT	OFF
 22. Adjust front-panel REF LEVEL dBm and REF LEVEL FINE controls to place signal peak in upper half of CRT display for convenient viewing.
 23. Adjust front-panel TUNING control to place signal peak 3.75 divisions to the left of center screen on the CRT.
 24. Connect the HIGH output of the function generator to an oscilloscope and adjust function generator output for a 0V to +20V ramp and frequency to 500 Hz.
 25. Disconnect the function generator from the oscilloscope and connect it to A5A2TP1 VARACTOR by using the 8120-1292 adapter.
 26. The following adjustments refer to aligning the Second Converter after internal repair of the converter. If the entire converter has been replaced, it will probably not be necessary to perform all of the adjustments.
 27. Adjustments A5Z1, A5Z2, A5Z3, and A5L2 are used to align the bandpass filter and output match of the Second Converter. Z1 and L2 are used to adjust amplitude and Z2 and Z3 are used to center the response about the center frequency.
-

ADJUSTMENTS

5-26. SECOND CONVERTER ADJUSTMENTS (Cont'd)

28. The requirements for the converter response are illustrated in Figure 5-13a and are as follows: Bandpass should be at least 17 MHz, 1 dB down. Amplitude of response at 3.75 divisions to the left and 3.75 divisions to the right of center screen should be as near the same as possible. These are the positions of the IF signals for regular and alternate IF. This is illustrated in composite photo Figure 5-13b. These positions should be the same distance from the roll-off point at each end of the response curve.
29. Distance from roll-off points can be checked by centering signal with function generator disconnected then reconnecting function generator and switching ALT IF on and off. This is illustrated in Figure 5-13c and 5-13d.
30. Adjust A5Z1, Z2, Z3 and L2 to satisfy the requirements of the converter response. If entire converter has been replaced, try adjusting A5Z1 and L2 first. Do not adjust A2 and A3 unless it is necessary to meet requirements. Do not sacrifice amplitude to achieve flatness.
31. When adjustment is complete, disconnect function generator from A5A2TP1, center signal on display, and turn ALT IF on and off while monitoring signal.
32. Amplitude difference between regular and alternate IF should be no more than 0.4 dB.

ADJUSTMENTS

5-26. SECOND CONVERTER ADJUSTMENTS (Cont'd)

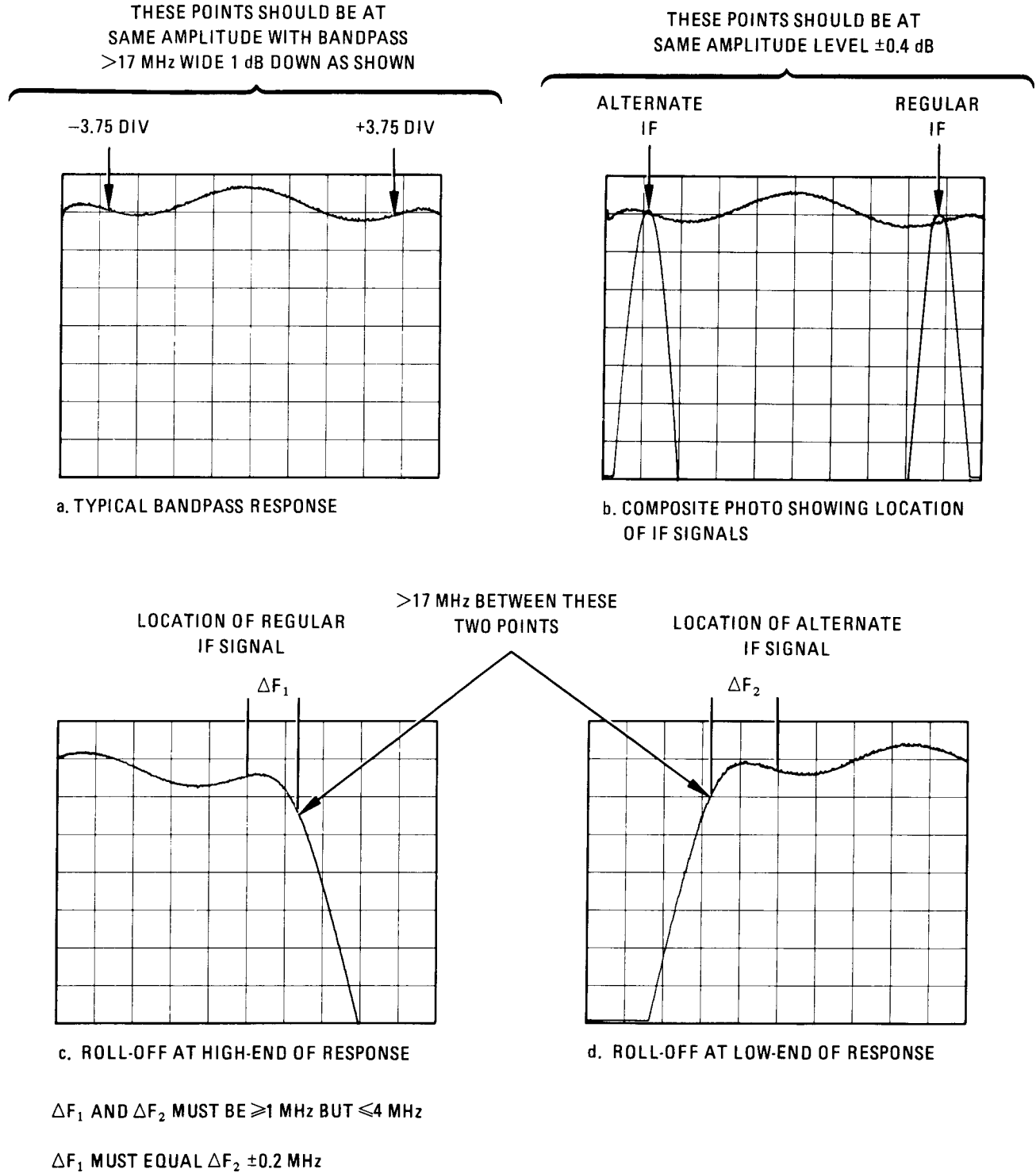


FIGURE 5-13. FIRST IF BANDPASS FILTER RESPONSE

ADJUSTMENTS

5-27. THIRD CONVERTER ADJUSTMENTS

REFERENCE:

A10 Schematic

DESCRIPTION:

First, the Third LO is adjusted for proper frequency using a frequency counter. Next, the second IF bandpass filter is aligned by injecting a frequency modulated 321.4 MHz signal at the necessary level and monitoring the 21.4 MHz output signal with another spectrum analyzer. The filter is aligned for a bandpass wide enough to accommodate any frequency drift occurring in the RF section of the analyzer and the amplitude necessary to provide the overall gain characteristics required by the analyzer.

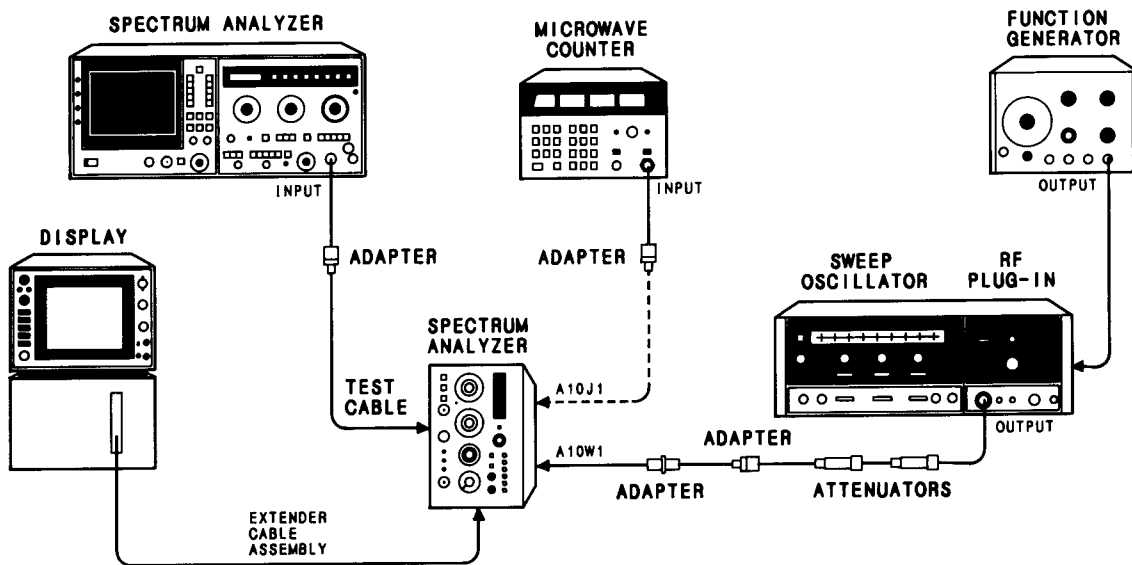


FIGURE 5-14. THIRD CONVERTER ADJUSTMENTS TEST SETUP

EQUIPMENT:

Frequency Counter	HP 5342A
Sweep Oscillator	HP 8620C/86222A
Spectrum Analyzer	HP 8569B
Function Generator	HP 3310A
Test Cable, BNC (m) to SMB (f) (2 required)	HP85680-60093
Adapter, SMC (m) to SMC (m)	HP 1250-0827
Adapter, Type N (m) to BNC (f) (3 required)	HP 1250-0780
20 dB Attenuator	HP 8491B, Option 020
10 dB Attenuator	HP 8491B, Option 010
Test Cable, BNC (m) to SMC (f)	HP 11592-60001
Extender Cable Assembly	HP 5060-0303

ADJUSTMENTS

5-27. THIRD CONVERTER ADJUSTMENTS (Cont'd)

PROCEDURE:

1. Allow one-half hour warmup time of equipment with analyzer connected to mainframe with extender cable.

Third LO Adjustment

2. Connect frequency counter to A10J1 300 MHz output using the BNC to SMB test cable.
3. Adjust A10L12 LO ADJ for frequency counter indication of 300.00 MHz \pm 0.1 MHz.

Second IF Bandpass Filter Alignment

4. Disconnect blue cable A10W1 at second converter output connector A5J2.
5. Set sweep oscillator controls for an output of 321.4 MHz at 0 dBm (measured directly at output of sweep oscillator). Use the frequency counter and spectrum analyzer to set the output frequency and amplitude.
6. Connect output through 10 and 20 dB attenuators to cable disconnected in step 4, using the BNC to SMB test cable and SMB male to SMB male adapter.
7. Place analyzer on right side and connect test cable to Third Converter 21.4 MHz output connector. If connector is not present (some early instruments were not so supplied), it is necessary to solder a coaxial cable to XA10P1 pin 18 and ground (center conductor of coaxial cable to XA10P1 and shield to ground).
8. Connect test cable or soldered cable to 8569B spectrum analyzer input.
9. Set 8569B spectrum analyzer controls as follows:

TUNING	21.4 MHz
RES BW	300 kHz
FREQ SPAN/DIV	1 MHz/DIV
INPUT ATTEN	10 dB
REF LEVEL dBm	- 10 dBm
Amplitude Scale	10 dB LOG
TIME/DIV	1 mSEC/DIV
10. Set HP 8559A RES BW to 1 kHz and TRIGGER to FREE RUN.
11. Center the 21.4 MHz signal on the 8569B spectrum analyzer, adjust reference level to place signal within top division on CRT, then change scale to 1 dB/DIV. Adjust REF LEVEL FINE to place signal peak in upper half of display.
12. Set function generator controls for a 200 Hz triangle wave output and connect to sweep oscillator RF Plug-In rear-panel FM input. Set FM/NORM/PL switch to FM.

ADJUSTMENTS

5-27. THIRD CONVERTER ADJUSTMENTS (Cont'd)

13. Adjust function generator amplitude and frequency for at least 10 MHz deviation (± 5 MHz) and an easy-to-view display on the 8569B spectrum analyzer. Refer to Figure 5-15. Increasing the frequency of the function generator will increase the swept frequency range of the sweep oscillator.
14. Adjust second IF bandpass filter adjustments A10C9 through A10C12 for the flattest bandpass response possible at the greatest amplitude possible centered at 21.4 MHz and at least 6 MHz (6 divisions) wide at 1 dB down from the highest point on the response curve. Do not sacrifice large amounts of amplitude for flatness. Some early instruments may display ripple on the response. This ripple should be ≤ 1 dB peak-to-peak. Peak of adjusted response should be at -10 dBm ± 2 dB.

NOTE

The output level of the third converter is actually 0 dBm. Due to the mismatch error (≈ 9.5 dB) encountered in this measurement, the level measured will be approximately -10 dBm.

15. Refer to Figure 5-15 for example of properly adjusted bandpass response and requirements for response.

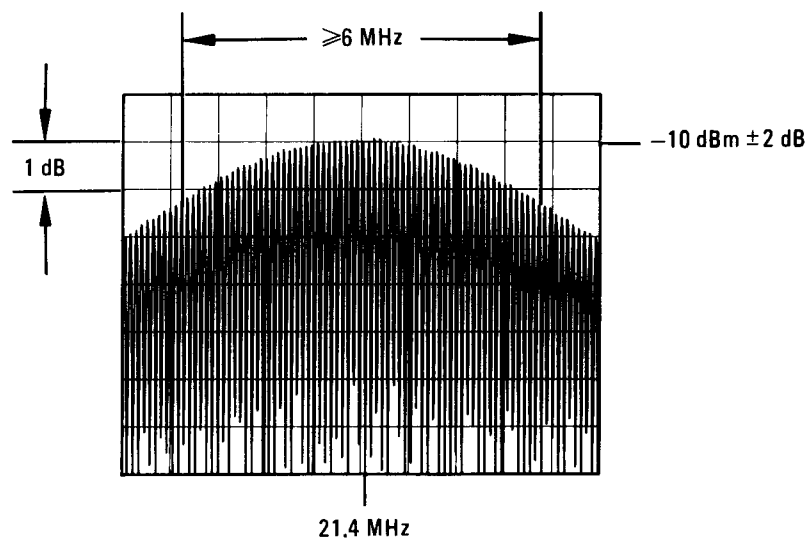


FIGURE 5-15. SECOND IF BANDPASS FILTER RESPONSE

ADJUSTMENTS

5-28. FREQUENCY RESPONSE ADJUSTMENTS

REFERENCE:

A3, A4, A5, A6, and A12 Schematics

NOTE

Perform CAL OUTPUT and REF LEVEL CAL adjustments (5-29) before proceeding with frequency response adjustments.

DESCRIPTION:

Frequency Response (flatness) is adjusted in six parts corresponding to the six harmonic bands of the analyzer. In each band, the analyzer is swept-tuned with a tracking signal source comprising a sweep oscillator and synchronizer. The sweep oscillator is tuned with an external sweep ramp generated by scaling the analyzer sweep output (AUX D) with a special tuning voltage circuit. This provides synchronization of the sweeps of the two instruments (sweep oscillator and analyzer), thus providing phase-lock of the two instruments. Each of the bands is adjusted for optimum flatness and all bands are adjusted for equal amplitudes.

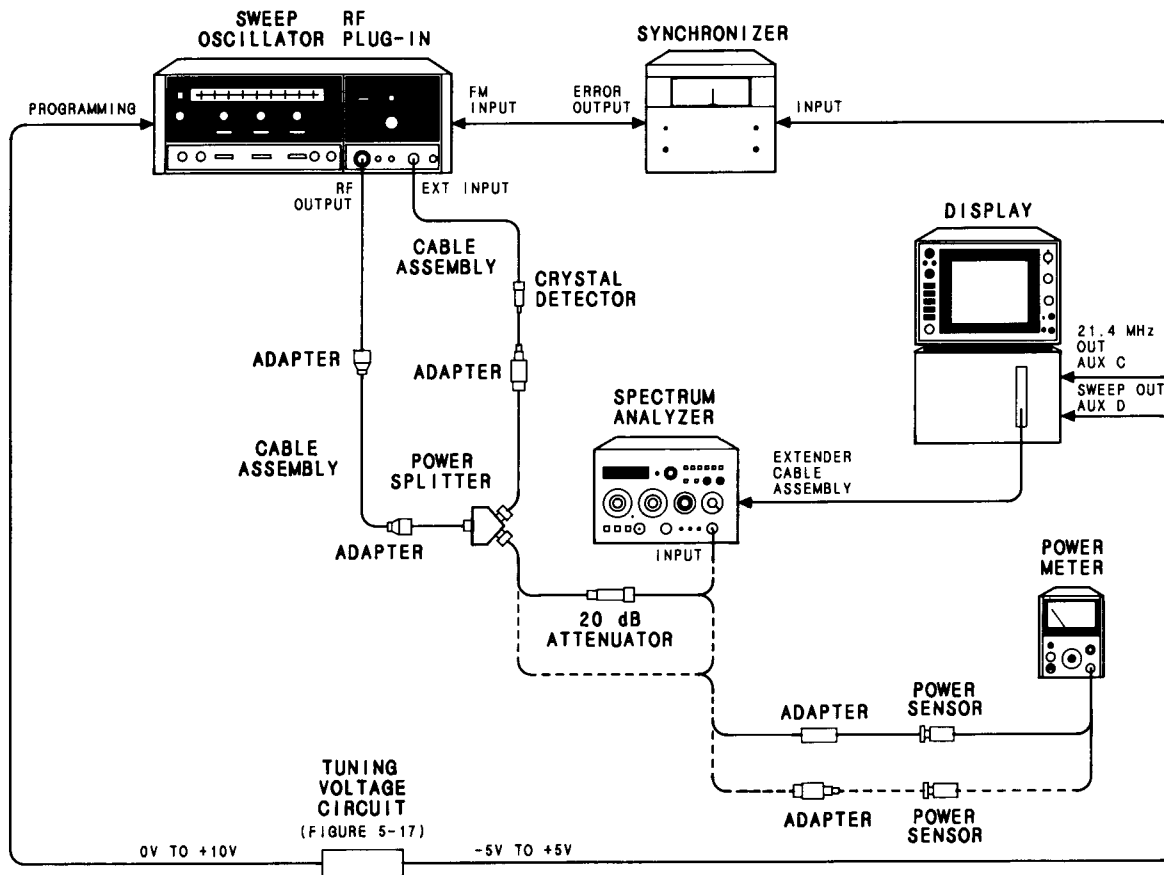
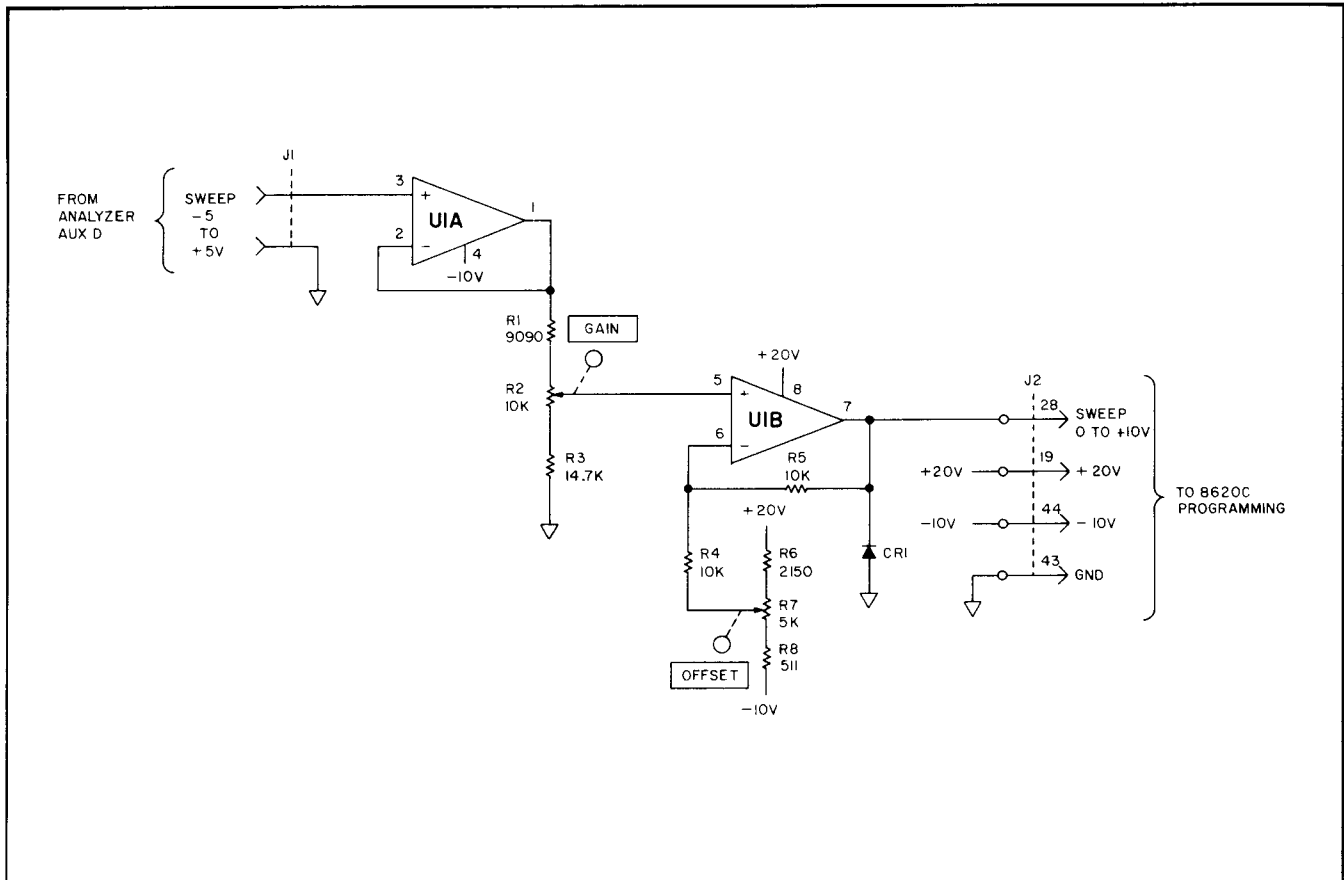


FIGURE 5-16. FREQUENCY RESPONSE ADJUSTMENTS TEST SETUP

ADJUSTMENTS

5-28. FREQUENCY RESPONSE ADJUSTMENTS (Cont'd)



REFERENCE DESIGNATOR	HP PART NUMBER	C D	DESCRIPTION
CR1	1901-0040	1	DIODE-SWITCHING 30V 50 MA 2NS DO-35
J1	1250-0118	3	CONNECTOR-RF BNC FEMALE 50-OHM
J2	1251-0086	6	CONNECTOR-MICRORIBBON 50-PIN MALE
R1	0757-0288	1	RESISTOR 9.09K 1% .125W
R2	2100-3414	2	RESISTOR-VAR CONTROL 10K 20% LIN
R3	0698-3156	2	RESISTOR 14.7K 1% .125W
R4	0757-0442	9	RESISTOR 10K 1% .125W
R5	0757-0442	9	RESISTOR 10K 1% .125W
R6	0698-0084	9	RESISTOR 2.15K 1% .125W
R7	2100-3421	1	RESISTOR-VAR CONTROL 5K 20% LIN
R8	0757-0416	7	RESISTOR 511 1% .125W
U1	1826-0092	3	OP AMP-GENERAL PURPOSE DUAL TO-99

FIGURE 5-17. TUNING VOLTAGE CIRCUIT

ADJUSTMENTS

5-28. FREQUENCY RESPONSE ADJUSTMENTS (Cont'd)

EQUIPMENT:

Sweep Oscillator	HP 8620C
RF Plug-In (.01 – 2.4 GHz)	HP 8622A/B
RF Plug-In (2 – 22 GHz)	HP 86290B-H08
Synchronizer	HP 8709A-H10
Power Meter	HP 435A/B
Power Sensor (.01 – 18 GHz)	HP 8481A
Power Sensor (.05 – 26.5 GHz)	HP 8485A
Crystal Detector (.01 – 26.5 GHz)	HP 33330C
20 dB Attenuator	HP 8491B, Option 020
Tuning Voltage Circuit	Refer to Figure 5-17
Cable, SMA (m) to SMA (m)	HP 8120-1578
Cable, BNC (m) to SMC (f)	HP 11592-60001
Adapter, Type N (m) to SMA (f) (2 required)	HP 1250-1250
Adapter, Type N (f) to SMA (f) (2 required)	HP 1250-1745
Adapter, Type N (f) to Type N (f)	HP 1250-1472
Extender Cable Assembly	HP 5060-0303
Power Splitter	11667A-C16

PROCEDURE:

1. Allow one-half hour warmup time of equipment with analyzer connected to mainframe with extender cable.
2. Connect equipment as shown in Figure 5-16 with power meter/power sensor connected to 20 dB attenuator and HP 8622A/B (.01 – 2.4 GHz plug-in) installed in sweep oscillator mainframe.
3. Set sweep oscillator controls as follows:

Mainframe:

SWEEP MODE	EXT
MARKERS	OFF
All rear panel switches	OFF

Plug-in

RF OFF/ON	OFF
ALC	EXT
POWER LEVEL	Fully CCW
FM/NORM/PL (rear-panel)	PL

4. Set synchronizer controls as follows:

POLARITY	–
SENSITIVITY	6 MHz/VOLT

ADJUSTMENTS

5-28. FREQUENCY RESPONSE ADJUSTMENTS (Cont'd)

5. Set spectrum analyzer controls as follows:

REF LEVEL FINE	0 dBm
REF LEVEL dBm	-20
INPUT ATTEN	10 dB
Amplitude Scale	10 dB/DIV
FREQ SPAN/DIV	F (full)
RESOLUTION BW	3 MHz
FREQUENCY BAND GHz .....	.01 - 3
TIME/DIV	20 msec
TRIGGER	FREE RUN
BL CLIP	OFF
VIDEO FILTER	MIN
ALT IF	OFF
SIG IDENT	OFF
TUNING	2.5 GHz

.01 - 3 GHz Adjustment

6. Place sweep oscillator plug-in RF OFF/ON switch to ON.
7. Adjust sweep oscillator controls for a CW output of 2 GHz at -7 dBm.
8. Disconnect power meter/power sensor and connect 20 dB attenuator directly to analyzer RF INPUT as shown in Figure 5-16.
9. Adjust sweep oscillator controls for full sweep.
10. Adjust Tuning Voltage Circuit GAIN control fully clockwise then adjust OFFSET control to center phase-locked signal on CRT. Refer to Figure 5-18a.

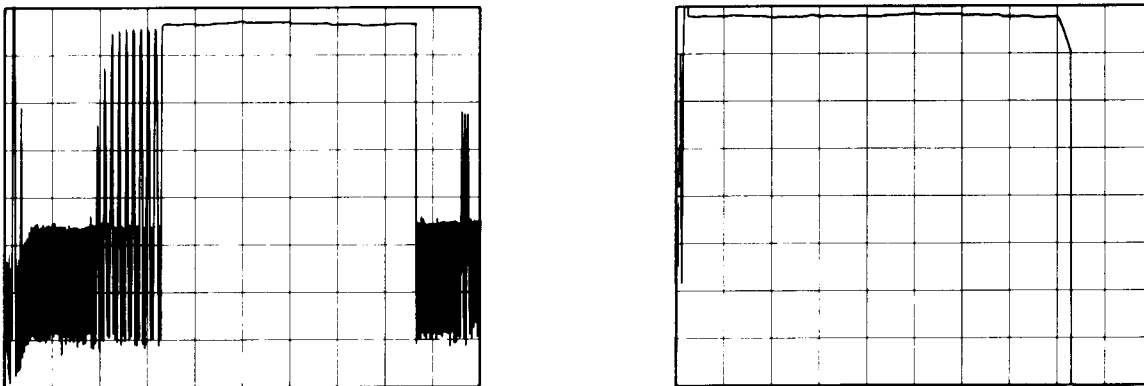


FIGURE 5-18. ILLUSTRATION OF PHASE-LOCKING PROCEDURE

 ADJUSTMENTS

5-28. FREQUENCY RESPONSE ADJUSTMENTS (Cont'd)

11. Adjust Tuning Voltage Circuit GAIN control to expand the phase-locked display over 8 1/2 divisions on CRT (.01 – 2.4 GHz). Refer to Figure 5-18b. It may be necessary to readjust OFFSET slightly to achieve phase-lock over entire range.
12. Optimum phase-lock is indicated by a smooth trace over full swept frequency range on CRT and minimum needle movement on synchronizer phase error meter.
13. Place CRT trace in top division of display using analyzer REF LEVEL FINE control.
14. Change spectrum analyzer Amplitude Scale to 1 dB/DIV and adjust REF LEVEL FINE control to place trace in upper half of display.
15. Remove CAUTION label (PC Board) from cover of A12 Step Gain by removing two pozi-drive screws.
16. Adjust A12R72 V1 (bias) for maximum amplitude of trace on CRT.
17. Adjust A12R47 1B (tilt) for best overall flatness of trace on CRT.

NOTE

Remember, you are viewing only a portion (.01 – 2.4 GHz) of Band 1. The remainder of Band 1 may have an effect on this adjustment.

18. Note highest and lowest points on CRT trace for reference. Also note level of trace at 2.1 GHz position on CRT (8th vertical graticule line).

Highest _____ Lowest _____ 2.1 GHz _____

19. Place sweep oscillator LINE switch OFF.
 20. Disconnect cables from HP 86222A/B (.01 – 2.4 GHz plug-in) and remove plug-in from sweep oscillator mainframe.
 21. Install HP 86290B (2 – 18.6 GHz plug-in) or HP 86290B-H08 (2 – 22 GHz plug-in), if available, in sweep oscillator mainframe and reconnect cables as shown in Figure 5-16 with 20 dB attenuator connected to analyzer RF INPUT.
 22. Set RF plug-in controls the same as for the plug-in removed (refer to step 3) and select Band 4 (2 – 18.6 or 2 – 22 GHz) on sweep oscillator mainframe.
 23. Place RF plug-in RF OFF/ON switch ON. Change analyzer Amplitude Scale to 10 dB/DIV.
 24. Adjust sweep oscillator for swept output from 2 to 3 GHz.
 25. Adjust spectrum analyzer TUNING controls for FREQUENCY GHz indication of 2.500 and change FREQ SPAN/DIV to 100 MHz. Make sure RES BW remains at 3 MHz.
-

ADJUSTMENTS

5-28. FREQUENCY RESPONSE ADJUSTMENTS (Cont'd)

26. Adjust Tuning Voltage Circuit GAIN and OFFSET controls to phase-lock swept signal from 2 to 3 GHz.
27. Adjust RF plug-in POWER LEVEL control to place trace at approximately -27 dBm on CRT.
28. Change spectrum analyzer Amplitude Scale to 1 dB/DIV.
29. Adjust RF plug-in POWER LEVEL control to place 2.1 GHz position of CRT trace to same level as that noted in step 18.
30. Note flatness of trace from 2 to 3 GHz. Total deviation of trace from .01 to 3 GHz should not exceed 2.0 dB.
31. Center trace about the sixth horizontal graticule line on the CRT using analyzer REF LEVEL FINE control. Do not change this setting for remainder of procedure. This will be used as amplitude reference for remaining frequency bands.

NOTE

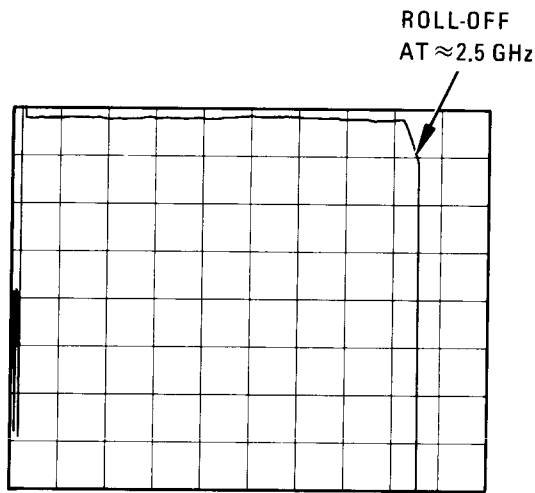
Be careful during the adjustment of the remaining frequency bands. It is possible to achieve a phase-locked display of a frequency range other than the one selected on the spectrum analyzer. For example, it is possible to achieve a phase-locked display for 6–9 GHz when 3–9 GHz has been selected. This can be avoided by paying close attention to synchronizer polarity and RF plug-in band switch points. Figure 5-19 illustrates the typical appearance of each of the bands. Use it for reference.

6 to 9 GHz Adjustment

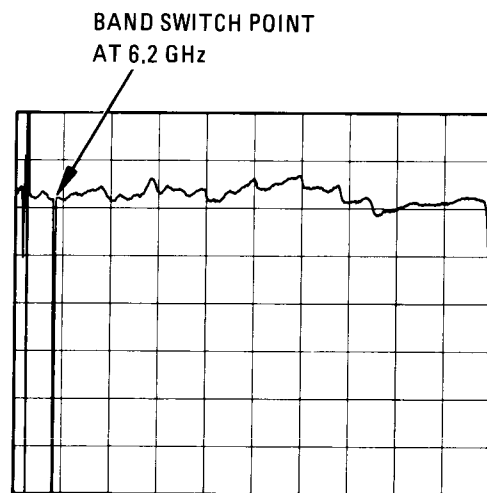
32. Change synchronizer POLARITY to +.
33. Change spectrum analyzer FREQ SPAN/DIV to F (full), Amplitude Scale to 10 dB/DIV, and FREQUENCY BAND GHz to 6–9. Set TUNING to above 9 GHz.
34. Adjust sweep oscillator for swept output from 6 to 9 GHz.
35. Adjust Tuning Voltage Circuit GAIN and OFFSET controls to phase-lock swept signal from 6 to 9 GHz. Refer to Figure 5-19b.
36. Change spectrum analyzer Amplitude Scale to 1 dB/DIV.
37. Adjust A12R58 2A (offset) and A12R48 2B (tilt) for best overall flatness of trace from 6 to 9 GHz with trace approximately centered about the sixth horizontal graticule line on the CRT.
38. Total deviation of CRT trace from 6 to 9 GHz should not exceed 2.0 dB.

ADJUSTMENTS

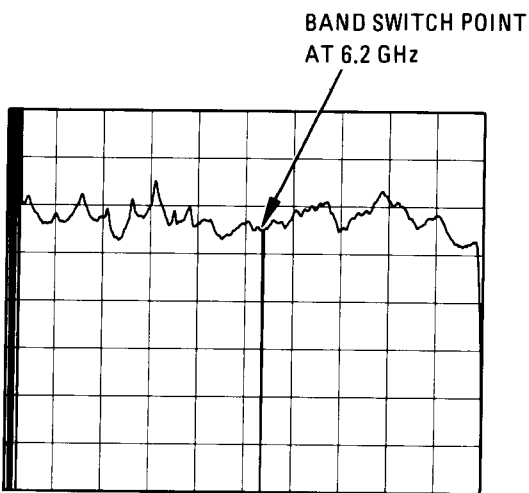
5-28. FREQUENCY RESPONSE ADJUSTMENTS (Cont'd)



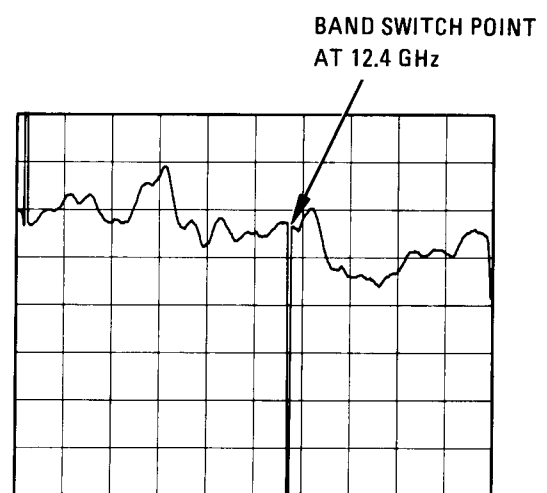
a. BAND 1 (.01-3 GHz)



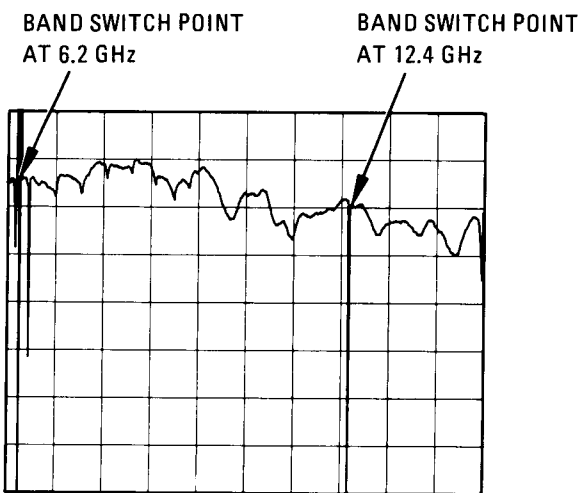
b. BAND 2 (6-9 GHz)



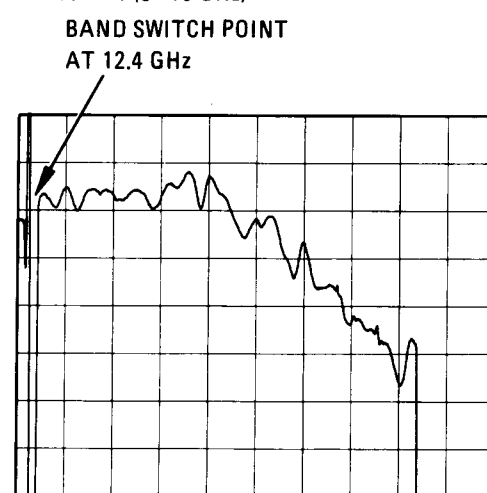
c. BAND 3 (3-9 GHz)



d. BAND 4 (9-15 GHz)



e. BAND 5 (6-15 GHz)



f. BAND 6 (12.1-21 GHz)

FIGURE 5-19. TYPICAL PHASE-LOCKED RESPONSE OF EACH FREQUENCY BAND

ADJUSTMENTS

5-28. FREQUENCY RESPONSE ADJUSTMENTS (Cont'd)**3 to 9 GHz Adjustment**

39. Change synchronizer POLARITY to - .
40. Change spectrum analyzer Amplitude Scale to 10 dB/DIV and FREQUENCY BAND GHz to 3 - 9.
41. Adjust sweep oscillator for swept output from 3 to 9 GHz.
42. Adjust Tuning Voltage Circuit GAIN and OFFSET controls to phase-lock swept signal from 3 to 9 GHz. Refer to Figure 5-19c.
43. Change spectrum analyzer Amplitude Scale to 1 dB/DIV.
44. Adjust A12R83 V2- (bias), A12R59 3A (offset), and A12R49 3B (tilt) for best overall flatness of trace from 3 to 9 GHz with trace approximately centered about the sixth horizontal graticule line on the CRT.
45. Total deviation of trace from 3 to 9 GHz should not exceed 3.0 dB.

9 to 15 GHz Adjustment

46. Change synchronizer POLARITY to + .
47. Change spectrum analyzer Amplitude Scale to 10 dB/DIV and FREQUENCY BAND GHz to 9 - 15.
48. Adjust sweep oscillator for swept output from 9 to 15 GHz.
49. Adjust Tuning Voltage Circuit GAIN and OFFSET controls to phase-lock swept signal from 9 to 15 GHz. Refer to Figure 5-19d.
50. Change spectrum analyzer Amplitude Scale to 1 dB/DIV.
51. Adjust A12R87 V2+ (bias), A12R60 4A (offset), and A12R51 4B (tilt) for best overall flatness of trace from 9 to 15 GHz with trace approximately centered about the sixth horizontal graticule line on the CRT.
52. Total deviation of trace from 9 to 15 GHz should not exceed 3.6 dB.

6 to 16 GHz Adjustment

53. Change synchronizer POLARITY to - .
 54. Change spectrum analyzer Amplitude Scale to 10 dB/DIV and FREQUENCY BAND GHz to 6 - 15.
 55. Adjust sweep oscillator for swept output from 6 to 15 GHz.
 56. Adjust Tuning Voltage Circuit GAIN and OFFSET controls to phase-lock swept signal from 6 to 15 GHz. Refer to Figure 5-19e.
-

ADJUSTMENTS

5-28. FREQUENCY RESPONSE ADJUSTMENTS (Cont'd)

57. Change spectrum analyzer Amplitude Scale to 1 dB/DIV.
58. Adjust A12R71 V3 – (bias), A12R61 5A (offset), A12R53 5B (tilt), and A12R54 5C (breakpoint) for best overall flatness of trace from 6 to 15 GHz with trace approximately centered about the sixth horizontal graticule line on the CRT.
59. Total deviation of trace from 6 to 15 GHz should not exceed 4.2 dB.

12.1 to 21 GHz Adjustment

NOTE

If an HP 86290B-H08 (2 – 22 GHz plug-in) is not available, a standard HP 86290B (2 – 18.6 GHz plug-in) may be used to adjust the spectrum analyzer flatness from 12.1 to 18.6 GHz using this procedure.

60. Change synchronizer POLARITY to +.
61. Change spectrum analyzer Amplitude Scale to 10 dB/DIV and FREQUENCY SPAN GHz to 12.1 – 21.
62. Adjust sweep oscillator for swept output from 12 to 18.6 GHz or 12 to 21 GHz, depending on which RF plug-in is used.
63. Adjust Tuning Voltage Circuit GAIN and OFFSET controls to phase-lock swept signal from 12 to 18.6 GHz or 12 to 21 GHz. Refer to Figure 5-19f.
64. Change spectrum analyzer Amplitude Scale to 1 dB/DIV.
65. Adjust A12R70 V3 + (bias), A12R62 6A (offset), A12R55 6B (tilt), and A12R56 6C (breakpoint) for best overall flatness of trace from 12.1 to 18.6 GHz or 12.1 to 21 GHz with trace approximately centered about the sixth horizontal graticule line on the CRT.
66. Total deviation of trace from 12.1 to 18 GHz should not exceed 4.6 dB and from 18 to 21 GHz should not exceed 6.0 dB.
67. If unable to achieve flatness specifications, it may be necessary to plot a characterization curve of the sweep oscillator output from 12 to 21 GHz. This can be done by measuring the power output of the sweep oscillator (at the 20 dB attenuator) every 500 MHz from 12 to 21 GHz using a power meter. The values obtained can then be plotted on the CRT and flatness adjusted to this corrected curve. Total deviation then becomes the difference between the largest positive and largest negative deviation from the plotted curve.

This characterization will require the use of an 18 – 21 GHz thermistor mount and K-Band waveguide adapter in addition to equipment previously used. Recommended equipment is listed under EQUIPMENT in this procedure along with previously used equipment.

ADJUSTMENTS

5-29. CAL OUTPUT AND REF LEVEL CAL ADJUSTMENTS

NOTE

These adjustments should be followed by frequency response adjustments, since adjustment of A12R57 1A (offset) will shift the frequency response of Band 1 (.01 – 3 GHz).

REFERENCE:

A10 and A12 Schematics

DESCRIPTION:

The 35 MHz CAL OUTPUT signal is adjusted for proper amplitude and frequency using a power meter and frequency counter. Adjustment range of the front-panel REF LEVEL CAL control is set using the CAL OUTPUT signal as a reference.

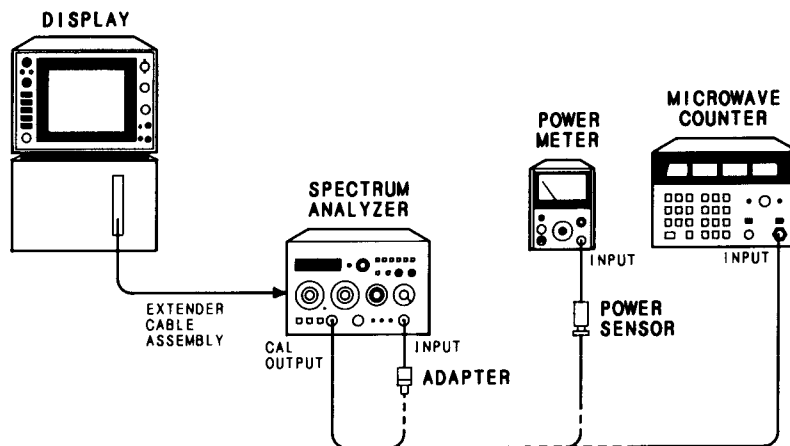


FIGURE 5-20. CAL OUTPUT AND REF LEVEL CAL ADJUSTMENTS TEST SETUP

EQUIPMENT:

Frequency Counter	HP 5342A
Power Meter	HP 432A/435A/B
Power Sensor	HP 8481A
Adapter, Type N (m) to BNC (f)	HP 1250-0780
Extender Cable Assembly	HP 5060-0303

ADJUSTMENTS

5-29. CAL OUTPUT AND REF LEVEL CAL ADJUSTMENTS (Cont'd)**PROCEDURE:****CAL OUTPUT Adjustment**

1. Allow one-half hour warmup time of equipment with spectrum analyzer connected to mainframe with extender cable.
 2. Connect power meter/power sensor to front-panel CAL OUTPUT connector as shown in Figure 5-20.
 3. Place spectrum analyzer on its right side. Adjust A10R13 CAL AMPL for power meter indication of $-10.0 \text{ dBm} \pm 0.1 \text{ dB}$. A10R13 is accessed through motherboard.
 4. Disconnect power meter/power sensor and connect frequency counter to CAL OUTPUT connector.
 5. Adjust A10C46 CAL FREQ for frequency counter indication of $35.00 \text{ MHz} \pm 0.01 \text{ MHz}$. A10C46 is accessed through motherboard.
 6. Repeat steps 2 through 5 until CAL OUTPUT signal is properly adjusted for both amplitude and frequency.
 7. Connect CAL OUTPUT to analyzer INPUT.
 8. If not already removed, remove CAUTION label (PC Board) from A12 Step Gain.
 9. Set spectrum analyzer controls as follows:

Amplitude Scale	10 dB/DIV
REF LEVEL dBm	0
INPUT ATTEN	10 dB
FREQ SPAN/DIV	1 MHz
RESOLUTION BW	1 MHz
TIME/DIV	AUTO
TRIGGER	FREE RUN
FREQUENCY BAND GHz .....	.01 - 3
 10. Center 35 MHz calibration signal on CRT using TUNING controls.
 11. Adjust front-panel REF LEVEL CAL fully counterclockwise.
 12. Change Amplitude Scale to 1 dB/DIV and adjust REF LEVEL FINE if necessary to place signal peak on first horizontal graticule line above bottom reference line of CRT.
 13. Adjust front-panel REF LEVEL CAL to raise signal peak three divisions (3 dB) on CRT (to fourth graticule line above bottom reference line on CRT).
 14. Change Amplitude Scale to 10 dB/DIV, REF LEVEL dBm to -10 , and set REF LEVEL FINE to 0 dBm.
-

ADJUSTMENTS

5-29. CAL OUTPUT AND REF LEVEL CAL ADJUSTMENTS (Cont'd)

15. Signal peak should now be approximately at top graticule line (Reference Level) on CRT.
16. Switch between 10 dB/DIV and LIN while adjusting A12R57 1A (offset) to place signal peak at same level in both 10 dB/DIV and LIN.
17. Level at which signal peaks are coincident should be at top graticule line (Reference Level). If not, adjust front-panel VERTICAL GAIN to place signal peak at Reference Level line. Be sure VERTICAL POSN is properly adjusted for baseline on bottom graticule line.
18. Replace CAUTION label (PC Board) on A12 Step Gain.

ADJUSTMENTS

5-30. FREQUENCY DISPLAY ADJUSTMENTS

REFERENCE:

A1 and A8 Schematics

DESCRIPTION:

The Digital Panel Meter (DPM) OFFSET and GAIN controls are adjusted for proper FREQUENCY display indication at corresponding tuning voltage (DPMA) levels.

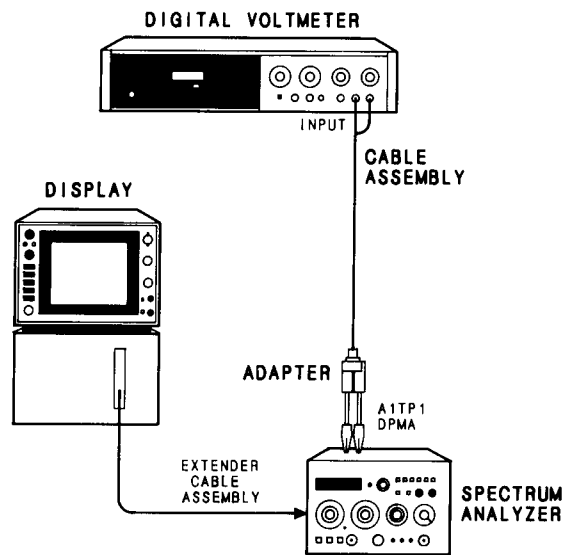


FIGURE 5-21. FREQUENCY DISPLAY ADJUSTMENTS TEST SETUP

EQUIPMENT:

Digital Voltmeter	HP 3456A
Cable, BNC (m) to Banana Plugs	HP 10111A
Extender Cable Assembly	HP 5060-0303
Adapter, BNC (f) to Alligator Clips	HP 8120-1292

ADJUSTMENTS

5-30. FREQUENCY DISPLAY ADJUSTMENTS (Cont'd)**PROCEDURE:**

1. Allow one-half hour warmup time of equipment with analyzer connected to mainframe with extender cable.
2. Jumper A8TP5 DPM to ground.
3. Set front-panel FREQUENCY BAND GHz to Band 1 (.01 – 3).
4. Connect DVM to A1A2TP1 DPMA. A1A2TP1 is located below the board and is accessible through cut-out in left side gusset.
5. Adjust A8R61 DPM ZERO for DVM indication of 0.000 Vdc.
6. Adjust A1A2R29 OFFSET for front-panel FREQUENCY GHz indication of 0.000.
7. Remove jumper from A8TP5 to ground.
8. Select Band 6 (12.1 – 21) on analyzer.
9. Adjust front-panel TUNING control for DVM indication of –4.000 Vdc.
10. Adjust A1A2R28 GAIN for front-panel FREQUENCY indication of 20.000.